IMPROVING CARE FOR SUICIDAL PATIENTS BY IMPLEMENTING GUIDELINE RECOMMENDATIONS

ON THE EFFECTS OF AN E-LEARNING SUPPORTED TRAIN-THE-TRAINER PROGRAM, AND THE ASSESSMENT OF SUICIDE IDEATION

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prof. dr. B. van Meijel
prof. dr. H. Riper

I'm sinking in the quicksand
of my thought
And I ain't got the power anymore
David Bowie, Quicksand (1971)

CHAPTER 1

GENERAL INTRODUCTION

Rationale and Aims

Evidence-based Guidelines

Quality of care for patients has become an important health care issue, not only for patients and caregivers, but also for managers, policy makers, health insurance companies and ministries of health [1]. One of the most important instruments in improving and justifying patient care is the development of evidence-based medicine (EBM) which is defined as "the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients" [2]. The foundation of EBM was laid down in 1972 with Cochrane's research report "effectiveness and efficacy" [3] in which he advocated the use of clinical epidemiology and controlled studies when assessing the effectiveness of medical treatments. His observations resulted in the thorough evaluation of health care interventions, and the use of randomized controlled trials and systematic reviews when deciding on the effectiveness of a medical intervention. Medicine became evidence-based instead of observationally or anecdotally based. Empirical findings are used to bring order with regard to the appropriateness of interventions. Interventions with the highest level of evidence (level A: meta-analysis or randomized controlled trials) are deemed more appropriate then interventions for which only consensus evidence is available (Level D: expert consensus). When all evidence on a specific topic is systematically collected and summarized into statements to assist practitioners and patients to make the most appropriate health decision, we speak of evidence-based guidelines [4].

The last decade saw the development of evidence-based guidelines in all forms of health care [4]. Increasingly, health professionals make clinical decisions for individual patients based on clinical guidelines. Health spending of governments and health coverage by insurance companies nowadays are mostly guided by EBM [5, 6].
The current interest can be motivated in different ways: the ambition to provide the best possible care, rapid developments in the field of medicine, an acknowledgment of inappropriate care because of variations in care provided, and the continuous rise of health care costs that lead to the demand for more efficient treatments [4].

Evidence-based Guidelines in Mental Health Care

In the field of psychiatry, a number of evidence-based guidelines have been made available over the last twenty years [7]. Several authors stress that guidelines in mental health care are often based on lower level evidence when compared to other health guidelines due to the multidisciplinary character, ethical issues, and the nature of the interventions in mental health care [8-10]. For EBM, randomized controlled trials (RCT's) are the gold standard. However, when dealing with highly vulnerable psychiatric patients, such as suicidal patients, randomization, or not intervening when necessary is regarded as unethical [11, 12, 13]. Excluding suicidal patients from RCT's is common practice. Blinding of participants to randomization in psychotherapy trials is also not possible due to the nature of the intervention. Also, within nursing, RCT's are simply not standard [8, 14]. These and several other arguments are problematic for the development of pure evidence-based guidelines in multidisciplinary mental health care. Still, the EBM methodology offers a good starting point.

Multidisciplinary Guidelines in Dutch Mental Health Care

Dutch mental health care was relatively late in developing guidelines [8, 15]. The first Dutch guideline on the treatment of depression in mental health care was released in 1997 and was largely monodisciplinary. During a conference organized by the Ministry of Health in 1998, it was acknowledged that guideline development is a complex process that demands the collaboration of all professions involved with patient care [8, 15]. The five main disciplines in Dutch mental health care (psychiatrists, general practitioners, psychotherapists, clinical psychologists and psychiatric nurses) took the lead in formulating multidisciplinary evidence based guidelines. Technical and secretarial support was offered by the CBO (Quality institute for Health Care) and the Trimbos-Institute (Netherlands institute for mental health and addiction). Since then, 15 Dutch multidisciplinary guidelines have been produced [15].

The Need for a Dutch Guideline on the Assessment and Treatment of Suicidal Behavior

In the Netherlands, about 1600-1800 persons a year die by suicide, and it is estimated that 99.600 suicide attempts take place annually [16]. Each year, 15.000 patients are treated in emergency departments, and 9000 are hospitalized after an attempt [17]. A recent study on disability weights placed suicide and suicide attempts at 11th on the list of most burdensome diseases in the Netherlands. This places the burden of suicidal behavior on patients between dementia and breast cancer. Also, suicidal thoughts are considered

to be as disabling for patients as alcohol dependence and severe asthma, and the burden after non-fatal suicide attempts is thought to be comparable to the burden of heroin dependence and initial stage Parkinson [18].
Suicide has a great impact on society. The emotional impact on people bereaved by suicide is enormous [19], and relatives of suicide completers show a heightened risk for suicidal behavior [20]. In the Netherlands, the direct medical costs for treatment of the 15.000 patients treated every year after suicide attempts in emergency departments are estimated to be around 36 million euro a year [21]. However, direct costs are only a part of the financial burden of suicide. To calculate the total costs per suicide, three types of costs are to taken into account; direct costs (e.g. demand on emergency services, funerals), indirect costs (loss of contribution to economy via paid work, family responsibilities) and intangible costs (pain and grief of family, loss of chance to experience all that life holds) [22]. In the UK, estimated total costs per suicide range from 1.5 million euro to 1.7 million euro [23].
No comparable economic studies have been done to estimate the costs of suicide ideation, but given the costs of depression (e.g. [24]), which reportedly 90% of people with suicide ideation suffer from [25], the costs are likely to be large. A recent cost-effectiveness analysis of a web-based self-help program to reduce suicide ideation [26] reported that for each significantly improved individual, €34.727 of societal costs were saved.

Although (attempted) suicide frequently occurs in Dutch Mental Health Institutions [27] (MHI's), up until 2012 there was no national evidence-based guideline on the assessment and treatment of suicidal behavior. The assessment and treatment of suicidality was dealt with only to a limited extent in other mental health guidelines (such as those for depression or schizophrenia). The depression guideline for general practitioners also only briefly dealt with suicidal behavior. Individual professionals could only adhere to foreign guidelines such as the guidelines from the American Psychiatric Association or the British National institute for health care and excellence. Local guidelines were available in a limited number of MHI's and when available, lacked important elements [28]. Results of the analysis of 505 completed suicides in Dutch mental health care services suggested that quality of care for suicidal patients could be improved by implementing clear standards for the assessment and treatment of suicide risk [27]. Furthermore, international guidelines suggested that the risk assessment of suicidal behavior should be carried out systematically. It was also reported that many mental health professionals are not adequately trained in suicide prevention during (post)doctoral training and therefore lack confidence and knowledge in dealing with suicidal behavior [29]. Furthermore, after a suicide, professionals were anxious regarding the inspectorate of health care because it was unclear what criteria were used to determine adequate care for suicidal patients [30].

Based on these findings, one of the most important recommendations in the advice on policy given to the Ministry of Health on the strengthening of suicide prevention was the development of a separate guideline on the assessment and treatment of suicidal behavior [29]. This national guideline should combine state-of-the-art scientific evidence with expert consensus and also consensus knowledge of patients and their family. When developed and authorized by the professional organizations of psychiatrist, psychologists and nurses, it could serve as the starting point for local protocols and guidelines in Dutch mental health care.

The Multidisciplinary Evidence Based Practice Guideline on the Assessment and Treatment of Suicidal Behavior

This policy advice resulted in the development of the Multidisciplinary evidence based practice guideline on the assessment and treatment of suicidal behavior (PGSB). The PGSB has been produced by representatives of the Netherlands Psychiatric Association (NVvP), the Dutch Association of Psychologists (NIP) and the Dutch Nurses' Association (V&VN). Representatives of the Dutch College of General Practitioners (NHG) were also involved, as were representatives of patient participation organizations and organizations for relatives bereaved by suicide. The development process was supported by the National Institute of Mental Health and Addiction in the Netherlands (Trimbos Institute). The project was funded by The Netherlands Organization for Health Research and Development (ZON-MW). The EBRO-format was used, which itself is based on the AGREE-method [8]. The EBRO-format emphasizes the evidence-based character of guidelines by translating practice-based issues into concrete questions, which are responded to by a summary of the available evidence. International suicide guidelines such as the suicide guideline of the American Psychiatric Association [31], the New Zealand Guideline Group [32] and the National Institute for Clinical Excellence (NICE) [33], served as starting points for literature searches, in addition to extensive reviews by the Scottish Government [34, 35] and up-to-date research on the assessment and treatment of suicidal behavior. Conclusions are formulated and a four-fold classification of the level of evidence ranging from level 1 (strong evidence, highly recommended or dissuaded) to level 4 (reflecting experts opinions) is provided. Recommendations are provided in terms of (professional) behavior according to available evidence, weighted or not by relevant considerations based on experts' opinion and/or clinical experience. The PGSB combines the stress-diathesis model [36] and the entrapment model of suicidal behavior [37] to explain the onset and maintenance of suicidal behavior. The integrated model depicts suicidal behavior as the outcome of a process influenced by the interaction of biological, psychological, environmental and situational

factors. The interaction of which may lead to entrapment. Entrapment is proposed to be the specific condition in which suicidal behavior arises. The PGSB recommends systematic investigation of the suicidal condition of patients by using the Chronological Assessment of Suicidal Events (CASE) interview [38]. Based on its outcome, risk and protection factors for suicide in individual patients are weighted. Subsequently, structured diagnosis, treatment strategy and a safety protocol are determined.

The Irony of Implementing Guidelines

In addition to the development of the guideline, the policy advice on the strengthening of suicide prevention also stressed the importance of structured implementation of the guideline [29]. There is a well-known gap between guideline development and implementation of the guideline in daily medical practice [39]. Despite the current development and dissemination of evidence based guidelines, patients do not always receive appropriate care. For example, although Cognitive Behavioral Therapy (CBT) is recommended in the United Kingdom [33], the USA [31] and Australia [40] as an effective therapy for anxiety and unipolar depression, evidence is found that few patients receive CBT and that it is often delivered sub optimally [41]. Studies on both sides of the Atlantic estimated that 30-40% of the patients do not receive optimal care, and 20-25% of the care provided is not needed or even harmful [41, 43]. Multiple structural factors at both professional and organizational levels, such as lack of knowledge, poor outcome expectations, material support, funding and time were found to be common barriers [44-46]. Structural guideline implementation is argued to improve adherence to mental health guidelines. The irony is that we have limited evidence-based knowledge or consensus on how to best implement guidelines. Guideline implementation strategies are more often based on the preference and availability of strategies than on evidence on its effectiveness [47]. For example, in the Netherlands, a package of multifaceted implementation strategies (Quality improvement collaborative: QIC) is popular when implementing guidelines in mental health care. However, a systematic review including 72 studies, of which only 2 were randomized, demonstrated that QIC had positive but limited results [48]. Another systematic review on implementation of psychiatric guidelines found a modest effect of implementation on quality of care and patient outcome, but stressed the need for more randomized studies on the effect of implementation on both patient and physicians level [7]. The lack of evidence-based implementation strategies was first noted by Grol in 1999 [39]. In 2004, it was concluded that progression had been made [47]. Current interventions did result in clinically important practice changes, although an empirical tested base is still lacking. The suggested way forward is to develop interventions which potential effectiveness

on health care professionals and patients is based on solid theory. Next, these carefully constructed interventions should be preferably tested in Randomized Controlled Trials with outcomes assessed at the professional, patient and organizational levels.

PITSTOP Suicide

To implement the PGSB in Dutch mental health care, we reviewed the literature on implementation strategies and suicide prevention training programs. Based on our findings which are described in detail in chapter four, we developed an e-learning supported Train-the-Trainer program (TtT-e) to be delivered to the staff of psychiatric departments to implement the PGSB [49]. The Train-the-Trainer model is based on the Adult Learning Theory [50] stating that the best resource for learning comes from peers, and on the Diffusion of Innovation Theory [51] stating that people adopt new information better through their trusted social networks. TtT-e combines a one-day face-to-face training program with an additional e-learning module. This form of blended learning is used extensively in medical education and has been found to be more effective when compared with traditional instructor-based training only [52, 53]. Suicide prevention training has been shown to improve knowledge, skills, and attitudes towards suicidal behavior of both gatekeepers [54-62] and mental health professionals [63, 64]. Additionally, professional and gatekeeper training in diagnosis and treatment of depressive disorders, which are associated with suicidal behavior [65] has been shown to result in a reduction of suicide rates [60, 69]. The best comparable initiative to the study proposed here is an ambitious Train-the-Trainer program in the US Air Force Suicide Prevention Program [69]. This initiative included a series of training programs on best practice guidelines that ultimately reached 75% of mental health providers in the US Air Force. At the 6 month follow-up, 44% of trained professionals reported increased confidence in assessing suicide risk, 54% reported increased confidence in managing suicidal patients, 83% reported changing suicide care practices, and 66% reported changing clinic policy in direct response to the training. Importantly, the number of suicides was significantly lower after the intervention than before. The actual number of suicides fell from 68 in the year before the program to 20 in the year after the program. Follow-up data demonstrated a decline of 20 percent in suicide rate from 1998 to 2008 with the exception of one year [70]. This demonstrates that training of professionals in suicide prevention skills can improve the quality of care, and even result in less suicidal behavior.

E-learning

Advances in technology, the rise in costs of health care and the need for continuous education of (para)medical professionals have made e-learning a popular new educational method [71-73]. E-learning is proposed as a solution to disseminate evidence based psychological treatments on a global scale [74]. Relatively little is known about how to best develop an effective e-learning module on a psychiatric topic. User preferences and effects on outcomes remain unclear, as most developers do not report any data on effectiveness. As the demand for e-learning in mental health is rapidly increasing, and policy makers advocate the use of e-learning to reduce costs, it is of importance to evaluate earlier modules so new modules can benefit from previous experience. In this thesis, we will evaluate the e-learning module that was developed to support a Train-the-Trainer program to implement the PGSB among mental health professionals.

Multicenter Cluster Randomized Trial

It is difficult to test the effect of guideline implementation in an RCT [7, 15]. Implementing guidelines in departments is already time consuming and expensive. It takes some effort to convince departments that are in need for training in suicide prevention to be randomized, and therefore to have a 50% change of having to do several assessments without receiving any training. However, due to the lack of RTC's, there is still little evidence on effective implementation. To more rigorously test the effect of a multifaceted implementation intervention, we decided to test the effect of our intervention in a randomized trial. For the PITSTOP suicide trial, Mental Health institutions were invited to provide departments for participation during nationally supported meetings and conferences on suicide prevention in the Netherlands from January 2009 until December 2011. Departments were considered eligible for participation if they treated patients aged ≥18 years, if professionals considered there was a need for training in suicide prevention skills, if the training was supported by the institutional board and if institutions were willing to accept costs due to loss of production. Eligible departments were matched in pairs based on primary patient diagnoses and average treatment duration [49]. Members of matched pairs were randomly allocated to either implementation as usual (IAU: control) or IAU + TtT-e (intervention). Outcomes were assessed at the professional, patient and organizational level. We hypothesized that professionals, patients and organizations would benefit from TtT-e.

The Assessment of Suicide Ideation

The primary outcome of our study is change in suicide ideation. We hypothesize that patients treated by multidisciplinary teams who were trained by the TtT-e program would recover more quickly from suicidal ideation as compared with patients treated by multidisciplinary teams who were not trained. Assessing suicidal thoughts is difficult for various reasons. Medical ethical committees are concerned that asking about suicidality might heighten suicide risk [13] making them more reluctant to improve research involving suicide items. Also, answering questions about suicide, especially at intake, might be burdensome for both patients and interviewers and result in dropout. The assessment of suicidal thoughts would benefit from short and reliable assessment tools. An important element of this thesis was to try to optimize the Beck Scale for Suicide Ideation by using techniques from modern test theory. The test theory most scientists and clinicians use to draw conclusions from questionnaires is the Classical Test Theory (CTT) [75]. In CTT, all item scores are summed to a total score that reflects the level of a participant on the latent trait. Although intuitively very strong, CTT has been unsatisfying for various reasons. Person and item characteristics cannot be studied separately, and the standard error of measurement is assumed to be the same for all participants. Questions that cannot be answered using CTT are for example: can a test be shortened without losing discriminating validity or do respondents interpret a given scale in a conceptually similar way over time. Latent variable theory, modern test theory or "new psychometrics" does allow us to answer this type of question. Instead of summing all items to a single total score, mathematical models express the association between an individual's response to an item and the underlying latent variables [76].

We applied modern test techniques to test 1) if the 19 item Beck scale for Suicide ideation can be shortened without losing discriminative validity when classifying patients as being at elevated risk for suicidal behavior and 2) whether participants have the same conceptual understanding of suicidal behavior at baseline and 3 month follow-up (whether the scale is measurement invariant). Finally we conducted a randomized trial among students to assess the impact of responding to the Beck Scale for Suicide Ideation among healthy participants on their mood.

Outline of the Thesis

This thesis is divided into three parts. The first part (chapter 2-4) is about the development of the intervention and the different hypotheses of the trial at the three different levels: the professional; the patient and the organizational. The second part (chapter 5-9) describes the results of our intervention on these different outcome levels. The third part (chapter 10-12) focusses on the improvement of the assessment of suicide ideation. In more detail, chapter 2 describes the design and hypotheses of the PITSTOP suicide study at both the professional and organizational level. We hypothesize that attitudes, knowledge, skills, competence and confidence of mental health care professionals towards suicidal behavior are more likely to improve by the application of an e-learning supported Train-the-Trainer program when compared to implementation as usual. Chapter 3 describes how we assessed both the clinical and the cost outcomes at the patient level. We hypothesized that individual suicidal patients treated by professionals who were trained by would recover more quickly from suicidal ideation as compared with patients treated by professionals who were not trained via our intervention. Next, we examined whether our intervention can be regarded as cost-effective compared to implementation as usual with regard to change in suicide ideation and change in quality of life. Chapter 4 offers a detailed description of the rationale and outline of our intervention taking existing similar programs and international research into account. Chapter 5 reports the results of our intervention on professionals thereby testing the hypotheses described in chapter 2. In chapter 6, we show the results of our intervention at the patient level as described in chapter 3. Cost-effectiveness outcomes are described in chapter 7. Via interviews with key players of mental health institutions we investigated the impact of our intervention on the implementation of the guideline, and the effects of the intervention at the organizational level to which we referred already in chapter 2. Chapter 9 provides a post-hoc evaluation of our e-learning module. The module was offered additional to the face-to-face training, and we aimed to describe the feasibility of e-learning among mental health professionals. The last part of the thesis focuses on the assessment of suicidal ideation. Chapter 10 offers a computer adaptive simulation on Beck Scale of Suicide Ideation. Chapter 11 further validates the Beck scale for Suicide Ideation by testing its measurement invariance. Chapter 12 tested the possible negative effect on mood of answering questions about suicide.

References

1. Grol R, Grimshaw J: **From best evidence to best practice: effective implementation of change in patients' care**. *The Lancet* 2003, **362**(9391):1225-1230.

2. Sackett DL, Rosenberg WM, Gray J, Haynes RB, Richardson WS: **Evidence based medicine: what it is and what it isn't**. *BMJ: British Medical Journal* 1996, **312**(7023):71.

3. Cochrane AL, Fellowship RC: **Effectiveness and efficiency: random reflections on health services**, vol. 900574178: Nuffield Provincial Hospitals Trust London; 1972.

4. Woolf SH, Grol R, Hutchinson A, Eccles M, Grimshaw J: **Clinical guidelines: potential benefits, limitations, and harms of clinical guidelines**. *BMJ: British Medical Journal* 1999, **318**(7182):527.

5. Tanenbaum SJ: **Evidence-based practice as mental health policy: Three controversies and a caveat**. *Health Affairs* 2005, **24**(1):163-173.

6. van Zorg RK, Klazinga N, Geneeskunde S, Nies H, van Bestuur VR, Vilans UP, Schuurmans MJ: **Een visie op richtlijnontwikkeling in Nederland**. *Den Haag: Regieraad Kwaliteit van Zorg* 2010.

7. Weinmann S, Koesters M, Becker T: **Effects of implementation of psychiatric guidelines on provider performance and patient outcome: systematic review**. *Acta Psychiatrica Scandinavica* 2007, **115**(6):420-433.

8. Hutschemaekers GJ: **Multidisciplinary guidelines in Dutch mental health care: plans, bottlenecks and possible solutions**. *Internationa Journal of Integrated Care* 2003, **3**.

9. Williams D, Garner J: **The case against 'the evidence': a different perspective on evidence-based medicine**. *The British Journal of Psychiatry* 2002, **180**(1):8-12.

10. van Hemert AM, Kerkhof AFJM, de Keijser J, verwey B: **Multidisciplinaire richtlijn voor diagnostiek en behandeling van suïcidaal gedrag.** Utrecht: Nederlandse Vereniging voor Psychiatrie/ Nederlands Instituut voor Psychologen/Trimbos Instituut; 2012.

11. Fisher CB, Pearson JL, Kim S, Reynolds.**Ethical issues in including suicidal individuals in clincial research**. *IRB: Ethics and Human Research* 2002, **24** (5):9-14.

12. Pearson JL, Stanley B, King CA, Fisher CB: **Intervention research with persons at high risk for suicidality: safety and ethical considerations**. *Journal of Clinical Psychiatry* 2001.

13. Lakeman R, FitzGerald M: **The ethics of suicide research: The views of ethics committee members**. *Crisis: The Journal of Crisis Intervention and Suicide Prevention* 2009, **30**(1):13.

14. Richards DA, Hamers JP: **RCTs in complex nursing interventions and laboratory experimental studies**. *International journal of nursing studies* 2009, **46**(4):588-592.

15. Franx G, Niesink P, Swinkels J, Burgers J, Wensing M, Grol R: **Ten years of multidisciplinary mental health guidelines in the Netherlands**. *International Review of Psychiatry* 2011, **23**(4):371-378.

16. CBS: **http://statline.cbs.nl/statweb//**. 2013.

17. Hoeymans N, Schoemaker C, Hoeymans N, Verkenningen VT: **De ziektelast van suïcide en suïcidepogingen**. *De Bilt: RIVM* 2010.

18. van Spijker BA, van Straten A, Kerkhof AJ, Hoeymans N, Smit F: **Disability weights for suicidal thoughts and non-fatal suicide attempts**. *Journal of Affective Disorders* 2011, **134**(1):341-347.

19. de Groot, MH, de Keijser J, Neeleman, J: **Grief shortly after suicide and natural death: a comparative study among spouses and first-degree relatives.** *Suicide and Life Threatening Behavior* 2006, **36**(4): 418-431

20. Kim CD, Sequin M, Therrien N, Riopel G, Chawky N, Lesage AD, Turecki G: **Familial aggregation of suicidal behavior: a family study of male suicide completers from the general population.** *The American Journal of Psychiatry,* 2005, **162**(5).

21 Lanting L, Hoeymans N: **Let op letsels. Preventie van ongevallen, geweld en suicide**: Rijksinstituut voor Volksgezondheid en Milieu RIVM; 2008.

22. Platt S, McLean J, McCollam A, Blamey A, Mackenzie M, McDaid D, Maxwell M, Halliday E, Woodhouse A: **Evaluation of the first phase of Choose Life: the national strategy and action plan to prevent suicide in Scotland**: Scottish Executive Social Research Edinburgh; 2006.

23. McDaid D, Kennelly B: **An economic perspective on suicide across the five continents**: Oxford University Press; 2009.

24. Kleine-Budde K, Müller R, Kawohl W, Bramesfeld A, Moock J, Rössler W: **The cost of depression – A cost analysis from a large database**. *Journal of affective disorders* 2013, **147**(1):137-143.

25. O'Connor RC, Platt S, Gordon J: **International handbook of suicide prevention: research, policy and practice**: John Wiley & Sons; 2011.

26. van Spijker BA, Majo MC, Smit F, van Straten A, Kerkhof AJ: **Reducing suicidal ideation: cost-effectiveness analysis of a randomized controlled trial of unguided web-based self-help**. *Journal of medical Internet research* 2012, **14**(5).

27. Huisman A, Robben P, Kerkhof A: **An examination of the Dutch Health Care Inspectorate's supervision system for suicides of mental health care users**. *Psychiatric Services* 2009, **60**(1):80-85.

28. Verwey B, Waarde Jv, Rooij Iv, Gerritsen G, Zitman FG: **[Guidelines in Dutch mental health institutions for dealing with persons attempting suicide]**. 2007.

29. Bool M, Doeven M: **Verminderen van suïcidaliteit: beleidsadvies: actualisering van het Advies inzake Suïcide, Gezondheidsraad 1986**: Trimbos-Instituut; 2007.

30. Huisman A, Robben PB, Kerkhof AJ: **Mental health reforms in Europe: further evaluation of the Dutch supervision system for suicides of mental health care users**. *Psychiatric services* 2013, **64**(1):10-12.

31. Jacobs D, Brewer M: **APA practice guideline**. *Psychiatric Annals* 2004, **34**(5):373.

32. Group NZG: **The assessment and management of people at risk for suicide** In. Wellington: New Zealand Guideline Group; 2003.

33. Health NCCfM: **Self-harm: the short-term physical and psychological management and secondary prevention of self-harm in primary and secondary care**. *National Institute for Health and Clinical Excellence website Available at: http://www nice org uk/nicemedia/pdf/CG016NICEguideline pdf Updated July* 2004.

34. McLean J, Maxwell M, Platt S, Harris F, Jepson R: **Risk and protective factors for suicide and suicidal behavior: a literature review**. *Health and Community Care, Scottish Government Social Research Scottish Government* 2008.

35. Leitner M, Barr W, Hobby L: **Effectiveness of interventions to prevent suicide and suicidal behavior: a systematic review**: Scottish Government; 2008.

36. Goldney R: **Suicide prevention**. Oxford: Oxford University Press; 2008.

37. Williams JMG, Williams M: **Cry of pain: Understanding suicide and self-harm**: Penguin Books London; 1997.

38. Shea SC: **The chronological assessment of suicide events: a practical interviewing strategy for the elicitation of suicidal ideation**. *Journal of Clinical Psychiatry* 1998, **59**:58-72.

39. Grol R, Grimshaw J: **Evidence-based implementation of evidence-based medicine**. *The Joint Commission journal on quality improvement* 1999, **25**(10):503-513.

40. Australian R: **Australian and New Zealand clinical practice guidelines for the management of adult deliberate self-harm**. *Australian and New Zealand Journal of Psychiatry* 2004, **38**(11-12):868-884.

41. Shafran R, Clark D, Fairburn C, Arntz A, Barlow D, Ehlers A, Freeston M, Garety P, Hollon S, Ost L: **Mind the gap: Improving the dissemination of CBT**. *Behavior Research and Therapy* 2009, **47**(11):902-909.

42. Grol R: **Successes and failures in the implementation of evidence-based guidelines for clinical practice**. *Medical care* 2001, **39**(8):II-46-II-54.

43. Schuster MA, McGlynn EA, Brook RH: **How good is the quality of health care in the United States?** *Milbank Quarterly* 2005, **83**(4):843-895.

44. van Splunteren P, Hermens M: **Van kennis naar actie. Toepassing van richtlijnen in de ggz**. *Gedragstherapie* 2011, **44**(4):285.

45. Cochrane LJ, Olson CA, Murray S, Dupuis M, Tooman T, Hayes S: **Gaps between knowing and doing: understanding and assessing the barriers to optimal health care**. *Journal of Continuing Education in the Health Professions* 2007, **27**(2):94-102.

46. Sinnema H, Franx, G., Op 't Land, H.: **Multidisciplinaire richtlijnen in de GGZ. Themarapportage. [reporting trends in mental health care. in Dutch]**. In. Edited by Institute T. Utrecht: Trimbos Institute; 2009.

47. Grimshaw JM, Eccles MP: **Is evidence-based implementation of evidence-based care possible?** *Medical Journal of Australia* 2004, **180**(6):S50.

48. Schouten LM, Hulscher ME, van Everdingen JJ, Huijsman R, Grol RP: **Evidence for the impact of quality improvement collaboratives: systematic review**. *Bmj* 2008, **336**(7659):1491-1494.

49. de Beurs DP, de Groot MH, de Keijser J, Verwey B, Mokkenstorm J, Twisk JW, van Duijn E, van Hemert AM, Verlinde L, Spijker10 J: **Improving the application of a practice guideline for the assessment and treatment of suicidal behavior by training the full staff of psychiatric departments via an e-learning supported Train-the-Trainer program: study protocol for a randomized controlled** *BMC trials* 2013, **14**(9).

50. Knowles MMS: **The modern practice of adult education**, vol. 41: Association Press New York; 1970.

51. Rogers EM: **Diffusion of innovations**: Simon and Schuster; 2010.

52. Means B, Toyama Y, Murphy RF, Baki M: **The Effectiveness of Online and Blended Learning: A Meta-Analysis of the Empirical Literature**. *Teachers College Record* 2013, **115**:1-47.

53. Pearce J, Mann MK, Jones C, van Buschbach S, Olff M, Bisson JI: **The most effective way of delivering a Train-the-Trainers program: A systematic review**. *Journal of Continuing Education in the Health Professions* 2012, **32**(3):215-226.

54. King KA, Smith J: **Project SOAR: a training program to increase school counselors' knowledge and confidence regarding suicide prevention and intervention**. *Journal of School Health* 2000, **70**(10):402-407.

55. Isaac M, Elias B, Katz LY, Belik S-L, Deane FP, Enns MW, Sareen J: **Gatekeeper training as a preventative intervention for suicide: a systematic review**. 2009.

56. Wyman PA, Brown CH, Inman J, Cross W, Schmeelk-Cone K, Guo J, Pena JB: **Randomized trial of a gatekeeper program for suicide prevention: 1-year impact on secondary school staff**. *Journal of consulting and clinical psychology* 2008, **76**(1):104.

57. Stuart C, WAALEN PhD JK, Haelstromm E: **Many helping hearts: An evaluation of peer gatekeeper training in suicide risk assessment**. *Death studies* 2003, **27**(4):321-333.

58. Joffe P: **An empirically supported program to prevent suicide in a college student population**. *Suicide and Life-Threatening Behavior* 2008, **38**(1):87-103.

59. Capp K, Deane FP, Lambert G: **Suicide prevention in Aboriginal communities: Application of community gatekeeper training**. *Australian and New Zealand Journal of Public Health* 2001, **25**(4):315-321.

60. Matthieu MM, Cross W, Batres AR, Flora CM, Knox KL: **Evaluation of gatekeeper training for suicide prevention in veterans**. *Archives of Suicide Research* 2008, **12**(2):148-154.

61. Gullestrup J, Lequertier B, Martin G: **MATES in construction: impact of a multimodal, community-based program for suicide prevention in the construction industry**. *International journal of environmental research and public health* 2011, **8**(11):4180-4196.

62. Chagnon F, Houle J, Marcoux I, Renaud J: **Control- Group Study of an Intervention Training Program for Youth Suicide Prevention**. *Suicide and Life-Threatening Behavior* 2007, **37**(2):135-144.

63. Oordt MS, Jobes DA, Fonseca VP, Schmidt SM: **Training mental health professionals to assess and manage suicidal behavior: Can provider confidence and practice behaviors be altered?** *Suicide and Life-Threatening Behavior* 2009, **39**(1):21-32.

64. Appleby L, Morriss R, Gask L, Roland M, Lewis B, Perry A, Battersby L, Colbert N, Green G, Amos T: **An educational intervention for front-line health professionals in the assessment and management of suicidal patients (The STORM Project)**. *Psychological Medicine* 2000, **30**(4):805-812.

65. Hawton K, van Heeringen K: **Suicide**. *The Lancet* 2009, **373**(9672):1372-1381.

66. Rutz W, Knorring vL, Wälinder J: **Frequency of suicide on Gotland after systematic postgraduate education of general practitioners**. *Acta Psychiatrica Scandinavica* 1989, **80**(2):151-154.

67. Hegerl U, Mergl R, Havers I, Schmidtke A, Lehfeld H, Niklewski G, Althaus D: **Sustainable effects on suicidality were found for the Nuremberg alliance against depression**. *European archives of psychiatry and clinical neuroscience* 2010, **260**(5):401-406.

68. Szanto K, Kalmar S, Hendin H, Rihmer Z, Mann JJ: **A suicide prevention program in a region with a very high suicide rate**. *Archives of General Psychiatry* 2007, **64**(8):914.

69. Knox KL, Litts DA, Talcott GW, Feig JC, Caine ED: **Risk of suicide and related adverse outcomes after exposure to a suicide prevention programme in the US Air Force: cohort study**. *Bmj* 2003, **327**(7428):1376.

70. Knox KL, Pflanz S, Talcott GW, Campise RL, Lavigne JE, Bajorska A, Tu X, Caine ED: **The US Air Force suicide prevention program: implications for public health policy**. *American journal of public health* 2010, **100**(12):2457.

71. Ruiz JG, Mintzer MJ, Leipzig RM: **The impact of e-learning in medical education**. *Academic medicine* 2006, **81**(3):207-212.

72. Cook DA, Levinson AJ, Garside S, Dupras DM, Erwin PJ, Montori VM: **Internet-based learning in the health professions**. *JAMA: the journal of the American Medical Association* 2008, **300**(10):1181-1196.

73. Maloney S, Chamberlain M, Morrison S, Kotsanas G, Keating JL, Ilic D: **Health Professional Learner Attitudes and Use of Digital Learning Resources**. *Journal of medical Internet research* 2013, **15**(1).

74. Fairburn CG, Patel V: **The Global Dissemination of Psychological Treatments: A Road Map for Research and Practice**. *American Journal of Psychiatry* 2014, **171**(5):495-498.

75. Embretson SE, Reise SP: **Item response theory**: Psychology Press; 2000.

76. van der Linden WJ, Hambleton RK: **Handbook of modern item response theory**: Springer; 1997.

PART 1

DESCRIPTION OF THE INTERVENTION AND DESIGN OF THE TRIAL

CHAPTER 2

IMPROVING THE APPLICATION OF A PRACTICE GUIDELINE FOR THE ASSESSMENT AND TREATMENT OF SUICIDAL BEHAVIOR BY TRAINING THE FULL STAFF OF PSYCHIATRIC DEPARTMENTS VIA AN E-LEARNING SUPPORTED TRAIN-THE-TRAINER PROGRAM: STUDY PROTOCOL FOR A RANDOMIZED CONTROLLED TRIAL

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Abstract

Background

In 2012, in The Netherlands a multidisciplinary practice guideline for the assessment and treatment of suicidal behavior was issued. The release of guidelines often fails to change professional behavior due to multiple barriers. Structured implementation may improve adherence to guidelines. This article describes the design of a study measuring the effect of an e-learning supported Train-the-Trainer program aiming at the training of the full staff of departments in the application of the guideline. We hypothesize that both professionals and departments will benefit from the program.

Method

In a multicenter cluster randomized controlled trial, 43 psychiatric departments spread over 10 regional mental health institutions throughout The Netherlands will be clustered in pairs with respect to the most prevalent diagnostic category of patients and average duration of treatment. Pair members are randomly allocated to either the experimental or the control condition. In the experimental condition, the full staff of departments, that is, all registered nurses, psychologists, physicians and psychiatrists (n = 532, 21 departments) will be trained in the application of the guideline, in a one-day small interactive group Train-the-Trainer program. The program is supported by a 60-minute e-learning module with video vignettes of suicidal patients and additional instruction. In the control condition (22 departments, 404 professionals), the guideline shall be disseminated in the traditional way: through manuals, books, conferences, internet, reviews and so on. The effectiveness of the program will be assessed at the level of both health care professionals and departments.

Discussion

We aim to demonstrate the effect of training of the full staff of departments with an e-learning supported Train-the-Trainer program in the application of a new clinical guideline. Strengths of the study are the natural setting, the training of full staff, the random allocation to the conditions, the large scale of the study and the willingness of both staff and management to participate in the study.

Trial registration

Dutch trial register: NTR3092

Keywords

Guideline, Implementation, Suicide prevention, Train-the-Trainer, e-learning, Healthcare professionals

Background

Suicide is a significant public health issue representing 1.8% of the global burden of disease [1]. The Netherlands ranks among the lower rates with 9.4 suicides per 100,000 inhabitants or approximately 1,500 to 1,600 cases annually [2]. Around 44% of these suicides involve patients in contact with mental health care services [3]. There is limited consensus on how to assess and treat suicidal patients [4]. As a consequence, suicidal patients may not always receive evidence-based care [5,6]. The Dutch Ministry of Health, Welfare and Sports (VWS) commissioned the development of an evidence-based multidisciplinary practice guideline for the assessment and treatment of suicidal behavior (further abbreviated PGSB), which was issued in early 2012 [7]. Adherence to guidelines, however, is not self-evident, due to multiple barriers at both professional and organizational levels. An extensive systematic review of implementation studies identified many barriers at both levels, such as lack of knowledge, and poor outcome expectations at the professional level. Material support, funding and time were found to be common barriers at the organizational level [8].

Grol and Grimshaw found that structured implementation can improve adherence to guidelines [9]. They argue that behavior change is more likely when the intervention is tailored to specific settings and target groups.

A recent systematic review of psychiatric practice guidelines found a modest effect of guideline implementation on provider performance and patient outcome [10]. The authors argue that ongoing support and feedback are effective in changing professional behavior. As suicide prevention in mental health care is essentially the work of multidisciplinary teams [7], and teamwork plays an important role in ensuring patients' safety and avoiding errors [11], it is advised to train in multidisciplinary teams and to train the full staff of the team [11, 12]. When implementing guidelines in a medical setting, a combination of small group interactive postgraduate training, including personalized feedback, and additional instruction material, such as a website, was found to be more successful than a single-faceted intervention [9, 13, 14]. Finally, e-learning is said to complement face-to-face training in a medical setting; it was found to help medical students become more actively involved in the study material and thereby help to internalize the material [15, 16].

Combining these findings, we developed a practical and multifaceted, small interactive group, e-learning supported Train-the-Trainer program (TtT-e) to be delivered to full staff of the departments called PITSTOP suicide (Professionals In Training to STOP suicide). Its content reflects the PGSB. The method of instruction is role play with personalized feedback and instructions by the trainers. The content of the role plays is tailored by the trainers to the specific patient category with which the trainees work on a daily basis in their respective departments. The Train-the-Trainer model of small group interactive educational training is based on Adult Learning Theory [17], which states that people who train others remember 90% of what they teach others, and on the Diffusion of Innovation Theory stating that people adopt new information better through their trusted social networks [18]. The effectiveness of a Train-the-Trainer model is expected since the profits of training by peer-assisted learning in medical health education are comparable to those achieved by professional teachers [19-24]. The Train-the-Trainer program is supported by an e-learning module to complement and prolong the effect of the training.

The PITSTOP suicide study is a cluster randomized controlled trial examining the effect of the TtT-e program on adherence to the PGSB compared with regular guideline dissemination (that is, easy access to guidelines from websites of involved associations, reviews in clinical journals, presentation at conferences, books and manuals), further abbreviated IAU (implementation as usual). The effects are to be examined at the professional and departmental level. We hypothesize that attitudes, knowledge, skills, competence and confidence of mental health care professionals towards suicidal behavior are more likely to improve by the application of the TtT-e program (further abbreviated IAU + TtT-e) than by IAU. Further, we hypothesize that the application of IAU + TtT-e results in better guideline adherence at a departmental level than IAU.

Method

Design

This is a multicenter cluster randomized controlled trial in which different psychiatric departments from multiple mental health institutions are clustered and randomized.

Mental health institution

A mental health institution (MHI) is a regional organization that hosts many different psychiatric departments. In The Netherlands there are 30 MHIs spread throughout the country. Each MHI has its own catchment area of patients and its own professionals [25]. For example, in 2011, MHI Rivierduinen had a catchment area of 1.1 million people within an area of approximately 1,500 square kilometers in the region of South Holland. MHI Rivierduinen hosted 44 different psychiatric departments that together treated 24,753 patients and employed 2,726 employees [26].

Psychiatric department

A psychiatric department is an independent unit within an MHI. It is an organizational unit with its own management and professional structure. Employees do not work in two departments at the same time. Within one department, patients with various diagnostic categories are treated. However, most departments have one primary diagnostic category that they treat the most, such as depression or personality disorders.

Recruitment

Recruitment of MHIs took place during meetings and conferences on suicide prevention in The Netherlands in the two years before the study started. Attending professionals were invited to participate with their MHI in the study. When MHIs expressed willingness to participate, they were requested to indicate at least two departments for inclusion. The MHIs were explicitly asked to provide departments that were hosted in separate buildings or on separate locations with the assurance that staff members were not exchanged or shared in between the departments, to prevent possible exchange of training material. This resulted in 43 participating departments distributed over 10 MHIs (Figure 1).

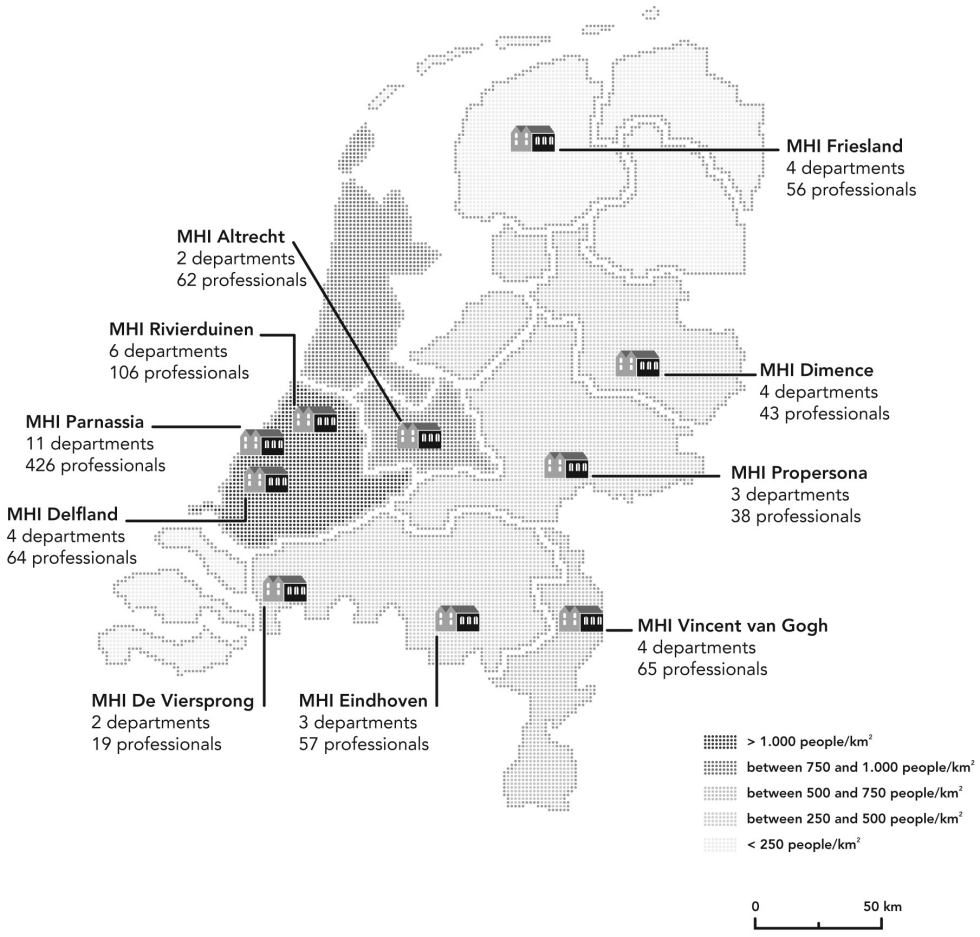

Figure 1 Overview of the 10 MHIs. Annotated are the number of departments and the total number of professionals attending PITSTOP suicide per MHI

Departments for adult patient care (>18 years) that were willing to participate were considered eligible for inclusion if: a) the need for training in suicide prevention skills is acknowledged by both the team of professionals and b) by the department's management, and c) actively supported by the board of the MHI; d) departments are prepared to deal with the demands made by the study (production loss due to the training, requirements for data collection, time needed to study the e-learning module and so on, willingness to be randomized and acceptance of a 50% change of being trained immediately, and a 50% change of a delay of training; e) departments are prepared to meet the demand of 100% participation of individual professionals in multidisciplinary training sessions; f) participating departments were located at separate locations, and that personnel was not exchanged

between departments (for example, departments do not share the same psychiatrist).

Each department eligible to join our study was asked to give the following information: prevalence of diagnostic categories, average treatment duration of patients in days, number of new patients admitted a year, and number of registered professionals. For example, an outpatient department of MHI Propersona reported that 70% of their patients have a diagnosis of depression, 10% a diagnosis of borderline, 5% a diagnosis of somatoform disorder, and that 15% have other diagnoses. They treat 200 new patients a year with a team of five psychologists, five psychiatrists and two nurses. The average treatment duration is 365 days. An overview of the information provided by the departments per MHI is shown in Table 1.

Table 1: Information received from departments: total professionals, number of nurses, psychologists, MD, average stay of patients in days, main diagnoses

Overview departments

MHC Delfland

Department	Prof	Nurse	Psycho	MD	Average stay	Main diagnoses
inpatient	11	8	0	3	1532	depression
outpatients	24	7	9	7	624	depression
Inpatient	13	11	0	2	1308	depression
Elderly	16	9	10	8	740	depression

MHC Parnassia

Department	Profs	N	Psy	MD	Average stay	Main diagnoses
outpatients	59	36	0	23	21	depression
acute	63	50	0	13	16	depression
long stay	29	18	9	2	250	borderline
Elderly	110	80	9	21	41	depression
outpatients	8	5	0	3	90	depr/bord/crisis
crisis center	47	28	0	19	1	depr/bord/crisis
inpatients	36	29	0	7	NA	depression
outpatients	8	0	2	6	240	addiction
elderly	22	14	3	5	730	dementia/depression
outpatients	32	19	5	8	700	dementia/depression
elderly	12	7	3	2	371	depression

MHC Eindhoven

Department	Profs	N	Psy	MD	Average stay	Main diagnoses
outpatients	9	0	4	5	150	depressie
crisis center	32	25	0	7	104	depr/bord/crisis
personality	16	14	0	2	305	personality

MHC Vincent van Gogh

Department	Profs	N	Psy	MD	Average stay	Main diagnoses
outpatient	13	10	1	2	172	personality
neuropsychiatry	22	14	4	4	96	mood disorders
inpatients	17	14	0	3	20	personality
outpatient	13	10	0	3	54	personality

MHC Dimence

Department	Profs	N	Psy	MD	Average stay	Main diagnoses
inpatient	16	11	0	4	NA	depression
personality	13	4	7	2	400	personality
outpatients	9	2	5	2	400	depression
consultation	5	2	0	3	1	depr/bord/crisis

MHC Altrecht

Department	Profs	N	Psy	MD	Average stay	Main diagnoses
elderly	20	18	0	2	42	depr/bord/crisis
elderly	42	26	9	7	150	depr/bord/crisis

MHC Friesland

Department	Profs	N	Psy	MD	Average stay	Main diagnoses
elderly	24	22	0	2	582	depression
elderly	18	11	2	5	814	depression
elderly	7	6	0	1	743	depression
elderly	7	4	1	2	602	depression

MHC Pro Persoona

Department	Profs	N	Psy	MD	Average stay	Main diagnoses
crisis center	12	9	0	3	1	depr/bord/crisis
crisis center	13	4	0	9	1	depr/bord/crisis
depression	13	3	5	5	365	depression

MHC Rivierduinen

Department	Profs	N	Psy	MD	Average stay	Main diagnoses
eating disorders	31	0	23	8	180	eating disorders
personality	20	8	9	3	270	personality disorders
inpatient	15	13	0	2	35	depression
personality	10	5	3	2	240	personality disorders
crisis center	10	NA	NA	NA	NA	depr/bord/crisis
outpatient	20	NA	NA	NA	NA	personality disorders

MHC de Viersprong

Department	Profs	N	Psy	MD	Average stay	Main diagnoses
personality	14	6	5	3	244	personality disorders
personality	5	1	2	2	240	personality disorders

Prof, total number of professionals; N, number of nurses; Psy, number of psychologists; MD, number of medical doctors; average treatment, average treatment duration of patients in days, NA, not available

In sum, 936 professionals from 43 participating departments are registered to participate in the study (222 psychiatrists, 130 psychologists, 536 nurses, 48 not defined). Various types of mental health care departments are represented in the study (in- and out-patient care, acute crisis units and long stay departments) treating patients of various diagnostic categories (personality disorder, depressive disorder, anxiety disorder, psychotic disorder).

Matching procedure

1) The first criterion for matching departments was the most prevalent main diagnostic category. For instance, a department that reported that 60% of their patients had a main diagnosis of depression was matched with another department that reported a comparable percentage of depressive patients.
2) Within groups with comparable diagnostic categories we matched the departments with comparable average treatment duration of patients. We assumed that departments who treat similar types of patients for a similar duration of time are most likely to be comparable on the level of suicidality of their patients. A total of 34 departments were matched according to this procedure.
3) The remaining nine departments differed in a mix of diagnostic categories of patients from other departments so they could not be matched according to the diagnostic criterion. We matched these departments according to comparable treatment duration. We wanted all interested departments that met our inclusion criteria to be able to join the study.

By doing so, our study contains a representative sample of all Dutch psychiatric departments that deal with suicidal patients. In the final analysis we will study the sample with and without these last nine departments. We have sent all the pairs to an independent researcher not involved in the study to perform randomization of the matched pairs. Results of the matching procedure and the randomization can be found in Table 2. As our study is performed in a naturalistic setting, we could not match the departments as one can do in a laboratory situation. Still, we believe that our matching procedure is the best possible procedure we could use given the real life conditions. As we matched according to diagnostic criterion and treatment duration, the number of professionals might be uneven as the departments also differed in the number of professionals. A matching procedure where we matched departments on the number of professionals did not work because then the treatment duration and patient categories were unbalanced between pairs. Because of the large number of departments and professionals included in our study we expect that the difference between the number of professionals in the experimental and control conditions will be acceptable. We do not think this will have an influence on the results.

Table 2 Results of the matching procedure per department

Result matching					
MHI	**Department**	**Average treatment**	**Main diagnosis**	**Condition**	**Profs**
Delfland	Inpatient	1,532	Depression	EXP	11
Delfland	Inpatient	1,308	Depression	CON	13
Delfland	Outpatient	624	Depression	EXP	24
Dimence	Outpatient	600	Depression	CON	9
Parnassia	Outpatient	21	Depression	CON	59
Parnassia	Inpatient	16	Depression	EXP	63
Delfland	Older persons	740	Depression	CON	16
Parnassia	Older persons	730	Depression	EXP	22
Propersona	Crisis	1	Depr/bord/crisis	CON	12
Propersona	Crisis	1	Depr/bord/crisis	EXP	13
Parnassia	Inpatient	250	Personality	EXP	29
Dimence	Personality	400	Personality	CON	13
Dimence	Crisis	1	Depr/bord/crisis	EXP	5
Parnassia	Crisis	1	Depr/bord/crisis	CON	47
Friesland	Older persons	582	Depression	EXP	24
Friesland	Older persons	814	Depression	CON	18
Friesland	Older persons	743	Depression	EXP	7
Friesland	Older persons	602	Depression	CON	8
Parnassia	Outpatient	90	Depression	EXP	8
Parnassia	Outpatient	21	Depression	CON	36
Viersprong	Personality	240	Personality	CON	5
Eindhoven	Personality	300	Personality	EXP	16
Eindhoven	Outpatient	150	Depression	CON	9
Eindhoven	Inpatient	104	Depression	EXP	32
Rivierduinen	Inpatient	35	Depression	EXP	15
Rivierduinen	Outpatient	240	Depression	CON	10
Parnassia	Older persons	41	Depression (older persons)	EXP	110
Parnassia	Older persons	missing	Depression (older persons)	CON	36
Dimence	Inpatient	90	Depression	CON	16
Propersona	Outpatient	365	Depression	EXP	13
Altrecht	Older persons	42	Depr/bord/crisis	EXP	20
Altrecht	Older persons	150	Depr/bord/crisis	CON	42
Vincent VG	Outpatient	172	Personality	CON	13
Vincent VG	Outpatient	54	Personality	EXP	13
Rivierduinen	Personality	270	Personality	CON	20
Rivierduinen	Eating disorders	180	Eating disorders	EXP	31
Viersprong	Personality	244	Personality	EXP	14
Parnassia	Addiction	240	Addiction	CON	8
Rivierduinen	Crisis	missing	Depr/bord/crisis	EXP	10
Rivierduinen	Personality	missing	Personality	CON	20
Vincent VG	Neuropsychiatry	96	Mood disorder NOS	CON	22
Vincent VG	Inpatient	20	Schizophrenia	EXP	17
Parnassia	Older persons	371	Depression (older persons)	CON	12

Average treatment, average treatment duration of patients in days; EXP, experimental condition; CON, control condition; Profs, total number of professionals

Intervention

In the TtT-e program, three types of participants are involved: masters, trainers and trainees. Training is applied on two levels: first, trainers are trained by masters. Subsequently, trainees are trained by trainers. All training sessions are supported by an e-learning module. The TtT-e program as applied by masters is similar to the program applied by trainers.

Masters are experts in the field of suicide prevention due to scientific performance and clinical practice. Trainers are mental health care workers of various disciplines (psychiatrists, psychologists or mental health nurses). They are selected by their management from the clinical staff of departments participating in the PITSTOP-study. Trainers have good training skills, know how to direct role plays, are prepared to train their co-workers and have been selected to serve as a role model on an institutional level and to provide future additional training after all training sessions in the study have been completed. Importantly, they are able to tailor the role plays of the TtT-e program to the needs of the specific patient category of their department. The trainers are instructed to combine the content of the TtT-e program with actual cases from their units. After the study, trainers are expected to continue their role as experts in suicide prevention skills, since on-going support and feedback when implementing psychiatric guidelines are likely to be effective [10].

The TtT-e program reflects the Dutch multidisciplinary guideline on the assessment and treatment of suicidal behavior [7]. The guideline combines the stress-diathesis model [27] and the entrapment model of suicidal behavior [28] to explain the onset and maintenance of suicidal behavior. The combined model depicts suicidal behavior as the outcome of a process that is influenced by the interaction of biological, psychological, environmental and situational factors the interaction of which may lead to entrapment. Entrapment is defined as the specific situation that characterizes suicidal behavior and the specific emotional condition of it. The empirical evidence for the PGSB reflects the international reviews [29-32].

The TtT-e program is supported by two e-learning modules. The first module is developed for the trainees. It consists of video vignettes in which experienced nurses, psychologists and psychiatrists interact with suicidal patients, played by actors, to teach the guideline recommendations. The role playing characters are of various ages, gender and diagnostic categories and they display prototypical suicidal symptoms, cognitions and interaction problems. In between vignettes, guideline topics and recommendations are explained by masters (that is, experts on the topic). Trainees have personalized access to the e-learning module, which can be viewed repeatedly. The total running time of the module is 60 minutes.

In addition to the e-learning module for all the trainees, a second e-learning module was developed specifically for trainers. It provides a video tape of the first training session provided by masters to trainers which was processed into an e-learning format that allows trainers to review the exercises. All trainers were instructed to follow the training protocol manual when

training trainees. To survey the adherence to the TtT-e program of trainers, graduate students will randomly visit training sessions. They rate the adherence on a Likert type scale. The scores will be used as a covariate when analyzing the effects of the training.

The difference between an experimental and a control department is that the full staff of the experimental department is trained and the staff of the control department is not trained. The training itself cannot be exchanged between these departments since it consists of a one day training including role playing and direct feedback. What we do not want to be exchanged are the e-learning module, the PowerPoint presentation and written training materials. Professionals in the intervention condition are clearly instructed not to share or distribute training materials with peers, particularly not with peers that work in the control departments. Also, access to the e-learning module is protected with a personalized login code.

Measurements

The study design and assessment schedule are summarized in Figure 2. The effect of IAU + TtT-e versus IAU will be assessed at the level of professionals and departments.

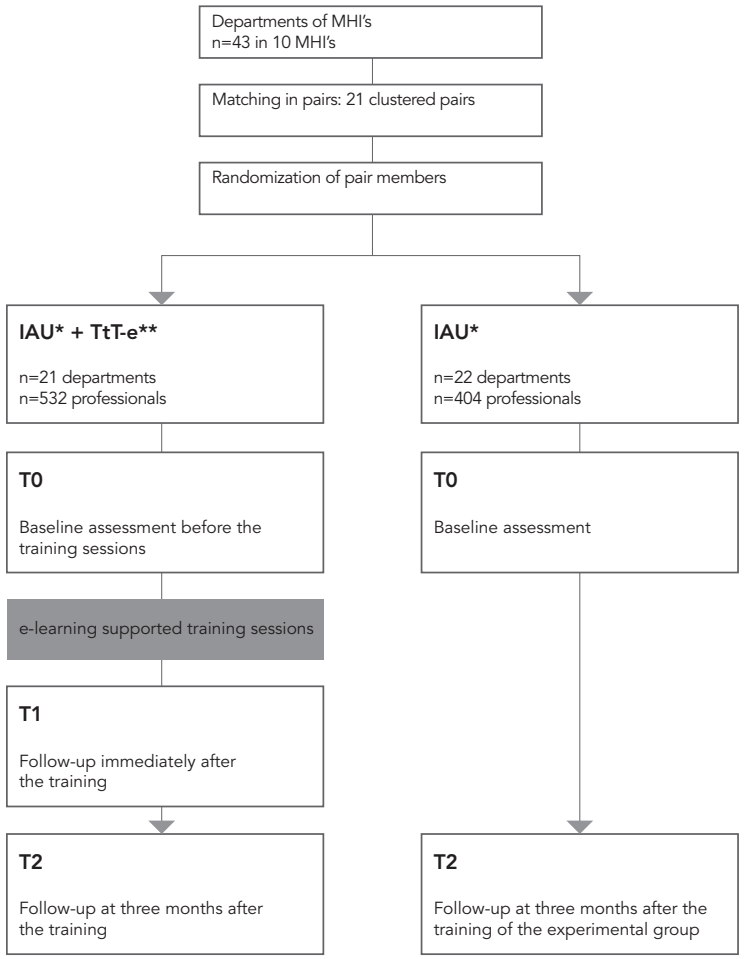

Figure 2 PITSTOP SUICIDE study design.
* IAU, implementation as usual. ** TtT-e, e-learning supported Train the trainer program.

A link to the assessment will be sent to participants by e-mail. Each participant will be asked to provide an online informed consent form before entering the study.

After completing baseline assessment (T0), participants in the intervention condition have access to the one-day training session and the e-learning module. Follow-up assessment takes place immediately after the training (T1) (participants in the intervention condition) and, subsequently, at three months (T2) after the training. To promote attendance of all professionals

in the experimental teams, professional credits, necessary to become or to remain registered as a professional, are awarded.

Measures at professional level

Measures at professional level concern skills, knowledge, confidence and attitudes of professionals. All scales have been translated into Dutch.

Self-evaluation of knowledge will be assessed by a sub-scale of the 14-item QPR questionnaire (Question, persuade, refer questionnaire [33]). The sub-scale has been found to measure differences in how professionals rate their knowledge of suicide prevention before and after training [33, 34]. Example: "How do you rate your knowledge on suicide prevention?" Scores range from 1(very low) to 5 (very high).

Provider confidence and beliefs is assessed by a six-item questionnaire (Confidence and Beliefs Questions [35]) that has been shown to be able to measure changes in confidence in suicidal behavior management (for example, 'I am confident in my ability to successfully assess a suicidal patient'). Scores range from 1 (not confident at all) to 5 (very confident).

The ability of professionals to recognize the appropriate response to suicidal patients was measured with the validated 25-item translation [36] of the Suicide Intervention Response Inventory-version 2 (SIRI-2) [37]. Participants have to rate the appropriateness of two "helper" responses on a "client" remark. Rating ranges from −3 (not appropriate at all) to 3 (very appropriate). We use a Visual Analogue Scale instead of the scoring from −3 to 3 to make the SIRI more user-friendly for on-line use.

Guideline adherence by professionals is established by having participants respond to video vignettes in which experienced nurses, psychologists and psychiatrists interact with suicidal characters, played by actors. The video fragments last 30 seconds. Then, professionals are asked to rate the likelihood that they would respond with any of the 25 different interventions on a Visual Analogue Scale (ranging from 1 to 100). For example: 'Ask whether the patient thinks about suicide', 'Ask how hopeless the patient is feeling'. At T0, T1 and T2, the same vignettes are displayed. An expert panel of masters who were involved in the guideline development will also complete the video vignettes. Their scores will serve as reference scores for "excellent guideline adherence". Scores of participants in the intervention group will be compared with scores of the control group, and with 'Excellent guideline adherence' scores of masters. The smaller the difference between the scores by the expert panel and the participant, the better the participant scores on guideline adherence.

Guideline adherence at departmental level will be assessed in both the control and experimental condition one year after the experimental group of the matched pair has completed the PITSTOP intervention. This will be done by NEDKAD (the Dutch Knowledge Center for Anxiety and Depression). For over four years, NEDKAD examines adherence to psychiatric guidelines in different MHIs and departments, using a specific protocol of 10 questions, for example, 'To what extent is the staff informed about the guideline?' and 'How are guideline recommendations translated into practice?' The NEDKAD procedure is a well-known protocol in The Netherlands for examining guideline adherence in mental health care. It is used as an instrument to assess guideline adherence for the treatment of anxiety and depression. As such, it is used as a regular independent assessment of the quality of care of departments specialized in the treatment of anxiety and depression. It is accepted by the Dutch MHI centers. Ten questions are being answered and scored by two independent assessors. The approach has not yet been published. We aim to further develop and systematize the instrument for measuring adherence to the suicide guideline. We will collaborate with NEDKAD.

Statistical analysis

Our study is a design with different levels. For the outcomes on the professional level we have repeated observations (level 1) that are nested within trainees (level 2). Trainees are nested within trainers (level 3), trainers within departments (level 4) and departments are nested within MHIs (level 5). For the analysis on an organizational level we have departments that are nested within MHIs. Multilevel models are hierarchal systems that estimate random coefficients and variance components for each level. Random intercepts will be included in the multilevel models [38].

Approval from the Medical Ethics Committee of the VU University Medical Center (registration number 2011/151) was requested and obtained. We have sent the advice from the Medical Ethics Committee to the ethical committees of the participating departments so they could give their own reaction. All other committees agreed with the Ethics Committee of the VU.

Discussion

This paper describes the study protocol of a cluster randomized controlled trial measuring the effects of a practical and multifaceted, e-learning supported Train-the-Trainer model at the professional and departmental level. Strengths of the study are the natural setting, the training of the complete staff in the experimental condition, the random allocation to dissemination

conditions, the large scale of the study, and the willingness of both staff and management to participate in the study.

Spill-over of training material to the control conditions is a potential risk of our design. By making sure that experimental and control departments are on different locations and do not share personnel, by restricting the e-learning module with a personal login code and by instructing trainees not to spread any material among peers in the control condition, we minimize contamination.

Up until now, willingness of both management and employees to participate in the TtT-e program is excellent. Boards of the participating centers provided consent and reserved time to elaborate upon the project with the research team. The first training was given in January 2012, and the final training will be given around November 2012. Results will be available in the beginning of 2013.

We included many different departments in our study. What all departments have in common is that they have a bottom-up wish for improving their skills in suicide prevention. From the literature we know that this is an important factor for success [12]. As a result of this study, we will know that for groups with a bottom-up need for training and top-down support, PITSTOP suicide is or is not an effective method to implement the guideline among professionals.

Abbreviations

NEDKAD, the Dutch Knowledge Center for Anxiety and Depression; IAU, implementation as usual; MHI, Mental Health Institution; PGSB, multidisciplinary practice guideline for the assessment and treatment of suicidal behavior; PITSTOP, Professionals In Training to STOP suicide; TtT-e, e-learning supported Train-the-Trainer program; VWS, Dutch Ministry of Health Welfare and Sports

Competing interests

The authors declare that they have no competing interest.

Authors' contributions

AK, MdG, JM and JdK obtained funding for this study. DP and MdG drafted the manuscript and will carry out the study. DP designed the e-learning modules. MdG and AK designed the TtT-e protocol; AK, BH and

BV contributed to writing the manuscript. All authors contributed to the execution of the study, and approved the final draft.

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References

1. World Health Organization: *Mortality Database*. Geneva: WHO; 2003.

2. StatLine Database: *Statistics Netherlands*. http://statline.cbs.nl/statweb.

3. Huisman A: *Learning from Suicides. Towards an Improved Supervision Procedure of Suicides in Mental Health Care*. Amsterdam: Vrije Universiteit; 2010.

4. Bool M, Blekman J, De Jong S, Ruiter M, Voordouw I: *Verminderen van suïcidaliteit. Actualisering van het Advies inzake Suïcide Gezondheidsraad 1986*. Utrecht: Trimbos Instituut; 2007.

5. Sahfran R, Clark DM, Fairburn CG, Arntz A, Barlow DH, Ehlers A, Freeston M, Garety PA, Hollon SD, Ost LG, Salkovskis PM, Williams JM, Wilson GT: **Mind the gap: improving the dissemination of CBT.** *Behav Res Ther* 2009, **47**:902–909.

6. Balkom T, Oostervaan D: **Leiden richtlijnen tot een betere klinische praktijk?** *Tijdschr Psychiatr* 2008, **50**:323–328.

7. Van Hemert A, Kerkhof A, de Keijser J, Verwey B: *Multidisciplinaire richtlijn voor diagnostiek en behandeling van suïcidaal gedrag*. Utrecht: Nederlandse Vereniging voor Psychiatrie/Nederlands Instituut voor Psychologen/Trimbos Instituut; 2012.

8. Cochrane LJ, Olson CA, Murray S, Dupuis M, Tooman T, Hayes S: **Gaps between knowing and doing: understanding and assessing the barriers to optimal health care.** *J Contin Educ Health Prof* 2007, **27**:94–102.

9. Grol R, Grimshaw J: **From best evidence to best practice: effective implementation of change in patients' care.** *Lancet* 2003, **362**:1225–1230.

10. Weinmann S, Koesters M, Becker T: **Effects of implementation of psychiatric guidelines on provider performance and patient outcome: systematic review.** *Acta Psychiatr Scand* 2007, **115**:420–433.

11. Baker DP, Gustafson S, Beaubien M, Salas E, Barach P: **Medical team training programs in health care**. In *Advances in Patient Safety: from Research to Implementation*. Edited by Henriksen K, Battles JB, Marks ES, Lewin DI. Rockville, Maryland, USA: AHRQ Publications; 2005.

12. Grol R, Grimshaw J: **Evidence-based implementation of evidence-based medicine.** *Jt Comm J Qual Improv* 1999, **25**:503–513.

13. Gross P, Greenfield S, Cretin S, Ferguson J, Grimshaw J, Grol R: **Optimal methods for guideline implementation.** *Med Care* 2001, **39**:II85–II92.

14. Bloom BS: **Effects of continuing medical education on improving physician clinical care and patient health: a review of systematic reviews.** *Int J Technol Assess Health Care* 2005, **21**:380–385.

15. Ruiz JG, Mintzer MJ, Leipzig RM: **The impact of e-learning in medical education.** *Acad Med* 2006, **81**:207–212.

16. Gormley GJ, Collings K, Boohan M, Bickle IC, Stevenson M: **Is there a place for e-learning in clinical skills? A survey of undergraduate medical students' experiences and attitudes.** *Med Teach* 2009, **31**:6–12.

17. Knowles M: *The Modern Practice of Adult Education: from Pedagogy to Andragogy*. New York: The Adult Education Company; 1980.

18. Rogers E: *Diffusion of Innovations*. 5th edition. New York: Free Press; 2003.

19. Topping KJ: **The effectiveness of peer tutoring in further and higher education: a typology and review of the literature.** *High Educ* 1996, **32**:321–345.

20. Fincher R, Simpson D, Mennin S, Rosenfeld G, Rothman A, McGrew M, Hansen PA, Mazmanian PE, Turnbull JM: **Scholarship in teaching. An imperative for the 21st century.** *Acad Med* 2000, **75**:887–894.

21. Goodfellow P, Schofield E: **Peer tutorials amongst medical students.** *Med Educ* 2001, **35**:1001–1002.

22. Perkins G, Hulme J, Bion J: **Peer-led resuscitation training for health care students: a randomised controlled study.** *Intensive Care Med* 2002, **28**:698–700.

23. Field M, Burke J, McAllister D, Loyd D: **Peer-assisted learning: a novel approach to clinical skills learning for medical students.** *Med Educ* 2007, **41**:411–418.

24. Cochrane L, Olson C, Murray S, Dupuin M, Tooman T, Hayes S: **Gaps between knowing and doing: understanding and assessing the barriers to optimal health care.** *J Contin Educ Health Prof* 2007, **27**:94–102.

25. GGZ Nederland: *GGZ instellingen in Nederland*. http://www.ggznederland.nl/de-ggz-sector/ggz-instellingen.html].

26. Rivierduinen: *Publieksjaarverslag*. 2011. http://www.rivierduinen.nl/~/media/_Rivierduinen/Organisatie/Publieksjaarverslag%202011.ashx.

27. Goldney D: *Suicide Prevention: a Practical Approach*. Oxford, UK: Oxford University Press; 2008.

28. Williams J, Barnhofer T, Duggan D: **Psychology and suicidal behavior: elaborating the entrapment model**. In *Prevention and Treatment of Suicidal Behavior: from Science to Practice*. Edited by Hawton K. Oxford, UK: Oxford University Press; 2005:71–78.

29. Wasserman D, Rihmer Z, Rujescu D, Sarchiapone M, Sokolowski M, Titelman D, Zalsman G, Zemishlany Z, Carli V, European Psychiatric Association: **The European Psychiatric Association (EPA) guidance on suicide treatment and prevention.** *Eur Psychiatry* 2012, **27**:129–141.

30. APA: *Practice Guideline for the Assessment and Treatment of Patients with Suicidal Behaviors*. Washington, DC: American Psychiatric Association; 2003.

31. New Zealand Guideline Group: *The Assessment and Management of People at Risk of Suicide*. Wellington: New Zealand Guideline Group; 2003.

32. McLean J, Maxwell M, Platt S, Harris F, Jepson R: *Risk and Protective Factors for Suicide and Suicidal Behavior*. Edinburgh: Scottish Government Social Research; 2008.

33. Tompkins T, Witt J: **The short-term effectiveness of a suicide prevention gatekeeper training program in a college setting with residence life advisers.** *J Prim Prev* 2009, **30**:131–149.

34. Wyman PA: **Randomized trial of a gatekeeper program for suicide prevention: 1-year impact on secondary school staff.** *J Consult Clin Psychol* 2008, **76**:104–115.

35. Oordt M, Jobes D, Fonseca V, Schmidt S: **Training mental health professionals to assess and manage suicidal behavior: can provider confidence and practice behaviors be altered?** *Suicide Life Threat Behav* 2009, **39**:21–32.

36. Scheerder G, Reynders A, Andriessen K, Van Audenhove C: **Suicide intervention skills and related factors in community and health professionals.** *Suicide Life Threat Behav* 2010, **40**:115–122.

37. Neimeyer RA, Fortner B, Melby D: **Personal and professional factors and suicide intervention skills.** *Suicide Life Threat Behav* 2001, **31**:71–82.

38. Twisk JWR: *Applied Longitudinal Data Analysis for Epidemiology*. 4th edition. Cambridge, UK: Cambridge University press; 2003.

CHAPTER 3

REDUCING PATIENTS' SUICIDE IDEATION VIA THE TRAINING OF MENTAL HEALTH TEAMS IN THE APPLICATION OF THE DUTCH MULTIDISCIPLINARY PRACTICE GUIDELINE ON ASSESSMENT AND TREATMENT OF SUICIDAL BEHAVIOR: STUDY PROTOCOL OF A RANDOMIZED CONTROLLED TRIAL

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Abstract

Background

To strengthen suicide prevention skills in mental health care in The Netherlands, multidisciplinary teams throughout the country are trained in the application of the new Dutch guideline on the assessment and treatment of suicidal behavior. Previous studies have shown beneficial effects of additional efforts for guideline implementation on professionals' attitude, knowledge, and skills. However, the effects on patients are equally important, but are rarely measured. The main objective of this study is to examine whether patients of multidisciplinary teams who are trained in guideline application show greater recovery from suicide ideation than patients of untrained teams.

Method

This is a multicenter cluster randomized controlled trial (RCT), in which multidisciplinary teams from mental health care institutions are matched pairwise, and randomly allocated to either the experimental or control condition. In the experimental condition, next to the usual dissemination of the guideline (internet, newsletter, books, publications, and congresses), teams will be trained in the application of the guideline via a 1-day small interactive group training program supported by e-learning modules. In the control condition, no additional actions next to usual dissemination of the guideline will be undertaken.
Assessments at patient level will start when the experimental teams are trained. Assessments will take place at admission and after 3 months, or earlier if the patient is discharged. The primary outcome is suicide ideation. Secondary outcomes are non-fatal suicide attempts, level of treatment satisfaction, and societal costs. Both a cost-effectiveness and cost-utility analysis will be performed. The effects of the intervention will be examined in multilevel models.

Discussion

The strengths of this study are the size of the study, RCT design, training of complete multidisciplinary teams, and the willingness of both management and staff to participate.

Trial registration

Netherlands trial register: NTR3092.

Keywords

Suicide prevention, Suicidal behavior, Guideline application, Implementation, Cost-effectiveness, Cost-utility, Multicenter, E-learning, Train-the-trainer, Professionals

Background

To strengthen suicide prevention in mental health care in The Netherlands, the Dutch multidisciplinary practice guideline on the assessment and treatment of suicidal behavior (PGSB) has been developed by representatives from the Dutch Association of Psychiatrists (NVvP), the Dutch Association of Psychologists (NIP), the Dutch Nurses' Association (V&VN), and supported by the Dutch Knowledge Center on Mental Health and Addiction (Trimbos Institute) [1]. The PGSB combines the stress-diathesis model [2] and the entrapment model [3] to explain the onset of suicidal behavior. It consists of chapters on the theoretical concept of suicidal behavior, basic assumptions of professional practice (fostering a therapeutic alliance with the suicidal patient, providing continuity of care and safety, and a systematic assessment of suicidal behavior), treatment of suicidal behavior, and professional practice following a suicide. Importantly, suicidal behavior is considered the focus of treatment. The guideline was issued in May 2012 [1].

One consistent finding in the literature is the gap between guideline development and the application of guidelines in daily health care practice [4-6]. As a consequence, patients do not always receive appropriate care [6,7]. Grol and Grimshaw (2003) suggested that structured implementation can improve adherence to guidelines [6]. Despite its importance, implementation science is still just emerging [8]. Theory-based and tailored implementation approaches are widely developed and studied [9] but no 'magic bullet' [10] to improve health care has been found to date. Knowledge of effective strategies is limited, whether from highly controlled studies with limited external validity, or from field studies with no significant effect or small effect sizes. Moreover, patient outcomes are rarely assessed in implementation studies. Regarding implementation in psychiatry, two systematic reviews [11,12] showed a modest effect of implementation of psychiatric guidelines on care and patient outcome, and concluded that there is a need for more studies on the effects of guideline implementation at both a patient and professional level. Overall, there is limited empirical evidence on the most effective strategy to implement guidelines in general [6,8,9], in particular in mental health care [11,12].

Considering the importance of the PGSB, the evidence on non-adherence to guidelines, and the lack of evidence-based implementation strategies,

the Dutch government commissioned a study on the effectiveness of the implementation of the PGSB. In 2011, the PITSTOP suicide (professionals in training to stop suicide) study started to examine the effect of a multifaceted, e-learning supported train-the-trainer implementation (TtT-e) program delivered to multidisciplinary teams of mental health care departments in a randomized cluster trial.

The content of the TtT-e program is based on the PGSB. In the TtT-e, senior staff members are trained by suicide experts. Subsequently, trained staff members train their multidisciplinary teams, using role play and personalized feedback.

The effectiveness of the TtT-e program on guideline implementation is expected since research has shown that small group training on suicidal behavior assessment with role play and personalized feedback leads to improved professional confidence and effective professional behavior [13]. Also, since suicide prevention in mental health care is essentially multidisciplinary, professionals are trained in multidisciplinary groups [4]. The training is supported by an e-learning module as e-learning is considered to complement face-to-face training in medical settings; Ruiz *et al.* reported that e-learning helped medical students become more actively involved in the study material, and thereby helped to internalize the material [14].

The PITSTOP suicide study aims to evaluate the effect of the TtT-e program at both a patient and professional level. The design of the study at the professional level has already been published [15] and the outcomes will be presented in a separate article. This article describes the protocol for the patient-level study.

The TtT-e program aims to strengthen the competences of health care professionals. The primary outcome of the present study is suicide ideation of patients due to improvement of professional skills. Professional and gatekeeper training in diagnosis and treatment of depressive disorders, which are associated with suicidal behavior [16], have been shown to result in a reduction of suicide rates when delivered to general practitioners [17-19]. A reduction of self-destructive acts in adolescents of an American Indian Tribal Nation was found after a suicidal behavior program [20], and a suicide prevention program in the US Air Force personnel resulted in a decline of the suicide rate [21]. However, the effects of professional or gatekeeper training programs on suicide rate and suicidal behavior are investigated in non-randomized controlled study designs. As a result, the research conducted to date does not clearly demonstrate whether professional or gatekeeper training has unique and independent effects on actually reducing suicidal behavior.

Due to increasing budget constraints and rising costs of mental health care, evidence on effectiveness alone is not sufficient for policy making. Policy makers aim to maximize health benefits from the budget available and, therefore, need information on both the costs and effects of the interventions. Thus, an economic evaluation to provide this information will also be performed. Most economic evaluations of guideline implementation strategies have methodological deficits and do not consider all relevant costs and benefits [22]. In the current study, we will estimate both the treatment and policy cost-effectiveness of the TtT-e program in comparison with usual care, as described by Mason *et al*. [23]. We will report the outcomes of the economic evaluation in a separate article.

In sum, the primary outcome of the current study is recovery from suicidal ideation. We hypothesize that patients treated by multidisciplinary teams who are trained by the TtT-e program will recover more quickly from suicidal ideation as compared with patients treated by multidisciplinary teams who were not trained.

Secondary outcomes are non-fatal suicide attempts and satisfaction with treatment. We hypothesize that patients in the intervention condition will report fewer non-fatal suicide attempts and more satisfaction with treatment than patients in the control condition.

A further aim of this study is to evaluate the cost-effectiveness and cost-utility of the intervention. We hypothesize that the intervention will be more cost-effective compared with implementation as usual (IAU).

Method

Design

This is a multicenter cluster randomized controlled trial (RCT) in which multidisciplinary teams from mental health institutions (MHIs) are matched pairwise with respect to patient diagnoses and average treatment duration. Subsequently, pair members are randomly allocated to treatment conditions.

A MHI is a regional organization with a specific catchment area of patients [24]. For example, in 2011, MHI Rivierduinen had a catchment area of 1.1 million people within an area of approximately 1,500 km2 in the region of South Holland. MHI Rivierduinen has 44 psychiatric departments and

treats an overall number of 24,753 patients annually with 2,726 employees [25]. Most of the psychiatric departments are specialized in the treatment of patients of specific diagnostic categories, such as depression or personality disorder.

Recruitment

Recruitment of MHIs took place during meetings and conferences on suicide prevention in The Netherlands between 2008 and 2010. MHIs were invited to participate in the study. When MHIs expressed willingness to participate, they were requested to indicate at least two multidisciplinary departments for adult care to be included in the study. To prevent exchange of training materials between the experimental and control condition, MHIs were explicitly asked to provide departments that were based in separate buildings and/or on separate locations, and to be sure that staff members were not exchanged or shared between departments. This resulted in 43 participating departments distributed over 10 MHIs (Figure 1). Various types of mental health care departments are represented in the study (inpatient and outpatient care, crisis departments, and long-stay departments) treating patients of various diagnostic categories (personality disorder, depressive disorder, anxiety disorder, and psychotic disorder) and of various ages.

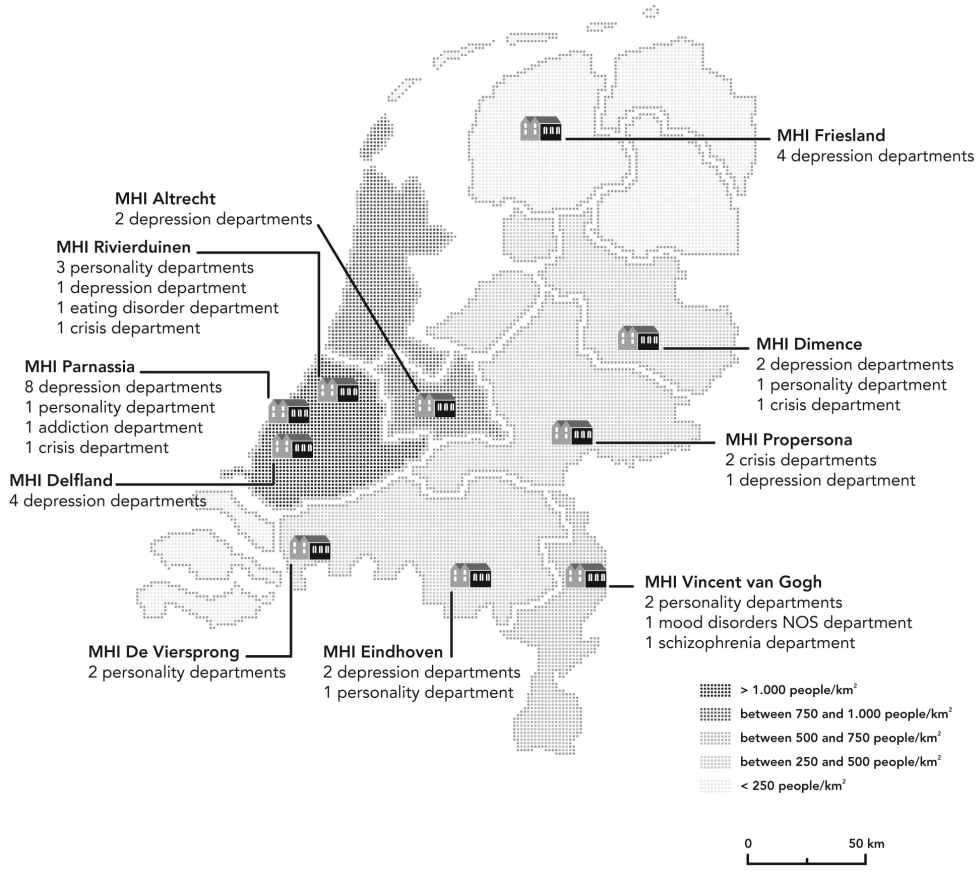

Figure 1 Overview of the ten MHIs. The number of departments and the primary patient group per department are indicated. MHI, mental health institution.

Measurement procedure

At patient level, the preferred mode of data collection is by routine outcome monitoring (ROM), an online system by which data on the effectiveness of treatment in everyday clinical practice are systematically collected [26]. In MHIs not using ROM, graduate students and/or research assistants will use paper and pencil questionnaires to collect data. The results from the graduate students/research assistants are expected to be comparable to the data collected via ROM. ROM also works with assistants to collect data and help participants to understand items/instructions [26]. Using differential item functioning (DIF) [27], we will investigate if the findings are indeed comparable, and control for any bias due to difference in data collection in the final analysis. By collecting data either via the ROM or graduate students/research assistants, we aim to reach all newly admitted patients in the participating

departments. As the intervention focuses on fostering a working relationship with suicidal patients, the intervention is expected to be most effective during the first month of treatment. Therefore, patients will be assessed directly at admission (T0) and at 3 months after admission (T1) (Figure 2). If a patient is discharged within 3 months, T1 will be arranged just before discharge. Measurements in the experimental departments will start immediately after all staff are trained. In the control departments, T0 will start when the department is informed of the allocation outcome. All eligible patients will be informed about the study and will be asked to provide written informed consent.

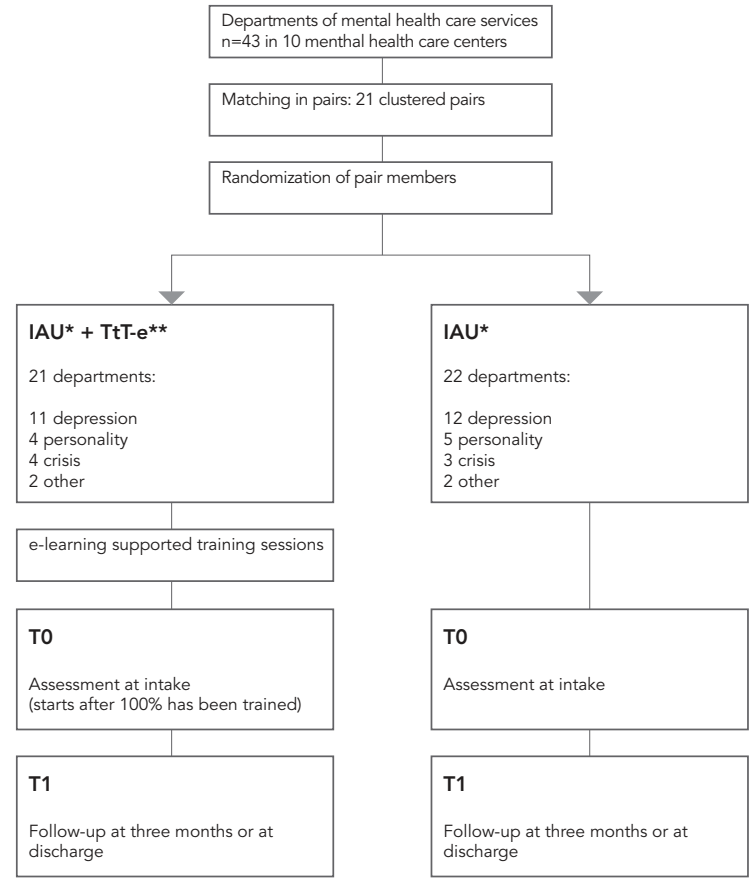

Figure 2 PITSTOP suicide study design. IAU, implementation as usual; PITSTOP suicide, professionals in training to STOP suicide; T0, admission; T1; 3 months after admission; TtT-e, e-learning supported train-the-trainer implementation.

Measurement at patient level

Suicide ideation and suicide attempts

The primary outcome, suicide ideation, will be measured using the Beck Scale for Suicidal Ideation (BSS) [28], a well-validated and widely used instrument. The BSS consists of 21 self-reported items. The first 19 items measure the severity of actual suicidal wishes and plans; item 20 assesses the number of previous suicide attempts; and item 21 assesses the severity of the last suicide attempt. If a patient scores 0 on items 4 and 5, items 6 through 5 are automatically scored 0, and the patient is directed to item 20. If the patient scores more than 0 on items 4 and 5, all items of the BSS are completed. The overall score is computed by summing the scores of the first 19 items. The overall score ranges from 0 to 38; a higher score indicates a higher level of suicide ideation. Item 20 and 21 are not used to calculate the ideation score, but are used to assess the number and intensity of previous suicide attempts.

Treatment satisfaction

Treatment satisfaction will be assessed with four items established to measure the quality of therapeutic alliance. The first two items are: 'How satisfied are you with your therapy?' and 'How would you evaluate your relationship with your therapist?'. These two items are rated from 0 to 10. Next, we will assess treatment satisfaction with reference to patients' suicidal behavior: 'Was there any attention for your suicidal thoughts during therapy?' and 'How did your therapist deal with your suicidal thoughts?'. These two items are scored on a four-point Likert scale ranging from: 1, very well, to 4, very poor. As the questions focus on the patient's experience, these four items will only be administered at T1.

Cost-effectiveness

Costs incurred by patients during the course of the study will be measured with an adapted version of the Trimbos questionnaire for costs associated with psychiatric illness (TiC-P) [29]. The TiC-P consists of two parts: part one measures direct medical costs (for example visits to a psychiatrist or a psychologist) and part two measures indirect costs (for example costs due to sick leave and productivity losses while being at work but not functioning optimally). If available, Dutch guideline prices will be used to value resource use [30]. Medication use will be valued using prices of the Royal Dutch Pharmaceutical Society. Lost productivity costs will be calculated according to the friction cost approach (friction period 154 days) using the mean age- and sex-specific income of the Dutch population [30]. Costs of the development of the intervention will be based on the salaries of the researchers for the development of the TtT-e program, material costs, implementation costs of the e-learning environment, and the costs of the production losses due to training of multidisciplinary teams.

Quality of life

Quality of life will be measured using the EQ-5D (EuroQol, Rotterdam, The Netherlands) [31]. This is a five-item questionnaire with an additional visual analogue scale (VAS) developed to assess health-related quality of life. The five items represent the dimensions of mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Items are scored on a three-point Likert scale: 1, no problem; 2, some problems; and 3, extreme problems. The health states obtained from EQ-5D will be converted to utility scores using the Dutch EQ-5D tariff. Quality-adjusted life years (QALYs) will be calculated using the area-under-the-curve method with linear interpolation between time points. A VAS is also included to measure the patient's self-rated health from: 1, best imaginable health state, to 5, worst imaginable health state.

Inclusion and exclusion criteria

Departments are considered eligible for participation if they treat patients aged ≥18 years and if professionals consider a need for training in suicide prevention skills, and their management are willing to provide support including financial support for covering loss of production.

Since basic clinical skills, such as establishing a therapeutic alliance with the patient, are an important part of the training and e-learning, it is expected that patients who report no suicide ideation at baseline will benefit from the TtT-e program. Therefore, all patients irrespective of being suicidal at baseline will be included. Since admitted patients will often be affected by emotional and/or cognitive problems, patients who are emotionally and/or cognitively unable to complete questionnaires properly will be excluded. Whether a patient is able to enter the study will be left to the discretion of the staff.

Randomization procedure

Eligible departments were clustered in pairs. It is assumed that similar types of patients treated for a similar duration of time are likely to be comparable. The first criterion for matching departments was the main diagnostic

category of patients. For instance, a department that reported that 60% of the patients had a main diagnosis of depression was matched with another department that reported a comparable percentage of depressive patients. Within groups of comparable patient diagnoses, departments were matched with departments with comparable average treatment duration of patients. Members of matched pairs were randomly allocated to either IAU (internet, newsletter, books, publications, and congresses; control) or IAU with the TtT-e program (intervention). Randomization was performed by an independent researcher of the research institution (EMGO+ Institute for Health and Care Research, Amsterdam, The Netherlands) who was not involved in the study. Table 1 displays an overview of the types of departments, patient diagnoses, and results of the matching procedure. Healthcare professionals are aware of the allocation outcome, but patients are not.

Table 1 Overview of the mental health institutions (MIHs), departments, main patient diagnoses, and results of the matching procedure.

MHI	Department	Average treatment duration of patients (days)	Main diagnosis	Condition
Delfland	Inpatient	1,532	Depression	EXP
Delfland	Inpatient	1,308	Depression	CON
Delfland	Outpatient	624	Depression	EXP
Dimence	Outpatient	600	Depression	CON
Parnassia	Outpatient	21	Depression	CON
Parnassia	Inpatient	16	Depression	EXP
Delfland	Outpatient	740	Depression	CON
Parnassia	Inpatient	730	Depression	EXP
Pro Persona	Crisis	1	Depr/bord/crisis	CON
Pro Persona	Crisis	1	Depr/bord/crisis	EXP
Parnassia	Inpatient	250	Personality	EXP
Dimence	Inpatient	400	Personality	CON
Dimence	Crisis	1	Depr/bord/crisis	EXP
Parnassia	Crisis	1	Depr/bord/crisis	CON
Friesland	Outpatient	582	Depression	EXP
Friesland	Outpatient	814	Depression	CON
Friesland	Outpatient	743	Depression	EXP
Friesland	Outpatient	602	Depression	CON
Parnassia	Outpatient	90	Depression	EXP
Parnassia	Outpatient	21	Depression	CON
Viersprong	Personality	240	Personality	CON
Eindhoven	Personality	300	Personality	EXP
Eindhoven	Outpatient	150	Depression	CON
Eindhoven	Inpatient	104	Depression	EXP
Rivierduinen	Inpatient	35	Depression	EXP
Rivierduinen	Outpatient	240	Depression	CON
Parnassia	Outpatient	41	Depression (older adults)	EXP
Parnassia	Outpatient	Missing	Depression (older adults)	CON
Dimence	Inpatient	90	Depression	CON
Pro Persona	Outpatient	365	Depression	EXP
Altrecht	Outpatient	42	Depr/bord/crisis	EXP
Altrecht	Inpatient	150	Depr/bord/crisis	CON
Vincent van Gogh	Outpatient	172	Personality	CON
Vincent van Gogh	Outpatient	54	Personality	EXP
Rivierduinen	Inpatient	270	Personality	CON
Rivierduinen	Outpatient	180	Eating disorder	EXP
Viersprong	Outpatient	244	Personality	EXP
Parnassia	Outpatient	240	Addiction	CON
Rivierduinen	Crisis	Missing	Depr/bord/crisis	EXP
Rivierduinen	Inpatient	Missing	Personality	CON
Vincent van Gogh	Inpatient	96	Mood disorder NOS	CON
Vincent van Gogh	Inpatient	20	Schizophrenia	EXP
Parnassia	Inpatient	371	Depression (older adults)	CON

CON, control; Depression/borderline/crisis; EXP, experimental; personality, personality disorder; MIH, mental health institution; missing, missing data; NOS, not otherwise specified.

Intervention

In the experimental condition, the complete multidisciplinary teams (all registered nurses, psychologists, physicians, and psychiatrists) will be trained in the application of the guideline via the TtT-e program. By training complete multidisciplinary teams, including all team members, irrespective of full- or part-time staff, we aim for 100% coverage. In the TtT-e program, three types of actors are involved: masters, trainers, and trainees. The training is applied on two levels: first, trainers are trained by masters. Subsequently trainees are trained by trainers. The training program is supported by two e-learning modules. The first module is developed for trainees. It consists of video vignettes in which experienced nurses, psychologists, and psychiatrists interact with suicidal patients (played by actors). The total running time of this module for trainees is 60 minutes. In addition to the e-learning module for trainees, a second e-learning module was

developed specifically for trainers. It provides a video of the first training session provided by masters to trainers, which was processed into an e-learning format allowing trainers to review the training session.

The TtT-e is a 1-day small interactive group program supported by e-learning modules, which reflects the PGSB recommendations [1]. The PGSB recommendations served as the starting point to set the content of the TtT-e program within the PITSTOP suicide study. First, all guideline recommendations were listed and clustered into six themes: 1) basic clinical skills when discussing suicidality; 2) systematic assessment of suicidal behavior; 3) diagnosis of the current suicidal condition; 4) safety and continuity of care, including participation of the patient's relatives; 5) treatment of suicidal behavior; and 6) chronic suicidal conditions. Second, clusters were transformed into six modules and scheduled according to the sequence of action in common clinical practice. For each module, goals and competences were set in terms of professional behavior. Furthermore, the PGSB recommends systematic investigation of the suicidal condition of patients by using the Chronological Assessment of Suicidal Events (CASE) interview [32]. Based on its outcome, risk and protection factors for suicide of individual patients are weighted. Subsequently, structured diagnosis, treatment strategy, and a safety protocol are determined. In the TtT-e program, the CASE interview is the overall framework for each of four role plays in which one trainee acts as a suicidal patient and the other trainee interviews the 'patient' via the CASE interview.

In the control condition, no additional actions next to IAU will be undertaken.

To survey adherence to the training program by trainers, graduate students will randomly visit training sessions, and will rate adherence on a four-point Likert scale: 1, *very strong adherence*, to 4, *very low adherence*.

Sample size

For the primary outcome (suicide ideation) we calculated the effect size according to the recommendations of Twisk [33]. The number of patients that needed to be included was set to 423. This number is sufficient to find a small effect size (Cohen's *d*) of 0.3, assuming an alpha of 0.05 and statistical power of 1-beta = 0.80. A correction of 20% for clustering of effects within departments is applied. An average number of 20 patients per department will be included.

Statistical analyses

As the study is a design with different levels, all outcomes will be analyzed using multilevel models. Patients are nested within departments (level 1), and departments are nested within MHI centers (level 2). Multilevel models are hierarchal systems that estimate random coefficients and variance components for each level [33]. Random intercepts will be included in the multilevel models. Data will be analyzed on an intention-to-treat basis.

To examine the hypothesis that suicide ideation in patients of professionals who received the TtT-e program is more likely to be reduced than patients of professionals who did not receive TtT-e, we will compare changes in BSS scores between patients of teams allocated to the intervention with patients of teams in the control group. To examine differences in the number and intensity of suicide attempts, mean scores on items 20 and 21 of the BSS will be compared between treatment groups. To examine the effect of the intervention on treatment satisfaction, mean scores of the four satisfaction items between groups will be compared. For the economic evaluation, missing cost and effect data will be imputed using multiple imputation according to the MICE algorithm [34]. The results of the imputed datasets will be pooled using Rubin's rules [35]. Bias-corrected and accelerated bootstrapping with 5,000 replications will be used to estimate 95% confidence intervals around the mean difference in total costs between the treatment groups. Incremental cost-effectiveness ratios (ICERs) will be calculated by dividing the difference in mean total costs between the treatment groups by the difference in mean effects between the treatment groups. Bootstrapping will also be used to estimate the uncertainty surrounding the ICERs, which will be graphically presented on cost-effectiveness planes. Cost-effectiveness acceptability curves will also be estimated. Cost-effectiveness acceptability curves will show the probability that the intervention is cost-effective in comparison with usual care for a range of different ceiling ratios (that is, the willingness to pay for one extra unit of effect) [36].

Approval was obtained from the Medical Ethics Committee of the VU University Medical Center, Amsterdam, The Netherlands (registration number: 2011/151). All local medical ethics committees agreed with this approval.

Discussion

This article describes the study protocol of a multicenter cluster RCT examining the additional effect of a multifaceted TtT-e program on suicide ideation with usual guideline implementation (IAU). Secondary outcomes are number and intensity of non-fatal suicide attempts, treatment satisfaction, cost-effectiveness, and cost-utility.

We hypothesize that, as a result of the improved skills and confidence of health care professionals due to IAU plus the TtT-e program, suicidal patients will recover more quickly from suicidal ideation and will show fewer suicide attempts as compared with patients in the control condition. Also, we hypothesize that patients from departments allocated to the experimental condition will show more treatment satisfaction. Additionally, we expect that IAU plus the TtT-e program will be more cost-effective compared to IAU.

To date, the evidence on effective strategies to implement guidelines in mental health care is scarce. If the study hypotheses are confirmed, the TtT-e program could be more widely distributed and applied in mental health care, reducing suicidal behaviors and limiting the costs due to suicidal behaviors.

A strength of this study is that data are collected in a naturalistic setting and hypotheses are examined in a RCT design. A further strength is the size of the study in which various MHIs and patients of miscellaneous diagnostic categories are included. We suggest that the patient flow within these 43 departments fairly represents the Dutch patients in mental health care. Of the 30 large MHIs in The Netherlands that were approached for the study, 10 were included in the study. From the many hundreds of psychiatric departments within these 10 MHIs, 43 departments joined the study. Patient diagnoses range from affective disorders, personality disorder, to addiction disorder. Among the 43 departments are long-stay, crisis, and inpatient and outpatient departments. The age of patients range from 18 to over 80 years. Figure 1 demonstrates that the included departments are located in urban and rural regions of The Netherlands. We conclude that the included departments provide a representative sample of all departments in mental health care institutions in The Netherlands. We will compare the patient characteristics of the sample with the national patient population available via the Dutch Association of Mental Health and Addiction Care (GGZ Nederland, Amersfoort, The Netherlands), and will describe the results to check external validity.

A possible limitation of the study is that budget cuts, reorganizations, and layoffs, commonplace in Dutch mental health care, may interfere with the study aims. Attrition of patients to the study is a further challenge, since not all patients will complete the ROM at all intervals due to the lack of time of professionals or inexperience with the ROM [37]. Using a strict protocol and local research assistants/nurses, we aim for limited drop-out. To prevent drop-out, research assistants will help patients to complete the questionnaires and will make appointments for follow-up assessment.

Commitment of both management and employees of the participating MHIs is crucial. To date, willingness of both management and employees to apply the TtT-e program is excellent. The findings from the current study may be generalized to implementation of other (mental) health care guidelines.

Trial status

Ongoing patient recruitment.

Abbreviations

BSS: Beck Scale for Suicidal Ideation; CASE: Chronological Assessment of Suicidal Events; DIF: differential item functioning; IAU: implementation as usual; ICER: incremental cost-effectiveness ratio; MHI: mental health institution; NIP: Dutch Association of Psychologists; NVvP: Dutch Association of Psychiatrists; PGSB: practice guideline on the assessment and treatment of suicidal behavior; PITSTOP suicide: professionals in training to STOP suicide; QALY: quality-adjusted life year; RCT: randomized controlled trial; ROM: routine outcome monitoring; TiC-P: Trimbos questionnaire for costs associated with psychiatric illness; TtT-e: e-learning supported train-the-trainer implementation; V&VN: Dutch Nurses' Association; VAS: visual analogue scale.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

AK, MdG, JM, and JdK obtained funding for this study. DdB, AK, MdG, JEB, and JdK, drafted the manuscript. DdB will undertake the study. MdG and AK designed the training protocol. EvD, RdW, BV, JEB, and JM participated in the design of the study, development of the intervention, and measurement procedure of patients. All authors read and approved the final in process.

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References

1. van Hemert AM, Kerkhof AFJM, de Keijser J,Verwey B: *Multidisciplinaire Richtlijn voor Diagnostiek en Behandeling van Suïcidal Gedrag.* Utrecht: Nederlandse Vereniging voor Psychiatrie (NVvP), Nederlands Instituut voor Psychologen (NIP), Trimbos Instituut; 2012.

2. Goldney R: *Suicide Prevention.* Oxford: Oxford University Press; 2008.

3. Williams JMG: *Cry of Pain: Understanding Suicide and Self-Harm.* London: Penguin Books; 1997.

4. Grol RPTM, Wensing MJP: *Implementatie: Effectieve Verbetering van de Patiëntenzorg. Maarssen:* Elsevier Gezondheidszorg; 2006.

5. Grol R, Grimshaw J: **Evidence-based implementation of evidence-based medicine.** *Jt Comm J Qual Improv* 1999, **25:**503–513.

6. Grol R, Grimshaw J: **From best evidence to best practice: effective implementation of change in patients' care.** *Lancet* 2003, **362:**1225–1230.

7. Shafran R, Clark D, Fairburn C, Arntz A, Barlow D, Ehlers A, Freeston M, Garety P, Hollon S, Ost L: **Mind the gap: Improving the dissemination of CBT.** *Behav Res Ther* 2009, **47:**902–909.

8. Proctor EK, Landsverk J, Aarons G, Chambers D, Glisson C, Mittman B: **Implementation research in mental health services: an emerging science with conceptual, methodological, and training challenges.** *Adm Policy Ment Health* 2009, **36:**24–34.

9. Hanbury A, Farley K, Thompson C, Wilson P, Chambers D: **Challenges in identifying barriers to adoption in a theory-based implementation study: lessons for future implementation studies.** *BMC Health Serv Res* 2012, **12:**422.

10. Oxman A, Flottorp S: **An overview of strategies to promote implementation of evidence based health care. In** *Evidence Based Practice in Primary Care. Edited by Silagy C, Haines A. London: BMJ Books;* 1998:91–109.

11. Weinmann S, Koesters M, Becker T: **Effects of implementation of psychiatric guidelines on provider performance and patient outcome: systematic review.** *Acta Psychiatr Scand* 2007, **115:**420–433.

12. Girlanda F, Fiedler I, Ay E, Barbui C, Koesters M: **Guideline implementation strategies for specialist mental healthcare.** *Curr Opin Psychiatry* 2013, **26:**369–375.

13. Oordt MS, Jobes DA, Fonseca VP, Schmidt SM: **Training mental health professionals to assess and manage suicidal behavior: can provider confidence and practice behaviors be altered?** *Suicide Life Threat Behav* 2009, **39:**21–32.

14. Ruiz JG, Mintzer MJ, Leipzig RM: **The impact of E-learning in medical education.** *Acad Med* 2006, **81:**207–212.

15. de Beurs DP, de Groot MH, de Keijser J, Verwey B, Mokkenstorm J, Twisk JW, van Duijn E, van Hemert AM, Verlinde L, Spijker J, van Luijn B, Vink J, Kerkhof AJ: **Improving the application of a practice guideline for the assessment and treatment of suicidal behavior by training the full staff of psychiatric departments via an e-learning supported Train-the-Trainer program: study protocol for a randomized controlled.** *Trials* 2013, **14:9**.

16. Hawton K, van Heeringen K: **Suicide.** *Lancet* 2009, **373:**1372–1381.

17. Rutz W, von Knorring L, Wålinder J: **Frequency of suicide on Gotland after systematic postgraduate education of general practitioners.** *Acta Psychiatr Scand* 1989, **80:**151–154.

18. Hegerl U, Mergl R, Havers I, Schmidtke A, Lehfeld H, Niklewski G, Althaus D: **Sustainable effects on suicidality were found for the Nuremberg alliance against depression.** *Eur Arch Psychiatry Clin Neurosci* 2010, **260:**401–406.

19. Szanto K, Kalmar S, Hendin H, Rihmer Z, Mann JJ: **A suicide prevention program in a region with a very high suicide rate.** *Arch Gen Psychiatry* 2007, **64:**914–920.

20. May PA, Serna P, Hurt L, Debruyn LM: **Outcome evaluation of a public health approach to suicide prevention in an American Indian tribal nation.** *Am J Public Health* 2005, **95:**1238–1244.

21. Knox KL, Litts DA, Talcott GW, Feig JC, Caine ED: **Risk of suicide and related adverse outcomes after exposure to a suicide prevention programme in the US Air Force: cohort study.** *BMJ* 2003, **327:**1376.

22. Vale L, Thomas R, MacLennan G, Grimshaw J: **Systematic review of economic evaluations and cost analyses of guideline implementation strategies.** *Eur J Health Econ* 2007, **8:**111–121.

23. Mason J, Freemantle N, Nazareth I, Eccles M, Haines A, Drummond M: **When is it cost-effective to change the behavior of health professionals?** *JAMA* 2001, **286:**2988–2992.

24. Hutschemaekers G, Tiemens B: **Het einde van eensectoraleggz. Ontwikkelingen, trends en controverses in Nederland.** *Tijdschr Psychiatr* 2006, **48:**27.

25. Rivierduinen G: *Publieksjaarverslag 2011.* ; 2012.

26. de Beurs E, den Hollander-Gijsman M, van Rood Y, van der Wee N, Giltay E, van Noorden M, van der Lem R, van Fenema E, Zitman F: **Routine outcome monitoring in the Netherlands: practical experiences with a web-based strategy for the assessment of treatment outcome in clinical practice.** *Clin Psychol Psychother* 2011, **18:**1–12.

27. Holland PW, Wainer H (Eds): *Differential Item Functioning. Abingdon:* Routledge; 1993.

28. Beck AT, Kovacs M, Weissman A: **Assessment of suicidal intention: the Scale for Suicide Ideation.** *J Consult Clin Psychol* 1979, **47:**343–352.

29. Hakkaart-van Roijen L, Straten A, Tiemens B, Donker M: *Handleiding Trimbos/iMTA questionnaire for Costs associated with Psychiatric illness (TiC-P). Rotterdam:* Institute of Medical Technology Assessment; 2002.

30. Tan SS, Bouwmans-Frijters CA, Hakkaart-van Roijen L: **Handleiding voor kostenonderzoek: methoden en referentieprijzen voor economische evaluaties in de gezondheidszorg.** *Tijdschrift voor gezondheidswetenschappen* 2012, **90:**367–372.

31. Brooks R: **EuroQol: the current state of play.***Health Policy* 1996, **37:**53–72.

32. Shea SC: **The chronological assessment of suicide events: a practical interviewing strategy for the elicitation of suicidal ideation.** *J Clin Psychiatry* 1998, **59:**58–72.

33. Twisk JW: *Applied Multilevel Analysis: A Practical Guide. Cambridge:* Cambridge University Press; 2006.

34. van Buuren S: **Multiple imputation of discrete and continuous data by fully conditional specification.** *Stat Methods Med Res* 2007, **16:**219–242.

35. Rubin DB: *Multiple Imputation for Nonresponse in Surveys. New York, NY: John* Wiley & Sons; 1987.

36. Fenwick E, O'Brien BJ, Briggs A: **Cost-effectiveness acceptability curves–facts, fallacies and frequently asked questions .***Health Econ* 2004, **13:**405–415.

37. van Fenema E, van der Wee N, Onstein E, Zitman F: **Care programmes at mental health centers: the degree of adherence in the first phase of treatment.** *Tijdschr Psychiatr* 2010, **52:**299–310.

CHAPTER 4

AN E-LEARNING SUPPORTED TRAIN-THE-TRAINER PROGRAM TO IMPLEMENT A SUICIDE PRACTICE GUIDELINE

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Under review of Internet Interventions

This chapter anticipates on some the results of PART II of the dissertation

Abstract

An e-learning supported Train-the-Trainer program was developed to implement the Dutch suicide practice guideline in mental health care. Publications on implementation strategies have been restricted to the final reporting of studies with little opportunity to describe relevant contextual, developmental and supporting work that would allow for a better interpretation of results and enhance the likelihood of successful replication of interventions. Therefore, in this paper we describe the theoretical and empirical background and the material of the intervention. We monitored the number of professionals that were trained during and after the trial, and we randomly assessed adherence to the trainings protocol.

Each element of the intervention (train-the-trainer element, one day face-to-face training, e-learning) is described in detail. During the trial 518 professionals were trained by 37 trainers. After the trial over 5000 professionals and 180 gatekeepers were trained. The e-learning module for trainees is currently being implemented among 30 mental health institutions from the Netherlands. Research assistants visited 5 face-to-face training sessions in which trained mental health professionals trained their own team. They found that adherence to the training protocol was good and that the program was well received by trainees. They also reported that ICT problems in mental health institution resulted in less uptake of the e-learning modules.

These results suggest that an e-learning supported Train-the-Trainer program is an efficient way to uptake new guidelines by professionals. The face-to-face training was well structured so that it was easy to adhere to the training protocol. Two e-learning modules made the spread of the training material more viable, although the spread was limited by the problems with ICT facilities. Overall the intervention was well received by both trainers and trainees. By thoroughly describing the material and spread of the training and by offering all material online we hope to stimulate the further dissemination of our intervention.

Keywords

suicide prevention; implementation; e-learning; train-the-trainer, guideline

Introduction

Background

A consistent finding in research of health services is the slow uptake of new evidence into clinical practice [1]. To address this problem, clinical practice guidelines in which evidence is transformed into recommendations are developed. However, difficulties arise in altering daily practice by the provision of guidelines, since adherence to guidelines is not self-evident [2]. In 2012, a new Dutch multidisciplinary 'Practice Guideline on the assessment and treatment of Suicidal Behavior' (PGSB) has been issued [3]. It is assumed that adherence to this guideline by (mental) health care professionals may result in a reduction of fatal and non-fatal suicidal behavior [4]. Aiming at reducing the suicide rate in The Netherlands, Dutch (mental) health care institutions now face the challenge of applying the guideline in daily practice.

It is suggested that the extent of guideline adherence depends on the effectiveness of dissemination and implementation strategies [5, 6]. Previously, we examined the effectiveness of an e-learning supported Train-de-Trainer program (TtT-e) aiming at improved guideline application by mental health care professionals and evaluated its cost-effectiveness [7, 8]. The effects have been compared with traditional guideline dissemination (easy access to guidelines via internet, reviews in clinical journals and conferences) at the level of mental health care professionals and patient level in a cluster randomized trial, including 45 departments (n=45) from 9 mental health care institutions (MHI) throughout The Netherlands (Dutch Trial Register NTR 3092).

Departments were randomly allocated to either the intervention condition (TtT-e) or the control condition in which the guideline has been disseminated traditionally (IAU; implementation as usual). It was hypothesized that guideline implementation via TtT-e results in better guideline adherence of professionals than IAU and that patients more quickly recover from suicidal thoughts if they were treated in trained departments. It has been shown in this study that, indeed, TtT-e results in stronger guideline adherence of professionals, in addition to increased self-evaluation of knowledge of suicidal behavior, and a more adequate response to suicidal behaviors of professionals as compared with traditional dissemination strategy. In addition, depressed suicidal patients treated in trained departments show a quicker recovery of suicidal ideation. We concluded that TtT-e is an effective strategy to disseminate the guideline since TtT-e more likely results in state-of-the-art dealing with suicidal behavior than IAU. Publications on implementation strategies have been restricted to the final reporting of studies with little

opportunity to describe relevant contextual, developmental and supporting work that would allow for a better interpretation of results and enhance the likelihood of successful replication of interventions [9]. Therefore, in this paper we describe the theoretical and empirical background and the development process of the TtT-e program. We also provide information on specific aims, outline, practical starting points and the supporting training materials. We monitored the number of trainees trained with our intervention during and after the trial. Finally, we will report the findings of research assistants who randomly and unannounced visited five face-to-face trainings provided by trained trainers who trained their colleague's.

Theoretical and empirical background of the TtT-e program

The TtT-e program is based on the recommendations of the PGSB. The development of the PGSB has been commissioned by the Dutch Ministry of Health, Welfare & Sports (VWS) and was carried out by representatives of the Netherlands Psychiatric Association (NVvP), the Dutch Association of Psychologists (NIP) and the Dutch Nurses' Association (V&VN). Representatives of the Dutch College of General Practitioners (NHG) were also involved, as were representatives of patient participation organizations and organizations for relatives bereaved by suicide. International suicide guidelines, such as the suicide guideline of the American Psychiatric Association and the Royal College of Psychiatrists [10, 11] in addition to extensive reviews of the Scottish Government [12, 13] served as starting points for literature searches. Conclusions were formulated in a four-fold classification of the level of evidence ranging from level 1 (strong evidence, highly recommended or dissuaded) to level 4 (reflecting experts opinions). If applicable, conclusions are followed by a paragraph with additional considerations weighting the evidence. Finally, recommendations were worded in terms of (professional) behavior. They vary across a continuum with respect to the strength of the evidence. By readers, the strength is recognizable as for each level, a standardized wording is applied.

The theoretical framework for the understanding of the onset of suicidal behavior

In the guideline, an integrated model of stress-diathesis [14] and entrapment [15] is used to understand the onset and maintenance of suicidal conditions, The integrated model depicts suicidal behavior as the outcome of a process influenced by the interaction of biological, psychological, environmental and situational factors [16]; the interaction of which may lead to entrapment. Entrapment is proposed to be the specific condition in which suicidal behavior arises. The guideline recommends systematic investigation of the suicidal condition with the Chronological Assessment of Suicidal Events

(CASE)-interview [17]. This is followed by weighting risk and protection factors for suicide in individual patients, and results in structured diagnosis, treatment strategy and a safety plan.

Empirical considerations of professional and gatekeeper training to enhance expertise in suicide risk management

Promising interventions likely to be effective in reducing suicidal behaviors are mental health practitioner and gatekeeper education [18, 19] aiming at early recognition and treatment of suicidal behavior and/or underlying psychiatric morbidity [20]. This type of training has shown to improve knowledge, skills, and attitudes towards suicidal behavior [21] of school staff [22], students [23, 24], members of an Aboriginal community [25], youth workers [26], US Veterans Affairs workers [27], construction workers [28] and mental health care workers [29, 30]. Additionally, professional and gatekeeper training in diagnosis and treatment of depressive disorders has been shown to result in a reduction of suicide rates when delivered to general practitioners [27, 31-34] and US Air Force personnel [35], and in a reduction of self-destructive acts in American Aboriginal adolescents [36].

Empirical considerations of a Train-the–Trainer approach

The Train-the-Trainer model of small interactive educational training is based on Adult Learning Theory [37], which states that people who train others remember 90% of what they teach others, and on Diffusion of Innovation Theory [38], stating that people adopt new information better through their trusted social networks. Training of mental health care professionals using a Train-the–Trainer model of small interactive training, limits the need to employ costly external expertise. Knowledge and skills are passed on and facilitated by peers instead of external experts. The effectiveness has been hypothesized since benefits of training by peer-assisted learning in medical health education are comparable to those achieved by professional teachers [39-43]. In addition, peer-assisted learning has been shown to enable peer teachers to improve their theoretical knowledge along with their practical skills [40].
Subsequent to the study period, trainers are supposed to continue their role as an expert in suicide prevention skills, as ongoing support and feedback when implementing psychiatric guidelines seems to be effective [44].

Empirical considerations of e-learning support

Advances in technology, the rise of costs in health care and the need for continuous education of (para)medical professionals have made e-learning

a popular new educational method [45-47]. In a review of effective implementation strategies, a combination of interactive postgraduate training including personalized feedback, and additional material such as a website was found to be more successful than a single-faceted approach [6, 48, 49]. E-learning is expected to complement face-to-face training in a medical setting; it was found to help medical students become more actively involved in the study material and thereby help to internalize the material [50].

Table 1: Themes and topics of the e-learning supported Train-the-Trainer program

Themes	Topics	Goals
1. Basic assumptions in dealing with suicidal behaviors	• fostering a therapeutic alliance with the suicidal patient, systematic assessment of suicidal behavior • participation of patient's VIPs* in the assessment and treatment of the patient's suicidal behavior • taking care of safety • providing continuity of care	
PRACTICING 1 THROUGH ROLE PLAY	• fostering a working relationship with a suicidal patient and (if applicable) patients VIPs* • experiencing and exploring what it is to be a suicidal character • receiving feedback of a suicidal character on displayed professional behavior towards the suicidal character	Exploring and discussing the current suicidal condition (course, intensity and repetition of suicidal thoughts, intent, urgency, preparations, plans, acts, proposed consequences, extent of hopelessness)
2 Systematic assessment of suicidal behaviors	• the theoretical framework for suicidal behavior: the integrated model of stress diathesis[1] and entrapment [2] • CASE-interview [3] for systematic assessment of current and previous suicidal episode(s)	
PRACTICING 2 THROUGH ROLE PLAY	• maintaining the working relationship with a suicidal patient and (if applicable) patients' VIPs* • experiencing the exploration of suicidal thoughts as a suicidal character	• exploring motives for the current episode (events, conditions, role of others, actions) • assessing previous suicidal episodes (course, intensity, intent, plans, preparations, consequences, urgency, extent of hopelessness, effective interventions, the role of VIPs*) • exploring the patient's view towards the future

3 Diagnosis of the current suicidal condition	• the etiology and pathogenesis of the current suicidal condition • participation of patient's VIPs* in the assessment of the patient's suicidal behavior	
PRACTICING 3 THROUGH ROLE PLAY	• maintaining the working relationship with a suicidal patient and (if applicable) patients' VIPs* • exercising on the application of the theoretical framework for suicidal behavior as a resource for the assessment of suicidal behavior • experiencing the discussion on hypotheses with the patient	• assessment of (current and previous) suicidal behavior • weighting risk and protection factors discussing the hypotheses with the patient and (if applicable) with VIPs* • formulating hypotheses on the etiology and pathogenesis of the current suicidal episode • using the therapeutic alliance with the patient to discuss hypotheses on the etiology and pathogenesis of the current suicidal condition
4 Safety and continuity of care	• setting safety priorities in suicidal crises • benefits and contents of a safety plan • possible roles and responsibilities of involved professionals and VIPs* • benefits and means of providing continuity of care	
5 Treatment of suicidal behavior	• possible interventions to enhance patient's safety • strategies of moderating the suicidal condition • strategies of moderating the impact of risk factors for suicidal behavior • strategies of strengthening protection factors for suicidal behavior • possible roles of VIPs* and other professionals in reducing the short and long term suicide risk	
PRACTICING 4 THROUGH ROLE PLAY	• using the therapeutic alliance with the patient to discuss treatment strategies • experiencing the discussion on treatment strategies as a suicidal patient	PRACTICING 4 • establishing treatment strategies to moderate the current suicidal condition and/or the impact of risk factors and to strengthen protection factors • establishing roles and responsibilities of (if applicable) VIPs* and professionals • adapting a safety plan • discussing treatment strategies with the suicidal patient and (if applicable) VIPs*

6 Chronic suicidal conditions	• suicidal behavior in patients with borderline personality disorder (BPS) • pitfalls in the management of suicidal behavior in patients with BPS • dealing with suicidal behavior in patients with BPS • professional consultation, intervision/ supervision

*VIPs= very important persons i.e. relatives and/or friends of the suicidal patient

The TtT-e program

Development process and training content

Guideline recommendations served as the starting point to set the competences in terms of professional behavior. First, all guideline recommendations were listed and clustered into six themes (Table 1). Second, themes are scheduled following the sequence of action in common clinical practice. For each theme, aims were set. Four role playing exercises in which dyads of professionals practiced knowledge and skills formed the core the training. During each role play, one professional practiced the structural assessment and treatment of suicidal behavior. The other professionals had to act as a suicidal patient from his/her own daily practice. Third, in two subsequent meetings with experts due to scientific achievements and/or clinical experience on the topic, the training was tried out. Subsequently, the content and scheduling was discussed. Based on feedback, adjustments were made. The competences to be achieved by the training are outlined in Table 2.

Table 2: competences after the training

After the training:

The professional deals with suicidal behaviors of patients in the context of the guideline's basic assumptions, to achieve structured diagnosis of the suicidal behavior and to establish an appropriate treatment strategy. Basic assumptions are:
- making contact with the suicidal thoughts of the patient is the bases of a therapeutic alliance with the suicidal patient and VIPs*;
- suicidal behavior is a separate focus of diagnosis & treatment;
- the patient's suicidal behavior is systematically assessed by using the integrated model of stress-vulnerability diathesis[1] and entrapment[2] to explain the onset of suicidal conditions and the CASE-interview[3] for the assessment of suicidal conditions;
- a focus on safety & continuity of care is a relevant part of the treatment strategy;
- the professional exerts on engagement of the patient's relatives in diagnosis & treatment.

2. **The professional is able to foster a therapeutic alliance with a suicidal patient (and if applicable VIPs).**
This goes to show that the professional:
- discusses suicidal feelings, thoughts, plans and (former or planned) suicidal acts without any reluctance;
- shows interest and understanding to the patient (and if applicable VIPS).

3. **The professional systematically explores risk and protection factors for suicide.**
This goes to show that the professional:
- uses the CASE-interview[3] for the assessment;
- focuses on stress and vulnerability factors that increases or decreases the suicide risk and explores to what extent the patient experiences his/her situation as being trapped.

4. **The professional uses knowledge of risk and protection factors to foster and maintain a working relationship with the patient (and if applicable VIPs).**
This goes to show the patient is (increasingly) prepared to share feelings, thoughts and relevant information with the professional.

5. **The professional formulates hypotheses on the etiology and pathogenesis of the patient's suicidal behavior.**
This goes to show that the professional:
- discusses the hypotheses with the patient (and if applicable VIPs);
- adjust hypotheses on the base of the patient's feedback (or feedback from his/her relatives)
- exerts on the patient's agreement (and if applicable on VIPs);

6. **The professional establishes short and long term strategies for the treatment of the suicidal behavior.**
This goes to show that the professional's proposed strategies are focused on resources and factors protecting the patient from (attempted) suicide.

7. **The professional establishes safety and continuity of care for the suicidal patient, possibly and preferably in corporation with VIPs.**
This goes to show that the professional:
makes a safety plan;
- sets and executes follow-up assessments of the suicidal ideation to observe the course of the suicidal behavior;
- adjusts treatment strategy if needed;
- exerts on the patient's agreement at all times (and if applicable on VIPs)

*VIPs = trusted relatives and friends of the patient

Practical starting points

In the application of the Train-the-Trainer model, there were three levels of acting: masters, trainers and trainees. Masters are experts in the field of suicide prevention due to scientific performance and/or clinical practice on the topic. Trainers were mental health care workers of various disciplines (psychiatrists, psychologists and registered mental health nurses), selected from the clinical staff of departments. Trainers ideally had good training skills, were prepared to train their co-workers and have been indicated to be competent to serve as a role model at institutional level and to provide future additional training. Trainees were members of multidisciplinary teams (e.g. psychiatrists, psychologists, nurses) engaged in the assessment, treatment and counselling of suicidal patients. Training was applied at two levels: first, trainers were trained by masters. Subsequently trainees were trained by trainers. The content of the training was similar at both levels. As mental health care is essentially multidisciplinary, trainings were provided to multidisciplinary teams [6] with a minimum of 12 and a maximum of 16 participants per training session. During the role plays, professionals experienced how it was to more systematically address suicidality. Importantly, when they had to act as a suicidal patient from their own daily practice during the role plays, they experienced the effect that such a systematic assessment could have on a patient.

Training materials

Before each training, trainees were enhanced to download and read the guideline summary of the PGSB. The summary includes a brief description of the theoretical and practical starting points of suicidal behavior management, schemes summarizing recommendations on diagnosis and treatment of suicidal behavior, treatment setting, professional acting following completed suicide, recommendations on legal issues, and privacy matters following completed suicide. It also includes specific recommendations for general practitioners and Aid & Emergency departments' staff [51].
A training manual was provided to help trainers organize the training. The manual provides a detailed description of competences (see Table 2) and aims per theme, a detailed minute-to-minute training time schedule, and appendices (e.g. the CASE-approach, the integrated stress-diathesis and entrapment model, practicing resources and forms to evaluate role playing sessions).
We designed a PowerPoint® Presentation to guide trainers and trainees throughout the training sessions. Digital versions of all training materials had been available by downloads from the research website www.pitstopsuicide.nl.

The TtT-e program is supported by two e-learning modules. Module 1 consists of video scenarios in which well-experienced nurses, psychologists and psychiatrists interact with suicidal characters (played by actors) according to the guideline recommendations. Suicidal characters of various age, gender and diagnostic category show prototypical suicidal symptoms, cognitions and interaction problems. In between the scenarios, guideline topics and recommendations are explained by masters. The total running time of Module 1 is 60 minutes. A demo can be found via www.pitstopsuicide.nl . Module 2 is developed for trainers and provided a video tape of the first master training session allowing trainers to review the exercises. Trainers and trainees had 24/7 personalized access to the modules that repeatedly could be viewed. To assess adherence to the training protocol, research assistants randomly visited 5 trainings in which trainers trained trainees.

Results

Trainings during the trial

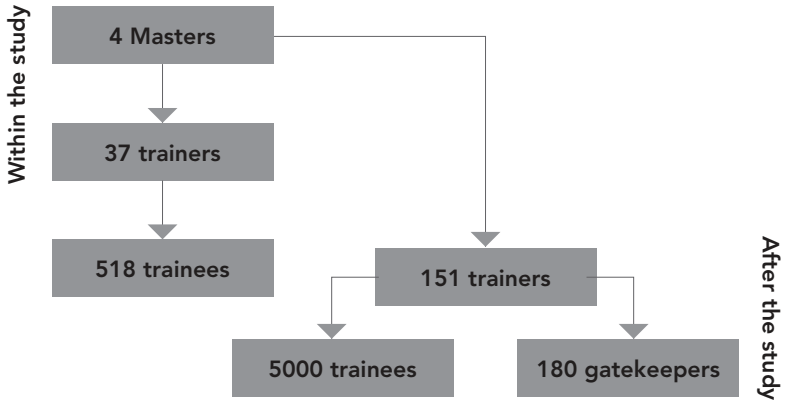

Figure 1: Flow of dissemination of the TdT-e intervention within and after the study

Four masters trained 37 trainer in two single sessions in October 2011 and January 2012 (Figure 1). Masters were individuals with expertise in the field of suicide by demonstrable clinical and / or scientific activities. Trained trainers were psychiatric nurses / advanced nurse practitioners (n = 17), psychologists (n = 11) and psychiatrists (n = 9) recruited from nine institutions. These trainers then trained their peers in 37 training sessions. A total of 518 professionals were trained in the study.

Adherence during the trial

Research assistants reported that all trainers adhered to the training protocol. Role play four, which focuses on the treatment of suicidal behavior sometimes resulted in some confusion as nurses usually are supportive but not responsible for determining treatment policy. Some trainees noted that the training was too long, and some reported that they were hindered by insufficient ICT facilities in their department so that were unable to view the e-learning modules. Trainees appreciated being trained by a peer. Also the small group interactive training element was highly valued as this provided the change for constructive feedback. The trainers found the e-learning module displaying a complete master training very good reference material.

Dissemination after the trial

Even before any results on the effectiveness of TtT-e were communicated, the intervention was spread widely as soon as the trial was finished in October 2013. As soon as the trail ended, our trainers started to further train colleagues and also trained peers. Apparently the training material was user-friendly and enabled newly trained trainers to subsequently train others as trainer. The additional e-learning module, developed to support trainers to provide the training, has been viewed 278 times from the start of the study up until 2014 and turned out to be well received. As far as we can ascertain, from October 2011 until December 2014 our trainers trained 151 new trainers, who trained 5,000 persons in the application of the guideline. In addition, approximately 180 gatekeepers (police officers, general practitioners, etc) were trained, alongside nurses from the Aid & Emergency department and the intensive care unit of a general hospital.

GGZ-ecademy

The e-learning module for trainees is currently being implemented among 30 mental health institutions from the Netherlands via the GGZ-ecademy (ggzecademy.nl). The GGZ-ecademy is a collaboration of MHI's in the Netherlands on the field of e-learning. The GGZ-ecademy incorporated the content and structure of our module and applied their format and educational experience to improve the module. The adapted version is currently available to over 30.000 mental health professionals throughout the Netherlands.

Discussion

This paper provides the rationale and outline of a structured e-learning supported train-the-trainer intervention to implement a suicide practice guideline. Results on adherence show that after a one-day training by masters, trainers were ready to train their colleagues and even to train other trainers. This demonstrates that the face-to-face training was well structured, and the training material (training manual and e-learning) provides sufficient material to replicate and disseminate the training. The e-learning modules for both the trainers and the trainees were well received, but there were problems with ICT-facilities that possibly may have limited the distribution of the online material.

Just after the trial ended, the module was spread among 5000 professionals. Apparently, the program addresses a need for training in suicide prevention skills of mental health care professionals. The e-learning module is currently being spread among 30.000 professionals. A common argument for the use of e-learning is its cost-effectiveness [45, 52]. Medical education is expensive [53], and via e-learning, costs can be reduced [45, 52]. As costs of (mental) health care keep on rising, and budgets keep on slinking, health managers and policy makers are keen to only offer e-learning. However, there is a lack of methodological sound studies examining the cost effectiveness of e-learning by (mental) health professionals [52, 54-56]. Therefore, the implementation of e-learning modules should be combined with a thorough validation of its (cost)effectiveness. Also, as we found that trainees highly appreciate the small group face-to-face training and the role plays, we argue that e-learning can be best offered in addition to a face-to-face training, rather than as a substitute. Future studies should investigate whether certain parts of the face-to-face training can be replaced by e-learning; this would allow to shorten the face-to-face training. By clearly describing the rationale and outline of the training, and by offering the full training material online, we aim to facilitate the distribution of the current intervention, and to stimulate subsequent research on guideline implementation in mental health care.

Competing interests

All authors declare to have no competing interests

Authors' contributions

AK, MdG, and JdK obtained funding for this study. MdG, JdK and AK designed the intervention. MdG and DdP drafted the manuscript. AK, and JdK contributed to the execution of the study, and to the manuscript writing.

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References

1. Bodenheimer T: **The American health care system; the movement for improved quality in health care.** *N Engl J Med* 1999, **340**:488-492.

2. Grol R, Grimshaw J: **From best evidence to best practice: effective implementation of change in patients' care**. *The Lancet* 2003, **362**(9391):1225-1230.

3. Van Hemert A, Kerkhof A, de Keijser J, Verwey B, van Boven C, Hummelen J, de Groot M, Lucassen P, Meerdinkveldboom J, Steendam M *et al*: **Multidisciplinaire richtlijn voor diagnostiek en behandeling van suïcidaal gedrag**. Utrecht: De Tijdstroom; 2012.

4. Bool M, Blekman J, De Jong S, Ruiter M, Voordouw I: **Verminderen van suïcidaliteit. Actualisering van het Advies inzake Suïcide Gezondheidsraad 1986**. In. Utrecht; 2007.

5. Davis D, Tailor-Vaisey A: **Translating guidelines into practice: a systematic review of theoretical concepts, practical experience and research evidence in the adoptions in clinical practice.** *Canadian Mediacl Association Journal* 1997, **157**:408-416.

6. Grol R, Grimshaw J: **From best evidence to best practice: effective implementation of change in patients' care**. *Lancet* 2003, **362**(9391):1225-1230.

7. De Beurs D, De Groot M, de Keijser J, Verwey B, Mokkenstorm J, Twisk J, Van Duyn E, Van Hemert A, Verlinde L, Spijker S *et al*: **Improving the application of a practice guideline for the assessment and treatment of suicidal behavior by training the full staff of psychiatric departments via an e-learning supported Train-the-Trainer program: study protocol for a randomized controlled trial.** *Trails* 2013, **14**(9).

8. de Beurs D, de Groot M, Bosmans J, de Keijser J, Mokkenstorm J, Verwey B, van Duijn E, de Winter R, Kerkhof A: **Reducing patients' suicide ideation through training mental health teams in the application of the Dutch multidisciplinary practice guideline on assessment and treatment of suicidal behavior: study protocol of a randomized controlled trial.** *Trials* 2013, **14** (372).

9. Eccles MP, Mittman BS: **Welcome to implementation science**. *Implementation Science* 2006, **1**(1):1.

10. Psychiatrists RCo: **Assessment following self-harm in adults**. London: Royal college of psychiatrists; 2004.

11. Psychiatrists RCo: **Self-harm, suicide and risk: helping people who self-harm College report CR158**. London: Royal college of psychiatrists; 2010.

12. McLean J, Maxwell M, Platt S, Harris F, Jepson R: **Risk and protective factors for suicide and suicidal behavior: a literature review**. In., edn. Edinburgh: Scottish Government Social Research; 2008.

13. Leitner M, Barr W, Hobby L: **Effectiveness of interventions to prevent suicide and suicidal behavior: a systematic review**. Edinburgh: Scottish Government Social Research; 2008.

14. Goldney D: **Suicide Prevention: a practical approach**. Oxford: Oxford University Press; 2008.

15. Williams J, Barnhofer T, Duggan D: **Psychology and suicidal behavior: elaborating the entrapment model**. In., edn. Edited by Hawton K. Oxford: Oxford University Press; 2005: 71-78.

16. Wasserman D, Rihmer Z, Rujescu D, Sarchiapone M, Sokolowski M, Titelman D, Zalsman G, Zemishlany Z, Carli V: **The European Psychiatric Association (EPA) guidance on suicide treatment and prevention.** *European psychiatry* 2012, **27**(2):129-142.

17. Shea S: **Psychiatric Interviewing, the art of understanding**. Philadelphia: Saunders Company; 1998.

18. Mann J, Apter A, J B, Beautrais A, Currier D, Haas A, Hegerl U, Lonnqvist J, Malone K, Marusic A *et al*: **Suicide prevention strategies: a systematic review**. *JAMA* 2005, **294**(16):2064-2074.

19. While D, Bickley H, Roscoe A, Windfuhr K, Rahman S, Shaw J, Appleby L, Kapur N: **Implementation of mental health service recommendations in England and Wales and suicide rates, 1997–2006: a cross-sectional and before-and-after observational study**. *The Lancet* 2012, **379**(9820):1005-1012.

20. Tompkins T, Witt J: **The short-term effectiveness of a suicide prevention gatekeeper training program in a college setting with residence life advisers.** *Journal of Primary Prevention* 2009, **30**(2):131-149.

21. Isaac M, Elias B, Katz L, Belik S, Deane F, Enns M, Sareen J: **Gatekeeper training as a preventative intervention for suicide: a systematic review.** *Canadian journal of psychiatry* 2009, **54**(4):260-268.

22. King K, Smith J: **Project SOAR: a training program to increase school counselors' knowledge and confidence regarding suicide prevention and intervention.** *Journal of Sch Health2000 Dec;70(10): 402-7Links* 2000, **70**(10):402-407.

23. Stuart C, Waalen J, Healstromm E: **Many helping hearts: an evaluation of peer gatekeeper training in suicide risk assessment.** *Death Studies* 2003, **27**(4):321-333.

24. Joffe P: **An empirically supported program to prevent suicide in a college student population.** *Suicide and Life-Threatening Behavior* 2008, **38**(1):87-103.

25. Capp K, Deane F, Lambert G: **Suicide prevention in Aboriginal communities: application of community gatekeeper training.** *1: Aust N Z J Public Health* 2001, **25**(4):315-321.

26. Chagnon F, Houle J, Marcoux I, Renaud J: **Control-group study of an intervention training program for youth suicide prevention.** *Suicide Life Threat Behav* 2007, **37**(2):135-144.

27. Matthieu M, Cross W, Batres A, Flora C, Knox KL: **Evaluation of gatekeeper training for suicide prevention in veterans.** *Archives of Suicide Research* 2008, **12**(2):148-154.

28. Gullestrup J, Lequertier B, Martin G: **MATES in construction: impact of a multimodal, community-based program for suicide prevention in the construction industry.** *Int J Environ Res Public Health* 2011, **8**(11):4180-4196.

29. Appleby L, Morriss R, Gask L, Roland M, Lewis B, Perry A, Battersby L, Colbert N, Green G, Amos T: **An educational intervention for front-line health professionals in the assessment and management of suicidal patients (The STORM Project).** *Psychological Medicine* 2000, **30**(4):805-812.

30. Oordt M, Jobes D, Fonseca V, Schmidt S: **Training mental health professionals to assess and manage suicidal behavior: can provider confidence and practice behaviors be altered?** *Suicide and Life-Threatening Behavior* 2009, **39**(1):21-32.

31. Rutz W, von Knorring L, Walinder J: **Long-term effects of an educational program for general practitioners given by the Swedish Committee for the Prevention and Treatment of Depression.** *Acta Psychiatr Scand* 1992, **85**(1):83-88.

32. Hegerl U, Mergl R, Havers I, Schmidtke A, Lehfeld H, Niklewski G, Althaus D: **Sustainable effects on suicidality were found for the Nuremberg alliance against depression.** *Eur Arch Psychiatry Clin Neurosci* 2010, **260**(5):401-406.

33. Szanto K, Kalmar S, Hendin H, Rihmer Z, Mann J: **A Suicide Prevention Program in a Region With a Very High Suicide Rate**. *Archives of General Psychiatry* 2007, **64**(8):914-920.

34. Wyman P, Brown C, Inamn J, Crss W, Schmeeld-Cone K, Guo J, Pena J: **Randomized trial of a gatekeeper program for suicide prevention: 1-year impact on secondary school staff.** *Journal of consulting and clinical psychology* 2008, **76**(1):104-115.

35. Knox KL, Litts DA, Talcott GW, Feig JC, Caine ED: **Risk of suicide and related adverse outcomes after exposure to a suicide prevention programme in the US Air Force: cohort study**. *BMJ* 2003, **327**(7428):1376.

36. May P, Serna P, Hurt L, Debruyn L: **Outcome evaluation of a public health approach to suicide prevention in an American Indian tribal nation.** *Am J Public Health* 2005, **95**:1238-1244.

37. Knowles M: **The Modern Practice of Adult Education: from Pedagogy to Andragogy.** New York: The Adult Education Company; 1980.

38. Rogers E: **Diffusion of innovations.**, 5 edn. New York: Free press; 2003.

39. Topping K: **The effectiveness of peer tutoring in further and higher education: a typology and review of the literature.** *High Educ 1996;32:321-45* 1996, **32**:321-235.

40. Fincher R, Simpson D, Mennin S, Rosenfeld G, Rothman A, McGrew M, Hansen P, Mazmanian P, Turnbull J: **Scholarship in teaching. An imperative for the 21st century.** *Academic medicine* 2000, **75**:887-894.

41. Goodfellow P, Schofield E: **Peer tutorials amongst medical students.** *Med Educ 2001;35:1001-2* 2001.

42. Perkins G, Hulme J, Bion J: **Peer-led resuscitation training for health care students: a randomised controlled study.** *Intensive Care Med* 2002, **28**(6):698-700.

43. Field M, Burke J, McAllister D, Loyd D: **Peer-assisted learning: a novel approach to clinical skills learning for medical students.** *Med Educ* 2007(41):411.

44. Weinmann S, Koesters M, Becker T: **Effects of implementation of psychiatric guidelines on provider performance and patient outcome: systematic review.** *Acta Psychiatrica Scandinavia* 2007, **115**:420-433.

45. Ruiz JG, Mintzer MJ, Leipzig RM: **The impact of e-learning in medical education**. *Academic medicine* 2006, **81**(3):207-212.

46. Cook DA, Levinson AJ, Garside S, Dupras DM, Erwin PJ, Montori VM: **Internet-based learning in the health professions**. *JAMA: the journal of the American Medical Association* 2008, **300**(10):1181-1196.

47. Maloney S, Chamberlain M, Morrison S, Kotsanas G, Keating JL, Ilic D: **Health Professional Learner Attitudes and Use of Digital Learning Resources**. *Journal of medical Internet research* 2013, **15**(1).

48. Gross P, Greenfield S, Cretin S, Ferguson J, Grimshaw J, Grol R: **Optimal Methods for Guideline Implementation.** *Medical care* 2001, **39**:85-92.

49. Bloom B: **Effects of continuing medical education on improving physician clinical care and patient health: a review of systematic reviews.** *Int J Technol Assess Health Care* 2005, **21**:380-385.

50. Ruiz J, Mintzer M, Leipzig R: **The impact of E-learning in medical education.** *Academic medicine* 2006, **81**(3):207-212.

51. Van Hemert A, Kerkhof A, de Keijser J, Verwey B, van Boven C, Hummelen J, de Groot M, Lucassen P, Meerdinkveldboom J, Steendam M *et al*: **Multidisciplinaire richtlijn voor diagnostiek en behandeling van suïcidaal gedrag. Samenvatting.** Utrecht: De Tijdstroom; 2012.

52. Welsh ET, Wanberg CR, Brown KG, Simmering MJ: **E-learning: emerging uses, empirical results and future directions**. *International Journal of Training and Development* 2003, **7**(4):245-258.

53. Walsh K, Levin H, Jaye P, Gazzard J: **Cost analyses approaches in medical education: there are no simple solutions**. *Medical education* 2013, **47**(10):962-968.

54. Cook DA, Levinson AJ, Garside S, Dupras DM, Erwin PJ, Montori VM: **Instructional design variations in internet-based learning for health professions education: a systematic review and meta-analysis**. *Academic medicine* 2010, **85**(5):909-922.

55. Gordon M, Chandratilake M, Baker P: **Low fidelity, high quality: a model for e-learning**. *The clinical teacher* 2013, **10**(4):258-263.

56. George PP, Papachristou N, Belisario JM, Wang W, Wark PA, Cotic Z, Rasmussen K, Sluiter R, Riboli-Sasco E, Car LT: **Online eLearning for undergraduates in health professions: A systematic review of the impact on knowledge, skills, attitudes and satisfaction**. *Journal of Global Health* 2014, **4**(1).

PART II
RESULTS OF THE INTERVENTION

CHAPTER 5

THE EFFECT OF AN E-LEARNING SUPPORTED TRAIN-THE-TRAINER PROGRAM TO IMPLEMENT SUICIDE GUIDELINES IN MENTAL HEALTH CARE

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Background

Randomized studies examining the effect of training of mental health professionals in suicide prevention guidelines are scarce. We assessed whether professionals benefited from an e-learning supported Train-the-Trainer program aimed at the application of the Dutch multidisciplinary suicide prevention guideline.

Methods

45 psychiatric departments from all over the Netherlands were clustered in pairs and randomized. In the experimental condition, full staff of psychiatric departments were trained by peers with an e-learning supported Train-the- Trainer program. Guideline adherence of individual professionals was measured with response to on-line video fragments.

Results

At 3 months follow-up, professionals who received the intervention showed greater guideline adherence, improved self-perceived knowledge and improved provider confidence than professionals who were only exposed to traditional guideline dissemination. Subgroup analyses showed that improved guideline adherence was found among nurses but not among psychiatrists and psychologists.

Conclusions

Our results support the idea that an e-learning supported Train-the-Trainer program is an effective strategy to implement clinical guidelines.

Trial registration

Netherlands Trial Register (NTR3092 www.trialregister.nl)

Introduction

Evidence-based guidelines improve patient care quality [1, 2]. In mental health care, guidelines inform professionals of diagnosis and treatment of patients with a mental disorder, particularly those with severe mental illness [3, 4]. Over the last twenty years, a large number of psychiatric guidelines have been published [5]. However, adherence to these guidelines has been unsatisfactory [5, 6]. Structured implementation of guidelines may improve adherence [2]. Only a few studies specifically address the implementation of psychiatric guidelines [5, 7], and there is a need for more randomized controlled studies. Although (attempted) suicide frequently occurs in Dutch Mental Health Institutions [8] (MHI's), up until 2012 there was no national evidence-based guideline on the assessment and treatment of suicidal behavior. Local guidelines were available in a limited number of MHI's and when available, lacked important elements [9]. It was argued that a national evidence-based guideline may result in better assessment and treatment of suicidal behavior [10]. In May 2012, the multidisciplinary practice guideline for the assessment and treatment of suicidal behavior (PGSB) [11] has been issued. A integrated model of stress-diathesis [12] and entrapment [13] is used to explain the onset and maintenance of suicidal behavior. The PGSB-recommendations are based on international guidelines on the assessment and treatment of suicidal behavior [14-17] and on two empirical reviews of the Scottish government [18, 19].

To implement the PGSB in Dutch mental health care, we developed an e-learning supported Train-the-Trainer program (TtT-e) to be delivered to the full staff of psychiatric departments [20]. The Train-the-Trainer model is based on the Adult Learning Theory [21] stating that the best resource for learning comes from peers, and on the Diffusion of Innovation Theory [22] stating that people adopt new information better through their trusted social networks. TtT-e combines a one day face-to-face training with an additional e-learning module. This form of blended learning is used extensively in medical education and has been found to be more effective when compared with solely traditional instructor-based trainings [23, 24].
Suicide prevention training has been shown to improve knowledge, skills, and attitudes towards suicidal behavior of both gatekeepers [25-33] and mental health professionals [34, 35]. Additionally, professional and gatekeeper training in diagnosis and treatment of depressive disorders, which are associated with suicidal behavior [36] has been shown to result in a reduction of suicide rates [31, 37-40]. However, except for one study [27], the effects of suicide prevention training were investigated in non-randomized controlled study designs.

In the current multicenter cluster randomized trial called PITSTOP suicide (Professionals In Training to STOP suicide [20]), we examined the effect of TtT-e in addition to implementation as usual (IAU; that is, dissemination of the PGSB guideline via websites of professional institutions, reviews in clinical journals, presentations at conferences, books and manuals) versus only IAU. Departments were clustered in pairs on basis of patient characteristics to ensure comparability of experience with suicidal patients of professionals in both conditions.
We hypothesized that individual professionals who were trained via TtT-e would show more adherence to the PGSB when compared with professionals who received only IAU. Since a multidisciplinary comparison [41] found that nurses are likely less trained in dealing with suicidal behavior of patients than psychiatrists or psychologists, we hypothesized that nurses would benefit more from TtT-e when compared with psychiatrists and psychologists.

Methods

Design

Multicenter cluster randomized controlled trial. MHIs were invited to provide departments for participation during nationally supported meetings and conferences on suicide prevention in the Netherlands from January 2009 until December 2011. Departments were considered eligible for participation if they treated patients aged ≥18 years, if professionals considered a need for training in suicide prevention skills, if the training was supported by the institutional board and if institutions were willing to accept costs due to loss of production. Eligible departments were matched in pairs based on primary patient diagnoses and average treatment duration [20].

Randomization

Members of matched pairs were randomly allocated to either IAU (control) or IAU + TtT-e (intervention). Binary randomization was performed by an independent researcher of the Institute for Health and Care Research (EMGO+) who was not involved in the study. Blinding of professionals to the outcome was not possible. Outcomes of matching and randomization are described elsewhere [20].

Ethics statement

Online informed consent was obtained for all individual participants after the procedures had been fully explained. The study (including digital informed consent) was approved by the Medical ethical commission of the VU Medical Center (2011/151) on 17 May 2011. It was registered in the Netherlands Trial Register (NTR3092 www.trialregister.nl) on 4 October 2011. The authors confirm that all ongoing and related trials for this intervention are registered.

Intervention

In the intervention condition, complete multidisciplinary teams (all registered nurses, psychologists, and psychiatrists) were trained by peers in the application of the PGSB via TtT-e. In TtT-e, three types of professionals were involved: masters, trainers and trainees. Training was applied on two levels: first, trainers were trained by masters. Subsequently, trainees were trained by trainers. The training consisted of a one day, small group face-to-face training and was supported by an additional e-learning module that lasted an hour.

Masters were experts in the field of suicide prevention due to scientific performance and clinical practice. Trainers were mental health professionals of various disciplines (psychiatrists, psychologists or nurses), selected by their management because of their role model in a team, and their excellent training skills. Trainees were health professionals within the team of the trainer.

The PGSB recommendations served as the starting point to set the content of the TtT-e program. The PGSB recommends systematic investigation of the suicidal condition of patients by using the Chronological Assessment of Suicidal Events (CASE) interview [42]. Based on its outcome, risk and protection factors for suicide of individual patients are weighted. Subsequently, structured diagnosis, treatment strategy, and a safety protocol are determined. In the TtT-e program, the CASE interview was the overall framework for each of four role plays in which one trainee acts as a suicidal patient and the other trainee interviews the ‘patient’ via the CASE interview. The intervention is described elsewhere in more detail [20].

Measurements

In the intervention condition, two weeks before the face-to-face training of the departments’ staff was planned, the baseline assessment (T0) was sent to the trainees by e-mail via a online survey platform [43]. Completing baseline assessment was mandatory to get entrance to the face-to-face training

and to gain access to the e-learning module. A follow-up assessment (T1) was planned at three months after the training. Professional credits were awarded to professionals if they had completed T0, T1 and attended the training. In the control condition, T0 was carried out as soon as the team was informed and a list of e-mail addresses of professionals was provided to the research team. T1 was scheduled three months after T0. To encourage professionals to complete the assessments, a coupon of 10 Euro per completed questionnaire was provided. Per assessment, three reminders were sent, and team managers were encouraged to motivate their staff to complete the assessments.

Professional recruitment and follow-up

Departments were recruited from January 2009 until December 2011. The first baseline assessments were send to individual participants at 24 November 2011. Last 3 months follow-up assessments was received at 28 February 2013.

Outcome measures

All outcome measures pertained to the individual level and consent was sought per individual. The primary outcome was guideline adherence, a self-constructed on-line measure. Professionals were asked to respond to 30-second video vignettes (n=5) in which experienced nurses, psychologists and psychiatrists interact with suicidal characters, played by actors. Professionals rated the likelihood of replying to the patient by using 25 different replies. Each reply could be rated on a Visual Analogue Scale, ranging from 1 to 100 (1=very unlikely, 100=very likely). For example: 'Ask whether the patient thinks about suicide', 'Ask how hopeless the patient is feeling'. The replies of professionals to patient behaviors in this measure reflect recommendations according to the PGSB. At T0 and T1, similar vignettes were displayed. Per assessment, all item scores were summed and subsequently divided by the total number of items (n=125), resulting in a mean score ranging from 0 to 100; a higher score represents stronger guideline adherence. A reference score was set twice. First by a panel of masters (n=6) who completed the video vignettes, resulting in a reference score of mean (SD) 75.0 (6.0). Second, by psychology students (n=351) resulting in a score of mean (SD) 59.0 (8.0) and a Cronbach's alpha of 0.92. A preview in English can be found at http://fppvu.eu.qualtrics.com/SE/?SID=SV_cw1bB0HVY2k0iqh.

The secondary outcome was measured by the 7-item subscale self-evaluation of knowledge on suicidal behavior of the 14-item Question-Persuade-Refer-questionnaire [44]. Another outcome, provider confidence, was calculated by summing the scores of the items 'I am confident in my ability to successfully assess suicidal patients' and 'I am confident in my ability to successfully treat suicidal patients' [34] . Finally, 'recognition of appropriate response to suicidal behavior' was measured with the validated 24-item Dutch version [45] of the Suicide-Intervention-Response-Inventory-version 2 (VROS [45]/SIRI-2 [46]). At T1, all professionals were asked if they read the summary of the guideline. In the intervention condition, professionals were also asked whether they used the e-learning module (YES/NO), and if so, for how many minutes and how they would rate the module (1 very bad- 10 very good). To observe adherence to the training program, training sessions were randomly visited by graduate psychology students. Adherence was scored on a 4-point Likert scale (1 = very strong, 4= very low).

Sample size

For the primary outcome (guideline adherence) the sample size was calculated according to Twisk [47]. The number of professionals needed to be included was set to 165. This number is sufficient to find a 10% change [48], assuming 0.05 alpha and the statistical power of 1- beta = 80 %. A correction of 20% for clustering of effects within departments was applied.

Deviations from Study Protocol

In our published protocol article [20], we described to have two follow-up assessments, one directly after the training, and one at three month follow-up. Due to ICT difficulties to display the video fragments of our self-constructed guideline adherence scale, which led to several complains of participants, we decided to skip the assessment directly after the training, and to only offer the 3 months follow-up. This way we hoped to reduce drop-out at 3 months follow-up.

Statistical analyses

First, we conducted a missing values analysis to identify patterns in missing values between the conditions. We found professionals in the intervention condition who were lost to follow up to systematically score lower on guideline adherence at baseline compared to other professionals. Based on this analysis we concluded that missing values were missing not at random. Therefore, we decided not to impute missing values and to conduct an available case analysis.
We analyzed the effect of the intervention on the primary and secondary outcomes by fitting multilevel models. Because multilevel modeling allows for the partition of the total variation in variation from differences in

measurements between professionals (level 1) and variation because of differences between departments (level 2), we could establish the impact of the observed changes on the different levels. The randomization condition was the between-subject factor. The baseline score of the dependent variable was added as covariate to adjust the outcome for baseline differences. The effect of the e-learning module above and beyond the face-to-face training was analyzed by fitting a multilevel model with 'usage of the e-learning module' (YES/NO) as between-subject factor and guideline adherence as outcome variable. Next, we separately analyzed the effect of the intervention for nurses, and psychiatrists/psychologists by rerunning all mixed model analyses with the total file split by profession. Differences between intervention and control condition were presented by a regression coefficient (B) and 95% confidence intervals and p-value. Cohen's d's represent the effect size of the TtT-e program.

Results

Figure 1: Flow of the study:

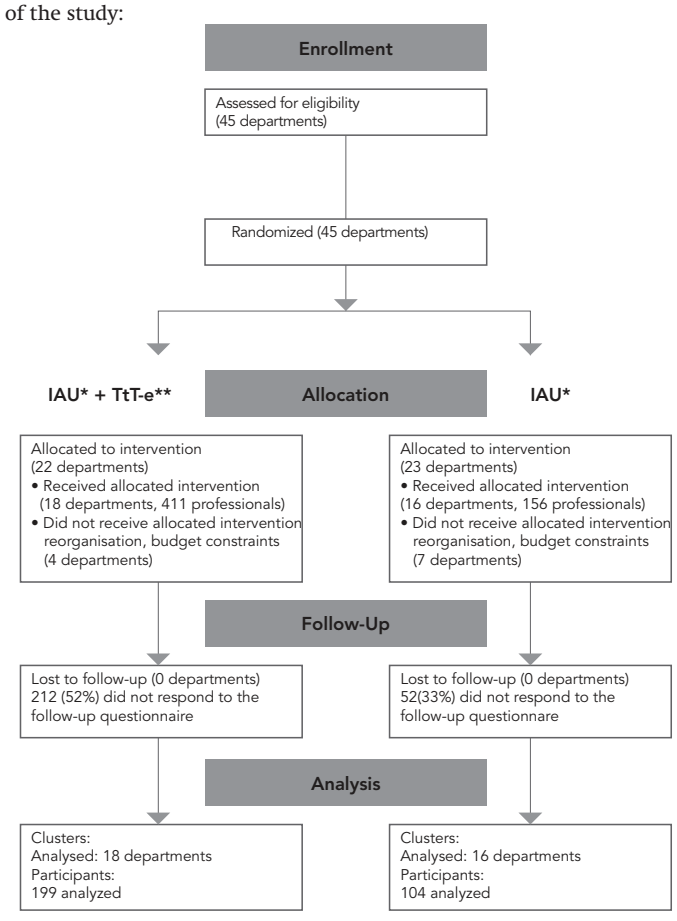

Fig 1 shows the flow of departments through the trial, showing that 34 departments completed the study. In the intervention condition, 40 trainers from 18 departments were trained by masters. Of the total 567 professionals that started T0, 303 (53%) completed the follow-up assessment. More professionals in the intervention group the study compared to the control group. Adherence to the training program was rated high (n=3) or very high (n=4).

Table 1: Sample features of completers at baseline in n (%) unless otherwise stated

	Intervention group n=199 18 departments	**Control group n=104 16 departments**
Female gender	139 (70)	67 (64)
Age mean (SD) yrs	42 (12)	43 (12)
Professional discipline		
nurse	121 (60)	51 (49)
psychologists/psychiatrists	52 (28)	32 (31)
other	26 (12)	21 (20)
Skills of professionals		
practice experience mean (SD) (yrs)	18 (11)	17 (12)
experience with suicidal behavior mean (SD) yrs	14 (10)	13 (10)
previously trained in discussing suicidal behavior	42 (21)	28 (27)
time span between T0 and T1 (months) mean(95% CI)	3.7(3.4-4.1)	4.1 (3.8-4.4)
guideline adherence mean (SD) min 0 max 100	64.0 (9.5)	65.6 (9.7)
self-evaluation of knowledge mean (SD) min 7 max 35	23.0 (3.8)	25.1 (4.5)
provider confidence mean (SD) min 2 max 10	6.8 (1.5)	7.2 (1.5)
appropriate response mean (SD)	56.1 (12.1)	52.9 (9.7)

Table 1 shows that relatively more nurses were allocated to the intervention condition. Groups show comparable scores on all outcomes at T0.

Table 2:Results of the multilevel analyses*at T1 for all completers

	Intervention	Control			
	n(199)	n(104)	B (95% CI)	p-value	effect size**
Guideline adherence range 1-100	70.5(12.5)	66.0(11.2)	4.6(1.6-7.5)	0.02	0.4
Self- evaluation of Knowledge Range 7-35	26.6(3.1)	24.1(2.3)	2.7(2.0-3.4)	<.001	1.0
Provider Confidence Range 2-10	7.7(1.1)	6.9(1.4)	0.8(0.4-1.2)	<.001	0.7
Appropriate Response Range 12-280	55(17.7)	53(9.1)	1.6(-1.7-4.9)	n.s.	

* Model with random intercept for department, controlling for baseline. Intracluster correlation coefficient = 6%

** Cohen's d

Table 2 shows the results of the multilevel analyses. At T1, the intervention condition showed significant higher scores on guideline adherence, self-evaluation of knowledge and provider confidence than the control condition. No difference on the SIRI-2 was found. Significant improvement of outcomes at T1 can be explained by changes between professionals (level 1; $p < 0.001$) but not by changes between departments (level 2; $p = 0.1$).

122 professionals (61%) in the intervention condition viewed the e-learning module for an average duration of 40 minutes (SD = 18). The average score of appreciation of the module was 6.9 (SD 1.4) on a scale of 1 to 10. The e-learning had no significant effect on guideline adherence above and beyond the face-to-face training (b = 1.9(-0.8-4.5), p = 0.2). In the intervention condition 85% (n=98/115) stated they had read the summary of the guideline at T1, compared to 20% (n=31/149) in the control condition ($\chi^2(1) = 80,5$ $p < 0.001$). In the control condition, 67(46%) professionals were not aware that the guideline had been issued in the previous year.

Table 3: Separate results of the multilevel analyses* at T1 for nurses and psychiatrists/psychologists

	Nurses N=172			Psychiatrists/psychologists N=84		
	B (95% CI)	p-value	Effect size**		p-value	Effect size
Guideline adherence	6.6 (3.2 to 10.0)	<0.001	0.6	-1.2 (-6.1-3.7)	Ns	
Self-evaluation of Knowledge	2.7 (1.7 to 3.8)	<0.001	0.9	1.9 (0.7 to 3.2)	0.005	0.8
Provider Confidence	0.7 (0.2 to 1.2)	0.009	0.5	1.0 (0.3 to 1.6)	0.007	0.7
Appropriate Response	0.0 (-3.5 to 3.6)	ns		5.5 (-2.7 to 13.9)	Ns	

* Model with random intercept for department, controlling for baseline. Intracluster correlation coefficient = 6%

** Cohen's d

Table 3 presents the effect of the intervention for nurses versus psychiatrists/psychologists. At T1, nurses but not psychiatrists/psychologists in the intervention group showed more guideline adherence than controls. Both nurses and psychiatrist/psychologists showed more self-evaluation of knowledge and provider confidence. No effect of the intervention was found on the SIRI-2.

Discussion

This study examined the additional effects of an e-learning supported Train-the-Trainer program (TtT-e) on adherence to the multidisciplinary practice guideline on the assessment and treatment of suicidal behavior [11]. At 3 months follow-up, mental health professionals who received TtT-e in addition to traditional guideline dissemination showed stronger guideline adherence, more self-perceived knowledge of suicidal behavior and more provider confidence in dealing with suicidal behavior than professionals who were only exposed to traditional guideline dissemination. However, subgroup analyses showed that improved guideline adherence was found among nurses but not among psychiatrists and psychologists.
As practice guidelines reflect every day practice, professionals already show certain levels of guideline adherence without being trained. Their score on guideline adherence at baseline was close to the score of masters and above the average student score. However, among nurses, we found a 10% improvement on guideline adherence, which is postulated to be the maximum increase to achieve after training professionals in guideline adherence [48], and resembles the 10% change of educative interventions found in other studies on guideline implementation in general medicine [48] and psychiatry [5].

No effect was found on the SIRI-2 which is in line with previous findings [35, 49], indicating a ceiling effect for mental health professionals, who are assumed to already have basic skills and knowledge of dealing with suicidal behaviors at baseline.

Nurses were more likely to improve on guideline adherence than psychologists/psychiatrists. This might be explained by daily practice in which nurses likely ask for psychiatrists' or psychologists' consultation in case of a patient's emerging suicide risks. Consequently, psychiatrists and psychologists are more often and more intrusively involved in systematic diagnosis of suicidal conditions than nurses. Additionally, contrary to nurses, psychiatrists and psychologists are obliged to follow post-doctoral education. Therefore, budgets for that goal fairly exceed budgets for nurses and chances to improve professional skills and knowledge are lower among nurses than among psychiatrists and psychologists.

Limitations and strengths

In the intervention condition, more professionals both started and dropped out of the study, compared to the control condition. This might be due to difference in motivation to participate in the study. For one, the incentive to finish the baseline assessment differed between the two conditions(mandatory for access to the training versus a coupon of 10 euro). We argue that some professionals in the intervention condition that started the study might not have been intrinsically motivated to participate in the study, but felt duty-bound . As completion of the follow-up assessment was not mandatory, but resulted in professional accreditation points, it might be that less motivated professionals dropped out more easily. We hypothesize that professionals in the control condition who completed T0, were more intrinsically motivated to participate in the study, and therefore more likely to complete T1 as well, resulting in a smaller drop-out rate.

One extra barrier for participation in our study was that the ICT environment in MHI's was often technically insufficient to display the video vignettes of the survey. This may have caused a considerable drop-out and possibly introduced selection bias, as professionals who were strongly affiliated to the theme of the study might have been more likely to finish the study. The technical difficulties might also partly explain why 46% (66) professionals did not use the e-learning module. Still, the overall drop-out rate in our study was comparable [34] or even better [50] when compared to other studies involving professionals.

A strength of this study is its randomized controlled design, which is scarce in this field of research [5]. A randomized controlled study of this size provides a high level of evidence. Also, the included departments well represent the psychiatric departments in the Netherlands [20]. Therefore, the external validity of the findings is considerable. Another strength was the timing of the study; we offered our intervention right after the PGSB had been released and endorsed by the Dutch Health Inspectorate. Therefore, we argue that TtT-e was welcomed by both management and professionals as a well-timed intervention.

Implications and further studies

Our results support the idea that an e-learning supported Train-the-Trainer program is an effective strategy to implement clinical guidelines. We found that TtT-e resulted in improvement of individual professionals, but not in improvement of team performance. As the assessment and treatment of suicidal behavior is a multidisciplinary team effort [11], more focus should be aimed at the improvement of complete teams. Offering role-plays and feedback that target multidisciplinary collaboration could result in more effect on team level. Our results suggest that the effect of TtT-e is enduring for over at least three months, but we do not know the effect on a longer term. A systematic review [51] found that booster sessions may be necessary to prolong the effect of our educational intervention. Next, we need to know the effect on clinical (patient) outcomes of our intervention and compare the found effects with other studies [1, 37-40, 52, 53]. In the current study, the relative effectiveness of the different elements of TtT-e (the Train the-Trainer element, the face-to-face training, the e-learning module, the multidisciplinary training) has not been examined separately. Future studies may disentangle the effects of the different elements, so that more targeted programs can be developed [51].

References

1. Grol R, Grimshaw J: **From best evidence to best practice: effective implementation of change in patients' care**. *The Lancet* 2003, **362**(9391):1225-1230.

2. Grol R, Grimshaw J: **Evidence-based implementation of evidence-based medicine**. *The Joint Commission Journal on Quality Improvement* 1999, **25**(10):503-513.

3. Wobrock T, Weinmann S, Falkai P, Gaebel W: **Quality assurance in psychiatry: quality indicators and guideline implementation**. *European Archives of Psychiatry and Clinical Neuroscience* 2009, **259**(2):219-226.

4. Hutschemaekers GJ: **Multidisciplinary guidelines in Dutch mental health care: plans, bottlenecks and possible solutions**. *International Journal of Integrated Care* 2003, **3**.

5. Weinmann S, Koesters M, Becker T: **Effects of implementation of psychiatric guidelines on provider performance and patient outcome: systematic review**. *Acta Psychiatrica Scandinavica* 2007, **115**(6):420-433.

6. Shafran R, Clark D, Fairburn C, Arntz A, Barlow D, Ehlers A, Freeston M, Garety P, Hollon S, Ost L: **Mind the gap: Improving the dissemination of CBT**. *Behavior Research and Therapy* 2009, **47**(11):902-909.

7. Girlanda F, Fiedler I, Ay E, Barbui C, Koesters M: **Guideline implementation strategies for specialist mental healthcare**. *Current Opinion in Psychiatry* 2013, **26**(4):369-375.

8. Huisman A, Robben P, Kerkhof A: **An examination of the Dutch Health Care Inspectorate's supervision system for suicides of mental health care users**. *Psychiatric Services* 2009, **60**(1):80-85.

9. Verwey B, Waarde Jv, Rooij Iv, Gerritsen G, Zitman FG: **[Guidelines in Dutch mental health institutions for dealing with persons attempting suicide]**. 2007.

10. Bool M, Doeven M: **Verminderen van suïcidaliteit: beleidsadvies: actualisering van het Advies inzake Suïcide, Gezondheidsraad 1986**: Trimbos-Instituut; 2007.

11. van Hemert AM, Kerkhof AFJM, de Keijser J, verwey B: **Multidisciplinaire richtlijn voor diagnostiek en behandeling van suïcidaal gedrag.** . In. Utrecht: Nederlandse Vereniging voor Psychiatrie/Nederlands Instituut voor Psychologen/Trimbos Instituut;; 2012.

12. Goldney R: **Suicide prevention**. Oxford: Oxford University Press; 2008.

13. Williams JMG, Williams M: **Cry of pain: Understanding suicide and self-harm**: Penguin Books London; 1997.

14. Association AP: **Practice guideline for the assessment and treatment of patients with suicidal behaviors**: American Psychiatric Association; 2003.

15. Health NCCfM: **Self-harm: the short-term physical and psychological management and secondary prevention of self-harm in primary and secondary care**. *National Institute for Health and Clinical Excellence website Available at: http://www nice org uk/nicemedia/pdf/CG016NICEguideline pdf Updated July* 2004.

16. Australian R: **Australian and New Zealand clinical practice guidelines for the management of adult deliberate self-harm**. *Australian and New Zealand Journal of Psychiatry* 2004, **38**(11-12):868-884.

17. Group NZG: **The assessment and management of people at risk for suicide** In. Wellington: New Zealand Guideline Group; 2003.

18. McLean J, Maxwell M, Platt S, Harris F, Jepson R: **Risk and protective factors for suicide and suicidal behavior: a literature review**. *Health and Community Care, Scottish Government Social Research Scottish Government* 2008.

19. Leitner M, Barr W, Hobby L: **Effectiveness of interventions to prevent suicide and suicidal behavior: a systematic review**: Scottish Government; 2008.

20. de Beurs DP, de Groot MH, de Keijser J, Verwey B, Mokkenstorm J, Twisk JW, van Duijn E, van Hemert AM, Verlinde L, Spijker10 J: **Improving the application of a practice guideline for the assessment and treatment of suicidal behavior by training the full staff of psychiatric departments via an e-learning supported Train-the-Trainer program: study protocol for a randomized controlled** *BMC trials* 2013, **14**(9).

21. Knowles MMS: **The modern practice of adult education**, vol. 41: Association Press New York; 1970.

22. Rogers EM: **Diffusion of innovations**: Simon and Schuster; 2010.

23. Means B, Toyama Y, Murphy RF, Baki M: **The Effectiveness of Online and Blended Learning: A Meta-Analysis of the Empirical Literature**. *Teachers College Record* 2013, **115**:1-47.

24. Pearce J, Mann MK, Jones C, van Buschbach S, Olff M, Bisson JI: **The most effective way of delivering a Train-the-Trainers program: A systematic review**. *Journal of Continuing Education in the Health Professions* 2012, **32**(3):215-226.

25. King KA, Smith J: **Project SOAR: a training program to increase school counselors' knowledge and confidence regarding suicide prevention and intervention**. *Journal of School Health* 2000, **70**(10):402-407.

26. Isaac M, Elias B, Katz LY, Belik S-L, Deane FP, Enns MW, Sareen J: **Gatekeeper training as a preventative intervention for suicide: a systematic review**. 2009.

27. Wyman PA, Brown CH, Inman J, Cross W, Schmeelk-Cone K, Guo J, Pena JB: **Randomized trial of a gatekeeper program for suicide prevention: 1-year impact on secondary school staff**. *Journal of consulting and clinical psychology* 2008, **76**(1):104.

28. Stuart C, WAALEN PhD JK, Haelstromm E: **Many helping hearts: An evaluation of peer gatekeeper training in suicide risk assessment**. *Death studies* 2003, **27**(4):321-333.

29. Joffe P: **An empirically supported program to prevent suicide in a college student population**. *Suicide and Life-Threatening Behavior* 2008, **38**(1):87-103.

30. Capp K, Deane FP, Lambert G: **Suicide prevention in Aboriginal communities: Application of community gatekeeper training**. *Australian and New Zealand Journal of Public Health* 2001, **25**(4):315-321.

31. Matthieu MM, Cross W, Batres AR, Flora CM, Knox KL: **Evaluation of gatekeeper training for suicide prevention in veterans**. *Archives of Suicide Research* 2008, **12**(2):148-154.

32. Gullestrup J, Lequertier B, Martin G: **MATES in construction: impact of a multimodal, community-based program for suicide prevention in the construction industry**. *International journal of environmental research and public health* 2011, **8**(11):4180-4196.

33. Chagnon F, Houle J, Marcoux I, Renaud J: **Control-Group Study of an Intervention Training Program for Youth Suicide Prevention**. *Suicide and Life-Threatening Behavior* 2007, **37**(2):135-144.

34. Oordt MS, Jobes DA, Fonseca VP, Schmidt SM: **Training mental health professionals to assess and manage suicidal behavior: Can provider confidence and practice behaviors be altered?** *Suicide and Life-Threatening Behavior* 2009, **39**(1):21-32.

35. Appleby L, Morriss R, Gask L, Roland M, Lewis B, Perry A, Battersby L, Colbert N, Green G, Amos T: **An educational intervention for front-line health professionals in the assessment and management of suicidal patients (The STORM Project)**. *Psychological Medicine* 2000, **30**(4):805-812.

36. Hawton K, van Heeringen K: **Suicide**. *The Lancet* 2009, **373**(9672):1372-1381.

37. Rutz W, Knorring vL, Wålinder J: **Frequency of suicide on Gotland after systematic postgraduate education of general practitioners**. *Acta Psychiatrica Scandinavica* 1989, **80**(2):151-154.

38. Hegerl U, Mergl R, Havers I, Schmidtke A, Lehfeld H, Niklewski G, Althaus D: **Sustainable effects on suicidality were found for the Nuremberg alliance against depression**. *European archives of psychiatry and clinical neuroscience* 2010, **260**(5):401-406.

39. Szanto K, Kalmar S, Hendin H, Rihmer Z, Mann JJ: **A suicide prevention program in a region with a very high suicide rate**. *Archives of General Psychiatry* 2007, **64**(8):914.

40. Knox KL, Litts DA, Talcott GW, Feig JC, Caine ED: **Risk of suicide and related adverse outcomes after exposure to a suicide prevention programme in the US Air Force: cohort study**. *Bmj* 2003, **327**(7428):1376.

41. Palmieri G, Forghieri M, Ferrari S, Pingani L, Coppola P, Colombini N, Rigatelli M, Neimeyer RA: **Suicide intervention skills in health professionals: a multidisciplinary comparison**. *Archives of Suicide Research* 2008, **12**(3):232-237.

42. Shea SC: **The chronological assessment of suicide events: a practical interviewing strategy for the elicitation of suicidal ideation**. *Journal of Clinical Psychiatry* 1998, **59**:58-72.

43. Snow J: **The Complete Research Suite: A Step By Step Guide To Using Qualtrics**. *Qualtrics, Provo* 2011.

44. Tompkins TL, Witt J: **The short-term effectiveness of a suicide prevention gatekeeper training program in a college setting with residence life advisers**. *The journal of primary prevention* 2009, **30**(2):131-149.

45. Scheerder G, Van Audenhove C: **Validation of an instrument measuring suicide intervention skills**. *Psychiatria Danubina* 2006, **18**(Suppl. 1):94-94.

46. Neimeyer RA, Maclnnes WD: **Assessing paraprofessional competence with the Suicide Intervention Response Inventory**. *Journal of Counseling Psychology* 1981, **28**(2):176.

47. Twisk JW: **Applied multilevel analysis: a practical guide**: Cambridge University Press; 2006.

48. Grol RPTM, Wensing MJP: **Implementatie: Effectieve verbetering van de patiëntenzorg**: Elsevier gezondheidszorg; 2006.

49. Gask L, Dixon C, Morriss R, Appleby L, Green G: **Evaluating STORM skills training for managing people at risk of suicide**. *Journal of advanced nursing* 2006, **54**(6):739-750.

50. Hanbury A, Farley K, Thompson C, Wilson P, Chambers D: **Challenges in identifying barriers to adoption in a theory-based implementation study: lessons for future implementation studies**. *BMC Health Services Research* 2012, **12**(1):422.

51. Cherry MG, Brown JM, Bethell GS, Neal T, Shaw NJ: **Features of educational interventions that lead to compliance with hand hygiene in healthcare professionals within a hospital care setting. A BEME systematic review: BEME Guide No. 22**. *Medical Teacher* 2012, **34**(6):e406-e420.

52. Hegerl U, Rummel-Kluge C, Värnik A, Arensman E, Koburger N: **Alliances against Depression–a community based approach to target depression and to prevent suicidal behavior**. *Neuroscience & Biobehavioral Reviews* 2013.

53. de Beurs DP, de Groot MH, Bosmans JE, de Keijser J, Mokkenstorm J, Verwey B, van Duijn E, de Winter RF, Kerkhof AJ: **Reducing patients' suicide ideation through training mental health teams in the application of the Dutch multidisciplinary practice guideline on assessment and treatment of suicidal behavior: study protocol of a randomized controlled trial**. *Trials* 2013, **14**(1):372.

CHAPTER 6

DO PATIENTS BENEFIT FROM THE TRAINING OF MENTAL HEALTH PROFESSIONALS IN SUICIDE PRACTICE GUIDELINES? A CLUSTER-RANDOMIZED TRIAL

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Background

Randomized studies examining the effect of suicide guideline implementation on patients are scarce.

Aims

To assess whether patients benefited from the structured implementation of suicide guidelines

Method

45 psychiatric departments were randomized. In the intervention condition, full staff of departments was trained with an e-learning supported Train-the-Trainer program. After the intervention, patients were assessed at intake and at three-months follow-up. Primary outcome was change in suicide ideation.

Results

For the total group of 566 suicidal patients, intention-to-treat analysis showed no effects of the intervention on patient outcomes at three-months follow-up. Suicidal patients with a DSM-IV diagnosis of depression (n = 154) did show a significant decrease in suicide ideation when treated in the intervention group. Also, patients in the intervention condition reported more often that suicidality was discussed during treatment.

Conclusion

Our findings demonstrate the potential of structured suicide guideline implementation on patients.

Declaration of interest

None

Introduction

Evidence-based practice guidelines should improve patient care [1, 2]. To strengthen suicide prevention in Dutch mental health care, the evidence-based multidisciplinary practice guideline for the assessment and treatment of suicidal behavior [3] (PGSB) was issued in May 2012. The PGSB is based on various international guidelines on the assessment and treatment of suicidal behavior [4-7] and two empirical reviews of the Scottish government [8, 9]. The PGSB combines the stress-diathesis [10] and entrapment [11] model to explain the onset and persistence of suicidal behavior and offers concrete recommendations to clinicians. Internationally, a large number of psychiatric guidelines has been made available over the last twenty years [12-15]. However, adherence to these guidelines in mental health care has been incomplete [12, 16, 17] with the result that patients do not always receive appropriate care [1, 17-19]. It is argued that structured implementation of guideline recommendations may improve adherence to guidelines [1], and thereby, improve patient care [1, 20, 21]. A recent systematic review [12] described all studies addressing the implementation of psychiatric guidelines, and concluded that randomized controlled studies on the effect of implementation strategies on patients well-being and recovery are needed to adequately implement new evidence and improve patient care.

Suicide prevention training has shown to improve knowledge, skills, and attitudes towards suicidal behavior of gatekeepers(teachers, general practitioners) [22-30] and mental health professionals [31, 32]. Also, professional and gatekeeper training in diagnosis and treatment of depressive disorder, likely results in a reduction of suicide rates [28, 33-36]. This might be explained by the strong association between a depressive disorder and suicide [37]. However, the actual effects of a specific suicide practice guideline training on suicidality of patients has not yet been examined in a randomized controlled trial.

Considering the relevance for the PGSB for Dutch mental health care [38], and the need for evidence on the effectiveness of guideline implementation [39], the Dutch health funding agency ZONMW funded a study on the implementation of the PGSB called PITSTOP suicide (Professionals in Training to STOP suicide). PITSTOP suicide is a cluster randomized controlled trial examining the effects of an e-learning supported Train-the-Trainer program (TtT-e) which content reflects the PGSB, delivered to multidisciplinary teams of mental health care departments. Departments were clustered in pairs on basis of patient characteristics to ensure comparability of experience with suicidal patients of professionals in both conditions. The Train-the-Trainer model is based on the Adult Learning Theory [40] stating that the best resource for learning comes from peers, and on the Diffusion of Innovation Theory [41] stating that people adopt new information better through their trusted social networks. TtT-e combines a one-day face-to-face training with an additional e-learning module. This form of blended learning [1] is used extensively in medical education and has been found to be more effective when compared with traditional instructor-based training [42, 43]. We previously found that TtT-e resulted in approximately 10% improvement on confidence, knowledge and guideline adherence of mental health care professionals [44].

In the current study, we hypothesized that individual suicidal patients treated by professionals who were trained by the TtT-e program (intervention) would recover more quickly from suicidal ideation as compared with patients treated by professionals who were not trained via TdT-e (control) but received information on the release of the guideline via the usual methods (internet, conferences, workshops etc). Secondary outcomes were self-reported non-fatal suicide attempts and treatment satisfaction. As fostering a working relationship with the patient is the most important part of TdT-e, we hypothesized that all patients, whether they present suicide ideation at baseline or not, show more treatment satisfaction in the intervention condition than patients in the control condition.

Methods

Design and sample recruitment

The PITSTOP suicide trial has been described in detail elsewhere [45]. In sum, PITSTOP suicide was a multicenter cluster randomized controlled trial. Clusters were care departments of Mental Health care Institutions (MHIs) throughout The Netherlands. Departments were considered eligible for participation if they treated patients of ≥18 years of age, if professionals felt a need for training in suicide prevention skills. Patients of included departments were eligible if they were ≥18 years of age and willing to provide a written informed consent. Whether a patient was able to enter the study was left to the discretion of the staff. Patients who were deemed emotionally and/or cognitively unable to complete questionnaires were excluded.

Matching and Randomization

Eligible departments were matched in pairs on basis of the main diagnostic DSM-IV category of patients treated in the department, and on comparable average length of treatment [46]. Members of matched pairs were randomly

allocated to either implementation as usual IAU (control) or TtT-e + IAU (intervention). Binary randomization was performed by an independent researcher of the EMGO+ research institution who was not involved in the study. Patients were blind to the result, whereas professionals were not.

Intervention

In the intervention condition, complete multidisciplinary teams of mental health professionals were trained in the application of the guideline via a 1-day small interactive group program supported by e-learning modules (TtT-e) [46]. Personalized feedback was an important element of the training. The training was provided by peers, who were trained by experts/masters in the field of suicidology according to the PITSTOP training protocol. The PGSB recommendations served as the starting point to set the content of the TtT-e program. The PGSB recommends systematic investigation of the suicidal condition of patients by using the Chronological Assessment of Suicidal Events (CASE) interview [47]. Based on its outcome, risk and protection factors for suicide of individual patients are weighted. Subsequently, structured diagnosis, treatment strategy, and a safety protocol are determined. In the TtT-e program, the CASE interview was the overall framework for each of four role plays in which one trainee acted as a suicidal patient and the other trainee interviewed the 'patient' via the CASE interview.

Data collection procedure

If possible, patient data were collected via Routine Outcome Monitoring (ROM), an online assessment by which data on the effectiveness of treatment in everyday clinical practice are systematically collected [48]. In MHI's not using ROM, data were collected by graduate students and/or research assistants using paper-and- pencil questionnaires. In the intervention condition, as soon as all staff was trained, newly admitted patients were assessed at admission or intake (T0) and subsequently three months after admission (T1). If a patient was discharged within three months, T1 was arranged just before discharge. In the control departments, T0 started at the time that the department was informed of the allocation outcome. At both T0 and T1, suicide ideation was measured with the first 19 items of the Beck Scale for Suicidal Ideation (BSS) [49]. Total score ranged from 0 to 38, a higher score reflects stronger suicide ideation. Frequency of self-reported non-fatal suicide attempts were assessed at admission (Did you ever do one or more suicide attempts?) and at T1 (Did you do one or more suicide attempts between now and the first questionnaire?). At T1, we also assessed treatment satisfaction with four items that had been established to measure the quality of therapeutic alliance. The first two items were: 'How satisfied are you overall with your treatment?' and 'How would you evaluate your relationship with your care provider?'. These two items were rated from 0 to 10. The other two items were: 'Was there any attention for your suicidal thoughts during treatment?' and 'How did your care provider deal with your suicidal thoughts?'. These two items were scored on a four-point scale ranging from 1= Yes/ Good to 4= No/Poor. Finally, the main DSM-IV diagnosis of each patient was collected from their electronic health record.

Ethics statement

Written informed consent was obtained for all individual participants after the procedures had been fully explained. The study was approved by the Medical ethical commission of the VU Medical Center (2011/151) and was registered in the Netherlands Trial Register (NTR3092 www.trialregister.nl).

Patient recruitment and follow-up

The first patients were assessed at 20 January 2012. Last 3 months follow-up assessments were completed at 26 September 2013.

Sample size

For the primary outcome (change in suicide ideation) the number of patients that needed to be included was set to 423. This number is sufficient to find a small effect size (Cohen's d) of 0.3, assuming an alpha of 0.05 and the statistical power of 1-Beta=0.80. A correction of 20% for clustering of effects within departments was applied.

Statistical analyses

Differences in baseline characteristics of patients who dropped out and those who did not were analyzed by using logistic regression.

Suicide ideation and non-fatal suicide attempts

For our primary analysis, change in suicide ideation, we selected only patients with suicide ideation at baseline (BSS > 0). Within this group of suicidal patients, baseline differences between the intervention and control group were described. Effects of the intervention on the BSS were analyzed on an intention-to-treat basis by using multiple imputation for missing values. We fitted a multilevel model with a random intercept at the department level. Score on the BSS at baseline was added as covariate and the randomization condition was the between subjects factor. A multilevel logistic

regression model was fitted to establish the effect of the intervention on self-reported non-fatal suicide attempt at T1. A subgroup analysis was done by repeating the same analysis for patients diagnosed with a depressive disorder and BSS > 0 at baseline. Results were presented using regression coefficients (b) or ORs, 95% confidence intervals and p-values. Cohen's d's represented the effect size of the TtT-e program.

Treatment satisfaction

The first two items on treatment satisfaction were analyzed by fitting linear multilevel models for all patients and, separately, for patients with baseline suicide ideation (BSS > 0). Data was analyzed on an intention-to-treat basis. Means, standard deviations and effect sizes were presented. Answers to the last two treatment satisfaction items were dichotomized by adding response option 1 and 2 into one response category (Yes/Good), and response 3 and 4 into another(No/Poor). All analysis were done with SPSS 21.

Results

CONSORT 2010 Flow Diagram

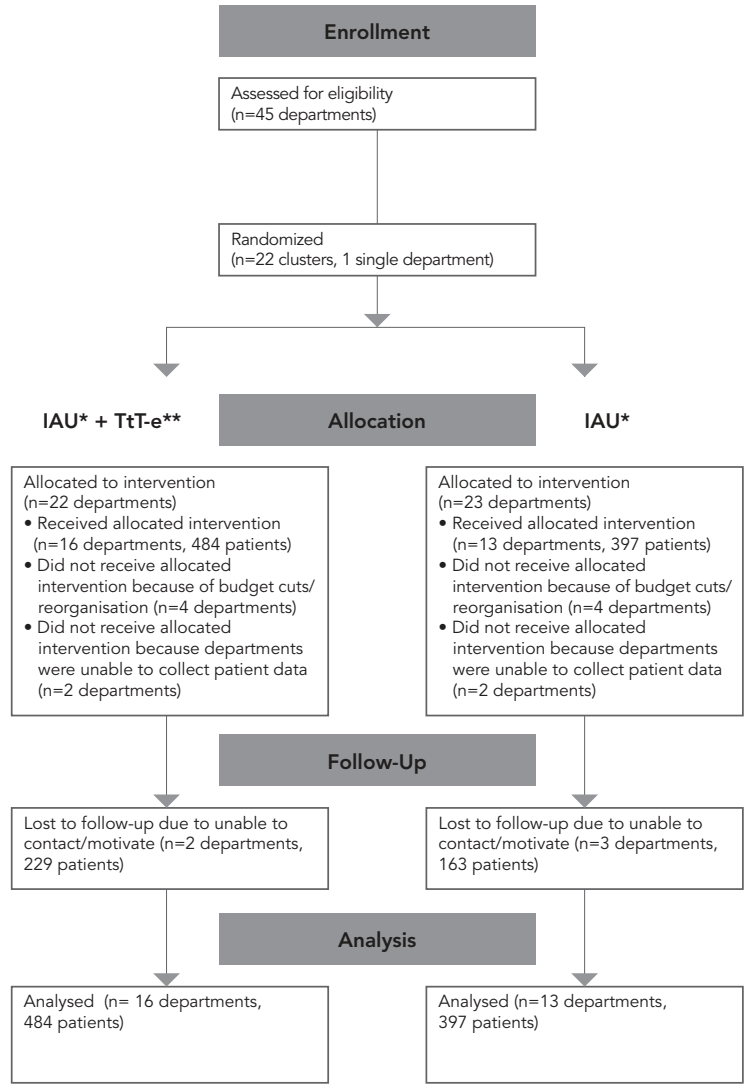

Figure 1 shows the flow of participants and departments through the trial, showing that 881 patients over 29 departments were included. Patients who were lost to follow-up were more likely allocated to the intervention condition (OR = 1.96 (95% CI 1.45-2.68), $p < 0.01$).

Table 1: Baseline characteristics of the total sample of patients. In N% unless otherwise specified

N(%)	Total group (n = 881)
Intervention group	484(55)
Demographic	
Female gender	457(54)
Age (M,SD)	43(15)
Education (n =540[1])	
Lower	72(13)
Intermediate	363(67)
Higher	105(19)
Living with partner	212(38)
Born in the NL (n=434[1])	409(93)
Paid employment (n=550[1])	80(14)
Data collected with ROM	287(32)
Clinical characteristics	
Suicidal ideation (BSS > 0)	566(64%)
Attempted suicide (n=682[1])	
Never	432(63)
Once	129(19)
More than once	121(18)
Diagnosis (n=549[1])	
Depression	222(40)
Anxiety	43(8)
Psychosis	51(9)
Personality disorder	77(14)
Substance dependence	89(16)
PTSS	22(4)
Eating disorder	45(8)

1 Data is missing for other patients

Table 1 shows baseline characteristics of all 881 included patients. 566 (64%) patients reported suicide ideation at baseline (BSS >0), and 250 (24%) patients reported a history of at least one suicide attempt.

Table 2: Baseline characteristics of patients with suicidal ideation at baseline (BSS>0), split per condition. In N% unless otherwise specified

N(%)	Total(n =566)	Intervention group 312	Control group 254
Demographic characteristics			
Female gender	295(55)	160(56)	134(46)
Age (M,SD)	42(15)	42(15)	41(14)
Education (n=3391)			
Lower	37(11)	21(10)	16(12)
Intermediate	233(69)	145(71)	88(65)
Higher	69(20)	37(18)	32(24)
Living with partner (n=353[1])	133(38)	84(40)	49(35)
Born in the NL (n=268[1])	253(94)	162(95)	91(92)
Paid employment (n=341[1])	47(16)	20(10)	27(11)
Data collected with ROM	192(34)	98(31)	94(37)
Clinical characteristics			
Suicidal thoughts(M,SD)	12(9)	13(9)	11(8)
Attempted suicide (n =538)[1]			
Never	304(57)	166(55)	137(59)
Once	120(22)	66(22)	54(23)
More than once	114(21)	72(23)	42(18)
Diagnosis (n=3581)			
Depression	154(41)	75(37)	79(50)
Anxiety	25(7)	12(6)	13(8)
Psychosis	29(8)	17(9)	12(8)
Personality disorder	62(17)	47(24)	15(9)
Substance dependence	39(11)	9(5)	30(19)
PTSS	21(6)	12(6)	9(6)
Eating disorder	27(7)	26(13)	1(6)

1 Data is missing for other patients

Within this sample of 567 patients with suicide ideation at baseline, relatively more females were included in the intervention condition when compared to the control condition (Table 2). Also, the intervention condition contained more patients with a diagnosis of a personality disorder or an eating disorder, whereas the control condition contained more patients with a substance dependence disorder. Distribution of suicidal ideation and percentage of previous attempters within the suicidal sample were comparable between both conditions.

Suicide ideation results and non-fatal suicide attempts

Table 3: Mean changes in suicide ideation from baseline to follow up and effect sizes

	Intervention M(SD)	Control M(SD)	B(CI 95%)	*P*	Effectsize
total group suicidal patients N (intervention) = 312 N (control) =254	4.2 (13.4)	4.9 (10.5)	-0.68(-0.26-1.21)	n.s.	
suicidal patients with diagnoses of depression N (intervention) = 75 N (control) = 79	8.4 (7.7)	4.8 (7.9)	3.41(0.38-5.93)	0.008	0.4

Multilevel analysis showed no effect of the intervention on change in suicide ideation (b = -0.68, 95% CI -0.26-1.21, p > 0.05) or on frequency of self-reported attempted suicide between baseline and follow up (OR= 1.18, 95% CI 0.62-2.57, $p > 0.05$). However, in a subgroup of patients with a diagnosis of depression with presence of suicide ideation at baseline (n = 154, intervention = 75, control = 79), a significant effect on change in suicide ideation between conditions was found: suicidal ideation decreased 8.4 points between baseline and follow up in the intervention group, compared to a decrease of 4.8 in the control group (b = 3.41, 95% CI 0.38-5.93, $p = .008$, effect size =0 .4 (See Table 3)). No effect of the intervention on self-reported attempted suicide was found within this subgroup (OR = 1.18, 95% CI 0.63-2.52). For any other subgroup (anxiety, personality, psychotic), numbers were too small or too unbalanced for any significant testing (Table 2).

Treatment satisfaction

Table 4: Mean treatment satisfaction at follow up for total group of patients

	Intervention M(SD) N = 484	Control M(SD) N = 397	B(CI 95%)	*P*	Effectsize
Overall satisfaction with therapy Range(0-10)	6.8 (4.4)	6.8(4.3)	-0.01(-0.58-5.61)	n.s.	
Satisfaction with relationship with therapist (Range 0-10)	6.9(4.1)	7.4(3.9)	0.61(0.04-1.22)	0.03	0.4

When analyzing the total group of patients, no significant effect on overall satisfaction with treatment was found (Table 4). The satisfaction with the relationship with the care giver was higher in the control condition when compared to the intervention condition (M (SD) intervention= 6.9 (4.1), M (SD) control = 7.4 (3.9), b = 0.61, 95% CI 0.04-1.22, $p = 0.03$, effect size = .4).

Table 5: N(%) YES/GOOD at follow up for total group, completers only

	Intervention	Control	OR(CI 95%)	*P*	effectsize
Were suicidal thoughts addressed during treatment? (yes(%)) N (exp) = 154 N (con) =118	85(54)	48(41)	1.78(1.1-2.93)	0.018	Risk ratio = 1.3, risk difference = 0.14
How did your therapist deal with your suicidal thoughts? (Good(%)) N(exp) =133 n(con) = 89	102(76)	63(71)	1.33(0.74-2.49)	n.s.	

Since > 70% of the responses on the two items, "were suicidal thoughts addressed during treatment" and "how did your care giver deal with your suicidal thoughts", were missing, we performed a complete case analysis only [50] (Table 5). Suicidal thoughts were more likely to be discussed in the intervention condition when compared to the control condition (b =1.78 CI 95% 1.12-2.93, $p = 0.02$, risk ratio = 1.3). No differences were found on the appraisal of the way the care giver dealt with suicidal ideations. When applying the same analysis for patients with suicidal ideation on baseline (BSS > 0), no significant effects of the intervention on any of the four items was found.

Sensitivity analysis

When comparing the analysis of the imputed data and the complete case data, all results were comparable, expect for "satisfaction with relationship with the therapist". When using complete case analysis, no significant difference between intervention and control condition was found on that item (M (SD) intervention = 7.1(3.2), M (SD) control = 7.5 (3.6), b = 0.41, 95% CI -0.32-1.16, $p = 0.2$).

Discussion

This study examined the additional effects on patients of an e-learning supported Train-the -Trainer program (TtT-e) aimed at the structural implementation of the Dutch guideline on the assessment and treatment of suicidal behavior. TtT-e was found to result in a 10% improvement of confidence, knowledge and guideline adherence among professionals [44]. We tested whether patients benefited from this 10% improvement of professionals.

For the total group of suicidal patients, no effect of the intervention was found on change in suicidal ideation or frequency of self-reported non-fatal suicide attempt(s) at 3 months follow up. As patients in the control group

also recovered significantly from suicidal ideation, any additional effect of TtT-e for the total group of suicidal patients was probably smaller than our sample size allowed us to detect. This is a common observation when implementing guidelines in psychiatry [12]. We did find a significant effect of our intervention for the group of 154 patients diagnosed with a depression who were suicidal at baseline. This is in line with a multicenter trial that demonstrated the effectiveness of depression guideline training of general practitioners on decline of suicide ideation among depressed elderly patients [51]. The effect of the intervention on only the group of depressed suicidal patients might be explained by the focus of TtT-e on making contact and discussing suicidality of the training program, which might be more appropriate for suicidal patients with a depressive disorder and less for suicidal patients with for example a borderline or psychotic disorder.

No effect of our intervention was found on overall satisfaction with the treatment. Patients in both conditions appeared to be quite satisfied with their treatment, making it difficult to achieve a significant increase in overall treatment satisfaction by training professionals in suicide guideline adherence. When analyzing the imputed data, patients in the control condition appear to be more satisfied with their care giver. As no significant effect was found when analyzing completers only data, and a sensitivity analysis found no other discrepancies between imputed data and completers only, we argue that this found effect might be explained by the difficulty to impute data for a single item on subjective experience [50].

We have shown that patients reported more often that suicidality was discussed during treatment, which indicates that we were able to change behavior of professionals in individual treatment sessions. This is in line with another randomized study that found that general practitioners assessed more patients for suicide risk after a tailored depression guideline implementation [20].

Limitations and strengths

Patients who were lost to follow-up were more likely allocated to the intervention condition. This might be explained by the fact that departments in the intervention condition seemed to be more motivated and successful to start data collection, resulting in the inclusion of more patients at baseline. Some of these patients might have had more severe levels in pathology, and were therefore more likely to drop out at follow-up. Although MHI institutional boards agreed on collecting patient data using ROM, only 32 % of the data was collected via ROM. For various reasons, mostly technical and organizational, most MHI's were not able to add our questionnaires to

their existing ROM. As data collecting via ROM is more systematically and on a larger scale when compared to data collection via paper-and-pencil questionnaires, we included less patients and had more missing values than we anticipated for. It was especially difficult for our research assistants to get access to the DSM-IV diagnosis of the patient. This resulted in a large amount of missing patient diagnoses (35%). Therefore, we were not able to test the effect of our intervention for other subgroups than patients with a diagnosis of depression. Also, the diagnoses were based on the registration in the electronic health records at admission. Next, we do not know if the diagnosis was changed during treatment.

Budget cuts in Dutch mental health care were introduced just after our randomization was completed. Various mental health care departments were shut down or did not have the resources anymore to fulfill the study requirements, resulting in a loss of 11 departments after randomization, leading to less power. Also, during our data-collection period, government retrenchment for mental health care made mental health care less accessible for patients. Patients suddenly were forced to pay a fair amount of money for the treatment in specialized mental health care, which resulted in a decrease in the numbers of new patients being admitted to the psychiatric departments resulting in less power.

An important focus of our intervention was making contact with suicidal patients, and paying more attention to suicidal ideation. Since most of the data (68%) was collected via paper-and-pencil instead of via the ROM, patients in both conditions might have experienced more attention being paid to their suicidal thoughts due to the assessment of suicidal ideation, making any effect of our intervention more difficult to detect. Finally, as part of our safety plan, when a patient showed increased suicidal ideation at baseline in either the control or the intervention condition, we reported this to their care giver. This monitoring and supervision has led to more attention for suicidal patients in both conditions, making it more difficult to find an effect of our intervention.

A strength of this study is its randomized controlled design, which is scarce in this field of research [12]. Also, the included departments are a good representation of the psychiatric departments in the Netherlands [46] making the results generalizable to other institutions. Finally, given the difficulty in collecting data among suicidal patients admitted to mental health care, the difficulties with the ROM and the challenges of the ongoing budget cuts and reorganizations, the patient data collection in our trial can be regarded as quite successful. The large amount of patients included in our study makes our findings more reliable and generalizable.

Implications and further studies

This is the first randomized trial to examine the effect of training of professionals in adherence to the PGSB on patients. We found that the structural training of professionals resulted in more attention for suicidality during treatment. This indicates that suicide guideline implementation can have an impact on actual clinical practice. We found a significant effect on decrease in suicide ideation within suicidal patients with a diagnosis of depression. It appears that compared to implementation as usual, structured implementation of suicide guidelines has beneficial effects on depressed suicidal patients. Future studies should investigate whether a more tailored program, with special attention for the specific patient group of a department, would result in the same effect on for example suicidal patients with a personality disorder, as currently found on depressed suicidal patients. Also, the relative effectiveness of the different elements of TtT-e (the Train the-Trainer element, the face-to-face training, the e-learning module, the multidisciplinary training) has not been examined separately. Future studies may disentangle the effects of the different elements, so that more targeted programs can be developed [52]. Finally, longitudinal studies should investigate the long term effect of suicide guideline implementation on patients.

Considering the methodological and diagnostic issues discussed earlier, our study needs replication. Ideally, data on suicidal ideation should be collected in a more systematic and less obtrusive manner via computerized outcome monitoring. However, implementation studies inevitably need to be done in a naturalistic sample. which has its limitations. In the current study, we managed to collect a large amount of data from multiple psychiatric departments among a heterogeneous sample of patients within a randomized design. Therefore, our findings offer the first evidence of effectiveness of suicide guideline training of professionals on the wellbeing of psychiatric patients, demonstrating the potential of structured guideline implementation.

Trial registration

Dutch trial register: NTR 3029

Authors' contributions

AK, MdG, en JdK obtained funding for this study. DdB carried out the study. DdB and MdG drafted the manuscript. AK, MdG, RdW, JdK, andEvD designed the training protocol and assisted in writing the manuscript. All authors contributed to the execution of the study, and to the manuscript writing.

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Conflict of interest

None

References

1. Grol R, Grimshaw J: **From best evidence to best practice: effective implementation of change in patients' care**. *The Lancet* 2003, **362**(9391):1225-1230.

2. Grol R, Grimshaw J: **Evidence-based implementation of evidence-based medicine**. *The Joint Commission journal on quality improvement* 1999, **25**(10):503-513.

3. van Hemert AM, Kerkhof AFJM, de Keijser J, verwey B: **Multidisciplinaire richtlijn voor diagnostiek en behandeling van suïcidaal gedrag.** . In. Utrecht: Nederlandse Vereniging voor Psychiatrie/ Nederlands Instituut voor Psychologen/Trimbos Instituut;; 2012.

4. Association AP: **Practice guideline for the assessment and treatment of patients with suicidal behaviors**: American Psychiatric Association; 2003.

5. Health NCCfM: **Self-harm: the short-term physical and psychological management and secondary prevention of self-harm in primary and secondary care**. *National Institute for Health and Clinical Excellence website Available at: http://www nice org uk/nicemedia/pdf/CG016NICEguideline pdf Updated July* 2004.

6. Australian R: **Australian and New Zealand clinical practice guidelines for the management of adult deliberate self-harm**. *Australian and New Zealand Journal of Psychiatry* 2004, **38**(11-12):868-884.

7. Group NZG: **The assessment and management of people at risk for suicide** In. Wellington: New Zealand Guideline Group; 2003.

8. McLean J, Maxwell M, Platt S, Harris F, Jepson R: **Risk and protective factors for suicide and suicidal behavior: a literature review**. *Health and Community Care, Scottish Government Social Research Scottish Government* 2008.

9. Leitner M, Barr W, Hobby L: **Effectiveness of interventions to prevent suicide and suicidal behavior: a systematic review**: Scottish Government; 2008.

10. Goldney R: **Suicide prevention**. Oxford: Oxford University Press; 2008.

11. Williams JMG, Williams M: **Cry of pain: Understanding suicide and self-harm**: Penguin Books London; 1997.

12. Weinmann S, Koesters M, Becker T: **Effects of implementation of psychiatric guidelines on provider performance and patient outcome: systematic review**. *Acta Psychiatrica Scandinavica* 2007, **115**(6):420-433.

13. Gaebel W, Weinmann S, Sartorius N, Rutz W, McIntyre JS: **Schizophrenia practice guidelines: international survey and comparison**. *The British Journal of Psychiatry* 2005, **187**(3):248-255.

14. Stiegler M, Rummel C, Wahlbeck K, Kissling W, Leucht S: **European psychiatric treatment guidelines: is the glass half full or half empty?** *European Psychiatry* 2005, **20**(8):554-558.

15. Franx G, Niesink P, Swinkels J, Burgers J, Wensing M, Grol R: **Ten years of multidisciplinary mental health guidelines in the Netherlands**. *International Review of Psychiatry* 2011, **23**(4):371-378.

16. Leucht S: **Psychiatric treatment guidelines: doctors' non- compliance or insufficient evidence?** *Acta Psychiatrica Scandinavica* 2007, **115**(6):417-419.

17. van Splunteren P, Hermens M: **Van kennis naar actie. Toepassing van richtlijnen in de ggz**. *Gedragstherapie* 2011, **44**(4):285.

18. Van Duin D, Franx G, Van Wijngaarden B, Van der Gaag M, Van Weeghel J, Slooff C, Wensing M: **Bridging the science-to-service gap in schizophrenia care in the Netherlands: the Schizophrenia Quality Improvement Collaborative**. *International Journal for Quality in Health Care* 2013:mzt072.

19. Shafran R, Clark D, Fairburn C, Arntz A, Barlow D, Ehlers A, Freeston M, Garety P, Hollon S, Ost L: **Mind the gap: Improving the dissemination of CBT**. *Behavior Research and Therapy* 2009, **47**(11):902-909.

20. Baker R, Reddish S, Robertson N, Hearnshaw H, Jones B: **Randomised controlled trial of tailored strategies to implement guidelines for the management of patients with depression in general practice**. *The British Journal of General Practice* 2001, **51**(470):737.

21. Worrall G, Angel J, Chaulk P, Clarke C, Robbins M: **Effectiveness of an educational strategy to improve family physicians' detection and management of depression a randomized controlled trial**. *Canadian Medical Association Journal* 1999, **161**(1):37-40.

22. King KA, Smith J: **Project SOAR: a training program to increase school counselors' knowledge and confidence regarding suicide prevention and intervention**. *Journal of School Health* 2000, **70**(10):402-407.

23. Isaac M, Elias B, Katz LY, Belik S-L, Deane FP, Enns MW, Sareen J: **Gatekeeper training as a preventative intervention for suicide: a systematic review**. 2009.

24. Wyman PA, Brown CH, Inman J, Cross W, Schmeelk-Cone K, Guo J, Pena JB: **Randomized trial of a gatekeeper program for suicide prevention: 1-year impact on secondary school staff**. *Journal of consulting and clinical psychology* 2008, **76**(1):104.

25. Stuart C, WAALEN PhD JK, Haelstromm E: **Many helping hearts: An evaluation of peer gatekeeper training in suicide risk assessment**. *Death studies* 2003, **27**(4):321-333.

26. Joffe P: **An empirically supported program to prevent suicide in a college student population**. *Suicide and Life-Threatening Behavior* 2008, **38**(1):87-103.

27. Capp K, Deane FP, Lambert G: **Suicide prevention in Aboriginal communities: Application of community gatekeeper training**. *Australian and New Zealand Journal of Public Health* 2001, **25**(4):315-321.

28. Matthieu MM, Cross W, Batres AR, Flora CM, Knox KL: **Evaluation of gatekeeper training for suicide prevention in veterans**. *Archives of Suicide Research* 2008, **12**(2):148-154.

29. Gullestrup J, Lequertier B, Martin G: **MATES in construction: impact of a multimodal, community-based program for suicide prevention in the construction industry**. *International journal of environmental research and public health* 2011, **8**(11):4180-4196.

30. Chagnon F, Houle J, Marcoux I, Renaud J: **Control-Group Study of an Intervention Training Program for Youth Suicide Prevention**. *Suicide and Life-Threatening Behavior* 2007, **37**(2):135-144.

31. Oordt MS, Jobes DA, Fonseca VP, Schmidt SM: **Training mental health professionals to assess and manage suicidal behavior: Can provider confidence and practice behaviors be altered?** *Suicide and Life-Threatening Behavior* 2009, **39**(1):21-32.

32. Appleby L, Morriss R, Gask L, Roland M, Lewis B, Perry A, Battersby L, Colbert N, Green G, Amos T: **An educational intervention for front-line health professionals in the assessment and management of suicidal patients (The STORM Project)**. *Psychological Medicine* 2000, **30**(4):805-812.

33. Rutz W, Knorring vL, Wålinder J: **Frequency of suicide on Gotland after systematic postgraduate education of general practitioners**. *Acta Psychiatrica Scandinavica* 1989, **80**(2):151-154.

34. Hegerl U, Mergl R, Havers I, Schmidtke A, Lehfeld H, Niklewski G, Althaus D: **Sustainable effects on suicidality were found for the Nuremberg alliance against depression**. *European archives of psychiatry and clinical neuroscience* 2010, **260**(5):401-406.

35. Szanto K, Kalmar S, Hendin H, Rihmer Z, Mann JJ: **A suicide prevention program in a region with a very high suicide rate**. *Archives of General Psychiatry* 2007, **64**(8):914.

36. Knox KL, Litts DA, Talcott GW, Feig JC, Caine ED: **Risk of suicide and related adverse outcomes after exposure to a suicide prevention programme in the US Air Force: cohort study**. *Bmj* 2003, **327**(7428):1376.

37. Hawton K, van Heeringen K: **Suicide**. *The Lancet* 2009, **373**(9672):1372-1381.

38. Bool M, Doeven M: **Verminderen van suïcidaliteit: beleidsadvies: actualisering van het Advies inzake Suïcide, Gezondheidsraad 1986**: Trimbos-Instituut; 2007.

39. Sinnema H, Franx, G., Op 't Land, H.: **Multidisciplinaire richtlijnen in de GGZ. Themarapportage. [reporting trends in mental health care. in Dutch]**. In. Edited by Institute T. Utrecht: Trimbos Institute; 2009.

40. Knowles MMS: **The modern practice of adult education**, vol. 41: Association Press New York; 1970.

41. Rogers EM: **Diffusion of innovations**: Simon and Schuster; 2010.

42. Means B, Toyama Y, Murphy RF, Baki M: **The Effectiveness of Online and Blended Learning: A Meta-Analysis of the Empirical Literature**. *Teachers College Record* 2013, **115**:1-47.

43. Pearce J, Mann MK, Jones C, van Buschbach S, Olff M, Bisson JI: **The most effective way of delivering a Train-the-Trainers program: A systematic review**. *Journal of Continuing Education in the Health Professions* 2012, **32**(3):215-226.

44. De Beurs DP, de Groot MH, De Keijser J, Van Duijn E, De Winter RF, Kerkhof AFJM: **The effect of an e-learning supported Train-the-Trainer program to implement suicide guidelines in mental health care.** *ARTICLE UNDER REVIEW* 2014.

45. de Beurs DP, de Groot MH, Bosmans JE, de Keijser J, Mokkenstorm J, Verwey B, van Duijn E, de Winter RF, Kerkhof AJ: **Reducing patients' suicide ideation through training mental health teams in the application of the Dutch multidisciplinary practice guideline on assessment and treatment of suicidal behavior: study protocol of a randomized controlled trial**. *Trials* 2013, **14**(1):372.

46. de Beurs DP, de Groot MH, de Keijser J, Verwey B, Mokkenstorm J, Twisk JW, van Duijn E, van Hemert AM, Verlinde L, Spijker10 J: **Improving the application of a practice guideline for the assessment and treatment of suicidal behavior by training the full staff of psychiatric departments via an e-learning supported Train-the-Trainer program: study protocol for a randomized controlled** *BMC trials* 2013, **14**(9).

47. Shea SC: **The chronological assessment of suicide events: a practical interviewing strategy for the elicitation of suicidal ideation**. *Journal of Clinical Psychiatry* 1998, **59**:58-72.

48. De Beurs E, den Hollander-Gijsman M, Van Rood Y, Van der Wee N, Giltay E, Van Noorden M, Van der Lem R, Van Fenema E, Zitman F: **Routine outcome monitoring in the Netherlands: practical experiences with a web-based strategy for the assessment of treatment outcome in clinical practice**. *Clinical psychology & psychotherapy* 2011, **18**(1):1-12.

49. Beck AT, Kovacs M, Weissman A: **Assessment of suicidal intention: the Scale for Suicide Ideation**. *Journal of consulting and clinical psychology* 1979, **47**(2):343.

50. Sterne JA, White IR, Carlin JB, Spratt M, Royston P, Kenward MG, Wood AM, Carpenter JR: **Multiple imputation for missing data in epidemiological and clinical research: potential and pitfalls**. *Bmj* 2009, **338**.

51. Alexopoulos G, Reynolds C, Bruce M, Katz I, Raue P, Mulsant B, Oslin D, Ten Have T, Group P: **Reducing suicidal ideation and depression in older primary care patients: 24-month outcomes of the PROSPECT study**. *American Journal of Psychiatry* 2009, **166**(8):882-890.

52. Cherry MG, Brown JM, Bethell GS, Neal T, Shaw NJ: **Features of educational interventions that lead to compliance with hand hygiene in healthcare professionals within a hospital care setting. A BEME systematic review: BEME Guide No. 22.** *Medical teacher* 2012, **34**(6):e406-e420.

CHAPTER 7

TRAINING MENTAL HEALTH PROFESSIONALS IN SUICIDE PRACTICE GUIDELINE ADHERENCE: COST-EFFECTIVENESS ANALYSIS ALONGSIDE A RANDOMIZED CONTROLLED TRIAL

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Background

As suicide rates are rising, while at the same time there is a need to reduce costs of mental health care, information on the cost-effectiveness of suicide prevention interventions is crucial. The current study examines the cost-effectiveness of a multifaceted structured intervention aiming to improve adherence to the national suicide practice guideline in comparison with usual implementation.

Methods

In the intervention condition, professionals of psychiatric departments were trained using an e-learning supported Train-the-Trainer program. Newly admitted suicidal patients were assessed as soon as their department was trained and at 3 months follow-up. Primary outcome was improvement in suicide ideation. Missing cost and effect data were imputed using multiple imputation. Cost-effectiveness planes were plotted, and cost-effectiveness acceptability curves were estimated.

Findings

For the total group of suicidal patients (n = 566), no effect of the intervention on suicide ideation or costs was found. For a subgroup of depressed suicidal patients (n = 154, intervention = 75, control = 79), mean level of suicide ideation decreased with 2.7 extra points in the intervention condition, but this was not statistically significant. For this subgroup, the intervention may be considered cost-effective in comparison with usual implementation if society is willing to pay ≥ € 6100 per unit of effect on the suicide ideation scale extra.

Conclusions

We presented the first randomized trial on cost-effectiveness of a suicide practice guideline implementation in mental health care. The intervention might be considered cost-effective for depressed suicidal patients if society is willing to make substantial investments. By collecting a large amount of data from multiple psychiatric departments within a randomized design, and by using state-of-the-art cost-effectiveness analysis, our study adds information on the cost-effectiveness of a structured suicide guideline implementation program.

Introduction

In the Netherlands, about 1700 persons a year die by suicide, and it is estimated that 99.600 suicide attempts take place annually [1]. Each year, 15.000 patients with non-fatal suicidal behavior are treated at aid and emergency departments, of whom 9000 are hospitalized [2]. About 40% of all suicides is completed by patients who are treated in mental health care [3]. The disability burden caused by suicide and suicide attempts is 11th on the list of most burdensome diseases in the Netherlands [4]. The economic impact of both completed and attempted suicides is substantial [5]. To calculate the total costs associated with suicide, three types of costs should be taken into account; direct costs (e.g. demand on emergency services, funerals), indirect costs (loss of contribution to economy via paid work, family responsibilities) and intangible costs (pain and grief of family, loss of chance to experience all that life holds). In Scotland, total costs per completed suicide were estimated to be around 1.6 million euro [6]. No comparable economic studies have been done to estimate the costs of suicide ideation, but given the estimated costs of depression (e.g. [7]), which is prevalent in 90% of people with suicide ideation [8], the costs are likely to be high. A recent cost-effectiveness analysis of a web-based self-help program to reduce suicide ideation [9] reported that for each significantly improved individual, €34,727 of societal costs were saved.

In May 2012, the evidence-based multidisciplinary practice guideline for assessment and treatment of suicidal behavior (PGSB) [10] was issued. It was argued that introduction of a national evidence-based guideline may result in better and therefore more cost-effective treatment of suicidal behavior [11]. Suicide prevention training has been shown to improve knowledge, skills, and attitudes towards suicidal behavior of both gatekeepers [12-20] and mental health professionals [21, 22]. Additionally, professional and gatekeeper training in diagnosis and treatment of depressive disorders, which are associated with suicidal behavior [23] has been shown to result in a reduction of suicides [18, 24-27]. However, adherence to evidence based guidelines has been shown to be unsatisfactory [28-31], resulting in less effective patient care, and thus extra costs for society. A structured implementation program may improve adherence to the guideline, which may result in better assessment and treatment of suicidal behavior, which might lead to less suicide attempts and suicide ideation.
To implement the PGSB in Dutch mental health care, we developed an e-learning supported Train-the-Trainer program (TtT-e) to be delivered to the full staff of psychiatric departments [32]. The Train-the-Trainer model is based on the Adult Learning Theory [33] stating that the best resource for learning comes from peers, and on the Diffusion of Innovation Theory [34] stating that people adopt new information better through their trusted social networks. TtT-e combines a one day face-to-face training with an additional e-learning module. This form of blended learning is used extensively in medical education and has been found to be more effective as compared with traditional instructor-based trainings [35, 36].
Little is known about the cost-effectiveness of suicide prevention programs consisting of training professionals in comparison with usual practice. By retrospectively considering the costs due to a reduction in suicides, an educational program for Swedish general practitioners in the Island of Gotland was argued to be cost-effective [5] when compared to not training professionals. It was estimated that the costs per life year gained of a training intervention in England [22] were €4049 in comparison with no additional training, which is considered to be highly cost effective.

Evidence on clinical effectiveness is not sufficient for policy making. Before policy makers and managers can decide to disseminate our intervention, information on the cost-effectiveness of the guideline implementation strategy evaluated in this study in comparison with implementation as usual (IAU) is needed.
This paper presents a cost-effectiveness analysis alongside a cluster randomized trial in which an e-learning supported Train-the-Trainer program (TtT-e) is compared with IAU with regard to change in suicide ideation and change in quality of life.

Methods

Study design, setting and participants

Our economic evaluation was performed alongside the PITSTOP suicide trial [37]. As soon as the professional staff in the intervention departments was trained in suicide guideline adherence, all newly admitted patients were assessed at admission (T0) and at three months after admission (T1). If a patient was discharged within three months, T1 was arranged just before discharge. In the control departments, T0 measurements started when the department was informed of the allocation outcome. Data was collected via Routine Outcome Monitoring (ROM), an online assessment method by which data on the effectiveness of treatment in everyday clinical practice are systematically collected [38]. In MHIs not using ROM, graduate students and/or research assistants used paper and pencil questionnaires to collect similar data.

All eligible patients were informed about the study and participants provided written informed consent. For each included patient, the main DSM-IV diagnosis as entered in their Electronic Health Record during enrolment was collected. We used the DSM-IV diagnosis for subgroup analysis for separate disorders.

Inclusion and exclusion criteria

Within the PITSTOP suicide trial, departments were considered eligible for participation if they treated patients ≥18 years of age, professionals felt a need for training in suicide prevention skills, and their management was willing to provide support, including financial support for covering loss of production while attending the training. For our economic evaluation, patients were eligible if they had suicide ideation at baseline (i.e. if they scored > 0 on the Beck Scale of Suicide Ideation [39]). As admitted patients were often affected by emotional and/or cognitive problems, patients who were emotionally and/or cognitively unable to complete questionnaires were excluded. Whether a patient was able to enter the study was left to the discretion of the staff.

Matching and Randomization

Eligible departments were matched in pairs on basis of the main diagnostic DSM-IV category of patients treated in the department, and on comparable average length of treatment. Members of matched pairs were randomly allocated to either implementation as usual (IAU) with TtT-e (intervention), or IAU (control condition). Binary randomization was performed by an independent researcher of the EMGO+ research institute who was not involved in the study. Patients were blind to the allocation, but due to the nature of the intervention professionals were not.

Intervention

In the intervention condition, complete multidisciplinary teams (all registered nurses, psychologists, and psychiatrists) were trained by peers via TtT-e in the application of the PGSB. In TtT-e, three types of professionals were involved: masters, trainers and trainees. Training was applied on two levels: first, trainers were trained by masters. Subsequently, trainees were trained by trainers. The training consisted of a one day small group training and was supported by an e-learning module that lasted an hour. The TtT-e program as applied by masters was similar to the program applied by the trainers.

Masters were experts in the field of suicide prevention due to extensive scientific and clinical experience with suicidal behavior. Trainers were mental health professionals of various disciplines (psychiatrists, psychologists or mental health nurses) selected by their management because of their role model in a team, and their excellent training skills. Trainees were health professionals within the team of the trainer.

The PGSB recommendations served as the starting point to develop the content of the TtT-e program. The PGSB recommends systematic investigation of the suicidal condition of patients by using the Chronological Assessment of Suicidal Events (CASE) interview [40]. Based on its outcome, risk and protection factors for suicide of individual patients are weighted. Subsequently, structured diagnosis, treatment strategy, and a safety protocol are developed. In the TtT-e program, the CASE interview was the overall framework for each of four role plays in which one trainee acts as a suicidal patient and the other trainee interviews the 'patient' via the CASE interview. The intervention is described elsewhere in more detail [32].
To survey adherence to the training program by trainers, graduate students randomly visited training sessions, and rated adherence on a four-point Likert scale: 1, very strong adherence, to 4, very low adherence.
In the control condition, no additional actions next to IAU were undertaken. Care was not restricted in any way in this condition.

Effect outcomes

Primary outcome of the study was change in suicide ideation. At both T0 and T1, level of suicide ideation was measured with the first 19 items of the Beck Scale for Suicidal Ideation (BSS) [41]. Total score ranged from 0 to 38, a higher score reflecting a higher level of suicide ideation. Patients that scored > 0 on the BSS have suicide ideation [39].

Quality of life was measured with the EQ-5D (EuroQol, Rotterdam, The Netherlands) [42] a five-item questionnaire developed to assess health-related quality of life. The five items represent the dimensions of mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Items are scored on a three-point Likert scale: 1, no problem; 2, some problems; and 3, extreme problems. The health states obtained from EQ-5D were converted to utility scores using the Dutch EQ-5D tariff. Quality-adjusted life years (QALYs) were calculated using the area-under-the-curve method with linear interpolation between time points.

Cost outcomes

Costs incurred by patients during the course of the study were measured from a societal perspective with an adapted version of the Trimbos questionnaire for costs associated with psychiatric illness (TiC-P) [43]. The TiC-P consists of two parts: part one measures direct medical costs (for example visits to a psychiatrist or a psychologist) and part two measures indirect costs (for example costs due to sick leave and productivity losses while being at work but not functioning optimally). Dutch standard costs were used to value resource use [44]. Lost productivity costs were calculated according to the friction cost approach (friction period 154 days) using the mean age- and sex-specific income of the Dutch population [44].

Per-patient Intervention Costs

To estimate the per-patient intervention costs, we first estimated the average cost to train one trainee/professional. After adding the salary costs of the trainees (on average €350) and the costs due to production losses of trainees (on average €640), the estimated cost to train one professional was set at €1000. For the intervention to be effective, professionals have to be trained once a year. So, per department, we multiplied the number of professionals with €1000 and divided this total cost estimate by the estimated number of patients treated each year within that department.

Sample size

For the primary outcome (suicide ideation) we calculated the effect size according to recommendations of Twisk [45]. The number of patients that needs to be included was set to 423. This number is sufficient to find a small effect size (Cohen's d) of 0.3, assuming an alpha of 0.05 and the statistical power of 1-Beta=0.80. A correction of 20% for clustering of effects within departments was applied.

Statistical analysis

All analyses were performed on patients who scored BSS > 0 at baseline. A subgroup analysis was done for patients diagnosed with a depressive disorder and with BSS >0 at baseline. The statistical analyses were performed according to the intention-to-treat principle (ITT). Multiple imputation was used to impute missing cost and effect data. Variables found to be related to cost and effect outcomes and missing follow-up data, were included in the multiple imputation model. Fifteen imputations were needed to reduce the fraction of missing information to less than 5% [46]. Each of the 15 imputed data sets was separately analyzed and the results of the 15 analyses were pooled using Rubin's rules [47]. For effects and costs, linear multilevel regression models were estimated. Clustering at the level of psychiatric department was included in these multilevel models. The models for BSS were adjusted for baseline BSS value. Costs generally have a highly skewed distribution; therefore, bootstrapping with 5,000 replications was used to estimate bias-corrected and accelerated confidence intervals around cost differences [48]. To account for the clustering of data, bootstrap replications were stratified for department [49]. ICERs were calculated by dividing the difference in total costs between the intervention and usual care group by the difference in clinical effects. This ICER indicates the additional cost per unit of health gain. The bootstrapped cost-effect pairs were plotted on a cost-effectiveness plane and used to estimate cost-effectiveness acceptability (CEA) curves. In a cost-effectiveness plane, incremental costs between the intervention and usual care are plotted on the y-axis and incremental effects on the x-axis resulting in four quadrants. The northeast quadrant indicates that the intervention is more expensive and more effective than usual care. In the southeast quadrant the intervention dominates usual care, i.e. is less expensive and more effective than usual care. In the southwest quadrant the intervention is less expensive and less effective than usual care. Finally, in the northwest quadrant the intervention is dominated by usual care (more expensive and less effective). Most newly developed interventions are more expensive and more effective than usual care, which implies that a trade-off needs to be made about whether the additional benefits justify the additional costs. This decision depends on the societal willingness to pay for an additional unit of effect. However, this willingness to pay is generally not known. CEA curves show the probability that the intervention is cost-effective in comparison with the control treatment for a range of willingness to pay values [50].

Results

Figure 1: flow of the trial

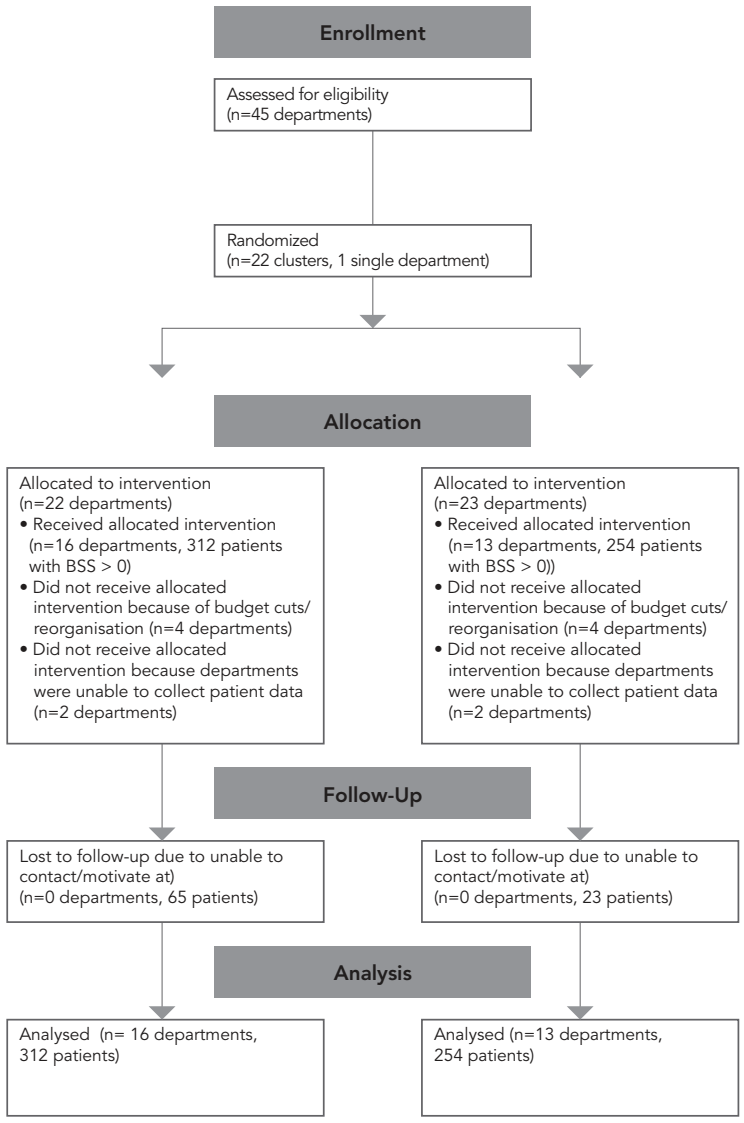

Figure 1 shows the flow of departments through the trial, showing that 566 patients with baseline suicide ideation from 33 departments started the study.

Table 1: Baseline characteristics of suicidal sample, split per condition. In N% unless otherwise specified

N(%)	Total(n =566)	Intervention group 312	Control group 254
Demographic characteristics			
Female gender	295(55)	160(54)	134(46)
Age (M,SD)	42(15)	42(15)	41(14)
Education			
Lower	37(11)	21(57)	16(43)
Intermediate	233(69)	145(62)	88(38)
Higher	69(20)	37(54)	32(46)
Living with partner	133(38)	84(63)	49(37)
Born in the NL	253(94)	162(64)	91(36)
Paid employment	34(16)	13(38)	21(62)
Data collected with ROM	193(34)	98(51)	94(49)
Clinical characteristics			
Suicidal thoughts(M,SD)	12(9)	13(9)	11(8)
Attempted suicide N = 538			
Never	304(57)	166(55)	137(45)
Once	120(22)	66(64)	54(46)
More than once	114(21)	72(63)	42(37)
Diagnosis N = 358			
Depression	154(41)	75(48)	79(52)
Anxiety	25(7)	12(47)	13(53)
Psychosis	29(8)	17(59)	12(41)
Personality disorder	62(17)	47(76)	15(24)
Substance dependence	39(11)	9(23)	30(77)
PTSS	21(6)	12(57)	9(43)
Eating disorder	27(7)	26(96)	1(4)

More females were included in the intervention condition when compared to the control condition (Table 1). Also, the intervention condition contained more patients with a diagnosis of a personality disorder or an eating disorder, whereas the control condition comprised more patients with a substance dependence disorder. Distribution of suicidal ideation and percentage of previous attempters within the suicidal sample were comparable between both conditions. DSM-IV diagnoses were missing in 36% (208) of the suicidal patients.

Results clinical outcome

For the total group of suicidal patients (n = 566), multilevel analysis showed no effect of the intervention on change in suicide ideation (b = 0.93, 95% CI -0.59;2.5) and QALYs (b= 0.01 CI 95% -0.003;0.03)(see also Table 3). For the depressed suicidal patients (n = 154, intervention = 75, control = 79), mean level of suicide ideation decreased with 2.7 extra points in the intervention condition, but this was not statistical significant (b =-2.7 CI 95% -5.6;0.19). No statistical significant effect between conditions was found in QALYs (b = 0.01 CI 95% -0.01;0.04) (see also Table 4).

Costs per patient

Average intervention costs per patient were € 68 with a range from €6.80 per patient to €312.50 per patient.

Table 2: mean (SE) of the costs(€) for the separate and total cost categories during 3 months follow-up

Cost category	Intervention	Usual care	Difference (95% CI)*
Primary care	228 (24)	425 (131)	-658 (-1539;-89)
Secondary care	8960 (1115)	5851 (914)	2562 (412;5211)
Home care	38 (20)	30 (10)	8 (-19;41)
Intervention	90 (5)	0 (0)	105 (101;110)
Lost productivity	118 (82)	796 (317)	-791 (-1400;-296)
Total costs	9434 (1100)	7103 (1042)	1572 (-732;4567)

* multilevel analysis with a level for department

Table 2 shows the mean (SE) of the costs for the separate and total cost categories after multiple imputation during 3 months follow up. There was no statistical significant difference in total costs between the intervention and the control group (mean difference € 1572; CI 95% -732;4567). Secondary care costs were the largest contributor to the total costs in both groups. Secondary care costs were statistically significantly higher in the intervention group, and primary care and lost productivity costs were statistically significantly higher in the control group.

Cost-effectiveness and cost-Utility for total group of suicidal patients

Table 3: Effects and costs (€) for the total Group with suicidal ideation

				CEA curve		
Outcome	Cost (95% CI)	effect (95% CI)	ICER	p(CE) at 0	p(CE) at 20,000	Ceiling ratio at p(CE)=0.95
BSS	1572 (-732;4567)	0.93 (-0.59;2.5)	1,683	0.18	0.10	NA
QALY	1572 (-732;4567)	0.01 (-0.003;0.03)	109,492	0.18	0.23	5,000,000

CE plane = Cost-effectiveness plane; CEA curve = cost-effectiveness acceptability curve; BSS = Beck Scale for suicide ideation; QALY = Quality of life;

Table 3 presents the results of the cost-effectiveness and cost-utility analyses for the total group of suicidal patients. No significant differences in effects and costs between the two groups on the BSS at follow-up were found. The difference in QALY between groups was extremely small, resulting in an extremely large and uninterpretable ICER. Based on the CEA curves, the maximum probability that our intervention would be considered cost-effective compared to implementation as usual 0.18 at a willingness to pay of €0 per point of improvement in BSS (not shown). The CEA curve decreased towards 0.10 for infinite values of willingness to pay.

Cost Utility and cost effectiveness for depressed suicidal patients

Table 4: Effects and costs(€) for Group with suicidal ideation and depressive symptoms

				CEA curve		
Outcome	Cost (95% CI)	effect (95% CI)	ICER	p(CE) at 0	p(CE) at 20,000	Ceiling ratio at p(CE)=0.95
BSS	1453 (-2263;5805)	-2.7 (-5.6;0.19)	-538	0.28	0.96	6100
QALY	1453 (-2263;5805)	0.01 (-0.01;0.04)	116,963	0.28	0.31	NA

CE plane = Cost-effectiveness plane; CEA curve = cost-effectiveness acceptability curve; BSS = Beck Scale for suicide ideation; QALY = Quality of life;

Table 4 shows the analysis for the subgroup of depressed suicidal patients. The ICER for reduction of suicide ideation was -€538. This means that €538 needs to be invested per depressed suicidal patient to decrease one extra point on the BSS in the intervention condition. Figure 2 shows the CE plane for reduction in suicide ideation. Most cost-effect pairs were located in the north east (62%) and south east (36%) quadrants. This means that, although not statistically significant, the intervention was more effective on the

reduction of suicide ideation, and associated with higher costs when compared to the control condition. The CEA curve (Figure 3) graphs the probability that the intervention was cost-effective compared to the control condition for a range of ceiling ratios. The probability that the intervention is cost effective is 28% if society is willing to invest €0 per one point reduction of suicide ideation and increases to 95% if society is willing to invest €6100. Again, differences in QALYs were very small leading to a very large ICER. The CEA curve showed that the probability of the intervention being cost-effective in comparison with control remained more or less stable at 0.28 regardless of the ceiling ratio.

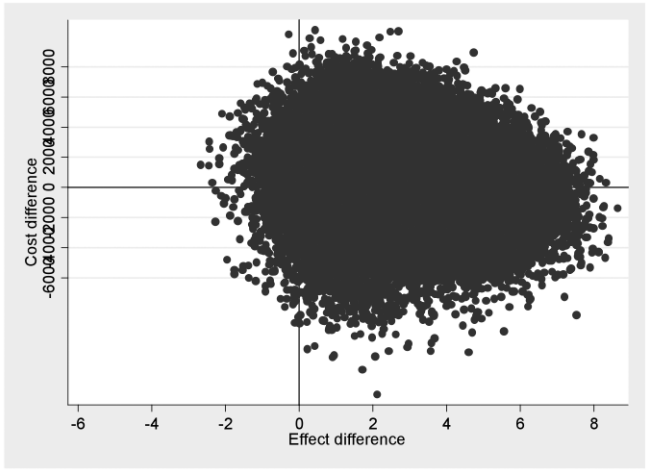

Fig 2: Cost-effectiveness plane for the reduction in score on suicide ideation during 3 months

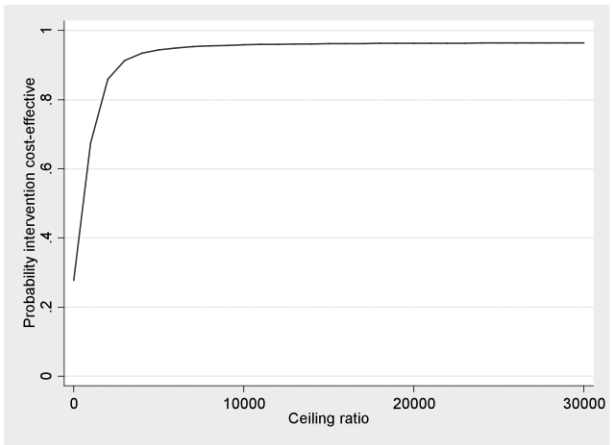

Fig 3: Cost-effectiveness acceptability curve for the reduction in score on suicide ideation during 3 months

Discussion

This study showed that a structured implementation of the Dutch guideline on the assessment and treatment of suicidal behavior did not result in statistically significant differences in costs or effects compared to implementation as usual. In the group of depressed suicidal patients, TtT-e may be considered cost-effective in comparison with usual implementation if society is willing to pay €6100 per unit of effect extra on the BSS. It is difficult to interpret the clinical importance of one point reduction on the BSS. A prospective study showed that, if a patient scores > 2 on the BSS, the risk for future suicidal behavior has been found to increase sevenfold [51]. Therefore, a reduction of one point on the BSS from 3 to 2 will have a larger effect on patients wellbeing when compared to a change on the BSS from 35 to 34. As there are no previous cost-effectiveness studies on the effect of guideline implementation on suicidal ideation, our results cannot be compared directly. Other studies [22, 24] on the training of professionals in suicide prevention skills estimated the saved costs retrospectively on basis of possible reduction of completed suicides but not on change in level of suicide ideation. Future studies on the cost-effectiveness of suicide prevention interventions should be conducted to put our findings in perspective.

As in earlier studies [9, 52], the ICER based on the scores of the EuroQol were very large making interpretation difficult. Moreover, the EuroQol is developed to measure improvements in various areas of health such as mobility and pain, making it less sensitive to change due to an implementation intervention based on improving suicide prevention skills. Future research should consider using other instruments to measure quality of life [53].
Our results showed that implementing suicide guidelines with an e-learning supported Train-the-Trainer program is not cost-effective for suicidal patients compared to implementation as usual. This may be explained by the fact that, since practice guidelines reflect every day practice, professionals already showed certain levels of guideline adherence without being trained leading to reduced suicide ideation in the usual implementation group. Therefore, the effectiveness of TtT-e on suicide ideation was presumably smaller than our sample size allowed us to detect. This is a common observation when implementing guidelines in psychiatry [30]. The finding that the intervention may be cost-effective in comparison with control for some ceiling ratios in the subgroup of depressed suicidal patients when compared to the non-findings for the total group might be explained by the current focus on making contact and discussing suicidality of the training program, which might be more appropriate for suicidal patients with a depressive disorder and less for suicidal patients with for example a borderline personality disorder or psychotic disorder.

Limitations and strengths

Although MHI institutional boards agreed on collecting patient data using ROM, only 34% (n = 192) of the data was collected via ROM. Although ROM collects data systematically and on a large scale compared to assessing each patient with a pencil and paper questionnaire, we had less participants and more missing values than we anticipated for. Considering the cost outcomes, we had almost no cases that were complete, and heavily relied on statistical techniques to impute the missing data. Also, due to the unavailability of the ROM, we were limited to assess patients at two time points (baseline and after three months). A three months period is a very short time span to measure any significant changes in health status or healthcare services uptake, especially for patients admitted to specialized mental health care institutions. Next, it was difficult for our research assistants to get access to the DSM-IV diagnosis of each patient. This resulted in a large amount of missing patient diagnoses (36%). Therefore, we were not able to test the effect of our intervention for other subgroups, except for patients with a diagnosis of depression. Also, the diagnoses were based on the registration in the Electronic Health Records. As this was a clinical diagnosis at intake, it is possible that the initial diagnosis was changed during hospitalization.

An important element of our intervention was making contact with suicidal patients, and having more attention for suicide ideation. As most of the data (66%) was collected via paper and pencil instead of via the ROM, patients in both conditions might have experienced more attention for their suicidal thoughts due to contact with the interviewer, making any effect of our intervention more difficult to detect. Finally, as part of our safety plan, when patients showed heighted suicide ideation at baseline in either the control or the intervention condition, we reported this to their therapist. This increased monitoring and supervision has led to more attention to suicidal patients in both conditions, making it more difficult to detect an effect of our intervention.

Importantly, costs calculated in this study only pertain to the direct and indirect costs made by the patient. The largest single component of costs of suicidal behavior are indirect lost productivity costs experienced by families. By not taking changes on these costs into account, we might underestimate the cost-effectiveness of our intervention [5].

A strength of this study is its randomized controlled design, which is scarce in this field of research [30] and provides a high level of evidence. Also, the included departments well represent the psychiatric departments in the Netherlands. Therefore, the external validity of the findings is considerable. Also, by using advanced statistical techniques such as multiple imputation, multilevel modeling and bootstrapping, the results are more reliable.

Future studies

This is the first randomized trial to investigate the cost-effectiveness of the implementation of suicide prevention guidelines in comparison with usual implementation. As suicide rates are rising, while at the same time there is a need to reduce costs within mental health care, information on the cost-effectiveness of suicide prevention interventions is crucial for policy advisors and managers. Training specialized professionals in evidence based guidelines is both necessary to improve the quality of care and expensive. Due to the high baseline level on outcomes at the professional level, change on professional outcomes due to any training is not likely to be larger than 10% [54, 55]. Also, guideline training, whether via e-learning, blended or face-to-face leads to both production loss (no patients are treated) and salary costs. Therefore, the training of highly specialized professionals is not likely to be cost-effective. We argue that training so-called gatekeepers (teachers, general practitioners, police) in suicide prevention might be a more likely to be cost-effective intervention compared to the training of specialized mental health professionals, as they are more likely to show more increase in professional outcome variables. This could then translate to the patient level, which ultimately could lead to less health care services up take from a societal perspective.

In our study we did not assess completed suicide. As total costs for a completed suicide are estimated to be around 1.6 million euro, the prevention of only one suicide due to training of professionals would make this structured approach cost-effective. Future studies should aim to also monitor completed suicides.

Considering the methodological and diagnostic issues discussed earlier, our study needs replication. Ideally, data on suicide ideation should be collected in a more systematic and less obtrusive manner via computerized outcome monitoring. Future studies should also investigate whether a more tailored program, with special attention for the specific patient group of a department, would result in the same effect on for example suicidal patients with a personality disorder, as we found for depressed suicidal patients. By collecting a large amount of data from multiple psychiatric departments among a heterogeneous sample of patients within a randomized design, and by using state of the art cost effectiveness analysis, our study adds information on the cost-effectiveness of a suicide guideline implementation program. In sum, our intervention was not cost-effective for all suicidal patients, but showed promising effects for depressed suicidal patients.

References

1. Hoeymans N, Schoemaker C, Hoeymans N, Verkenningen VT. De ziektelast van suïcide en suïcidepogingen. *De Bilt: RIVM* 2010.

2. Kerkhof A, Mulder S, Draisma J. Suïcidepogingen behandeld in Nederlandse ziekenhuizen. *TSG* 2007; **85**(1): 37-42.

3. Huisman A, Robben P, Kerkhof A. An examination of the Dutch Health Care Inspectorate's supervision system for suicides of mental health care users. *Psychiatric Services* 2009; **60**(1): 80-5.

4. van Spijker BA, van Straten A, Kerkhof AJ, Hoeymans N, Smit F. Disability weights for suicidal thoughts and non-fatal suicide attempts. *Journal of affective disorders* 2011; **134**(1): 341-7.

5. McDaid D, Kennelly B. An economic perspective on suicide across the five continents: Oxford University Press; 2009.

6. Platt S, McLean J, McCollam A, et al. Evaluation of the first phase of Choose Life: the national strategy and action plan to prevent suicide in Scotland: Scottish Executive Social Research Edinburgh; 2006.

7. Kleine-Budde K, Müller R, Kawohl W, Bramesfeld A, Moock J, Rössler W. The cost of depression-A cost analysis from a large database. *Journal of affective disorders* 2013; **147**(1): 137-43.

8. O'Connor RC, Platt S, Gordon J. International handbook of suicide prevention: research, policy and practice: John Wiley & Sons; 2011.

9. van Spijker BA, Majo MC, Smit F, van Straten A, Kerkhof AJ. Reducing suicidal ideation: cost-effectiveness analysis of a randomized controlled trial of unguided web-based self-help. *Journal of medical Internet research* 2012; **14**(5).

10. van Hemert AM, Kerkhof AFJM, de Keijser J, verwey B. Multidisciplinaire richtlijn voor diagnostiek en behandeling van suïcidaal gedrag. . Utrecht: Nederlandse Vereniging voor Psychiatrie/Nederlands Instituut voor Psychologen/Trimbos Instituut;, 2012.

11. Bool M, Doeven M. Verminderen van suïcidaliteit: beleidsadvies: actualisering van het Advies inzake Suïcide, Gezondheidsraad 1986: Trimbos-Instituut; 2007.

12. King KA, Smith J. Project SOAR: a training program to increase school counselors' knowledge and confidence regarding suicide prevention and intervention. *Journal of School Health* 2000; **70**(10): 402-7.

13. Isaac M, Elias B, Katz LY, et al. Gatekeeper training as a preventative intervention for suicide: a systematic review. 2009.

14. Wyman PA, Brown CH, Inman J, et al. Randomized trial of a gatekeeper program for suicide prevention: 1-year impact on secondary school staff. *Journal of consulting and clinical psychology* 2008; **76**(1): 104.

15. Stuart C, WAALEN PhD JK, Haelstromm E. Many helping hearts: An evaluation of peer gatekeeper training in suicide risk assessment. *Death studies* 2003; **27**(4): 321-33.

16. Joffe P. An empirically supported program to prevent suicide in a college student population. *Suicide and Life-Threatening Behavior* 2008; **38**(1): 87-103.

17. Capp K, Deane FP, Lambert G. Suicide prevention in Aboriginal communities: Application of community gatekeeper training. *Australian and New Zealand Journal of Public Health* 2001; **25**(4): 315-21.

18. Matthieu MM, Cross W, Batres AR, Flora CM, Knox KL. Evaluation of gatekeeper training for suicide prevention in veterans. *Archives of Suicide Research* 2008; **12**(2): 148-54.

19. Gullestrup J, Lequertier B, Martin G. MATES in construction: impact of a multimodal, community-based program for suicide prevention in the construction industry. *International journal of environmental research and public health* 2011; **8**(11): 4180-96.

20. Chagnon F, Houle J, Marcoux I, Renaud J. Control-Group Study of an Intervention Training Program for Youth Suicide Prevention. *Suicide and Life-Threatening Behavior* 2007; **37**(2): 135-44.

21. Oordt MS, Jobes DA, Fonseca VP, Schmidt SM. Training mental health professionals to assess and manage suicidal behavior: Can provider confidence and practice behaviors be altered? *Suicide and Life-Threatening Behavior* 2009; **39**(1): 21-32.

22. Appleby L, Morriss R, Gask L, et al. An educational intervention for front-line health professionals in the assessment and management of suicidal patients (The STORM Project). *Psychological Medicine* 2000; **30**(4): 805-12.

23. Hawton K, van Heeringen K. Suicide. *The Lancet* 2009; **373**(9672): 1372-81.

24. Rutz W, Knorring vL, Wålinder J. Frequency of suicide on Gotland after systematic postgraduate education of general practitioners. *Acta Psychiatrica Scandinavica* 1989; **80**(2): 151-4.

25. Hegerl U, Mergl R, Havers I, et al. Sustainable effects on suicidality were found for the Nuremberg alliance against depression. *European archives of psychiatry and clinical neuroscience* 2010; **260**(5): 401-6.

26. Szanto K, Kalmar S, Hendin H, Rihmer Z, Mann JJ. A suicide prevention program in a region with a very high suicide rate. *Archives of General Psychiatry* 2007; **64**(8): 914.

27. Knox KL, Litts DA, Talcott GW, Feig JC, Caine ED. Risk of suicide and related adverse outcomes after exposure to a suicide prevention programme in the US Air Force: cohort study. *Bmj* 2003; **327**(7428): 1376.

28. Grol R, Grimshaw J. From best evidence to best practice: effective implementation of change in patients' care. *The Lancet* 2003; **362**(9391): 1225-30.

29. Shafran R, Clark D, Fairburn C, et al. Mind the gap: Improving the dissemination of CBT. *Behavior Research and Therapy* 2009; **47**(11): 902-9.

30. Weinmann S, Koesters M, Becker T. Effects of implementation of psychiatric guidelines on provider performance and patient outcome: systematic review. *Acta Psychiatrica Scandinavica* 2007; **115**(6): 420-33.

31. Wobrock T, Weinmann S, Falkai P, Gaebel W. Quality assurance in psychiatry: quality indicators and guideline implementation. *European archives of psychiatry and clinical neuroscience* 2009; **259**(2): 219-26.

32. de Beurs DP, de Groot MH, de Keijser J, et al. Improving the application of a practice guideline for the assessment and treatment of suicidal behavior by training the full staff of psychiatric departments via an e-learning supported Train-the-Trainer program: study protocol for a randomized controlled *BMC trials* 2013; **14**(9).

33. Knowles MMS. The modern practice of adult education: Association Press New York; 1970.

34. Rogers EM. Diffusion of innovations: Simon and Schuster; 2010.

35. Means B, Toyama Y, Murphy RF, Baki M. The Effectiveness of Online and Blended Learning: A Meta-Analysis of the Empirical Literature. *Teachers College Record* 2013; **115**: 1-47.

36. Pearce J, Mann MK, Jones C, van Buschbach S, Olff M, Bisson JI. The most effective way of delivering a Train-the-Trainers program: A systematic review. *Journal of Continuing Education in the Health Professions* 2012; **32**(3): 215-26.

37. de Beurs DP, de Groot MH, Bosmans JE, et al. Reducing patients' suicide ideation through training mental health teams in the application of the Dutch multidisciplinary practice guideline on assessment and treatment of suicidal behavior: study protocol of a randomized controlled trial. *Trials* 2013; **14**(1): 372.

38. De Beurs E, den Hollander-Gijsman M, Van Rood Y, et al. Routine outcome monitoring in the Netherlands: practical experiences with a web-based strategy for the assessment of treatment outcome in clinical practice. *Clinical psychology & psychotherapy* 2011; **18**(1): 1-12.

39. Beck AT, Brown GK, Steer RA. Psychometric characteristics of the Scale for Suicide Ideation with psychiatric outpatients. *Behavior Research and Therapy* 1997; **35**(11): 1039-46.

40. Shea SC. The chronological assessment of suicide events: a practical interviewing strategy for the elicitation of suicidal ideation. *Journal of Clinical Psychiatry* 1998; **59**: 58-72.

41. Beck AT, Kovacs M, Weissman A. Assessment of suicidal intention: the Scale for Suicide Ideation. *Journal of consulting and clinical psychology* 1979; **47**(2): 343.

42. Brooks R. EuroQol: the current state of play. *Health policy* 1996; **37**(1): 53-72.

43. Hakkaart-van Roijen L, Straten Av, Tiemens B, Donker M. Handleiding Trimbos/iMTA questionnaire for Costs associated with Psychiatric illness (TiC-P): Institute of Medical Technology Assessment (iMTA), 2002.

44. Tan SS, Bouwmans-Frijters CA, Hakkaart-van Roijen L. Handleiding voor kostenonderzoek: methoden en referentieprijzen voor economische evaluaties in de gezondheidszorg. *Tijdschrift voor gezondheidswetenschappen* 2012; **90**(6): 367-72.

45. Twisk JW. Applied multilevel analysis: a practical guide: Cambridge University Press; 2006.

46. White IR, Royston P, Wood AM. Multiple imputation using chained equations: Issues and guidance for practice. *Statistics in medicine* 2011; **30**(4): 377-99.

47. Rubin DB. Multiple imputation for nonresponse in surveys: Wiley. com; 2009.

48. Chaudhary MA, Stearns SC. ESTIMATING CONFIDENCE INTERVALS FOR COST-EFFECTIVENESS RATIOS: AN EXAMPLE FROM A RANDOMIZED TRIAL. *Statistics in medicine* 1996; **15**(13): 1447-58.

49. Van der Leeden R, Meijer E, Busing FM. Resampling multilevel models. Handbook of multilevel analysis: Springer; 2008: 401-33.

50. Drummond MF, O'Brien B, Stoddart GL, Torrance GW. Methods for the economic evaluation of health care programmes. Oxford: Oxford University Press.-05.

51. Brown GK, Beck AT, Steer RA, Grisham JR. Risk factors for suicide in psychiatric outpatients: a 20-year prospective study. *Journal of consulting and clinical psychology* 2000; **68**(3): 371.

52. Van Spijker B. Reducing the burden of suicidal thoughts through online self-help. 2012.

53. Günther OH, Roick C, Angermeyer MC, König H-H. The responsiveness of EQ-5D utility scores in patients with depression: A comparison with instruments measuring quality of life, psychopathology and social functioning. *Journal of affective disorders* 2008; **105**(1): 81-91.

54. Grol RPTM, Wensing MJP. Implementatie: Effectieve verbetering van de patiëntenzorg: Elsevier gezondheidszorg; 2006.

55. Grimshaw JM, Eccles MP. Is evidence-based implementation of evidence-based care possible? *Medical Journal of Australia* 2004; **180**(6): S50.

CHAPTER 8

IMPLEMENTING SUICIDE PRACTICE GUIDELINES IN MENTAL HEALTH CARE WITH AN E-LEARNING SUPPORTED TRAIN-THE-TRAINER MODEL. A PROCES EVALUATION

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Background

The effectiveness of an e-learning supported train-the-trainer program to disseminate a suicide practice guideline in mental health care was examined in a cluster randomized trial. Monitoring of an implementation process is an essential part of implementation procedures. We investigated the guideline dissemination in mental health care institutions and monitored process to gain insight in facilitators and barriers of the program and suggestions for improvement.

Method

Dissemination was quantitatively investigated by monitoring the number of training sessions that were provided during and after the trial. Ten interviews with 19 key professionals from eight mental health institutions were conducted and audio taped. Via an inductive procedure, the content was abstracted step by step. Outcomes are presented in the tables.

Results

During the trial, four masters trained 37 trainers in two single sessions. These trainers then trained 518 peers in 37 training sessions. After the trial, over two years 151 new trainers were trained who subsequently trained 5,000 professionals. The program was well received, especially with regard to the multidisciplinary approach. Changes were principally manifested on the level of individual professionals, such as being more on the alert of high risk patients. In some MHIs also institutional policies toward suicidal behavior were modified, such as removal of non-suicide contracts. E-learning was appreciated but insufficient ICT-facilities in institutions hindered its use.

Conclusions

We conclude that an e-learning supported train-the trainer program is a useful way to implement recommendations of the guideline. The intervention has been found easy to spread, both during and after the trial and was well received by its users. Key professionals propose that adjustments of the program may strengthen the impact. Key recommendations are provided to enhance (further) dissemination of the suicide practice guideline with a e-learning supported train-the-trainer program: train professionals with special interest in suicide prevention to train their own multidisciplinary teams; use e-learning support material; make key professionals within institutions responsible for further implementation; develop a long term implementation strategy focusing on team and institutional performance; tailor the training when training different psychiatric teams; be prepared that financial investments are needed if all staff is to be trained.

Introduction

In 2012, the Dutch multidisciplinary practice guideline for the assessment and treatment of suicidal behavior (PGSB) has been issued to strengthen suicide prevention. To promote implementation of the guideline in Dutch mental health care, an e-learning supported Train-the-Trainer program (TtT-e) has been developed [1] (see Table 1). The effectiveness of this TtT-e program was examined in a cluster randomized controlled trial (the PITSTOP suicide trial [2]). Forty-five psychiatric departments from nine Mental Health care Institutions (MHIs) throughout The Netherlands were matched pairwise; pair members were randomized to either TtT-e (intervention) or control (=implementation as usual (IAU): dissemination via conferences, internet, books etc.). Effects were examined at the level of professionals [2] and patients [3].
In the TtT-e program staff members of departments are trained in guideline application via a one-day face-to-face multidisciplinary training based on the PGSB, combined with a 60-minute e-learning module. Outcomes show that TtT-e results in better guideline adherence of nurses, and more confidence and knowledge regarding suicidal behavior among staff of all disciplines (nurses, psychiatrists , psychologists) [4]. At the patient level, we found that TtT-e trained professionals more likely discuss suicidal behavior with patients diagnosed with depression, and that patients reported that their suicidality was more often discussed by professionals [5].

Tabel 1: Characteristics of the e-learning supported Trainthe-Trainer model (TtT-e) to enhance the application of the guideline

Actors
- masters (staff with expertise in the field of suicide prevention, demonstrated by clinical and/or scientific activities)
- trainers (trained staff in Mental Health care Institutions)
- trainees (staff member of [mental] health care institutions who are trained by trainers).
- Trainers are trained by masters; then trainers train trainees (= multidisciplinary teams of co-workers).

Aim
To provide knowledge and exercise skills regarding diagnosis and treatment of suicidal behavior and care for (potentially) suicidal patients according to the basic assumptions of the Dutch Multidisciplinary guideline for diagnosis and treatment of suicidal behavior (PGSB) [6].

Practical starting points
An integrated model of stress-vulnerability [7 3] and entrapment [8] serves as the explanation of the onset and maintenance of suicidal conditions. For systematic assessment of suicidal behavior of patients, the CASE-interview [9]) is applied. During role plays, one colleague uses the CASE-interview to structurally assess suicidality of a suicidal patient, that is played by another colleague. The one-day training is multidisciplinary and supported by e-learning.

Content
The program is designed in reference of the basic assumptions of the PGSB:
- fostering therapeutic alliance with a suicidal patient by making contact with the patient's suicidal thoughts
- systematic assessment and treatment of suicidal behavior
- organizing safety and continuity of care
- stimulating engagement of significant others (relatives, friends of the patient) in diagnosis and treatment.

E-learning support
The program is supported by two e-learning modules:
1. A module to assist trainers in providing training (footage of prior training sessions)
2. A module for trainers and trainees. In five video tapes, professionals show how to make contact with suicidal patients (played by actors) according to the basic assumptions of the PGSB. The integrated model of stress-vulnerability and entrapment is explained by a master.

Training materials
To help trainers replicate the master training, a trainer manual, appendices and a PowerPoint are designed. The materials (versions in Dutch and in English) can freely be downloaded via the research website www.pitstopsuicide.nl

Monitoring of implementation processes is an essential part of implementation procedures; knowledge of and reflection on facilitators and barriers enhances future application of the strategy [10], is helpful to understand quantitative findings and can be used to adjust and/or improve elements and procedures [11].
In the current study, we quantitatively investigated the dissemination of TtT-e program during and after the PITSTOP suicide trial, made an inventory of facilitators and barriers of the TtT-e program application in mental health care institutions (MHIs) and identified changes in MHIs regarding management of suicidal behavior after the study, and facilitators and barriers that

were likely relevant for (further) dissemination of the PGSB in MHIs. The outcomes of the study will finally be discussed in reference of factors that are relevant for the uptake of evidence in mental health care practice, such as the attributes of evidence, barriers and facilitators to changing practice [12]. With the outcomes we aim at a more profound understanding of the trial outcomes, and provide a reference frame to MHIs who consider using the TtT-e program to disseminate the PGSB.

Methods

Quantitative and qualitative methods were combined. To investigate dissemination of the TtT-e program within and outside the framework of the study, we monitored the number of professionals that were trained to be a trainer, and how many trainees were subsequently trained via the TtT-e program. Monitoring was done in MHIs that participated in the PITSTOP trial during and after the trial course (from October 12, 2011 to October 1, 2013) and in MHIs not participating in the PITSTOP trial from October 12, 2011 to January 2015. Information on numbers of trained professionals was gathered by contacting local PITSTOP-trial contact persons and/or staff of institutional training departments. Whether trained trainers used e-learning module 1 was assessed by looking at the log files of the e-learning server. Whether study participants used e-learning module 2 and for how many minutes was assessed within the PITSTOP study [2]. For details on the recruitment of MHIs for the PITSTOP trial, see [3, 13].
Qualitative methods were used to gain insight in facilitators and barriers regarding the TtT-e program [14] . We conducted a multiple case study; MHIs (n=9) that participated in the PITSTOP study were considered cases. With a letter, sent to local contact persons in MHIs, key professionals in the institution who had also been closely engaged in the TtT-e program application (e.g. as a trainer, manager, planner) were invited to be in-depth open-interviewed by a team of two researchers (MdG and DPdB). It was left at the discretion of the MHIs who were considered key professionals. Key professionals from the separate MHI were face-to-face interviewed in groups. The open themes were:
1) What are your experiences within your institution with the application of the TdT-e model?
2) In what way affected the application of the TdT-e program institutional policies toward management of suicidal behaviors? The interview took approximately two hours and was audio-taped after oral consent in situ. Confidentiality and anonymity were guaranteed.

Data analysis

Dissemination of TtT-e training within and outside the PITSTOP trail was analyzed with descriptive statistics. The audio tapes of the interviews were analyzed by two members of the research team (MdG and DPdB) using content analyses [15]. First, the tapes were monitored and for each institution findings were summarized in a report. Second: the report was sent to key professionals to provide informant feedback (member check). Summaries were adjusted on the base of informant feedback. Subsequently, three themes were identified: feedback on I) TtT-e training program, II) e-learning support, III) multidisciplinary approach. Feedback was listed in a matrix and sub headed under the three themes. Then, feedback was first described in terms of effects, and subsequently in terms of desired or unwanted effects, and suggested or achieved adjustments. Causes of desired effects were defined as facilitators, of unwanted effects as barriers (see Table 2). During the data analyses, the researchers (MdG and DPdB) repeatedly discussed the outcomes and only after full consensus, the next step in data analyses was made. Via a similar inductive procedure, facilitators and barriers regarding dissemination of the PGSB in MHI were identified. We distinguished facilitators and barriers or PGSB dissemination during and after the study (Table 3). All suggestions, provided by key professionals during the interviews, either regarding to (possible) adjustments of the TtT-e program or to (further) guideline dissemination are displayed in Table 2 and 3 respectively. The study was funded by The Netherlands Organization for Health Research and Development (ZonMW 171103006) and ethical approval was obtained from the Medical Ethics Committee of VU University Amsterdam (registration number 2011/151).

Results

Quantitative findings

Training inside the frame of the PITSTOP study

In October 2011 and January 2012, four masters trained an overall number of 37 trainers in two single sessions. Trained professionals were mental health care nurses/nurse specialists (n=17), psychologists (n=11) and psychiatrists (n=9). These trainers subsequently trained teams of co-workers in 37 training sessions. A total of 518 professionals were trained. The e-learning module 1 (see Table 1) was completed by 122/518 (23%) professionals for m=40 (SD=16) minutes and was well received. E-learning module 2 was used 279 times by the trained trainers.

Dissemination of the TtT-e program after the trial course

As soon as the trial period ended (October 2013), new trainers were trained. From different departments not included in the PITSTOP study, we found that 151 new trainers were trained who subsequently trained at least approximately 5000 professionals.

Qualitative findings

Between December 2013 and March 2014, 19 key professionals (nurses, psychiatrists, psychologists, managers) from eight MHIs were interviewed in ten sessions. Due to agenda difficulties, we were unable to meet key professionals from one MHI.

Rationale for TtT-e program application

MHIs reported various reasons to apply the TtT-e program; all were related to the availability of the PGSB and the supervision of the health inspectorate. These reasons were changes in institutional or local policies towards formal responsibility for treatment of suicidal persons and the national trend to reduce clinical mental health care by substitution of in-patient care by out-patient care. MHIs were all convinced that these challenges require good and up-to-date professional skills. Institution-specific reasons for using the TdT-e model were related to a (sudden/unexplained) increase of suicide rates within the institutions and strengthened supervision of the health care inspectorate. MHIs with staff that had expertise on the subject acknowledged that this had encouraged participation in the PITSTOP trial.

Feedback on the TtT-e program and achieved or suggested adjustments (Table 2)

MHIs reported that the TdT-e program was helpful to increase knowledge on suicide prevention and skills in dealing with suicidal behavior. The CASE-interview and multidisciplinary approach were regularly noted as principal strengths. According to key professionals, the program resulted in increased awareness of suicidal conditions of patients and diminished reluctance to discuss this with a patient. In addition, key professionals reported that TtT-e training likely resulted in an increased notion that a working relationship with a suicidal patient is needed to affect the behavior, and in reducing ‘demoralization’ in the relationship with chronically suicidal patients. it sometimes turned out to be challenging to translate the assumptions of the stress-vulnerability-entrapment model, which is the basic assumption of both the PGSB and the TtT-e (see Table 1), into systematic assessment of suicidal behavior. Three MHI’s felt the need for more knowledge and skills

on suicidal behavior of patients with borderline personality disorder, and knowledge on how to engage a patient's relatives in diagnosis and treatment of suicidal behavior.

Multidisciplinary training was experienced as meaningful by all disciplines and had led to increased mutual respect and understanding between members of different disciplines. For an optimal effect, key professionals recommended to provide future training by a couple of trainers from different professional background. Participation of clinicians (psychiatrists, psychologists) however, was limited , either because they thought or established that the training program was too basic and lacked knowledge and skills on specific treatment strategies, or could not find time due to production pressures. To meet the various needs, it was suggested to remove parts of the training schedule and give these as homework to limit the duration. Clinicians also suggested to organize (mono disciplinary) training sessions with a focus on specific treatment components, but it was acknowledged that this may result in losing the benefits of multidisciplinary training. Although the e-learning module was highly appreciated, ICT facilities in MHIs generally turned out to be insufficient to display the e-learning modules. Table 2 shows results in more detail as well as suggested and achieved adjustments.

Tabel 2: Facilitators and barriers regarding the TtT-e training program's form and content

	results	suggestions for adjustment
FACILITATORS		
I Training program		
• comprehensive structure • basic guideline assumptions recognizable • practice-based • sufficient time for discussion and skills practicing	• active involvement of participants • in-depth insight in distinct types of suicidal behaviors • guideline recommendations directly applicable in daily practice	• develop role playing to facilitate practicing of team performance • add theory and recommendations for dealing with suicidal behavior of patients with borderline personality disorder
• systematic assessment of suicidal behavior of patients using the CASE-interview [16]	• systematic approach of the assessment of suicidal behavior • improves 'common language' regarding suicidal behavior in between members of different disciplines	• stronger emphasize on the relationship between the CASE-interview and the integrated stress-vulnerability-entrapment model
• readymade training material	• preparation time for trainers is limited	

II E-learning		
• recognizable scenes • informative • fun to do	• information on the guideline was available 24/7	• add footage of how to deal with suicidal behavior of patients with borderline personality disorder* • add interactive elements **
III Multidisciplinary approach		
• training in multidisciplinary groups with respect to professional discipline and treatment setting • couples of trainers from different professional background	• more profound understanding and feedback in between disciplines • teambuilding and fun ('better than a day of paintball') • enhances emancipation of the nursing discipline • useful in reference of the policy of increasing outpatient care • protective against complaints of patients and relatives	• increase the focus on team performance • develop exercises focused on team performance
BARRIERS		
I Trainings program		
• training schedule somewhat overloaded • too much focus on fostering a working relationship with the suicidal patient • low attention to dealing with chronic suicidal patients • skills on how to engage significant others is lacking	• learning effect is shrinking during the day • training schedule was limited to half a day (or even less) • unmet needs regarding management of chronic suicidal conditions	• merge exercises** • tailor the focus to specific needs of departments** • add theory on how to deal with chronic suicidal behavior of patients with borderline personality disorder * • add skills training on engagement of significant others
• content too limited for specialized clinicians	• low participation rate of psychiatrists / psychologists	• motivate clinicians to become a trainer • add information on specialized treatment of suicidal behavior • design specific training om treatment options
• good quality of training sessions not guaranteed	• limited effectiveness	• enhance training skills of trainers* • training provided by institutional experts on the topic**

III E-learning		
• unfamiliarity with e-learning • insufficient ICT facilities • professionals not willing to complete the e-learning module at home • login code was lost • unclear to trainers and trainees how to use the e-learning in addition to face-to-face training	• limited use of e-learning • not optimal use of e-learning	• improve ICT facilities • offer e-learning module via 'GGZ- ecademy' (= external organization responsible for e-learning modules in mental health care)** • offer instruction on the application of e-learning • facilitate professionals to complete e-learning at home
III Multidisciplinary approach		
• training of clinicians by a nurse-trainer goes against hierarchal structure • production loss and organizational problems due to training of complete teams at the same time	• participants feel uncomfortable • low participation of clinicians	• focus on the benefits of a multidisciplinary approach in managing suicidal behavior

*in progress; ** achieved

Facilitators and barriers for dissemination of the PGSB during and after the trial course

All MHIs suggested that comprehensive institutional policy and/or at least a project-based approach for PGSB implementation is needed to fully incorporate PGSB -recommendations in care processes. Closely tuning on external partners in care (GP's, general hospitals, emergency services) is needed. It was suggested that interventions aiming at adjustment at the institutional level might be integrated in the TtT-e program, such as designing a format for reporting the outcomes of the systematic assessment of suicidal behavior in the electronic patient records, or a systematic method to evaluate professional performance after a patient suicide. The production losses due to large-scale training of professionals was mentioned as barrier of great significance. It was suggested that in times of scarcity, priority should be given to departments most often involved with suicidal behavior.

Staff members with specific affinity with the subject had promoted early adoption of the TtT-e program, but it deemed to depend on the strategic position of these staff members and to the extent to which they were able to put suicide prevention on the institutional policy agenda to establish ongoing efforts to disseminate the PGSB after the study. In large MHIs with locations scattered in a wide region, strong institution-specific incentives and a top-down approach were deemed critical to further disseminate the PGSB.

Tabel 3 Facilitators and barriers for dissemination of TtT-e during and after the trial course

	result	suggestions to increase success
FACILITATORS		
During the trial		
• timing of the availability of the TtT-e program (just after release guideline) • influential position of experts in the institution	• sense of urgency to strengthen suicide prevention activities • improving care • 'early adapting'	
After the trial		
• benefits of the TtT-e program for all disciplines • readymade training materials	• willingness to execute institutional policy on suicide prevention	• flexible application of the training program*
• organization of training sessions by institutional education departments	• participation of professionals more likely	• assign accreditation to participation*
BARRIERS		
During the trial		
• large size of the MHI	• information of TdT-e was fragmented, not all departments were well informed of training possibilities • to most managers, planners and clinicians, it was unknown that some of their colleagues were trained as trainers. • planning of training was complex	• structural program to spread across MHI*
• reorganization of MHIs	• replacement of trainers • experts moved to another MHI • need to deploy external trainers	• facilitate the expert role of trainers*
• research status of the TtT-e program	• relation between study participation and PGSB implementation not always clear • no plan for further PGSB dissemination after the trial	• develop long term implementation strategy
• production loss	• departments were not trained due to lack of resources	• prioritize departments with the most stressing need of training* • smartly combine face-to-face with e-learning ('blended learning')

After the trial		
• no internal or external incentives • no sense of urgency	• attention for suicide prevention fades over time	• make suicide prevention a policy priority * • slightly add other implementation strategies ('blended learning') • make (at least) one professional responsible to keep suicide prevention on the agenda*
• TtT-e just improves individual skills	• no effects on team or institutional level	• develop and examine interventions on team and institutional level e.g. • systematic recording of suicidal behaviors • systematic examination of guideline application in reference of suicide cases

*in progress; ** achieved

Changes at the institutional level regarding suicidal behavior

Mixed results were found regarding to modifications of work processes or policy regarding management of suicidal behavior. Three key professionals mentioned no change after the trial was ended. In four MHIs, it was noted by the key professionals that the effect was principally manifested at the level of the individual professionals. Others reported changes in for example the registration of suicidal behavior, and the removal of non-suicide contracts. Some key-professionals stated that more attention was paid to suicidality during transition moments. They felt that because of TtT-e, there was less taboo associated with asking about suicidality, and noticed an increased common understanding of suicidal behavior between professionals. Differentiating between chronical suicidal behavior and acute suicidal behavior on top of chronical suicidal behavior had improved. The training also resulted in diminished reluctance to engage significant others in diagnosis, treatment and safety procedures. TtT-e training (or parts thereof) were included in training curricula for clinicians. In two institutions adjustments in the electronic patients record (EPR) were made to report outcomes of systematic assessment of suicidal behavior. In one institution, non-suicide contracts were removed.

Discussion

This study shows that the TtT-e model has been found easy to disseminate, both during and after the trial and was well received by its users. From 2012 until December 2014, over 5.500 mental health professionals have be trained according to TtT-e, indicating a well perceived need to improve suicide prevention skills within Dutch mental health care. MHIs reported that the program sufficiently meets the need for knowledge and skills on suicide prevention. The effects of TtT-e application are manifested in individual professionals, which is in line with the quantitative findings from this study [4, 5]. In a few MHIs modification of work processes were observed.

The likeliness of evidence-based acting of professional depends on the perceived effectivity and complexity of interventions, and whether interventions match with existing or desired values [12]. Although prevention of suicide is complex, we observed that MHIs inside and outside the PITSTOP study were prepared to establish an evidence-based approach towards suicide prevention. Qualitative and quantitative outcomes of this study suggest that TtT-e application is helpful to deal with the complexity of suicidal behavior. We argue that this may further enhance application of the PGSB due to increased access to the evidence. In addition, more time is needed to further integrate the PGSB recommendations in care processes; institutional policy is needed to establish this.

One of the main barriers to train teams is the obvious loss of production. To reduce costs, e-learning might be used to shorten face-to-face training. Professionals might prepare the face-to-face training by first completing the module either at work or at home, which could shorten the time needed for face-to-face training. Besides, professionals have to make clear to insurance companies, governments and civilians that suicide prevention costs money. To minimize reluctance to complete e-learning, ICT facilities should be sufficient and participation should be compensated by the institution.

Strengths and limitations

Qualitative methods result in a broad description of phenomena aiming at transferability of the findings in a different context. The findings from MHIs included in this study may be biased by MHIs' strong motivation to target the problem of suicide (early adapting). One MHI could not be interviewed whereas in this MHI enduring efforts to strengthen suicide prevention were applied even before the PITSTOP study. Although we observed that experiences in this MHI do not differ from others, we don't know if this introduced bias. Bias may have been introduced as both the interviews and analyses were executed by the same researchers who possibly had a pre-existing notion of the study outcomes. To address this, the interviewers encouraged key professionals to be critical. A strength of the study is it's large size and almost full participation of all included MHIs. We are certain that in the interviews, saturation of information was achieved. This underlines the findings' credibility.

Final remarks and implications

The focus of the intervention was mainly on the improvement of individual performance [17] and indeed resulted in change principally at the level of the individual professional. It was expected that due to individual change, both teams and institutions would also change their policy and work process. However, successful adaptation of changes at the institutional level was scarce, in particular in large institutions. Since Dutch mental health care is a complex system with a large number of stakeholders, local governments, insurance companies, patients and professional standards that display competing demands, change is difficult. Also, within our study, improvement on the institutional level was not clearly defined, making the assessment and comparison of change across several institutions difficult.

In a health care system overloaded with competing demands, guidelines cannot be well implemented without explicit guidance. We argue that future efforts to disseminate guidelines, in particular the PGSB, should explicitly target the implementation at the institutional level and should let the institutions formulate themselves what they consider to be relevant changes, and how they will operationalize successful implementation. Helping mental health care to define their own ambitioned change and holding them accountable for the results, may result in enduring improvements after guideline implementation. We argue that successful implementation of guidelines within (mental) health departments start with enthusiastic, energetic and charismatic key professionals who are responsible for the process of implementation. Panel 1 shows a summary of key recommendations for future implementers to keep in mind.

Panel 1: Key recommendations for future implementation of suicide guidelines in mental health care

- Make key professionals within MHIs responsible for suicide guideline implementation
- Develop a long term implementation strategy that focusses not only on individual performance, but also on team and institutional performance
- Train professionals to train their own team
- Train multidisciplinary teams by a multidisciplinary couple
- E-learning is highly appreciated, can reduce the length of the face-to-face training, and make the intervention more scalable [18]. Use e-learning modules to support face-to-face training
- Tailor the training to specific patient groups
- Training is more effective if it is provided by professionals with special interest on the subject
- Investments are needed if all staff is to be trained

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References

1. de Groot MH, De Beurs DP, de Keijser J, Kerkhof AJFM: **An e-learning supported Train-the-Trainer program to implement a suicide practice guideline**. UNDER REVIEW.

2. De Beurs D, De Groot M, de Keijser J, Verwey B, Mokkenstorm J, Twisk J, Van Duyn E, Van Hemert A, Verlinde L, Spijker S *et al*: **Improving the application of a practice guideline for the assessment and treatment of suicidal behavior by training the full staff of psychiatric departments via an e-learning supported Train-the-Trainer program: study protocol for a randomized controlled trial.** *Trails* 2013, **14**(9).

3. de Beurs DP, de Groot MH, Bosmans JE, de Keijser J, Mokkenstorm J, Verwey B, van Duijn E, de Winter RF, Kerkhof AJ: **Reducing patients' suicide ideation through training mental health teams in the application of the Dutch multidisciplinary practice guideline on assessment and treatment of suicidal behavior: study protocol of a randomized controlled trial**. *Trials* 2013, **14**(1):372.

4. de Beurs DP, de Groot MH, de Keijser J, Van Duijn E, de Winter R, Kerkhof AJFM: **the effect of an e-learning supported Train-the-Trainer program to implement suicide guidelines in mental health care**. *UNDER REVIEW*.

5. De Beurs DP, De Groot MH, De Keijser J, Van Duijn E, De Winter R, Kerkhof AJFM: **Do patients benefit from the training of mental health professionals in suicide practice guidelines? A cluster randomized trial**. UNDER REVIEW.

6. Van Hemert A, Kerkhof A, de Keijser J, Verwey B, van Boven C, Hummelen J, de Groot M, Lucassen P, Meerdinkveldboom J, Steendam M *et al*: **Multidisciplinaire richtlijn voor diagnostiek en behandeling van suïcidaal gedrag**. Utrecht: De Tijdstroom; 2012.

7. Goldney D: **Suicide Prevention: a practical approach**. Oxford: Oxford University Press; 2008.

8. Williams JMG, Pollock LR: **The psychology of suicidal behaviour**. In: *The International Handbook of Suicide and Attempted Suicide.* edn. Edited by Hawton K, Heeringen Kv. Chichester: John Wiley & Sons; 2000: 79-94.

9. Shea SC: **The chronological assessment of suicide events: a practical interviewing strategy for the elicitation of suicidal ideation**. *Journal of Clinical Psychiatry* 1998, **59**:58-72.

10. Campbell M, Fitzpatrick R, Haines A, Kinmonth AL, Sandercock P, Spiegelhalter D, Tyrer P: **Framework for design and evaluation of complex interventions to improve health**. *BMJ: British Medical Journal* 2000, **321**(7262):694.

11. Jones R: **Why do qualitative research?** *British Medical Journal* 1995, **311**((6996)):1.

12. Grol R, Grimshaw J: **From best evidence to best practice: effective implementation of change in patients' care**. *Lancet* 2003, **362**(9391):1225-1230.

13. de Beurs DP, de Groot MH, de Keijser J, Verwey B, Mokkenstorm J, Twisk JW, van Duijn E, van Hemert AM, Verlinde L, Spijker10 J: **Improving the application of a practice guideline for the assessment and treatment of suicidal behavior by training the full staff of psychiatric departments via an e-learning supported Train-the-Trainer program: study protocol for a randomized controlled** *BMC trials* 2013, **14**(9).

14. Mortelmans D: **Handboek kwalitatieve onderzoeksmethoden**: Acco; 2007.

15. Nandy BR, Sarvela P: **Content analysis reexamined: A relevant research method for health education**. *American Journal of Health Behavior* 1997, **21**(3):222-234.

16. Shea S: **Psychiatric Interviewing, the art of understanding**. Philadelphia: Saunders Company; 1998.

17. Spyridonidis D, Calnan M: **Opening the black box: a study of the process of NICE guidelines implementation.** . *Health policy* 2011, **102**(2):8.

18. Fairburn CG, Patel V: **The Global Dissemination of Psychological Treatments: A Road Map for Research and Practice**. *American Journal of Psychiatry* 2014, **171**(5):495-498

CHAPTER 9

E-LEARNING AS AN ADJUNCT TO A FACE-TO-FACE TRAINING ON SUICIDE PRACTICE SKILLS. A POST-HOC EVALUATION

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Background

E-learning is becoming a popular educational method to train mental health professionals. However, there is not much information on the development and evaluation of e-learning within mental health care.

Objective

To facilitate developers of new e-learning modules by evaluating use and appreciation of an e-learning module that was part of a Train-the-Trainer program to implement a suicide practice guideline

Methods

Post-hoc analysis of data collected in the intervention condition of a large national randomized controlled trial. An e-learning supported Train-the-Trainer program was used to train the staff of 22 departments spread over 9 mental health institutions. Each participant in the intervention condition received an online questionnaire before the start of the intervention. After completing baseline items participants automatically received an email with the login codes for the e-learning module. Next, they followed a face-to-face training given by a colleague, who was trained by experts on suicide prevention to train his own peers. The training given to peers consisted of a one day, small group face-to-face training, focusing on the structural interviewing, diagnosis and treatment of suicidal patients. The e-learning module was offered additional to the face-to-face training and could be accessed before and after the training. Three months after the face-to-face training, professionals answered items on guideline adherence and on the use and appreciation of the e-learning module.

Results

The module was developed in half a year, primarily by a PhD candidate without specific programming skills. No effect of the e-learning above and beyond the face-to-face training was found. Problems with the ICT environment within all 9 mental health institutions limited access to e-learning module. 55% (n = 124) of the 224 respondents stated they had used the e-learning module for an average time of 40 (SD =18) minutes. 77% (n = 95) of the professionals stated they learned a lot on the topic of suicide prevention, 87%(n = 105) found the e-learning a good addition to the training, and that 78% (n = 104) would recommend the e-learning module to their colleagues.

Conclusions

It was possible to develop an e-learning module with little means that was highly appreciated. However, no differences on outcomes between users and non-users were found. Future studies should investigate the effectiveness of e-learning compared to face-to-face using a randomized design. Special care should be taken to (technically) facilitate access to the e-learning module at work.

Background

In 2012, the Dutch multidisciplinary Practice Guideline on the Assessment and Treatment of Suicidal Behavior has been issued [1]. To implement the guideline in Dutch mental health care, an e-learning supported Train-the-Trainer program (TtT-e) was delivered to the staff of psychiatric departments [2]. Professionals were trained by experts in suicide prevention. Next, these professionals trained their own peer-colleagues in a one day face-to-face training. The face-to-face training was supplemented with an e-learning module, as multifaceted interventions have been found to be more effective when compared with single interventions [3, 4]. Advances in technology, the rising costs in health care and the need for continuous education of (para)medical professionals have made e-learning a popular new educational method [5-7]. In both undergraduate and graduate medical programs, the use of e-learning modules is widespread [8-10]. It is used successfully in several medical fields [8] such as dermatology [11] and surgery [12] as these disciplines allow to teach concrete and measurable skills such as skin examination. Interpersonal skills, the basis of the psychiatric discipline, are perhaps more difficult to learn via e-learning [13], resulting in less application of e-learning in psychiatry when compared to other disciplines [8, 9]. However, also in mental health, e-learning is gaining popularity. Currently, the university of Oxford is developing e-learning modules to disseminate psychological treatments around the world [14, 15] and in the Netherlands, mental health institutions are joining hands to make e-learning widely available to mental health professionals in the Netherlands.

Previously, we examined the effectiveness of the blended intervention (face-to-face + e-learning) in a cluster randomized trial [16, 17]. Preliminary results [18] showed that the use of a TtT-e model is effective to implement the guideline at both the professional and patient level. Compared with conventional strategies, TtT-e leads to better guideline adherence by nurses and more confidence and knowledge regarding suicidal behavior among members of all disciplines (nurses, psychiatrists , psychologists, therapists). At the patient level, we found that the training had a positive effect on suicidal patients with a depression.

We did not investigate the relative effectiveness of the e-learning module in comparison with the face-to-face training. We did find that the e-learning module was well received, and that there is a clear need for more information on how to develop an e-learning module [19].

By post –hoc describing the development and feasibility of the e-learning module used alongside a Train-the-Trainer program, we aim to facilitate

new developers of e-learning modules. . As blended learning is assumed to be more effective than only face-to-face training [8, 9], we argue that outcomes would be better for professionals that followed both the e-learning module and the face-to-face training , when compared to professionals that followed face-to-face training only. First, we describe the design of the PITSTOP suicide trial [2], focussing on the role of the e-learning module within the intervention. Next, we elaborate on the development of the e-learning module. Using baseline and 3 month follow-up data from the intervention condition of the PITSTOP suicide trial, we evaluated post-hoc whether baseline characteristics such as age and gender could indicate which participants would use the e-learning module. We also report on the professional's use and appreciation of the module. Finally, we examined if guideline adherence at follow-up of professionals that used both the e-learning and the face-to-face training differed from the outcomes of professionals that only followed the face-to-face training.

PITSTOP suicide trial

The e-learning module was part of a large national randomized controlled trial investigating the effects of an e-learning supported Train-the-Trainer program (TtT-e) called PITSTOP suicide [2]. Within the trial, psychiatric departments were considered eligible for participation if they treated patients aged ≥18 years, if professionals considered a need for training in suicide prevention skills, if the training was supported by the institutional board and if institutions were willing to accept costs due to loss of production. Eligible departments were matched in pairs based on primary patient diagnoses and average treatment duration. Members of matched pairs were randomly allocated to either Implementation as usual (internet, congresses, booklets etc.) or TtT-e (intervention). Binary randomization was performed by an independent researcher of the Dutch Institute for Health and Care Research who was not involved in the study. Outcomes of matching and randomization are described elsewhere [2]. Twenty two departments spread over 9 mental health institutions were randomized to the intervention condition. Each participant in the intervention condition received an online questionnaire two weeks before the face-to-face training. After completing all baseline items participants automatically received an email with the login codes for the e-learning module. Next, they followed the face-to-face training given by a colleague, who was earlier trained by experts on suicide prevention. The training consisted of a one day, small group face-to-face training, focusing on the structural interviewing, diagnosis and treatment of suicidal patients and is described in more detail elsewhere [2]. The e-learning module was offered additional to the face-to-face training and could be accessed before and after the training. E-learning was expected to complement the face-to-face training; it was found to help medical students become more actively involved in the study material and thereby help to internalize the material [20]. Three months after the face-to-face training, professionals received a second questionnaire.

Measurement

In the intervention condition, two weeks before the face-to-face training of the departments' staff was planned, the baseline assessment (T0) was sent to the trainees by e-mail via an online survey platform called Qualtrics [21]. Completing baseline assessment was mandatory to have entrance to the face-to-face training and to gain access to the e-learning module. A follow-up assessment (T1) was planned at three months after the training. Professional credits were awarded if professionals completed T0 and T1 and had attended the training.

Baseline characteristics

At baseline, we asked for demographics and profession (nurse, psychologist, psychiatrist, other), years of experience in psychiatry , years of experience with suicidal behavior and number of trainings followed on discussing suicidal behavior.

Primary outcome

The primary outcome was improvement in suicide practice skills due to the blended intervention. Most instruments that measure clinical skills are self-report measurements, i.e. they ask the respondent to reflect on his clinical skills [15]. To more directly and realistically assess change in clinical skills, we selected five 30-second video vignettes from the e-learning module material. Two vignettes introduced a suicidal depressed old man, one video displayed a suicidal psychotic man, the fourth a young woman after a suicide attempt, and the last one a narcissistic widower with a death wish. Participants were asked to rate (on a Visual Analogue Scale ranging from 1 to 100) the likelihood that, within the next 10 minutes, they would respond with 25 possible replies. The content of the replies was based on the recommendations of the guideline. For example: 'Ask whether the patient thinks about suicide', 'Ask how hopeless the patient is feeling'. The items and an example of a video vignette can be found in Multimedia Appendix 2.
To estimate guideline adherence, all 125 item scores (25 items times five vignettes) were summed and divided by the total amount of items, resulting in mean scores ranging from 0 to 100, with higher scores representing stronger guideline adherence. A reference score was set by a panel of suicidology

experts (n = 6) who once completed the video vignettes, resulting in a score of mean (SD) 75.0 (6.0). Cronbach's alpha within the sample for the total 125 items was .88. Cronbach's alpha for items of individual vignettes ranged from 0.88 to 0.91.

Feedback regarding technical difficulties

As we got several complaints from users that they could not use the module due to technical problems (fire-wall, no sound card), we asked key professionals from each institution to report on the most prominent technical barrier after all data was collected.

Post-Hoc Data analysis

To explore the relation between the use of the e-learning module and outcomes at follow-up, we fitted a linear model with follow-up outcome scores as the dependent variable, baseline outcome score as a covariate, module use (yes/no) as a between-group factor. Mean (SD) differences between baseline and follow-up between users and non-users were expressed as regression coefficients (b), 95% confidence intervals and p-values.To investigate whether baseline characteristics related to the use of the e-learning module, we used a logistic regression analysis. The binary dependent variable was use of the module (yes/no) and the independent variables were gender, age, profession, years of experience in psychiatry, years of experience with suicidal patients, any previous training in discussing suicidal behavior, and the baseline scores on the primary outcome. Differences between users and non-users with regard to each variable were expressed as odd ratio's (B), 95% confidence intervals and associated p-values.

Development of the E-learning module

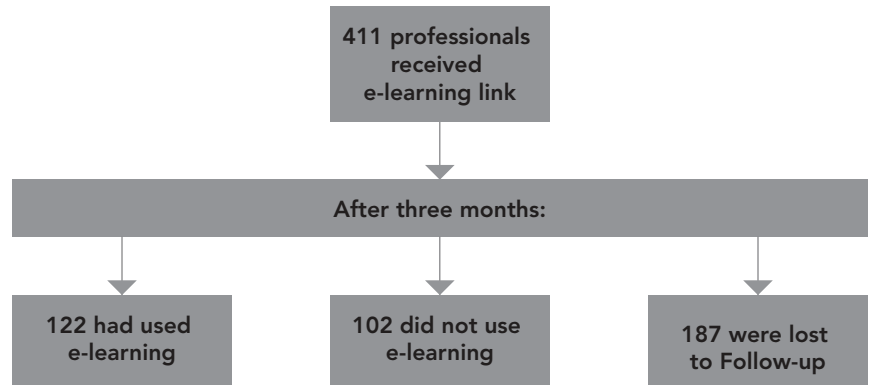
The e-learning module for trainees is based on the five main recommendations of the guideline [22] (I: making contact, II: safety of patients, III: involving significant other, IV: continuity of care, V: systematic assessment and treatment of suicidal behavior). To cover the content of the guideline [22], scenario's for six videos were developed by the research team (a chronically depressed older man, a young girl with a borderline disorder, a psychotic homeless man, a narcissistic old widower with a death wish, a young man with latent suicidal thoughts and a chronically suicidal woman in a hospital after being treated at the emergency department for a suicide attempt). These patients were found to represent the variety of suicidal patients in mental health care [23]. By choosing a wide range of patients, we hoped to make the module useable for professionals from different psychiatric departments. We deliberately did not script the dialogues as we wanted to have as much a realistic scene as possible, and did not want the professionals to be acting. From the suicide expert network that was involved in the development of the guideline, two experienced nurses and two experienced psychiatrists were selected to play a role model in the module. We hired five actors to play the five different patients. Media professionals of VU University and a sound engineer recorded the scenes with two cameras, while the first and last author were directing the scenes. We recorded each scene for over three hours. Next, the first author edited the videos into 5-minute scenes, selecting those parts that reflected the guideline recommendations best. Next, he developed the e-learning module by integrating the recommendations with the video clips, using a plug-in of PowerPoint called Adobe Presenter 7. Adobe Presenter allows to turn a set of powerpoint slides in e-learning content without any additional computer coding. It enables users to record narration over PowerPoint slides, and to add existing Video clips. The module was put online through Adobe Connect Pro, a program that allows to publish Adobe Presenter files on a special Adobe Connect Server. The link to the e-learning was send to the research team and the experts that were in the video's. They all commented extensively on the selected video's and specifically on the text that accompanied the scenario's. When all experts agreed to the final version, the module was pilot tested among mental health professionals that were involved in the development of the guideline. All in all, the module was developed in half a year, demonstrating it is possible to develop a first version of an e-learning module without a team of experts in a short period of time. A short translated demo is available as Multimedia Appendix. Table 1 presents an overview of the structure, learning goals and guideline recommendations addressed in the module.

Table 1: content of the e-learning module

STRUCTURE OF MODULE	LEARNING GOALS	GUIDELINE recommendation
Introduction	• Introduction to content and use of the module	
Scene 1: An interaction between a nurse and a chronically depressed patient who has been in a mental health hospital for a long time	• Making contact • Openly discussing suicidality • Validation of emotion • Asking for hopelessness	I, IV
POWERPOINT LECTURE: Explanation of the model of suicidal behavior as used in the guideline	• To gain insight in the stress-vulnerability-entrapment model • To learn how to structurally assess suicidality • To obtain examples of protective and risk factors	I, V
Scene 2: A young man, who was just brought in by the police because he was walking by the rails, is being assessed by a nurse	• Making contact • Asking about hopelessness • Asking about the future	I,V
POWERPOINT LECTURE: on the basic recommendations of the guideline	• Introduction of the five main themes of the guideline	I,II, III,IV, V
Scene 3: interaction between a nurse and a young girl who asks to be hospitalized	• Safety of the patient • Making contact • Openly discussing suicidality	I, II
POWERPOINT LECTURE: on the topic of safety from the viewpoint of a nurse	• Safety of a patient • Continuity of care	I,II,IV
Scene 4: Elderly man with death wish has a consultation with a psychiatrist	• Making contact • Assessing somatic problems • Asking for hopelessness • Assessing the occurrence of a depression • Offering a compromise between the death wish of the patient and the options of the doctor	I, V
Scene 5: Psychotic young man has consultation with his psychiatrist after his coach is worried about his suicidality	• Making contact • Involving significant other • Admitting the patient to a hospital	I, II, III, IV
Scene 6: Consultation in a hospital of a young woman after suicide attempt	• Making contact • How to get back on track after a suicide attempt • Safety of the patient	I, II,V
Summary of the recommendations		I,II, III,IV, V

Results of post-hoc analysis

Figure 1: Participation and use of the e-learning module



In the intervention condition 518 professionals were invited to participate in the study. 411 finished baseline and therefore also received the password and link to the e-learning module. 224 professionals answered questions on the e-learning module at 3 months follow-up. Of those, 55% (n = 122) stated they used the e-learning module for an average time of 40 minutes (SD = 18). When comparing scores on guideline adherence at 3 months follow-up, no effect of the e-learning module above and beyond the face-to-face training was found (b = - 2.6, CI 95% (-0.21 – 5.4), p = 0.065).

No significant differences in baseline scores between users and non-users were found (table 2).

Table 2: Results of the logistic regression tests of the baseline characteristics as predictors of e-learning module use

Baseline variables:	**Users n=122**	**Non users n=102**	**Odds(95%CI)**	P
Female	79(64%)	71 (69%)	0.58 (0.29-1.1)	*0.12*
Age mean (SD) yrs	43 (11)	43 (11)	0.98(0.93-1.03)	*0.36*
Professional discipline			1.37(0.66-2.8)	*0.39*
Nurse*	81 (65)	57 (54)		
Psychologists/psychiatrists	28 (23)	31 (32)		
Other	16 (12)	14 (13)		
Skills of participants				
Practice experience mean (SD) yrs	18.9 (11.5)	18.2 (11.4)	1.04(0.97-1.17)	*0.27*

Experience with suicidal behavior mean (SD) yrs	13.6 (10.3)	13.8 (10.4)	0.97(0.92-1.02)	*0.24*
Previously trained in discussing suicidal behavior (YES)	24 (19)	21 (20)	1.29(0.75-2.25)	*0.36*
Guideline adherence range 1-100	63.3(9.2)	64 (9)	1.00(1.00-1.00)	*0.73*

N(%) unless otherwise noted.
*Reference group

The ICT environment of all 9 mental health institutions (MHI) was insufficient to display the module. Three institutions recently changed their network to "Citrix", so videos were displayed but with no sound. Six reported to have no soundcard or boxes in their computers. In one MHI, the browsers were outdated, but employees had no administration rights to update any browser.

User evaluation

Table 3 shows that 77% stated they learned a lot on the topic of suicide prevention, 87% found the e-learning a good addition to the training, and that 78% would recommend the e-learning module to their colleagues. Thirty percent (n = 42) said they learned more from the module than from the small group interactive training.

Table 3. Evaluation of the e-learning module by user (n = 122).

	Response n (%)		
Item	**No**	**Neutral**	**Yes**
I learned a lot on the topic of suicide prevention from the module	8 (7)	19 (16)	95 (77)
The module is a good supplement to the training	4 (3)	13 (10)	105 (87)
I feel more secured when dealing with suicidal patients because of the e-learning module	18 (15)	27 (23)	77 (62)
I would recommend the e-learning module to college's	11 (9)	17(13)	104 (78)
I learned more from the e-learning module than from the training	45 (38)	37 (32)	40 (30)

Discussion

To facilitate developers of e-learning modules in mental health we evaluated an e-learning module that was part of Train-the-Trainer program on the assessment and treatment of suicidal behavior. Importantly, no beneficial effect of the use of the e-learning module above and beyond the face-to-face training was found. This was unexpected because blended learning has been

found to be more effective when compared to only face-to-face learning [8, 9]. As we did not randomize access to the e-learning module, we do not know if the guideline adherence scores at follow-up of the participants who used the module would have been lower if they would not have had access to the module. As 77% stated they learned a lot from the module, and 30% stated to have learned more from the e-learning module than from the training, this might be the case. Also, as all professionals are likely to have improved in suicide prevention skills after the face-to-face training, our non-findings might indicating a ceiling effect of our self-constructed guideline adherence scale.

We found baseline characteristics such as age to not indicate future use of the module. This might be explained by studies indicating that the level of computer literacy is high among higher educated participants, no matter what age or gender they have [24].

An important finding was that problem with hardware, software and security levels in all of the 9 mental health care institutions troubled access to the e-learning module. Videos could not be opened and if they could be opened sound boxes were often lacking. Different solutions were tried per MHI, either by providing free earphones or by bypassing security. In most MHI's, the best solution was to let the participants complete the module at home. However, not all professionals were willing to access the module at home, unless they were being compensated for working at home.

Technical realization

We demonstrated that to develop the first prototype of an e-learning module, no expert team of computer scientists is necessary. With relative little means, no specific programming knowledge, an enthusiastic PhD candidate and good actors, we developed an acceptable and highly appreciated e-learning module. We do argue that expert knowledge might have helped to anticipate the technical difficulties within mental health institutions. Also, when implementing an e-learning module after the study on a larger scale, expert knowledge is required to make the module more interactive.

Strengths and limitations

Offering the e-learning module as non-required, and having several ICT problems may have caused possibly introduced selection bias, as professionals who were strongly affiliated to the theme of the study or who had interested in e-learning might have been more likely to use the module. Also, the nature of our design does not allow us to drawn any casual conclusions on the effectiveness of e-learning. Finally, we used a non-validated scale as a primary outcome, which makes it difficult to put the findings in perspective.

Our study is the first to extensively report on the development and feasibility of an e-learning module on suicide prevention practice guideline adherence. Most studies on e-learning are done amongst (under)graduate students. By evaluating our module among a wide range of professionals from many different psychiatric departments, our findings add new and generalizable information for e-learning developers.

Implications and future studies

Although the e-learning module was highly appreciated, no differences on outcomes between users and non-users were found. Future studies in which a person is randomized to either a face-to-face training, an e-learning module or to a blended intervention could further investigate the effect of e-learning on suicide practice skills. Importantly, the scale to assess the primary outcome, guideline adherence, was developed for this study and has not been validated elsewhere. As professionals stated they learned a lot from the module, the non-findings of our study might be attributed to the non-responsiveness of our guideline adherence scale. Future studies should use validated outcome measures to assess change in suicide practice skills.

As is done more often [25, 26], even without any direct evidence of its effectiveness, our module is currently being implemented among 30 mental health institutions from the Netherlands via the GGZ-Ecademy (ggzecademy.nl). The GGZ-ecademy incorporated the content and structure of our module and applied their format and educational experience to improve the module. The new module is currently available to over 30.000 mental health professionals all throughout the Netherlands. It has been noted that e-health research cannot keep up with technological advances and implementation of online innovation [26]. Standard scientific designs such as a randomized controlled trial are argued to be incapable of offering the information needed in the field of e-health. Therefore, in collaboration with the GGZ-ecademy we strive to test the efficacy of the e-learning module using more responsive and pragmatic designs such as a stepped wedge design [27]. An often used argument for the use of e-learning is its cost-effectiveness [5, 24]. Medical education is expensive [28], and via e-learning costs can be reduced [5, 24]. However, there is a lack of studies examining the cost effectiveness of e-learning [8, 24, 26, 29, 30]. Therefore, the ongoing implementation of e-learning modules in mental health care should be combined with the thorough validation of its (cost)effectiveness using pragmatic designs.

References

1. Van Hemert A, Kerkhof A, de Keijser J, Verwey B, van Boven C, Hummelen J, de Groot M, Lucassen P, Meerdinkveldboom J, Steendam M *et al*: **Multidisciplinaire richtlijn voor diagnostiek en behandeling van suïcidaal gedrag**. Utrecht: De Tijdstroom; 2012.

2. de Beurs DP, de Groot MH, de Keijser J, Verwey B, Mokkenstorm J, Twisk JW, van Duijn E, van Hemert AM, Verlinde L, Spijker10 J: **Improving the application of a practice guideline for the assessment and treatment of suicidal behavior by training the full staff of psychiatric departments via an e-learning supported Train-the-Trainer program: study protocol for a randomized controlled** *BMC trials* 2013, **14**(9).

3. Grol R, Grimshaw J: **From best evidence to best practice: effective implementation of change in patients' care**. *The Lancet* 2003, **362**(9391):1225-1230.

4. Pearce J, Mann MK, Jones C, van Buschbach S, Olff M, Bisson JI: **The most effective way of delivering a Train-the-Trainers program: A systematic review**. *Journal of Continuing Education in the Health Professions* 2012, **32**(3):215-226.

5. Ruiz JG, Mintzer MJ, Leipzig RM: **The impact of e-learning in medical education**. *Academic medicine* 2006, **81**(3):207-212.

6. Cook DA, Levinson AJ, Garside S, Dupras DM, Erwin PJ, Montori VM: **Internet-based learning in the health professions**. *JAMA: the journal of the American Medical Association* 2008, **300**(10):1181-1196.

7. Maloney S, Chamberlain M, Morrison S, Kotsanas G, Keating JL, Ilic D: **Health Professional Learner Attitudes and Use of Digital Learning Resources**. *Journal of medical Internet research* 2013, **15**(1).

8. George PP, Papachristou N, Belisario JM, Wang W, Wark PA, Cotic Z, Rasmussen K, Sluiter R, Riboli-Sasco E, Car LT: **Online eLearning for undergraduates in health professions: A systematic review of the impact on knowledge, skills, attitudes and satisfaction**. *Journal of Global Health* 2014, **4**(1).

9. Means B, Toyama Y, Murphy RF, Baki M: **The Effectiveness of Online and Blended Learning: A Meta-Analysis of the Empirical Literature**. *Teachers College Record* 2013, **115**:1-47.

10. Schopf T, Flytkjær V: **Impact of interactive web-based education with mobile and email-based support of general practitioners on treatment and referral patterns of patients with atopic dermatitis: randomized controlled trial**. *Journal of medical Internet research* 2012, **14**(6).

11. Farrimond H, Dornan T, Cockcroft A, Rhodes L: **Development and evaluation of an e-learning package for teaching skin examination. Action research**. *British Journal of Dermatology* 2006, **155**(3):592-599.

12. Corrigan M, Reardon M, Shields C, Redmond H: **"SURGENT"- student e-learning for reality: the application of interactive visual images to problem-based learning in undergraduate surgery**. *Journal of surgical education* 2008, **65**(2):120-125.

13. Hare EE: **E-learning for psychiatrists**. *Psychiatric Bulletin* 2009, **33**(3):81-83.

14. Fairburn CG, Cooper Z: **Therapist competence, therapy quality, and therapist training**. *Behavior research and therapy* 2011, **49**(6):373-378.

15. Helgadottir FD, Fairburn CG: **Web-centerd training in psychological treatments: A study of therapist preferences**. *Behavior research and therapy* 2014, **52**:61-63.

16. De Beurs D, De Groot M, de Keijser J, Verwey B, Mokkenstorm J, Twisk J, Van Duyn E, Van Hemert A, Verlinde L, Spijker S *et al*: **Improving the application of a practice guideline for the assessment and treatment of suicidal behavior by training the full staff of psychiatric departments via an e-learning supported Train-the-Trainer program: study protocol for a randomized controlled trial.** *Trails* 2013, **14**(9).

17. de Beurs D, de Groot M, Bosmans J, de Keijser J, Mokkenstorm J, Verwey B, van Duijn E, de Winter R, Kerkhof A: **Reducing patients' suicide ideation through training mental health teams in the application of the Dutch multidisciplinary practice guideline on assessment and treatment of suicidal behavior: study protocol of a randomized controlled trial.** *Trials* 2013, **14** (372).

18. de Beurs DP, de Groot MH, de Keijser J, Van Duijn E, de Winter R, Kerkhof AJFM: **the effect of an e-learning supported Train-the-Trainer program to implement suicide guidelines in mental health care**. *UNDER REVIEW*.

19. Ardito C, Costabile MF, De Marsico M, Lanzilotti R, Levialdi S, Roselli T, Rossano V: **An approach to usability evaluation of e-learning applications**. *Universal access in the information society* 2006, **4**(3): 270-283.

20. Ruiz J, Mintzer M, Leipzig R: **The impact of E-learning in medical education.** *Academic medicine* 2006, **81**(3):207-212.

21. Snow J: **The Complete Research Suite: A Step By Step Guide To Using Qualtrics**. *Qualtrics, Provo* 2011.

22. van Hemert AM, Kerkhof AFJM, de Keijser J, verwey B: **Multidisciplinaire richtlijn voor diagnostiek en behandeling van suïcidaal gedrag.** . In. Utrecht: Nederlandse Vereniging voor Psychiatrie/Nederlands Instituut voor Psychologen/Trimbos Instituut;; 2012.

23. Huisman A, Kerkhof AJ, Robben P: **Suicides in users of mental health care services: treatment characteristics and hindsight reflections**. *Suicide and Life-Threatening Behavior* 2011, **41**(1):41-49.

24. Welsh ET, Wanberg CR, Brown KG, Simmering MJ: **E-learning: emerging uses, empirical results and future directions**. *International Journal of Training and Development* 2003, **7**(4):245-258.

25. Ruwaard J: **Wild west in de e-health: eerst invoeren, dan pa s valideren**. *Kind & Adolescent Praktijk* 2014, **13**(1):24-26.

26. Glasgow RE, Phillips SM, Sanchez MA: **Implementation science approaches for integrating eHealth research into practice and policy**. *International journal of medical informatics* 2013.

27. Brown CA, Lilford RJ: **The stepped wedge trial design: a systematic review**. *BMC medical research methodology* 2006, **6**(1):54.

28. Walsh K, Levin H, Jaye P, Gazzard J: **Cost analyses approaches in medical education: there are no simple solutions**. *Medical education* 2013, **47**(10):962-968.

29. Cook DA, Levinson AJ, Garside S, Dupras DM, Erwin PJ, Montori VM: **Instructional design variations in internet-based learning for health professions education: a systematic review and meta-analysis**. *Academic medicine* 2010, **85**(5):909-922.

30. Gordon M, Chandratilake M, Baker P: **Low fidelity, high quality: a model for e-learning**. *The clinical teacher* 2013, **10**(4):258-263.

PART III

THE ASSESSMENT OF SUICIDE IDEATION

CHAPTER 10

APPLYING COMPUTER ADAPTIVE TESTING TO OPTIMIZE ONLINE ASSESSMENT OF SUICIDAL BEHAVIOR: A SIMULATION STUDY

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Abstract

Background

The Internet is being used increasingly for both suicide research and prevention. To optimize online assessment of suicidal patients, there is a need for short, good quality tools to assess elevated risk of future suicidal behavior. Computer adaptive testing (CAT) can be used to reduce response burden and improve accuracy, and make the available pencil-and-paper tools more appropriate for online administration

Objective

The aim was to test whether an item response–based computer adaptive simulation can be used to reduce the length of the Beck Scale for Suicide Ideation (BSS).

Methods

The data used for our simulation was obtained from a large multicenter trial from The Netherlands, the Professionals in Training to STOP suicide (PITSTOP suicide) study. We applied a principal components analysis (PCA), confirmatory factor analysis (CFA), a graded response model (GRM), and simulated a CAT.

Results

The scores of 505 patients were analyzed. Psychometric analyses showed the questionnaire to be unidimensional with good internal consistency. The computer adaptive simulation showed that for the estimation of elevation of risk of future suicidal behavior, on average, 4 items (instead of the full 19) were sufficient.

Conclusions

This study demonstrated that CAT can be applied successfully to reduce the length of the Dutch version of the BSS. We argue that the use of CAT can improve the accuracy and the response burden when assessing the risk of future suicidal behavior online. Because CAT can be daunting for clinicians and applied scientists, we offer a concrete example of our computer adaptive simulation of the Dutch version of the BSS at the end of the paper.

Keywords

Suicide; Psychometrics; Computing methodologies; Internet; Suicidal ideation, Risk assessment

Introduction

Suicide ideation is defined as the presence of thoughts, plans, and wishes in an individual to end his/her own life [1]. Assessment of suicide ideation is argued to be important because it may precede an attempt and it could provide information on the seriousness and lethality of the suicidal intention [2]. The Beck Scale for Suicide Ideation (BSS) is the 19-item self-report version of the Scale for Suicide ideation, a systematic interviewing tool developed for the assessment of suicide ideation and risk of future suicidal behavior [1,3]. The BSS inquires about suicidal thoughts and attitudes of subjects toward them. Because the BSS is widely accepted and has strong psychometric properties, the BSS is frequently used in research and clinical practice to assess risk of future suicidal behavior [4].

The role of the Internet in suicide prevention is increasing [5,6]. Online self-help interventions are offered to recover from suicide ideation [7], researchers collect data on suicidal behavior in real time via mobile applications [8,9], and mental health institutions monitor suicidal behavior of patients via online questionnaires [10]. Attrition in online interventions and studies is a well-known problem [11]. To optimize online assessment of patients and thereby limit attrition, there is a need for a shorter and more accurate questionnaire to assess risk of suicidality. The use of traditional pencil-and-paper mental health questionnaires have a large respondent burden because they require patients to answer questions that do not provide any additional information. In our example, the BSS has 19 items and a score range from 0 to 38. However, a prospective study showed that subjects who scored >2 were 7 times more likely to show future suicidal behavior than those that scored 2 or less [2]. It seems that when assessing risk of future suicidal behavior, if a subject scores >2 there is no need to complete the other items. Computer adaptive testing (CAT) [12] allows us to reduce the number of items in a questionnaire without losing discriminatory validity. Its applicability has been demonstrated in depression [13] and anxiety [14], but not yet in the assessment of the risk of suicidal behavior. Because answering several items on suicidal behavior online can be burdensome for patients, especially at baseline or on intake [15,16], a shorter assessment of suicidal ideation is preferable.

Computer Adaptive Testing

CAT is possible because of item response theory (IRT) and the wide availability of the Internet. IRT is based on a computerized iterative process that, for each item, regresses the patient's response on a latent trait score (theta ; in our example suicide ideation), the estimated value of which maximizes the likelihood of the patient's pattern of responses [17]. More concretely, a

patient answers an item online and, based on the response to that single item, the computer follows an IRT-based algorithm that offers the patient the next most informative item. After the patient's score has been estimated at the predefined level of precision, no more items are administered. So, per patient, only the fewest possible items are offered, resulting in less respondent burden and even more accurate outcomes [17]. Due to these advantages, IRT and CAT are currently being applied in health outcomes research to develop or improve existing measures. For example, The Patient-Reported Outcomes Measurement Information System (PROMIS), a large project funded by the National Institute of Health to develop valid, reliable, and standardized questionnaires to measure patient outcomes [12] relies heavily on IRT and CAT modeling.

Current Study

The goal of the current study was to investigate whether we can use CAT to shorten the BSS without losing discriminatory validity. We followed the 5 steps of the psychometric analysis plan as used in the PROMIS project [12]. We provided descriptive statistics, evaluated the assumptions for the IRT, fitted an IRT model to our data, tested for item bias, and stimulated a CAT on our data. Because this paper is the first to apply IRT and CAT in the field of suicidology, we explain every step of the process in depth. We have ended this paper with a concrete example of a shortened version of the Dutch version of the Beck Scale for Suicide Ideation (BSS-NL). An overview of the 5 psychometric steps are:

- Descriptive statistics
- Testing of assumptions about the IRT model
- Fitting of the IRT model to the data
- Evaluating differential item functioning (DIF) between gender and method of administration
- Computer adaptive testing

Method

Measurement Procedure

We used the data collected at baseline in the Dutch Professionals in Training to STOP suicide (PITSTOP suicide) study [18]. In the study, mental health professionals were trained in guideline adherence via an e-learning–supported Train-the-Trainer program. Although the intervention was aimed at improving suicide prevention skills of professionals [19], the primary outcome of the study was a change in suicide ideation of patients as measured with the Dutch version of the BSS, the BSS-NL. The BSS was translated into Dutch making use of forward and back translation, and was recently used in a clinical trial study [20]. The preferred mode of data collection among patients was via the routine outcome monitoring (ROM) system, an online system by which data on the effectiveness of treatment in everyday clinical practice are systematically collected [3]. In departments not using ROM, graduate students and/or research assistants used paper-and-pencil questionnaires to collect data. The main *Diagnostic and Statistical Manual of Mental Disorders* (Fourth Edition) *DSM-IV* diagnosis of each patient was assessed at intake via a structured interview by a mental health professional.
All eligible patients were informed about the study and all provided informed consent.

Software

All analyses were performed in R [21]. Descriptive statistics and principal components analysis (PCA) were obtained via the psych package [22]. The confirmatory factor analysis (CFA) models were estimated using the package lavaan [23]. Graded response models (GRM) were fitted using the latent trait modeling (LTM) package [24]. The mokken package was used to estimate monotonicity [25]. DIF was checked via the lordif package [26]. The CatIRT package was used for the CAT simulation [27].
We followed the 5 steps as used in the PROMIS study as listed in the Introduction.

Step 1: Descriptive Statistics

Descriptive statistics were described. Cronbach alpha [28] was used to test internal consistency reliability, with .8 as acceptable minimum.

Step 2: Testing Assumptions About the Item Response Theory Model

Before fitting the IRT model, the basic assumptions for IRT models were

tested. The assumptions for IRT are unidimensionality, local independency, and monotonicity [17].

For unidimensionality, we performed a PCA to examine whether a 1-dimensional test explained at least 20% of the variance and whether the ratio of explained variance of the first factor to the second was 4 or higher [29]. Next, we used a CFA to test unidimensionality by using various fit indexes [12]. The residual matrix produced by this single factor CFA was used to test the second assumption, local independence. Correlations >.2 were flagged and considered as possible violations of local independence [12]. Finally, monotonicity was examined by fitting a nonparametric IRT model that resulted in IRT probability curves. Nonmonotonic items with a scalability coefficient <.3 [25] were flagged [12] and described.

Step 3: Fit an Item Response Theory Model to the Data

There are a great number of different IRT models [30]. For questions with ordered response categories, the graded response model (GRM) [31] was proposed. Because the BSS has 3 ordered response options (0, 1, and 2; a higher score represents a higher level of suicide ideation), we fitted a GRM to our data.

As an introduction to the GRM, we provided an example of a GRM for item 7 (frequency of thinking about suicide) of the BSS. Figure 1 shows a function per response category (0, 1, and 2) that corresponds to the chance that a participant chooses that option given a certain score of theta. Because each item of the BSS has 3 response options (0, 1, and 2) per item, 3 curves are presented. The combined chance of all 3 response curves at any certain level of is always 1. In other words, in Figure 1, if a patient has a of –2, the chance that a patient will choose option 0 is approximately 1. If a patient has a theta of 1.5, he/she has an approximately zero chance of endorsing option 0, 0.65 chance of endorsing option 1, and 0.35 (1-(0+0.65)) of endorsing option 2. Patients that score theta ≥ 2 will most likely endorse option 2. Every single item is defined by a discrimination parameter (alpha) and 2 location parameters (β1 and β2). The item parameters of the current example are estimated to be β=4.117, β1=0.171, β2=1.243. The discrimination parameter reflects the true difference in theta per item and is comparable to a factor loading. The betas (threshold parameters) indicate the location on the scale of the latent continuum where the item best discriminates among individuals.

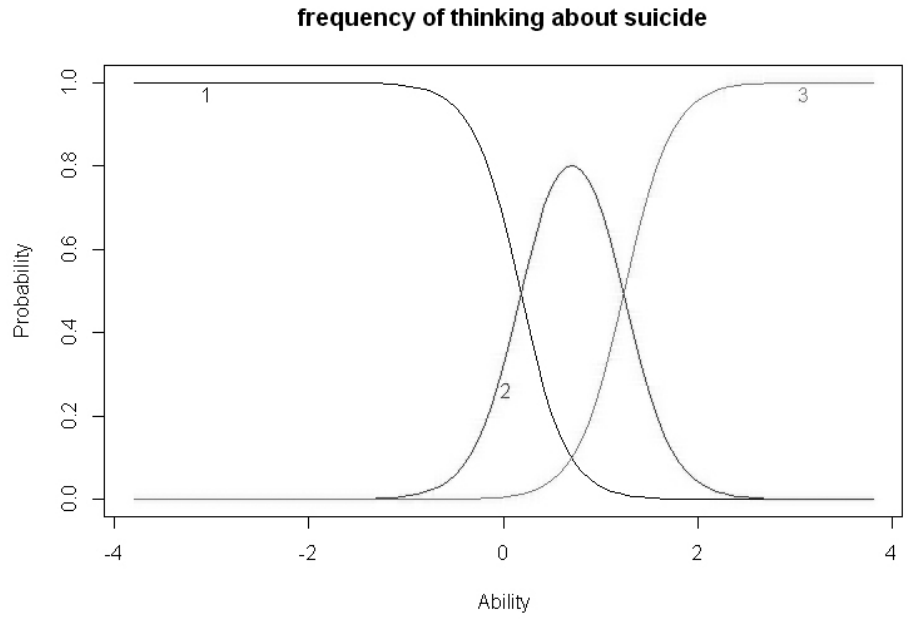

Figure 1. Example of category response curve for item 7 (frequency of thinking about suicide). Number and colors (0 (black, 1 (red), 2(green) reflect answer options.

To evaluate the fit of the IRT model to the data, for each single item, category response curves (CRC) such as in Figure 1 were plotted.

Step 4: Evaluation of Differential Item Functioning

Differential item functioning (DIF) exists if patients from 2 groups (eg, men and women) who are equal in terms of the level of theta, do not have the same probability of endorsing a test item [32]. Similarly to the PROMIS study, 4 important covariates were considered: gender, age (18-49 years, 50-69 years), education (low level of education/college or advanced degree), and method of administration (computer vs paper and pencil). The IRT item parameters (discrimination and threshold parameters) are assumed to be linear invariant with respect to group membership. Any difference found in CRC then indicates that patients with the same level of theta but from different groups have a different probability of endorsing an item. Items that show DIF at an alpha level of 0.01 were flagged. Because statistical power is dependent on sample size, trivial but nonzero differences are likely to be found to be significant in our large sample. Therefore, we also reported effect sizes to further investigate the magnitude of the DIF. McFadden's pseudo *R2* <.13 are negligible, and effect sizes between .13 and .26 are moderate [26].

Step 5: Computer Adaptive Testing

The Package CatIRT performs a post hoc CAT. The IRT parameters obtained in step 3 were used for our CAT simulation unless the DIF analysis suggested using different parameters for subgroups of patients. As a starting point, we set an entry level, which is normally chosen to be 0 [13]. The first item to be selected was the item with the most information at this initial level of suicide ideation. The next item was selected via maximum Fisher information method, related to the theta estimated on basis of the just-selected item and the response to that item. Finally, we determined a stopping rule. As a stopping rule, we will use a value of theta that reflects BSS >2 (θ >–1). Our CAT is terminated if the confidence interval surrounding an estimate of theta was fully within 1 of the categories (elevated risk/no elevated risk). We used a confidence interval of 99%. As questionnaires in mental health care tend to peak at the relative higher levels of the clinical outcome [13,17,33], we also added a second stopping rule to prevent subjects without suicide ideation from having to complete all 19 items. The second stopping rule was use a maximum of 6 items. We compared the classification differences when using none, 1 or 2 stopping rules.

Results

We applied the CAT to the 505 patients within the PITSTOP suicide trial that completed the full 19 items. Initially, data were collected via the ROM. After the start of the study, it appeared difficult for most departments to collect our data via the ROM. In total, only 43% (217/505) of the data was collected using the ROM. As an alternative, research assistants and clinicians were instructed to complete the questionnaire via paper and pencil. Of the 505 patients, 93 (18.4%) patients had a total BSS score of 0, and 254 (50.3%) had a score <8; 128 (25,3%) had depression as their primary diagnosis and 50 (9.9%) had a personality disorder. Mean age was 42 (SD 9.2) years. At baseline, 183 (36.2%) patients stated they had attempted suicide at least once.

Step 1: Descriptives

The overall Cronbach alpha was .94. Average score on the BSS was 10.4 (SD 9.4). As Table 1 shows, removing 1 item did not lead to a substantial improvement of the internal consistency. The item-rest or remainder correlations (*R*rest) were also satisfactory.

Table 1. Descriptive statistics of the single items of the BSS-NL

Single Item Content	Category			Mean (SD)	Cronbach α	*R* rest
	0	**1**	**2**			
1. Wish to live	242	195	68	0.66 (0.79)	0.94	0.67
2. Wish to die	199	196	110	0.82 (0.70)	0.93	0.74
3. Reasons living/dying	278	157	70	0.59 (0.84)	0.93	0.69
4. Desire to kill oneself	246	171	88	0.69 (0.76)	0.93	0.80
5. Save my life	248	174	83	0.67 (0.77)	0.93	0.63
6. Periods thinking about suicide	319	113	73	0.51 (0.90)	0.93	0.76
7. Frequency of thinking about suicide	310	160	35	0.46 (0.96)	0.93	0.80
8. Acceptance of idea of suicide	285	153	67	0.57 (0.85)	0.93	0.73
9. Ability to not commit suicide	344	140	21	0.36 (1.08)	0.93	0.68
10. Reasons for not committing suicide	314	138	53	0.48 (0.93)	0.93	0.70
11. Reasons for wanting to commit suicide	223	47	235	1.02 (0.67)	0.93	0.48
12. Specific plan to commit suicide	318	118	69	0.51 (0.91)	0.93	0.71
13. Access to suicide method	335	31	139	0.61 (0.82)	0.93	0.60
14. Courage/ability to commit suicide	279	152	74	0.59 (0.83)	0.93	0.74
15. Expectation to commit suicide	318	153	34	0.44 (0.98)	0.93	0.76
16. Preparations for suicide	391	89	25	0.28 (1.19)	0.93	0.63
17. Writing of suicide note	394	72	39	0.30 (1.16)	0.93	0.49
18. Arrangements for after suicide	354	106	45	0.39 (1.04)	0.93	0.37
19. Conceal ideation	308	123	74	0.54 (0.88)	0.93	0.47

Step 2: Testing of Assumptions of the Item Response Theory Model

When fitting a 1-factor PCA, we found that 50% of the proportional variance was explained by the first factor (Table 2). The ratio between a 1- and a 2-factor model indicated that the first factor model explained 14 times more variance than the second factor. When fitting a confirmatory analysis we found a Comparative Fit Index of 0.999, a Tucker-Lewis Index of 0.989, a Root Mean Square Error of Approximation of 0.045 (CI 90% 0.038-0.053) and a Standardized Root Mean Square Residual of 0.059.
No item pair showed a residual correlation higher than *r*=.2. Next, Mokken scaling found the BSS-NL to be highly monotonic (all scalability coefficients >3).

STEP 3: Fitting of a Graded Response Model

Table 3 shows that all 19 items had an alpha higher than 1. Item 7, the frequency of thinking about suicide seems to discriminate best between patients with a high or lower level of suicidal ideation, as indicated by the high alpha of 4.117.

Table 3. Graded response model parameters for the Dutch version of the Beck Scale for Suicide Ideation (BSS-NL).

Item and content	Parametera		
	α	**β1**	**β2**
1. Wish to live	2.366	0.029	0.556
2. Wish to die	3.197	–0.159	0.180
3. Reasons living/dying	3.036	0.034	0.937
4. Desire to kill oneself	4.082	–0.123	0.691
5. Save my life	2.270	–0.188	0.898
6. Periods thinking about suicide	3.434	0.276	1.054
7. Frequency of thinking about suicide	4.117	0.171	1.243
8. Acceptance of idea of suicide	3.437	0.071	0.985
9. Ability to not commit suicide	3.165	0.386	1.587
10. Reasons for not committing suicide	3.048	0.263	1.258
11. Reasons for wanting to commit suicide	1.557	0.001	0.100
12. Specific plan to commit suicide	3.003	0.305	1.122
13. Access to suicide method	2.479	0.550	0.616
14. Courage and ability to commit suicide	3.780	0.045	0.932
15. Expectation to commit suicide	3.825	0.232	1.369
16. Preparations for suicide	2.532	0.754	1.815
17. Writing of suicide note	1.786	1.016	1.952
18. Arrangements for after one had committed suicide	1.098	0.887	2.414
19. Hide, conceal, or lie about suicide ideation	1.436	0.334	1.466

Category Response Curves

Of the 19 items, 17 showed CRC plots as expected. Items 11 (Reasons for wanting to commit suicide) and 13 (Access to suicide method) showed CRCs that warranted extra inspection. Table 4 shows the mean overall theta of participants per response option for 3 different items: item 7, which had a good CRC, and for items 11 and 13, which showed unsatisfactory CRCs. For items 11 and 13, the difference in mean theta for responses 1 and 2 was small and their confidence intervals overlapped, indicating that a higher score on 1 of these items does not necessarily reflect a higher level of suicidal ideation.

Table 4. The mean theta of patients that endorsed response option 0,1 and 3 for item 7,11 and 13..

Item and response	Mean Θ	95% CI
7. Frequency of thinking about suicide		
0	–1.7	–2.0, –1.4
1	1.4	1.3, 1.5
2	2.6	2.4, 2.8
11. Reasons for wanting to commit suicide		
0	–2.3	–2.6, –1.9
1	0.9	0.6, 1.2
2	1.0	0.8, 1.1
13. Access to suicide method		
0	–1.5	–1.7, –1.2
1	1.3	1.1, 1.6
2	1.6	1.4, 1.7

Step 4: Differential item Functioning

No items were flagged for DIF when analyzing differences in gender, age or education. When analyzing the effect for the administration method, 7 items were flagged. However, *R2* were all <.13.

Step 5: Computer Adaptive Testing

When administrating all 19 items, 345 patients were classified as being at risk (Table 5). When allowing the number of items to vary between 3 and 19, CAT simulations showed that, on average, 10 items were sufficient to meet the same classification as the first model. For a large number of patients with a low trait of suicidal ideation, all items were exhausted before the stopping rule was met (Figure 2).When using a maximum of 6 items, 336 instead of 345 patients were classified as having an elevated risk (Table 5).

Table 5. Classification of risk for several stopping rules for Beck Scale for Suicide Ideation scores >2.

Stopping rule		Mean (SD)	Number of patients with Low risk of future suicidal behavior	Number of patients with elevate risk of future suicidal behavior
Min items	**Max items**			
19	19	19 (0)	160	345
3	19	9.7 (7.7)	162	343
3	6	4.2 (1.4)	169	336

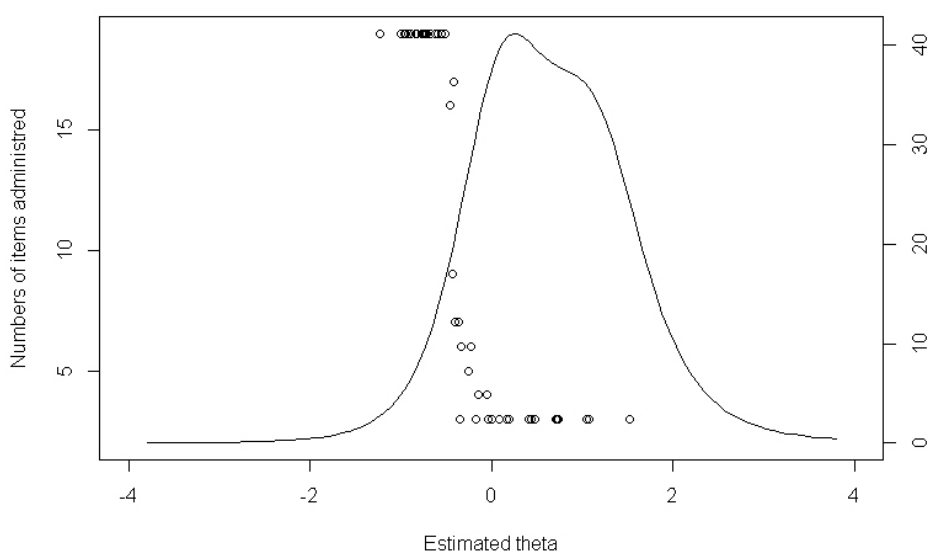

Figure 2. Relationship between level of theta and the number of administered items under stop rule 1. The curve represents test information as a function of theta.

Discussion

Main Findings

Our simulation showed that an IRT model can be fitted to the BSS-NL and that CAT can successfully be applied to reduce the length of the BSS-NL when assessing risk of future suicidal behavior. PCA and confirmatory factor analysis found the scale to be highly unidimensional. No local independence or violation of monotonicity was found. Therefore, all assumptions for IRT modeling were met. For 17 of 19 items, IRT parameters were satisfactory indicating that most items are well-suited to providing differential information on a patient's level of suicidal ideation. When using CAT with a maximum of 6 items, only 9 of 505 (1,7%) patients were classified in a different category when compared to the classification under all 19 items. Importantly, this simulation demonstrated that CAT makes it possible to administer, on average, only 4 items instead of the full 19 without losing discriminatory validity.

Improvement of the Items 11 and 13

We found items 11 (Reasons for wanting to commit suicide) and 13 (Access to suicide method) to show unsatisfactory item parameters. Further inspection revealed that, for both items, patients with comparable levels of suicide ideation were equally likely to endorse either option 1 or 2. Consider for example item 13. Our data showed that patients with low suicidal trait were more likely to endorse option 0 (have no access to means) and patients with higher levels of suicidality were equally likely to endorse option 1 (it takes time to find means) or 2 (I have access to means). Due to this overlap, patients with the same level of suicidal ideation might end up with different summed total scores. Therefore, when using the full-scale version of the BSS, we advise rephrasing the response options of both items, offering them as dichotomous items or excluding them.

Strengths and Limitations

Because this is a simulation study, real-time CAT studies are needed to determine the most accurate item parameters. Few clinical studies have implemented CAT in real time, but those studies that did show a good comparison with simulation studies (eg, [34]). Next, it is necessary to compare the parameters of the current study with, for example, data collected with the original English-language version of the BSS. For our simulation, we used a fixed theta as cut-off score, instead of the established BSS score >2. Future prospective studies must examine the most plausible theta cut- off to predict elevated risk of suicidal behavior. Also, we had no long-term follow-up data on whether patients actually engaged in any suicidal behavior after the assessment. Therefore, we were not able to compare the predictive validity of the CAT with the predictive validity of the full test. An additional limitation of CAT approaches might be that CAT data would not be comparable to normative data. By standardizing outcomes as done in meta-analysis [35], scores assessing the same outcome, but measured in a variety of ways can still be compared.

With the BSS-NL, it seems to be difficult to investigate small differences in patients with a low suicidal trait. This has been found more often in mental health assessments [13,17,33]. A hybrid CAT approach, such as the 2-stage semiadaptive testing strategy recommended by Choi et al [35], might also be appropriate and result in even more accurate classification.

Finally, although wireless Internet and reliable hardware are widely available, the current state of ICT in (Dutch) Mental Health Care reduces the feasibility of large-scale CAT implementation. Even for our normal (non-CAT)

assessments, many of the research assistants within our study had to resort to paper-and-pencil testing because computerized testing was technically not possible. Obviously, this precludes CAT.

Strengths of this study pertain to its large sample size; 505 patients from various psychiatric departments completed the BSS. Therefore, the external validity of the findings is considerable. Another strength of the current paper is the application of modern psychometric techniques within the field of clinical psychology/psychiatry. For several reasons, such as lack of interest in new techniques and insufficient mathematical training, the integration of new techniques in psychology/psychiatry has been suboptimal at least [36]. By thoroughly explaining every step of our analysis, and by focusing on the actual application of IRT and CAT in the clinical field, this paper hopes to stimulate the use of contemporary psychometric techniques.

Concrete Example of the Computer Adaptive Testing

As stated previously, due to the mathematical and computational modeling, IRT and CAT can be a bit daunting for clinicians and applied scientists. Therefore, we provide a concrete example of our last CAT simulation (theta bound=–1, max items=6) (Figure 3). In our simulation, all patients started with item 4. Based on the answer to item 4, either item 2 or item 6 is selected, or the person is at an elevated risk (if the participant answers with response 2). For example, if a patient states for item 4: “I have a weak desire to kill myself” (response 1), the next most informative item would be item 6 (“length of periods of thinking about killing oneself”). If a patient answers that item with either moderate or long periods (responses 1 or 2), they would be categorized to be at high risk. If a patient selects response 0 (very brief periods), the next item would be item 7 (frequency of suicidal thoughts). Following this algorithm, a high-risk patient needs only 1 or 2 items to be classified as having an elevated risk.

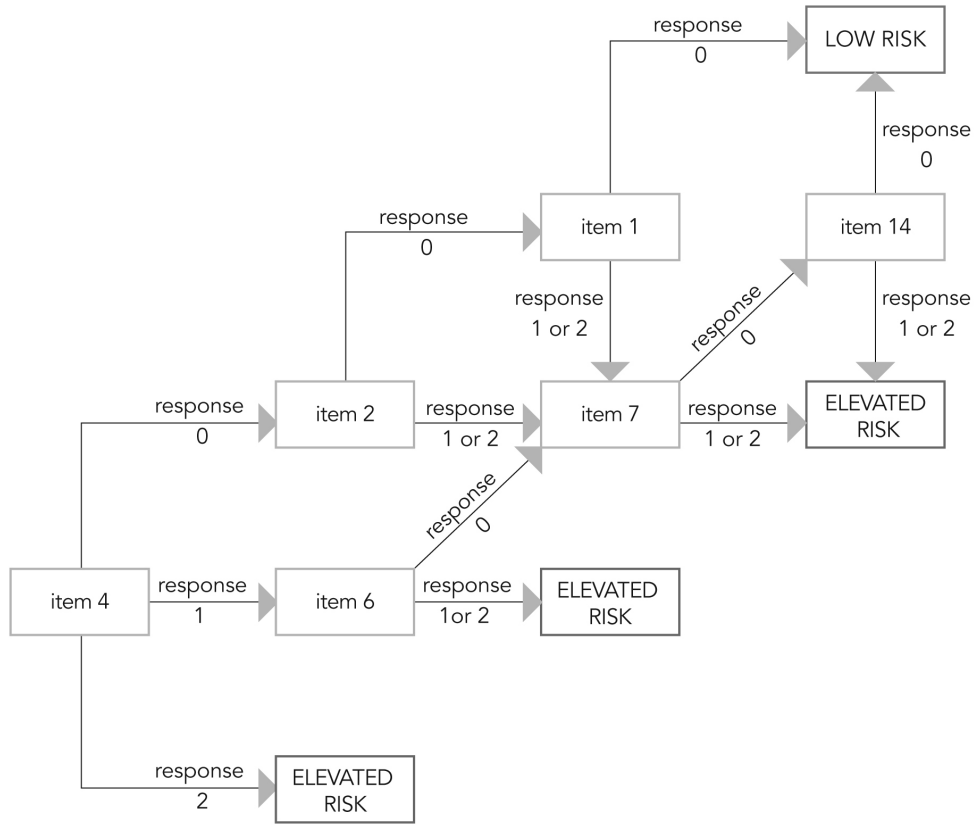

Figure 3. Concrete example of a the result of a CAT simulation.

Conclusion

One of the main advantages of CAT is the reduction of respondent burden. Answering items on suicidal behavior online can be difficult for patients, resulting in a high dropout rate. Because attrition is a well-known problem in eHealth, reducing response burden of online assessment of suicidal behavior is important. It should be noted that our CAT simulation showed that the number of items can be considerably reduced when using the BSS-NL to assess elevated risk of suicidal behavior. Our simulation showed that, on average, 4 items were sufficient. Obviously, for CAT to be widely accepted and implemented, many more (prospective) studies should be done, and ICT within mental health or research settings should be drastically improved. However, considering the need for rapid yet accurate online assessment of suicide risk in both clinical and research practice, we argue that IRT and CAT are likely to play important roles in the development of better measurement methods for the assessment of risk of suicidal behavior.

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Authors' Contributions

AK, MdG, and JdK obtained funding for this study. DdB carried out the study. DdB and AdV drafted the manuscript. AK, MdG, JdK contributed to the execution of the study and to the manuscript writing.

Conflicts of Interest.

None declared.

Abbreviations

BSS: Beck Scale for Suicide Ideation
BSS-NL: Dutch version of the BSS
CAT: computer adaptive testing
CFI: comparative fit index
DIF: differential item functioning
IRT: item response modeling
PCA: principal component analysis
PITSTOP suicide: Professionals in Training to STOP suicide
PROMIS: The Patient-Reported Outcomes Measurement Information System
R_{rest}: item-rest correlation

References

1. Beck AT, Kovacs M, Weissman A: **Assessment of suicidal intention: the Scale for Suicide Ideation**. *Journal of consulting and clinical psychology* 1979, **47**(2):343.

2. Brown GK, Beck AT, Steer RA, Grisham JR: **Risk factors for suicide in psychiatric outpatients: a 20-year prospective study**. *Journal of consulting and clinical psychology* 2000, **68**(3):371.

3. Beck AT, Steer RA, Ranieri WF: **Scale for suicide ideation: Psychometric properties of a self-report version**. *Journal of clinical psychology* 1988, **44**(4):499-505.

4. Brown GK: **A review of suicide assessment measures for intervention research with adults and older adults**: GK Brown; 2001.

5. Mishara B, Kerkhof A: **Suicide Prevention and New Technologies: Evidence Based Practice**: Palgrave Macmillan; 2013.

6. De Jaegere E, Portzky G: **Analysis of Available Technology-Based Suicide Prevention Programmes**.

7. Van Spijker B: **Reducing the burden of suicidal thoughts through online self-help**. 2012.

8. Myin-Germeys I, Oorschot M, Collip D, Lataster J, Delespaul P, van Os J: **Experience sampling research in psychopathology: opening the black box of daily life**. *Psychological medicine* 2009, **39**(09):1533-1547.

9. Nock MK, Prinstein MJ, Sterba SK: **Revealing the form and function of self-injurious thoughts and behaviors: A real-time ecological assessment study among adolescents and young adults**. *Journal of Abnormal Psychology* 2009, **118**(4):816.

10. De Beurs E, den Hollander-Gijsman M, Van Rood Y, Van der Wee N, Giltay E, Van Noorden M, Van der Lem R, Van Fenema E, Zitman F: **Routine outcome monitoring in the Netherlands: practical experiences with a web-based strategy for the assessment of treatment outcome in clinical practice**. *Clinical psychology & psychotherapy* 2011, **18**(1):1-12.

11. Eysenbach G: **The law of attrition**. *Journal of medical Internet research* 2005, **7**(1).

12. Reeve BB, Hays RD, Bjorner JB, Cook KF, Crane PK, Teresi JA, Thissen D, Revicki DA, Weiss DJ, Hambleton RK: **Psychometric evaluation and calibration of health-related quality of life item banks: plans for the Patient-Reported Outcomes Measurement Information System (PROMIS)**. *Medical care* 2007, **45**(5):S22-S31.

13. Smits N, Cuijpers P, van Straten A: **Applying computerized adaptive testing to the CES-D scale: A simulation study**. *Psychiatry research* 2011, **188**(1):147-155.

14. Walter OB, Becker J, Bjorner JB, Fliege H, Klapp BF, Rose M: **Development and evaluation of a computer adaptive test for 'Anxiety'(Anxiety-CAT)**. *Quality of Life Research* 2007, **16**(1):143-155.

15. Jorm AF, Kelly CM, Morgan AJ: **Participant distress in psychiatric research: a systematic review**. *Psychological medicine* 2007, **37**(07):917-926.

16. Younes N, Chee CC, Turbelin C, Hanslik T, Passerieux C, Melchior M: **Particular difficulties faced by GPs with young adults who will attempt suicide: a cross-sectional study**. *BMC family practice* 2013, **14**(1):68.

17. Embretson SE, Reise SP: **Item response theory**: Psychology Press; 2000.

18. de Beurs DP, de Groot MH, Bosmans JE, de Keijser J, Mokkenstorm J, Verwey B, van Duijn E, de Winter RF, Kerkhof AJ: **Reducing patients' suicide ideation through training mental health teams in the application of the Dutch multidisciplinary practice guideline on assessment and treatment of suicidal behavior: study protocol of a randomized controlled trial**. *Trials* 2013, **14**(1):372.

19. de Beurs DP, de Groot MH, de Keijser J, Verwey B, Mokkenstorm J, Twisk JW, van Duijn E, van Hemert AM, Verlinde L, Spijker10 J: **Improving the application of a practice guideline for the assessment and treatment of suicidal behavior by training the full staff of psychiatric departments via an e-learning supported Train-the-Trainer program: study protocol for a randomized controlled** *BMC trials* 2013, **14**(9).

20. van Spijker BA, van Straten A, Kerkhof A: **The effectiveness of a web-based self-help intervention to reduce suicidal thoughts: A randomized controlled trial**. *Trials* 2010, **11**(1):25.

21. Team RDC: **R version 2.9. 2**. In.: R Project for Statistical Computing Vienna, Austria; 2009.

22. Revelle W: **An overview of the psych package**. 2013.

23. Rosseel Y: **lavaan: an R package for structural equation modeling and more**. *Version 04-8 Abgefragt am* 2011, **25**.

24. Rizopoulos D: **ltm: An R package for latent variable modeling and item response theory analyses**. *Journal of Statistical Software* 2006, **17**(5):1-25.

25. Van der Ark LA: **Mokken scale analysis in R**. *Journal of Statistical Software* 2007, **20**(11):1-19.

26. Choi SW, Gibbons LE, Crane PK: **Lordif: An R package for detecting differential item functioning using iterative hybrid ordinal logistic regression/item response theory and Monte Carlo simulations**. *Journal of Statistical Software* 2011, **39**(8):1.

27. Nydick SW, Nydick MSW: **Package 'catIrt'**. 2013.

28. Gadermann AM, Guhn M, Zumbo BD: **Estimating ordinal reliability for Likert-type and ordinal item response data: A conceptual, empirical, and practical guide**. *Practical Assessment, Research & Evaluation* 2012, **17**(3):1-13.

29. Reise SP, Waller NG: **Item response theory and clinical measurement**. *Annual review of clinical psychology* 2009, **5**:27-48.

30. van der Linden WJ, Hambleton RK: **Handbook of modern item response theory**: Springer; 1997.

31. Samejima F: **Estimation of latent ability using a response pattern of graded scores**. *Psychometrika monograph supplement* 1969.

32. Holland PW, Wainer H: **Differential item functioning**: Routledge; 1993.

33. Young MA, Halper IS, Clark DC, Scheftner W, Fawcett J: **An item-response theory evaluation of the Beck Hopelessness Scale**. *Cognitive Therapy and Research* 1992, **16**(5):579-587.

34. Kocalevent R-D, Rose M, Becker J, Walter OB, Fliege H, Bjorner JB, Kleiber D, Klapp BF: **An evaluation of patient-reported outcomes found computerized adaptive testing was efficient in assessing stress perception**. *Journal of clinical epidemiology* 2009, **62**(3):278-287. e273.

35. Borenstein M, Hedges LV, Higgins JP, Rothstein HR: **Introduction to meta-analysis**: John Wiley & Sons; 2011.

36. Choi SW, Reise SP, Pilkonis PA, Hays RD, Cella D: **Efficiency of static and computer adaptive short forms compared to full-length measures of depressive symptoms**. *Quality of Life Research* 2010, **19**(1):125-136.

37. Borsboom D: **The attack of the psychometricians**. *Psychometrika* 2006, **71**(3):425-440.

CHAPTER 11

LONGITUDINAL MEASUREMENT INVARIANCE OF THE BECK SCALE FOR SUICIDE IDEATION

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Abstract

In mental health care, both clinical and scientific decisions are based on within-subject comparisons of test scores on the same self-report questionnaire at different points in time. To establish the validity of test score comparisons over time, longitudinal measurement invariance should be established. The current study tested whether the 19 item Beck Scale for Suicide Ideation is measurement invariant over time. As the first 5 items of the scale are often used to screen for the presence of suicidal thoughts, we also tested a model consisting of only the first five items. Psychiatric in- and out-patients (n = 475) completed the questionnaire upon admission and after three months. By means of confirmatory factor analysis we tested whether the parameters of a single factor model were equal over time. All fit indices indicated that both the 19-item questionnaire and the 5-item screener were measurement invariant over time. This means that changes in test-scores over time can be attributed to true changes in the construct of interest. These findings legitimate the use of the 19 item scale and the 5-item screener in longitudinal assessments.

Keywords

Suicide ideation, Measurement invariance, Response shift, Response bias, Screener

Introduction

After the start of the financial crisis in 2008, suicide rates increased substantially both in Europe and America [1, 2]. A recent study showed 4884 additional suicides compared to the expected number based on the trend in 2000-2007 worldwide [1]. Since 2007, in the Netherlands, the absolute number of suicides rose from 1353 to 1753, an increase of 30% [3]. Governments are seeking new ways to improve care for suicidal patients [4, 5]. Research on the effects of prevention strategies for suicide ideation may be used to improve health care [5]. In both mental health care practice and research, self-reporting tools are used to assess and monitor patients' health. Although a wide range of suicide scales are available, the Beck Scale for Suicide Ideation (BSS) is one of the most frequently used self-reporting scales for the assessment of suicidal thoughts [6, 7]. It consists of 19 items and was developed to detect current intensity of a patient's attitudes, plans and behaviors towards suicide. It also contains two additional items that assess the number of previous attempts and the intensity of the strength of the intent to die during the last attempt. The first five items serve as a screener for suicide ideation. More specifically, if a participant answers item 4 and 5 with the zero statements (indicating no active suicide intention and an avoidance of death if presented with a life-threatening situation), then he/she is allowed to skip all 14 additional items and asked to answer two extra items on previous suicide attempts. In common research and clinical practice, all first 5 items are used as a screener for suicide ideation [8, 9]. Internal reliability, test-retest stability and concurrent validity for the BSS have been established in earlier studies [6, 10]. The BSS is modeled on the basis of the interviewer-rated Scale for Suicide Ideation, one of the few suicide assessment tools with documented predictive validity for completed suicide [8].

In mental health care, a single administration can be used to provide information on the current status of the patient. But most of the time clinical and scientific decisions are based on the comparison of inter-subject scores on the same questionnaire at different points in time. The measurement over time is getting more important as policy makers and insurance companies ask for evidence of treatment effectiveness [11, 12]. In Dutch mental health care, mental health institutions are required by insurance companies to assess patients' mental health at regular intervals [13]. Failure to do so leads to budget-cuts. Thus, clinical, scientific and management decisions are at least partly based on the change in scores on self-reporting measures over time. However, by their very nature, self-reporting measures are subjective [14]. As a consequence, a patient's understanding of the underlying construct measured by a questionnaire can change over time. For example, as psychoeducation is recommended in most treatment guidelines [15], a patient's

perception of the construct measured at different occasions, may change over time, due to treatment [16]. Also, other changes in patient's perceptions and internal standards may confound measurements over time [17].

Measurement invariance and response shift

To reach valid conclusions on the basis of repeated measurements, it has to be ensured that a patient's score at the baseline measurement represents the same construct as the patients score at follow-up. In the literature on measurement of change, a distinction is made between measurements of real change and measurements confounded by changes in patients' perception over time [18]. A scale is thought to be measurement invariant (MI) if it measures the same construct across populations, groups or across measurement intervals [19]. Most often, MI is studied across groups, to compare measurement models between for example different countries or ethnicities [18]. However, MI can also be used to study measurement models within the same sample over time: longitudinal MI. This form of MI can be used to test for response shifts. The concept of response shift was introduced at the same time in education [20] and management science [21]. The following definition was provided [22]:

Response shift refers to a change in the meaning of one's self-evaluation of a target construct as a result of a) a change in the respondent's internal standards of measurement (scale recalibration); b) a change in the respondent's values (reprioritization); or c) a redefinition of the target construct (reconceptualization) (p. 1532).

To illustrate, imagine the same patient completing the BSS at two different times: once upon admission and once after three months of therapy. True change would mean an actual improvement or worsening of suicide ideation. Recalibration would mean that a patient has revised the response scale values between baseline and follow-up assessment. After therapy, a score of 1 on item 7 (I frequently think about killing myself) may reflect another level of rumination about suicide than before treatment. Reprioritization reflects the importance of an item in the context of the total scale. The writing of a suicide note (item 17) may have had more importance for a patient at baseline when compared to frequency of suicidal thoughts (item 7), but due to therapy, this prioritization may have changed. Finally, reconceptualization indicates a change in meaning of the content of the item. A patient's understanding of his/her actual wish to die (item 2) may be different upon admission, than after three months of treatment, due to therapeutic intervention.
Following the operationalization by Oort (2005), the occurrence of response shift can be tested by comparing the factorial models that underlie

consecutive assessments. More specifically, via confirmatory factor analysis (CFA), it can be tested whether the parameters of a factor model are different across consecutive measurements. Differences in item intercepts would indicate recalibration and differences in factor loadings would suggest reprioritization. Different salient factor loadings over time would indicate the occurrence of response shift due to reconceptualization [23].
To the authors' knowledge, there has been no prior research into the (longitudinal) measurement invariance of the Beck Scale for Suicide Ideation (BSS). In the present study we have used the dataset from a multicenter controlled study [5] to assess longitudinal MI of the 19-item BSS. As researchers and clinicians often use the first five BSS items to screen for suicide risk, we also tested longitudinal measurement invariance for the BSS using a model consisting only of the first five BSS items.

Methods

Data set

We used the data of the PITSTOP suicide study [5, 24], a multicenter controlled study measuring the effect of guideline implementation on suicide ideation. Although the intervention was aimed at the training of professionals [24], the primary outcome was at patient level. Patients were assessed directly upon admission to the psychiatric department (T0) and after three months (T1). All patients were informed about the study and provided written informed consent before joining the study.

Translation procedure

The original version of the BSS [7] was translated into Dutch for a clinical trial [9] using the following process based on the WHO translation protocol [25] : 1) Two PhD candidates, familiar with the terminology used in the scale, independently translated the original version of the BSS into Dutch. Both were fluent in English, but their primary language was Dutch 2) both translations were compared to create a consensus version 3) the consensus version was then translated back into English by an independent translator whose primary language is English and who had no knowledge of the questionnaire 4) the final version was reviewed by an expert in suicide prevention (Professor Kerkhof) and final adjustments were made. This final version was recently used in a trial [26, 27].

Beck Scale for Suicide Ideation

The original BSS was developed in 1988, and was modeled after a successful interviewer-rated version, the Scale for Suicide Ideation [28]. The BSS contains 19 items that measure the severity of actual suicidal wishes and plans. Scores range from 0-38, a higher score indicating a higher level of suicide ideation. Two studies [8, 29] indicated that the best cut-off to indicate high/low risk was BSS ≥ 2. Originally, if a patient scored 0 on item 4 and 5, the patient was directed to item 20. If the patient scored > 0 on item 4 and 5, all items of the BSS are completed. However, in most studies, the first 5 items are used as the screener [8, 9]. In the PITSTOP suicide study, participants were instructed to complete the full 19 items, even when they scored 0 on the first five items [5, 10]. In the current study, we included all patients that completed at least the first five items at both assessments and that completed a minimum of 2 items from items 6 through 19. The overall score is computed by totaling up the scores of the first 19 items.

Participants

For our analysis we used data from 872 patients who responded to baseline assessment, and 487 that completed 3 months follow-up. The preferred mode of data collection among patients was via the routine outcome monitoring system (ROM), an online system by which data on the effectiveness of treatment in everyday clinical practice are systematically collected [13]. After the start of the study, it appeared impossible for most departments to collect our data via the ROM. In total, data of 287 (32%) patients was collected using the ROM. The rest of the data was collected via research assistants and clinicians that administered a paper and pencil version of the BSS to patients. Patients were instructed to complete the full BSS irrespective of scores on the first 5 items. However, to reduce patient burden, when a patient's cumulative score was 0 on the first 5 items, and the patient did not want to continue answering questions, they were allowed to quit item administration after item 5. A total of 151 participants at baseline and 138 participants at T1 answered the first five items with 0 and then stopped. Following recommendations of Beck (1988), the remaining items were scored as 0. After scoring the remaining items with 0, missing items at both T0 and T1 of all other cases was 4%, which is negligible. As this is a pragmatic solution, we will repeat the analysis on the item score of the patients that completed all items at both occasions (n= 219), and on the dataset without the added zero scores on items 6-19.
Of the 872 patients included at baseline, 457 (53%) were female. Average age was 43 (SD = 15), 567 (64%) scored BSS > 0 and 250 patients (30%) reported a history of suicide attempt. We were able to collect DSM-IV diagnoses for

549 (62%) of the 872 patients. Of these patients, 222 (40%) had a primary diagnosis of depression, 77 (14%) had a personality disorder, and 51 (9%) had a psychotic disorder.

Software

All analyses were performed in R (R development core team, 2009). All confirmatory factor analysis (CFA) models were estimated using the package lavaan, version 2.15.3 (Rosseel, 2012).

Estimation

Because of the ordinal nature of the data, mean- and variance-adjusted weighted least squares (WLSMV) estimation was used [30]. In lavaan, this means that diagonally weighted least squares (DWLS) is used to estimate the model parameters, but the full weight matrix is used to compute robust standard errors, and a mean- and variance-adjusted test statistic. WLSMV estimation has been shown to result in unbiased parameter and standard error estimates, and acceptable type-I error rates for structural equation modeling with (skewed) ordinal variables [31, 32].

Model identification

With WLSMV estimation of ordered categorical data, it is assumed that underlying every categorical observed response variable, there is a continuous latent response variable (i.e., observed item response variables are categorized continuous variables). These continuous latent response variables are regressed on a common (latent) factor. The scales of the latent variables are unknown, and have to be identified by fixing a number of parameters in the model. In the current study, the latent response variables were scaled to have unit variance. The variances of the common factors were identified by fixing the loading of the first item to one (at both time intervals). The mean structure of the model was identified by fixing all intercepts of the regressions of the latent response variables on the common factors, and the thresholds of the first response category of the first item to zero (at both time intervals).

Longitudinal measurement invariance

Most publications on MI use a multi-group CFA framework [18]. Because the current study deals with longitudinal MI, a single group CFA framework was used, in which some variables in the model are allowed to correlate over time intervals, to take the longitudinal nature of the data into account [16].

The responses on the 19 BSS items within each measurement occasion were regressed on two common factors: suicidal ideation at T0 and suicidal ideation at T1. The common factors were allowed to correlate across time intervals. Similarly, residuals of the same continuous latent response variables were allowed to correlate between time intervals (Figure 1).

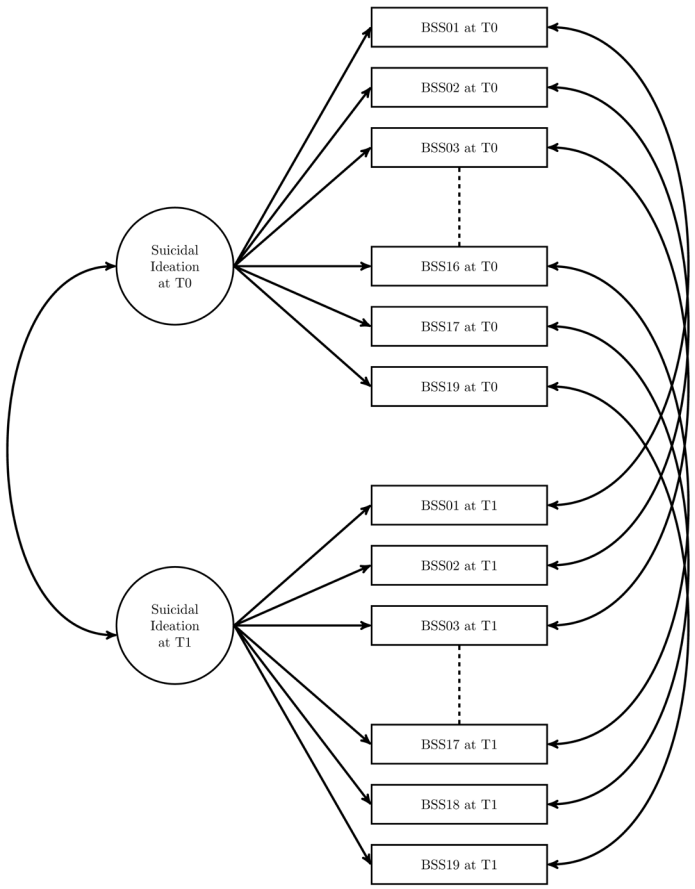

Figure 1: model to estimate measurement invariance

To assess MI of ordinal measures, three nested models are fit to the same dataset [33]. First, a configural invariance model is estimated, in which loadings and thresholds are free parameters (with exception of parameters fixed for identification of the model). Second, a loading invariance model is estimated, in which the loadings are constrained to be equal across time intervals. Third, a threshold invariance model is estimated, in which the loadings, as well as the thresholds are constrained to be equal across time intervals. For every model, parameter estimates and model fit indices are inspected to evaluate model fit. Acceptable model fit of a less restricted model is a necessary condition for application of further model restrictions.

Model fit assessment

Overall model fit can be assessed by means of model fit indices. The use of several fit indices for evaluating model fit is recommended, to minimize type I and type II error [34]. In the current study, root mean square error of approximation (RMSEA), comparative fit index (CFI), and the minimum function test statistic are used. For CFI, models with values ≥ 0.95 have acceptable fit [35]. For RMSEA, models with values ≤ 0.06 have acceptable fit [35]. Finally, the minimum function test statistic can be evaluated by comparing its value to a chi-square distribution with degrees of freedom (df) equal to the df of the model. However, because of their dependency on sample size (i.e., they are almost always significant with N ≥ 400), we have focused on assessing model fit with CFI and RMSEA [36].
In addition, the fit of two nested models can be compared by taking the difference of the fit indices. For WLSMV estimation, a scaled chi-square difference test for nested models [37] can be computed in lavaan. However, the scaled chi-square difference suffers from the same dependency on sample size as the minimum fit function statistic. Therefore, we focused on changes in model fit according to CFI and RMSEA. We used the criteria suggested by Chen (2008): a decrease in CFI of ≥ 0.01, and an increase in RMSEA of ≥ 0.015 was taken as an unacceptable decrease of model fit. Chen (2008) suggested a cutoff of 0.005 for sample sizes < 300, uniform patterns of non-invariance and unequal sample sizes. Meade, Johnson and Braddy (2008) suggested stricter criteria: a decrease in CFI of ≥ 0 .002 should be taken as an unacceptable decrease of model fit.

5- item screener

To test longitudinal measurement invariance for the 5-item screener, we used a model consisting only of the first five BSS items. The methods to analyze MI were the same for as described above for the 19-item scale. Results of the 5-item screener were presented separately.

Results

Descriptives

Table 1 presents the descriptive statistics of the items scores at baseline and follow up. The mean of all individual items show a decrease from T0 to T1, indicating that at T1, patients show lower scores on the suicide ideation scale than at baseline. Cronbach's alphas were similar at T0 (0.93) and at T1 (0.93).

Table 1: descriptives of BSS-NL item scores at T0 and T1

			T0			T1	
#	**content**	**n**	**M**	**VAR**	**N**	**M**	**VAR**
1	wish to live	868	0.50	0.84	487	0.28	1.41
2	wish to die	866	0.65	0.63	486	0.40	1.06
3	reasons living/dying	870	0.46	0.92	487	0.26	1.46
4	desire to kill oneself	872	0,51	0.81	487	0.31	1.31
5	save my life	851	0.53	0.79	487	0.31	1.29
6	periods thinking about suicide	797	0.41	1.02	453	0.23	1.58
7	frequency of thinking about suicide	800	0.37	1.14	451	0.22	1.63
8	acceptance of idea of suicide	816	0.46	0.93	461	0.32	1.26
9	ability to not commit suicide	819	0.29	1.36	461	0.16	1.87
10	reasons for not committing suicide	807	0.36	1.15	465	0.25	1.51
11	reasons for wanting to commit suicide	751	0.89	0.46	424	0.63	0.64
12	specific plan to commit suicide	795	0.41	1.03	448	0.29	1.38
13	access to suicide method	742	0.49	0.86	441	0.40	1.06
14	courage/ability to commit suicide	800	0.48	0.88	451	0.32	1.28
15	expectance to commit suicide	809	0.35	1.19	460	0.20	1.69
16	preparations for suicide	791	0.20	1.69	455	0.12	2.06
17	writing of suicide note	776	0.24	1.54	448	0.15	1.93
18	arrangements for after suicide	789	0,.3	1.26	452	0.28	1.42
19	conceal ideation	771	0.6	0.93	457	0.32	1.28

Note. n = number of participants, M = mean, VAR = variance

Invariance models for the 19-item scale

Table 2 presents the fit indices for each of the invariance models. The configural invariance model proved to have good model fit, judging by its CFI value of 0.981 and RMSEA value of 0.041. In addition, the 90% confidence interval of the RMSEA did not include 0.06. However, a negative error variance for item 13 was observed at T1, although the model estimation converged normally, and all other parameter estimates had plausible values. Following recommendations (Chen et al., 2001), we constrained the error covariance across time intervals for item 13 to a theoretically plausible value. In the unconstrained model, the error variance of item 13 was 0.390 at T0, and 0.158 at T1; so theoretically, the error covariance cannot exceed $\sqrt{(0.390 \cdot 0.158)} = 0.248$. In the unconstrained model, the error covariance across time intervals for item 13 was 0.260 (SE = 0.044), resulting in a negative error variance for item 13 at T1. Therefore, we fixed the error covariance to 0.245 in the configural invariant model. This did not result in a change in model fit indices, with exception of a slight improvement of the minimum fit function value.

Restricting all loadings to be equal across time intervals resulted in a slight improvement in model fit, according to the increase in CFI of 0.001 and decrease in RMSEA of 0.001. No negative variances were observed in this model, so the error covariance across time intervals for item 13 was freely estimated in the models with invariant loadings.
Next, restricting all item thresholds to be equal across time intervals resulted in a slight improvement of model fit, as well. CFI increased by 0.001, RMSEA decreased by 0.001, and the entire 90% confidence interval of the RMSEA remained < 0.06.
Performing the analysis on the dataset of completers only, and the dataset without added zeros for items 6-19, resulted in very similar findings: RMSEA and CFI for the configural invariance model showed good model fit, and restricting loadings and thresholds to equality across time intervals resulted in slight improvements of model fit. In addition, parameter estimates for the configural invariance model were very similar for all three datasets.

Table 2. Model fit indices for the MI models

Model	minimum fit function	df	p-value	scaled chi-square difference test statistic: test statistic	df	p-value	CFI	RMSEA	RMSEA 90%-CI
Configural invariance	1391.887	646	<.0001	N/A	N/A	N/A	0.981	0.041	0.038-0.044
Loading invariance	1368.792	663	<0.001	50.275	17	<.001	0.982	0.040	0.037-0.043
Threshold invariance	1424.050	700	<.0001	96.652	37	<.001	0.982	0.039	0.036-0.042

Note. All fit indices based on robust standard errors and WLSMV estimator.df = degrees of freedom, CFI =comparative fit index, RMSEA = root mean square error of approximation, CI = confidence interval

Invariance models for the 5- item screener

Table 3 presents the fit indices for each of the invariance models consisting only of the first 5 BSS items. It indicates a good fit for the unidimensional models on both measurement occasions: CFI was 0.997 and the 90% confidence interval of the RMSEA was <.06. Restricting factor loadings and thresholds to equality on both measurement occasions resulted in an improvement of fit, judging by the decrease in RMSEA, and no deterioration according to the CFI, which remained the same.

Discussion

The present study is the first to examine longitudinal measurement invariance of the Beck Scale for Suicide Ideation. Longitudinal measurement invariance is a prerequisite for the comparison of repeated measurements with a (mental health) test, such as when a test is used for routine outcome monitoring [13, 38]. A lack of measurement invariance can lead to confounded interpretation of change scores. For example, a recent study found the widely used Beck Depression Inventory was not measurement invariant over the course of depression treatment [16]. This resulted in an underestimation of depressive symptoms at baseline compared to follow-up measurement. In addition, measurement errors were smaller, and correlations between different constructs of the BDI were stronger at follow-up. The consequence is that comparison of the observed total scores of the BDI may underestimate treatment efficacy and result in biased conclusions. Via a longitudinal CFA

model we examined the occurrence of response shift when using the Beck Scale for Suicide Ideation in a multicenter RCT. Our results show the BSS to be measurement invariant over time. This means no relevant response shift occurred, and any change found over time on the scale can be interpreted as actual change. These findings legitimize the use of the scale in longitudinal assessments. One of the reasons that the BSS is invariant could be that the BSS is a unidimensional scale with very specific and clearly worded items such as: “I have the courage to commit suicide”. When compared to the three dimensional BDI, with more broad items like: “I am disappointed in myself”, the items of the BSS are more straightforward, and therefore less vulnerable to differing interpretations over time. Importantly, the first five items were also found to be measurement invariant. As asking about suicidality can be difficult for both patients [39, 40] and professionals [41], a short screener that is measurement invariant over time is much desired. Our findings indicate that the 5-item screener of the BSS can be used over time, and that change on the 5-item screener represents true change in suicide ideation.

This study has several limitations. First, although patients and research assistants were encouraged to complete all 19 items even when a participant scored 0 on the first 5 items [5], 22% (n = 188) of the patients at T0 and 33 % (n = 180) at T1 stopped after answering the first 5 items with 0. Also, considering the participants that continued responding after item 5, 4% of the scores were missing. As is common when using the BSS [8, 9], we estimated the missing items to reflect score 0, but this may be an underestimation of actual suicide ideation. As the procedure for dealing with missing values was the same at baseline and at T1, and an additional completers-only analysis showed no differences in the values of fit indices, this should not have led to different conclusions concerning MI of the BSS.

Strength of the current study is the large number of psychiatric patients with two assessments of the BSS. Normally, the number of respondents to suicide questionnaires is too small for assessment of longitudinal MI [9]. Also, for reasons discussed elsewhere [42], MI is seldom investigated in longitudinal mental health trials. By investigating MI in a large study population, we further validated the BSS and justified its longitudinal use. It is necessary to compare the CFA parameters of our study with, for example, data collected with the original English BSS. This study hopes to encourage other researchers in mental health care to test MI of frequently used mental health questionnaires, and thereby identify the measurement of true and potentially confounded changes before drawing clinical, managerial or scientific conclusions.

Abbreviations

MI = measurement invariance, CFA = confirmatory factor analysis, BSS = Beck Scale for Suicide ideation, CFI =comparative fit index, RMSEA = root mean square error of approximation, CI = confidence interval, ROM = routine outcome monitoring, PITSTOP suicide = professionals in training to STOP suicide, DF = degrees of freedom

Competing interests

All authors declare that they have no competing interests

Authors' contributions

AK, MdG, and JdK obtained funding for this study. DdB carried out the study. DdB and MF drafted the manuscript. AK, MdG, JdK contributed to the execution of the study, and to the manuscript writing.

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References

1. Gunnell D, Platt S, Hawton K: **The economic crisis and suicide**. *Bmj* 2009, **338**.

2. Stuckler D, Basu S: **The Body Economic: Why Austerity Kills**: Basic Books; 2013.

3. CBS: **http://statline.cbs.nl/statweb/**. In.; 2013.

4. Hegerl U, Rummel-Kluge C, Värnik A, Arensman E, Koburger N: **Alliances against Depression - a community based approach to target depression and to prevent suicidal behavior**. *Neuroscience & Biobehavioral Reviews* 2013.

5. de Beurs DP, de Groot MH, Bosmans JE, de Keijser J, Mokkenstorm J, Verwey B, van Duijn E, de Winter RF, Kerkhof AJ: **Reducing patients' suicide ideation through training mental health teams in the application of the Dutch multidisciplinary practice guideline on assessment and treatment of suicidal behavior: study protocol of a randomized controlled trial**. *Trials* 2013, **14**(1):372.

6. Brown GK: **A review of suicide assessment measures for intervention research with adults and older adults**: GK Brown; 2001.

7. Beck AT, Steer RA, Ranieri WF: **Scale for suicide ideation: Psychometric properties of a self-report version**. *Journal of clinical psychology* 1988, **44**(4):499-505.

8. Brown GK, Beck AT, Steer RA, Grisham JR: **Risk factors for suicide in psychiatric outpatients: a 20-year prospective study**. *Journal of consulting and clinical psychology* 2000, **68**(3):371.

9. van Spijker BA, van Straten A, Kerkhof A: **The effectiveness of a web-based self-help intervention to reduce suicidal thoughts: A randomized controlled trial**. *Trials* 2010, **11**(1):25.

10. De Beurs DP, de Vries AL, de Groot MH, de Keijser J, Kerkhof AJ: **Applying Computer Adaptive Testing to Optimize Online Assessment of Suicidal Behavior: A Simulation Study**. *Journal of Medical Internet Research* 2014, **16**(9):e207.

11. Young AS, Grusky O, Jordan D, Belin TR: **Routine outcome monitoring in a public mental health system: the impact of patients who leave care**. *Psychiatric Services* 2000, **51**(1):85-91.

12. Van Os J, Kahn R, Denys D, Schoevers R, Beekman A, Hoogendijk W, van Hemert A, Hodiamont P, Scheepers F, Delespaul PA: **ROM: gedragsnorm of dwangmaatregel? Overwegingen bij het thermanummer over routine outcome monitoring**. *Tijdschrift voor psychiatrie* 2012, **54**(3):245-253.

13. De Beurs E, den Hollander-Gijsman M, Van Rood Y, Van der Wee N, Giltay E, Van Noorden M, Van der Lem R, Van Fenema E, Zitman F: **Routine outcome monitoring in the Netherlands: practical experiences with a web-based strategy for the assessment of treatment outcome in clinical practice**. *Clinical psychology & psychotherapy* 2011, **18**(1):1-12.

14. Borsboom D: **Measuring the mind: Conceptual issues in contemporary psychometrics**: Cambridge University Press; 2005.

15. Lukens EP, McFarlane WR: **Psychoeducation as evidence-based practice: Considerations for practice, research, and policy**. *Brief Treatment and Crisis Intervention* 2004, **4**(3):205.

16. Fokkema M, Smits N, Kelderman H, Cuijpers P: **Response shifts in mental health interventions: An illustration of longitudinal measurement invariance**. *Psychological assessment* 2013, **25**(2):520.

17. Sprangers MA, Schwartz CE: **Integrating response shift into health-related quality of life research: a theoretical model**. *Social science & medicine* 1999, **48**(11):1507-1515.

18. Vandenberg RJ, Lance CE: **A review and synthesis of the measurement invariance literature: Suggestions, practices, and recommendations for organizational research**. *Organizational research methods* 2000, **3**(1):4-70.

19. Millsap RE: **Statistical approaches to measurement invariance**: Routledge New York; 2011.

20. Howard GS, Ralph KM, Gulanick NA, Maxwell SE, Nance DW, Gerber SK: **Internal invalidity in pretest-posttest self-report evaluations and a re-evaluation of retrospective pretests**. *Applied Psychological Measurement* 1979, **3**(1):1-23.

21. Golembiewski RT, Billingsley K, Yeager S: **Measuring change and persistence in human affairs: Types of change generated by OD designs**. *The Journal of Applied Behavioral Science* 1976, **12**(2):133-157.

22. Schwartz CE, Sprangers MA: **Methodological approaches for assessing response shift in longitudinal health-related quality-of-life research**. *Social science & medicine* 1999, **48**(11):1531-1548.

23. Oort FJ: **Using structural equation modeling to detect response shifts and true change**. *Quality of Life Research* 2005, **14**(3):587-598.

24. de Beurs DP, de Groot MH, de Keijser J, Verwey B, Mokkenstorm J, Twisk JW, van Duijn E, van Hemert AM, Verlinde L, Spijker10 J: **Improving the application of a practice guideline for the assessment and treatment of suicidal behavior by training the full staff of psychiatric departments via an e-learning supported Train-the-Trainer program: study protocol for a randomized controlled** *BMC trials* 2013, **14**(9).

25. Demyttenaere K, Bruffaerts R, Posada-Villa J, Gasquet I, Kovess V, Lepine J, Angermeyer MC, Bernert S, de Girolamo G, Morosini P: **Prevalence, severity, and unmet need for treatment of mental disorders in the World Health Organization World Mental Health Surveys**. 2013.

26. van Spijker BA, Majo MC, Smit F, van Straten A, Kerkhof AJ: **Reducing suicidal ideation: cost-effectiveness analysis of a randomized controlled trial of unguided web-based self-help**. *Journal of medical Internet research* 2012, **14**(5).

27. van Spijker BA, van Straten A, Kerkhof AJ: **Effectiveness of online self-help for suicidal thoughts: Results of a randomised controlled trial**. *PloS one* 2014, **9**(2):e90118.

28. Beck AT, Kovacs M, Weissman A: **Assessment of suicidal intention: the Scale for Suicide Ideation**. *Journal of consulting and clinical psychology* 1979, **47**(2):343.

29. Beck AT, Brown GK, Steer RA, Dahlsgaard KK, Grisham JR: **Suicide ideation at its worst point: a predictor of eventual suicide in psychiatric outpatients**. *Suicide and Life-Threatening Behavior* 1999, **29**(1):1-9.

30. Reeve BB, Hays RD, Bjorner JB, Cook KF, Crane PK, Teresi JA, Thissen D, Revicki DA, Weiss DJ, Hambleton RK: **Psychometric evaluation and calibration of health-related quality of life item banks: plans for the Patient-Reported Outcomes Measurement Information System (PROMIS)**. *Medical care* 2007, **45**(5):S22-S31.

31. Lei P-W: **Evaluating estimation methods for ordinal data in structural equation modeling**. *Quality and Quantity* 2009, **43**(3):495-507.

32. Flora DB, Curran PJ: **An empirical evaluation of alternative methods of estimation for confirmatory factor analysis with ordinal data**. *Psychological methods* 2004, **9**(4):466.

33. Millsap RE, Yun-Tein J: **Assessing factorial invariance in ordered-categorical measures**. *Multivariate Behavioral Research* 2004, **39**(3):479-515.

34. Bentler PM: **Comparative fit indexes in structural models**. *Psychological bulletin* 1990, **107**(2):238.

35. Hu Lt, Bentler PM: **Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives**. *Structural Equation Modeling: A Multidisciplinary Journal* 1999, **6**(1):1-55.

36. Cheung GW, Rensvold RB: **Evaluating goodness-of-fit indexes for testing measurement invariance**. *Structural equation modeling* 2002, **9**(2):233-255.

37. Satorra A: **Scaled and adjusted restricted tests in multi-sample analysis of moment structures**: Springer; 2000.

38. Meredith W: **Measurement invariance, factor analysis and factorial invariance**. *Psychometrika* 1993, **58**(4):525-543.

39. Jorm AF, Kelly CM, Morgan AJ: **Participant distress in psychiatric research: a systematic review**. *Psychological medicine* 2007, **37**(07):917-926.

40. Younes N, Chee CC, Turbelin C, Hanslik T, Passerieux C, Melchior M: **Particular difficulties faced by GPs with young adults who will attempt suicide: a cross-sectional study**. *BMC family practice* 2013, **14**(1):68.

41. Sher L: **Teaching medical professionals about suicide prevention: what's missing?** *QJM* 2011, **104**(11):1005-1008.

42. Borsboom D: **The attack of the psychometricians**. *Psychometrika* 2006, **71**(3):425-440.

CHAPTER 12

PSYCHOLOGICAL DISTRESS BECAUSE OF ASKING FOR SUICIDAL THOUGHTS. A RANDOMIZED CONTROLLED TRIAL AMONG STUDENTS

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Abstract

To investigate the effect of the items of the Beck Scale for Suicide Ideation on psychological well-being among healthy participants.

Methods

A randomized controlled study. 301 participants answered the same four questionnaires on psychopathology. The experimental group additionally answered 21 items of the Beck Scale for Suicide Ideation. The control group answered 19 items on Quality of Life.

Results

The experimental condition showed a significant smaller decrease of negative affect compared to the control condition. When analyzing participants with elevation of distress, 80% were part of the experimental condition.

Conclusions

For most participants, answering suicide items does not affect their mood. A small group of participants did react with distress to the suicide items. As the suicide items were administered immediately before the items on negative affect, the suicide items could have worked as a negative mood challenge. Future experimental research should further investigate the effect of suicide items among healthy participants, especially on the long term.

Keywords

Suicide, Screening, Iatrogenic effect

Introduction

In the Netherlands, safety for participants in research is regulated by law since 1999 (Ministry of Health, 1999). (Para) medical studies have to be approved by medical ethic committees. Normally, committees approve asking about psychopathology via questionnaires. But on the topic of suicidality, committees become more stringent. An international survey among medical committees showed that the main concern is that asking about suicide might reinforce such thoughts or acts (Lakeman & Fitzgerald, 2009). Several studies, both experimental and observational, have examined this possible iatrogenic effect of suicide items ((Biddle et al., 2013; Crawford et al., 2011; Cukrowicz et al., 2010; Gould et al., 2005; Harris et al., 2011; Mathias et al., 2012; Reynolds et al., 2006). Two of these studies showed that asking about suicide in high risk populations (borderline, adolescents who experienced inpatient care, chronically suicidal patients) did not result in differences in mean scores on mood and suicidality (Reynolds et al., 2006; Mathias et al., 2012). The same result was found after a much more intense suicide intervention. 30 suicidal participants answered several questionnaires and were exposed to images of suicide. No increase in suicide ideation was found after the tests. The authors concluded that research among individuals at high risk is possible when a good safety procedure is available (Cukrowicz et al., 2010). The pooled results of four different studies on the experiences of vulnerable participants in qualitative research on the topic of suicidality showed that most participants actually benefited from participating in the study (Biddle et al., 2013). A systematic review showed that positive reactions following participation in psychiatric research are generally more common than negative ones and that no long term effects of distress or effects on functioning were found (Jorm et al., 2007).

In clinical settings, asking about suicidality is part of daily treatment. When developing screeners for suicide risk, research is conducted among the general population, i.e. participants not in a protected treatment environment. The possible iatrogenic effects of suicide screeners (questionnaires, interviews) in general population are not well studied according to Gould et al (2005). She conducted a study on the effect of screening for suicidality among adolescents. In the experimental condition, 1172 adolescents completed numerous questionnaires, which included 22 items on suicidality. The control group (n = 1170) was asked the same questions as the experimental group, but the suicide items were omitted. Mood and suicidality were assessed before and after answering the questions. On average, adolescents in the experimental condition showed no more stress or change in mood when compared with the control group. Also, adolescents at risk for suicide (high scores on depression questionnaires, substance abuse)

showed no more change in depression or suicide ideation after answering suicide items when compared to controls. The same results have been found among Taiwanese students (Harris et al., 2011). 259 students were divided at random into either the experimental or the control group. Students in the experimental group answered seven questionnaires about psychopathology on the computer. One questionnaire contained several suicide items. The control group completed the same questionnaires as the experimental group, but answered questions on quality of life instead of the suicide items. Psychological distress was operationalized as change on the Positive and Negative Affect Schedule (PANAS) conducted before and after the other questionnaires. In this study, also no effect on negative or positive affect because of the suicide items was found. Participants that scored high on the depression questionnaires did experience a negative mood change, but this effect was seen in both the experimental and the control group. In the current study, we replicated the study of Harris among Dutch students. We were particularly interested in possible distressing effects of answering the self-report version of the Beck Scale for Suicide Ideation (BSS, (Beck et al., 1979).The BSS is one of the most widely used self-report questionnaires in suicide research (Brown, 2013). Analogue to Harris we hypothesized that asking for suicidal ideation via the BSS would not result in higher negative affect or lower positive affect when compared to the control group. We also hypothesized that when selecting high risk students (high score on depression, loneliness or negative affect at baseline) still no effect of suicide items would be found. As it is know that a small percentage of participants (generally <10%) in psychiatric research does get distressed (Jorm et al., 2007; Biddle et al., 2013) we also investigated the distribution of these expected 10% of participants among the experimental and the control condition.

Methods

Design

The study was a randomized controlled trial conducted at the VU University in the Netherlands.

Participants

Eligible participants had to be 18 years or older, registered as a student at a Dutch University and fluent in Dutch.

Experimental Procedure

We replicated the design of Harris et al (2012). From 15 April 2012 until 25 April 2012, participants were recruited at the student computer facility of the faculty of Psychology and Education of the VU University Amsterdam. Participants were told they were attending a study to validate different questionnaires that measure emotional problems. They were offered 3.5 euro or course credits for participation. They were randomly assigned to a computer cubicle and provided an informed consent. Each cubicle had an anonymous link to either the experimental or the control condition on its desktop. In both conditions, the participants were asked to fill in seven questionnaires (fig1). The two groups differed only in the fifth questionnaire. In the experimental condition the fifth questionnaire contained 21 items of the BSI. The control condition answered 19 items on Quality of Life as the fifth questionnaire.
Special care was taken to debrief the participants in both conditions. The total study (questionnaires and debriefing) took approximately 30 minutes per student.

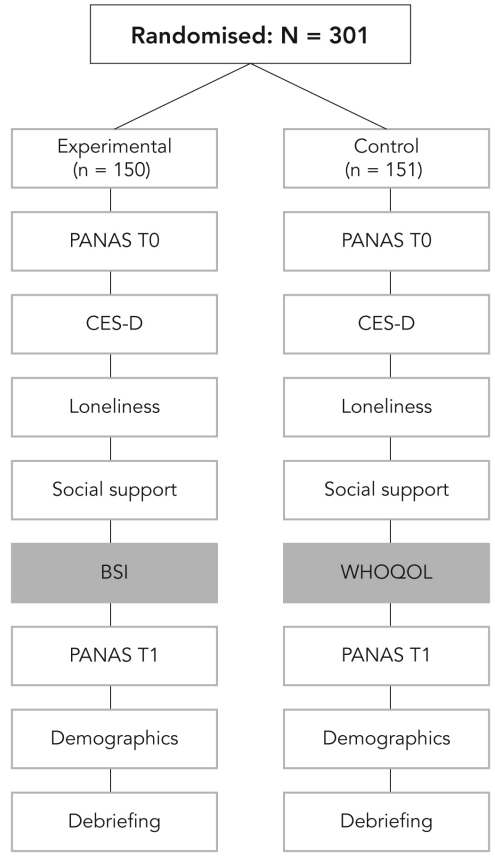

Figure 1: design of the study

Questionnaires

The Positive and Negative affect Schedule (PANAS (Watson & Clark, 1988))
Psychological distress was operationalized as change in score on the pre (T0) and post (T1) measurement of the PANAS. Both the Positive affect (PA) and the Negative affect (NA) subscale have been found to be able to detect change in mood (Watson & Clark, 1988). Total scores ranged from 10-50.

Center for Epidemiologic Studies Depression Scale (CES-D (Redloff, 1977))
The CES-D is a self-report questionnaire that measures depressive symptoms in general population. The scores range from 0- 60. Internal consistency is good (Redloff, 1977).

World health organization Quality of life abbreviated (WHOQOL-BREV (Skevington et al., 2004)).

The instrument measures the following broad domains: physical health, psychological health, social relationships, and environment(Skevington et al., 2004).

De Jong Gierveld Scale For Loneliness (De Jong-Gierveld, 1987)
The loneliness scale is a widely used and cited scale for scientific usage (Jong Gierveld & Tilburg, 2010) . The scale consists of 11 items. Minimum score is 11, maximum score is 55.

Beck Scale of Suicide Ideation (BSI, (Beck et al., 1988))
Our intervention is the Beck Scale for Suicidal Ideation (BSI), a well validated and widely used instrument (Beck et al., 1979). The BSI consists of 21 self-report items. The first 19 items measure the severity of actual suicidal wishes and plans. Item 20 assesses the number of previous suicide attempts and item 21 the severity of the last suicide attempt.

Social Support Questionnaire (Kempen & Eijk, 1995)
We measured social support with a 12 item version of the Social Support Questionnaire (Kempen & Eijk, 1995). A high score reflects a low level of perceived social support.

Debriefing
After the task, participants were taken into a separate room for a structured debriefing. Participants were asked how they experienced the questions in general, if they had trouble with any of the questionnaires, and if their mood changed because of answering the items. If a participant reported change in mood, a note with the telephone number of the specialized psychologists was provided with a clear invitation to contact the psychologist if the participant kept feeling negative. No participant contacted the specialized psychologist during or after the study.

Approval from Medical Ethics Committee

Approval from the Medical Ethics Committee of the VU University Medical Center was requested and obtained (registration number 2012/121).

Statistical analysis

To analyze the effect of answering suicide items on Negative Affect (NA) at T1, a univariate ANCOVA was performed. Fixed factor was condition, and NA at T0 was used as a covariate. We conducted the same analysis for different selections of high risk participants. (CESD > 15, CESD> 22, Loneliness > 30, NA T0> 22). The same analysis were done for the subscale Positive Affect

(PA). Finally, we looked at the distribution over condition of participants who reported a positive change of NA of at least 1.5 standard deviation above the mean change in NA.

Results

301 participants were included in our study. All data assumptions were met. The control and the experimental groups showed comparable demographics and scores at baseline Average mean (SD) on the BSS in the experimental group was 0,9 (2). 14 participants scored >2 on the BSS.

Effect of the BSS on the NA scale

For the total sample we found a significant effect of condition on the mean of NA at T1 , $F(1,295) = 7.36$, $p < 0.01$, effect size = 0.3. When controlling for NA at T0, NA at T1 was significantly higher in the experimental group when compared to the control group. No effect for the different subgroups was found.

Effect of the BSS on the PA scale

The same analyses with the five different subgroups of participants were done for the scores on the PA. No significant effects were found for condition on PA T1.

Distribution of participants that showed elevated NA

To investigate clinical relevant rise in affect, we selected participants that showed an elevation of NA of 1.5 standard deviation above the mean change in NA (i.e. a change score of 3.9 or higher). 24 participants met this criteria. 19 of these participants were part of the experimental condition. The distribution between condition and whether or not a participant scored 1.5. standard deviation above the mean was significant (χ^2 (1) = 11, p =0,001). Seven participants in the experimental condition scored higher than the highest score on the control condition. Three participants in the experimental condition showed an increase of NA of 20% (= increase of 10 points or higher). Multivariate analyses showed that the 24 participants with elevated NA were characterized by significant higher scores on loneliness compared to the other 273 participants.

Discussion

Our study suggests that the answering of suicide items does result in distress for a small minority of more vulnerable individuals .For most participants, answering the suicide items of the Beck Scale for Suicide Ideation does not affect their mood, but when looking at the distribution of participants who showed significant elevation of NA, most (80%) were part of the experimental condition. Our results differ from other studies that showed no negative effect of suicide items.
A possible explanation for the found effect could be that in our study, the suicide items worked as a negative mood priming challenge, as the BSS was administered just before the items on negative affect. Several studies have shown that negative mood can be induced in healthy participants by listening to negative self-statements, or thinking about a personally upsetting event (Robinson et al, 2012). No negative long term effects of these mood induction methods are documented. A follow up study should replicate the design with a few questionnaires between the BSS and the negative affect scale to further investigate any possible priming effect of the BSS.
Another explanation could be found in the Theory of Terror Management (Greenberg et al., 1992). The theory states that self-esteem protects people from the anxiety that awareness of their vulnerability and mortality would create. In our present study, we ask participants first about their level of loneliness, perceived social support, and then about suicide. If a participant is reminded that he has no friends and that he actually is lonely, and then is reminded about his own mortality via suicide items, according to the Theory of Terror Management it should come as no surprise that mood decreases.

Strengths and limitations

The strength of this study is the experimental design and the relative large sample size, which makes it possible to investigate the effect of answering the BSS. A limitation of this study is that, as all of the participants studied at the university, our results are not to be generalized among all 18-24 olds. Furthermore, the sample of this study scored relatively high on the psychopathology questionnaires 30% of our sample scored above the cut off score of 16 on the CESD, which is comparable to other studies among undergraduates(Regestein et al., 2010) but high compared to the general population (Redloff, 1977). Also, given the small number of participants in the different subgroups (for example, only 48 participants scored CESD > 22), we need to be cautious about the robustness of our findings.
Most importantly, we did not include a follow up. One wants to know if the

effect of the items prolongs for hours or perhaps days. Although a systematic review found little indication of any longer-term harm to participants, following research should include a long term follow up.

Implications and conclusions

Most participants, even participants at high risk, showed no distress from answering suicide questions. We did find that a small group of participants reacted with distress to the suicide items. This group was characterized by higher but not extreme scores on loneliness, depression, perceived lack of social support and negative affect at baseline. Although experimental studies should investigate whether our effect was as a result of negative priming, and whether it has any long effect, researchers should be aware of the possible adverse effect of suicide research and make sure to develop a sufficient safety protocol. Both researchers and Medical Ethical Committees should consider the likelihood and impact of distress against the importance of new research when using the BSS.

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Authors' contributions

AK was the initiator of the study. DP drafted the manuscript. All authors contributed to the execution of the study, and to the manuscript writing.

References

Beck, A. T., Steer, R., & Ranieri, W. (1988). Scale for suicide ideation: Psychometric properties of a self-report version. *Journal of Clinical Psychology, 44,* 499-505.

Beck, AT., Kovacs, M., & Weissman, A. (1979). Assessment of suicidal intention: the Scale for Suicide Ideation. *Journal of consulting and clinical psychology, 47,* 343-352.

Biddle, L., Cooper, J., Owen-Smith, A., Klineberg, E., Bennewith, O., Hawton, K. et al. (2013). Qualitative interviewing with vulnerable populations: individuals' experiences of participating in suicide and self-harm based research. *J.Affect.Disord., 145,* 356-362.

Brown, G. K. (2013). A Review of Suicide Assessment Measures for Intervention Research with Adults and Older Adults. Web Page. Available at: http://www.nimh.nih.gov/research/adultsuicide.pdf.

Crawford, M. J., Thana, L., Methuen, C., Ghosh, P., Stanley, S. V., Ross, J. et al. (2011). Impact of screening for risk of suicide: randomised controlled trial. *British Journal of Psychiatry, 198,* 379-384.

Cukrowicz, K., Smith, P., & Poindexter, E. (2010). The Effect of Participating in Suicide Research: Does Participating in a Research Protocol on Suicide and Psychiatric Symptoms Increase Suicide Ideation and Attempts? *Suicide and Life-Threatening Behavior, 40,* 535-543.

De Jong-Gierveld, J. (1987). Developing and testing a model of loneliness. *Journal of personality and social psychology, 53,* 119.

Gould, M., Marrocco, F., Kleinman, M., Thomas, J., Mostkoff, K., Cote, J. et al. (2005). Evaluating iatrogenic risk of youth suicide screening programs: a randomized controlled trial. *Journal of the American Medical Association, 293,* 1635-1643.

Greenberg, J. S., Pyszczynski, T., Solomon, S., Rosenblatt, A., Burling, J., Lyon, D. et al. (1992). Why Do People Need Self-Esteem? Converging Evidence That Self-Esteem Serves an Anxiety-Buffering Function. *Journal of Social and Personal.Relationships., 63,* 913-922.

Harris, K., Goh, M., & Chew, E. (2011). Is suicide research risky for participants? Unpublished Work

Jong Gierveld, J. d. & Tilburg, v. T. (2010). The De Jong Gierveld short scales for emotional and social loneliness: tested on data from 7 countries in the UN generations and gender surveys. *European journal of aging, 7,* 121-130.

Jorm, A. F., Kelly, C. M., & Morgan, A. J. (2007). Participant distress in psychiatric research: a systematic review. *Psychol.Med., 37,* 917-926.

Kempen, G. I. J. M. & Eijk, v. L. M. (1995). The psychometric properties of the SSLI-12, a short scale for measuring social support in the elderly. *Social indicators research, 35,* 303-312.

Lakeman, R. & Fitzgerald, M. (2009). Ethical suicide research: a survey of researchers. *Int.J.Ment.Health Nurs., 18,* 10-17.

Mathias, C. W., Michael, F. R., Sheftall, A. H., Hill-Kapturczak, N., Crum, P., & Dougherty, D. M. (2012). What's the harm in asking about suicidal ideation? *Suicide Life Threat.Behav., 42,* 341-351.

Ministry of Health, W. a. S. (1999). Wet Medisch wetenschappelijk onderzoek met mensen.

Redloff, L. S. (1977). The CESD-D scale; a self-report depression sacale for research in the general population. *Applied Psychological Measurement, 1,* 385-401.

Regestein, Q., Natarajan, V., Pavlova, M., Kawasaki, S., Gleason, R., & Koff, E. (2010). Sleep debt and depression in female college students. *Psychiatry Res., 176,* 34-39.

Reynolds, S. K., Lindenboim, N., Comtios, K. A. C., Murray, A., & Linehan, M. (2006). Risky Assessments: Participant Suicidality and Distress Associated with Research Assessments in a Treatment Study of Suicidal Behavior. *Suicide-Life-Threat-Behav., 36,* 19-34.

Robinson, O.J., Grillon, C., & Sahakian, B.J. (2012). The mood induction task: a standardized, computerized laboratory procedure for altering mood state in humans. Protocol Exchange.

Russel, D. W. (1996). The UCLA loneliness scale: reliability, validity and factorstructure. *Journal of personality assessment, 66*.

Skevington, S. M., Lotfy, M., & O'Connell, K. A. (2004). The World Health Organization's WHOQOL-BREF quality of life assessment: psychometric properties and results of the international field trial. A report from the WHOQOL group. *Qual.Life Res., 13,* 299-310.

Tabachnick, B. G. & Fidell, L. S. (2001). Screening Data prior to analysis. In R.Pascal (Ed.), *Using multivariate statistics* (4th ed., pp. 56-111). Needham Heights: Pearson education group.

Watson, D. & Clark, L. A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of personality and social psychology, 54,* 1063-1070.

Ziment, G. D., Dahlem, N. W., Zimet, S. G., & Farley, G. K. (1988). The multidimensional scale of percieved social report. *Journal of personality assessment, 52,* 30-41.

CHAPTER 13

SUMMARY AND GENERAL DISCUSSION

In this thesis, we have aimed to collect empirical knowledge on a particular strategy to implement the recommendations of the multidisciplinary practice guideline on the assessment and treatment of suicidal behavior in specialized mental health care. We tested the effectiveness of an e-learning supported Train-the-Trainer program which content reflected the practice guideline. Its effectiveness was measured at three levels: the professional, the patient and the organizational. Also, special care was taken to further validate the most commonly used questionnaire to assess suicidal thoughts, the Beck Scale for Suicide Ideation.
We will first summarize the main findings of each chapter of this thesis. Next, we will reflect on our findings and discuss the implications. Methodological considerations and suggestions for future studies are detailed in the last part.

Summary of the Main Findings

Chapter 2 described the study protocol of our cluster randomized controlled trial investigating the effect of our intervention at the professional and organizational level.

Chapter 3 described the study protocol of our cluster randomized controlled trial investigating effects on outcomes, cost-effectiveness and cost utility at the patient level.

Chapter 4 details the scientific rationale and the outline of our e-learning supported Train-the-Trainer intervention (TtT-e) so that organizations, scientists and clinical practitioners can evaluate, copy and adjust every step of our program.

In chapter 5, we tested the hypothesis that structured training via TtT-e would lead to more confidence, knowledge and suicide guideline adherence of professionals when compared to professionals in the control condition. At the time of the 3-month follow-up, trained professionals showed stronger guideline adherence, more self-perceived knowledge of suicidal behavior and more confidence as providers in dealing with suicidal behavior. Sub-group analyses showed that improved guideline adherence was found among nurses but not among psychiatrists and psychologists.

Chapter 6 presented the results of our intervention on patients. For the total sample of patients with suicidal ideation at baseline, no effect of the intervention was found at the level of suicide ideation or frequency of self-reported suicide attempts at the 3 month follow-up. We found our

intervention had an effect for patients diagnosed with depression and with suicide ideation at baseline. Patients reported more often that suicidality was adressed during therapy, which indicated that TtT-e was able to change the behavior of professionals in individual therapy sessions.

Chapter 7 displayed the results of our cost-effectiveness analysis. No statistically significant differences in costs were found for the total group of suicidal patients between the intervention and the control group. The intervention might be considered cost-effective for depressed suicidal patients if society is willing to make substantial investments.

In chapter 8, we evaluated the implementation process and described the effect of TtT-e at the organizational level. Results were mixed. Some institutions reported no differences in the work process after the intervention. Others reported changes in daily practice, such as the structural registration of suicidal behavior, and the removal of non-suicide contracts. Some key-professionals stated that they were more alert for suicidal behavior and more attention was paid to suicidality during transition moments. They felt that because of TtT-e there was less taboo associated with asking about suicidality, and noticed a common understanding of suicidal behavior between professionals. Differentiating between chronical suicidal behavior and acute suicidal behavior on top of chronical suicidal behavior had improved in some departments. The TtT-e model has been found easy to disseminate, both during and after the trial and was well received by its users. From 2012 until end of 2014, over 5500 mental health professionals have been trained according to TtT-e, indicating a well perceived need to improve suicide prevention skills among Dutch mental health professionals.

Chapter 9 presented the development and feasibility of the e-learning module that supported the Train-the-Trainer program. The module was well received, and participants stated that they learned a lot about the topic of suicide prevention, and that they gained confidence in dealing with suicidal behavior. No effect on outcomes of the e-learning above and beyond the face-to-face training was found.

In chapter 10 we applied modern techniques to shorten the Beck Scale for Suicide Ideation. A computer adaptive test simulation demonstrated that when using the scale for classification, on average 4 items instead of the full 19 items were sufficient. This greatly reduces respondent burden when assessing the risk of suicide with the Beck Scale for Suicide Ideation.

In chapter 11 we applied confirmatory factor analyses to demonstrate whether any change found between baseline and follow-up can be regarded as real change, as opposed to change due to a different understanding of the construct. We found the Beck Scale for Suicide Ideation to be measurement invariant over time, thereby legitimizing its use in longitudinal assessment.

Chapter 12 demonstrated that on average, asking about suicide does not result in effects on mood. A small sub-sample of vulnerable participants did experience a minor negative effect on mood after answering questions about suicide.

Discussion of the Main Findings

An e-learning supported Train-the-Trainer program to improve suicide practice skills of professionals

We hypothesized that mental health professionals would benefit from the training in suicide practice skills by a trained peer, in small interactive multidisciplinary groups with e-learning support. Both our empirical findings and our interviews with key professionals demonstrated the success of our chosen strategy. The training offered hands-on techniques that could be directly applied in clinical practice. This was highly appreciated by trainees as they directly understood and experienced the effects of the training.
Also, the statistical rarity of suicide, the difficulty of the topic and the lack of formal training during (post) graduate education makes structured training in suicide practice skills a welcome intervention [1]. No matter how experienced a professional is, dealing with suicidal patients remains difficult, and therefore our intervention was welcomed by all professionals, whether novices or highly experienced. Within our study, we trained expert professionals to train their own team. This was well received for various reasons. Being trained by a peer in your own team makes it easier to relate to and implement the training content in actual daily clinical practice. Also, within the current time frame, with its focus on production, there is little time for reflection on work processes. Even teams dealing with suicidal behavior on a frequent basis were found to not often discuss suicidal behavior. Our intervention brought together existing teams of experienced and less experienced professionals of all disciplines to deal with suicidal behavior.

As expected, implementation as usual resulted in little uptake of the guideline. At 3 month follow-up, most participants in the control condition had not read the summary of the guideline, and almost half of the professionals in the control condition did not even know that the guideline had been released.

In contrast, after TtT-e, 85% of the professionals stated to have read the summary of the guideline. We found that individual professionals improved around 10% on our outcome measures after TtT-e. As practice guidelines reflect every day practice, professionals already show high levels of guideline adherence without being trained. In a systematic review of 235 studies on guideline dissemination, 10% change has been found to be the maximum expected change when training experienced professionals [2].
Although our intervention resulted primarily in change at the level of the individual, we argue that the program can easily be adapted to facilitate change in complete teams by offering role-plays and feedback that target

multidisciplinary collaboration. If anything, our training offered teams a common and unifying vocabulary to more easily deal with suicidal behavior in the future. Professionals from all disciplines with a wide range of experience in suicidal behavior all increased significantly in confidence in dealing with suicidal behavior, showing that even highly experienced and specialized professionals benefited from the training.
One of the main barriers when training complete teams is the obvious loss of production and the logistical difficulty of finding staff to fill during training of a complete team. E-learning might be used to shorten the face-to-face training and to make the program more flexible and scalable [3, 4]. Professionals could prepare the face-to-face training by first viewing the module either at work or at home. Also, on-line training material can be viewed repeatedly and long after the face-to-face training has been provided, making it a useful reference manual. Professionals who used the e-learning module of our study were found to highly appreciate the e-learning module, and they stated that they had learned a lot on the topic of suicide prevention and gained confidence. When offering the module at work, one must improve the ICT facilities, as we found them to be insufficient to display the module. When offering the module at home, professionals might be compensated for time spent, as we found most professionals not motivated to follow the module in their leisure time.

An e-learning supported Train-the-Trainer program to improve care for suicidal patients

Care for suicidal patients has greatly improved during the last decades [5]. Although still present, the taboo and myths surrounding suicidal behavior have decreased. Suicide is recognized as a topic in its own right, not just a by-product of Axis I or II disorders [6]. It is accepted that suicide cannot be accurately predicted, but an individual risk can be assessed, and an appropriate treatment plan can reduce the risk [6]. Psychiatrists, psychologists and nurses have come to accept the multidisciplinary character of suicidal behavior. The development of the current guideline fits in this movement towards improved and integrated care for suicidal patients [1]. By developing a guideline created by leading experts that is authorized by the professional organizations, mental health professionals, suicidal patients and their families have a sound starting point for the best possible care. Our intervention translated the most important recommendations into concrete and directly useable techniques. For example, the CASE interview method [6] offers all professionals a structured and successful method to systematically assess suicidal behavior. During four role plays, professionals experienced how it was to more systematically address suicidality by interviewing a colleague that had to act as a suicidal patient from his/her own daily practice.

Importantly, by having to act as a suicidal patient, the professional could experience the effect that such a systematic assessment could have on patients. We hypothesized that by training professionals in these concrete techniques, and by letting them experience the impact of the technique on themselves, care for suicidal patients would improve and suicide ideation would decline faster. In our study, a wide range of psychiatric departments was included, from acute psychiatry departments to out-patient depression units [8]. When analyzing the results of all patients together, we found no effect on suicidal behavior or treatment satisfaction. We did find an effect on suicide ideation when focusing on suicidal patients with a diagnosis of depression. Apparently, the current focus of the intervention, making contact, might be effective for depressed suicidal patients, but it may fall short for other suicidal patients. We therefore argue that offering the same training to different psychiatry departments might not be effective, as suicidal behavior among disorders is diverse. It is argued that the effect of guideline implementation is more optimal when the proposed recommendations are discrete and delimited [9]. As the PGSB focusses on the assessment and treatment of suicidal behavior in general, implementation strategies might be more effective if they focus on suicidal behavior within a specific patient group. A highly tailored intervention aimed to implement anxiety guidelines found comparable effects on patients with an anxiety disorder as we found within depressed suicidal patients [10]. Therefore, we argue that tailoring the content of TtT-e for different psychiatric departments would result in a different focus during the training, and might thereby improve the impact on both professionals and patient care. Currently, Dutch experts on suicidal behavior of patients with personality disorders are modifying the content of our intervention to optimize the impact when training staff of personality disorder departments.

Based on the results of the current trial, we must conclude that an e-learning supported Train-the-Trainer program cannot be considered cost-effective in comparison with implementation as usual. This leads to the obvious observation that it is expensive to train specialized (and therefore expensive) professionals. However, cost-effectiveness will seldom be the primary reason for training specialized teams [11]. Training is desired because knowledge on care is constantly changing, and we want our specialized professionals to provide state-of-the-art care [12]. We have to accept that in order to have the best possible care, we should invest in the training of professionals. In the long run, this might have a cost-effective effect, as patients will receive the best possible treatment by many more professionals. However, no spectacular short-term cost-effective effects can be expected. Also, we only assessed direct and indirect costs, such as health care uptake of individual patients. Intangible costs of direct family make up a much larger fraction of the costs when compared to direct costs [13]. By not assessing these costs, we are likely to have underestimated the cost-effectiveness of our intervention.

An e-learning supported Train-the-Trainer program to help organizations implement guidelines

In our protocol article [14], we hypothesized that our intervention would result in more guideline adherence at institutional and department level. Mixed results were found. Some organizations reported an overall change in dealing with suicidal behavior, while others indicated no difference beyond the individual level. These mixed results might be explained by several factors. Firstly, the focus of the intervention was mainly on the improvement of suicide practice skills of individual professionals [15], resulting in change visible at individual level. It was expected that because of the intervention on the individual level, both complete teams and organizations would change their work processes. However, current literature [16] on organizational change argues that successful adaptation to change at the organizational level is rare, and becomes even rarer as organizations become larger and less flexible. Dutch mental health care is a vast system with a large number of stakeholders. Government bodies, insurance companies, patients and professional guilds all manifest competing demands, resulting in system complexity. Therefore, the expectation of considerable change in a complex organization such as the Dutch mental health care system after an intervention such as TtT-e is unrealistic. Also, within our study, improvement at the organizational level was not clearly defined, making the assessment and comparison of change across several institutions difficult [17, 18].
We argue that future implementation interventions should more explicitly target the organizational structure and should let the organizations formulate what they consider to be effective change, and how they would operationalize successful implementation.

Further Dissemination

An important question is what happens with the TtT-e now the PITSTOP study has finished. As with many implementation studies [19-21], we found positive short term effects of our intervention. Concerns are that implementation effects will disappear as the researchers leave. Departments in our trial did ask us for an after-care program. As the training was well received, they wanted to know how to keep the level of suicide prevention high. Currently we do not know at what frequency the intervention (or part of the intervention) should be repeated. After our study we can conclude that the effect of our intervention lasts for 3 months, but we have no data on the effect after

3 months. The guideline recommends training professionals regularly in suicide practice skills, without recommending the frequency of training [6]. We asked key professionals from institutions in the study about the further dissemination of the intervention. We found that most institutions had the ambition to train many more teams with their own trainers. However, "between dreams and realization, there are laws and practical objections [9]". Some institutions could not find the support of higher management, others could not find the funding. Some had to hire external trainers because the trained colleagues' were too busy. So, although the intervention was well received by individual professionals, it remains difficult to realize further dissemination on the organizational level. The sociological Normalization Process Theory helps to understand why some health innovations become normalized in every day practice while others do not and could serve as the starting point for new implementation strategies [22]. The theory relates the individual professionals to the organizational capacity. By regarding the individual within the organizational context, interventions based on this theory might result in longer-term improvement of health care after guideline implementation than interventions that focus mainly on the individual.

Despite all barriers, at the end of 2014, over 5500 professionals have been trained according to TtT-e. Importantly, 113online [23], an expertise center for suicide prevention in the Netherlands, will start to coordinate the training of mental health professionals via our method from 2015. Also, our e-learning module is being implemented in over 30 mental health institutions and several private practices in the Netherlands via the so-called GGZ-ecademy (an e-learning organization for Dutch mental health care), and publisher Bohn, Stafleu and van Loghum. Both organizations incorporated the content and structure of our e-learning module and applied their format and educational experience to improve the module. The new module is currently available to over 30.000 mental health professionals all throughout the Netherlands. These initiatives indicate that our intervention will continue to be spread among mental health professionals long after the trial ended. The uptake of implementation interventions after a trial has ended is an important goal of the program Health Care Efficiency Research of The Netherlands Organization for Health Research and development (ZONMW) that funded the current study.

A Call for a Practice-based Guideline on Guideline Implementation

Over the years, multiple implementation studies have been carried out, implementing several guidelines using several kinds of methodology and interventions [20, 24]. Results vary and recommendations are usually open-ended. Even the terminology used when discussing implementation science is inconsistent, with multiple and diverse terms being used to describe the same ideas and strategies [25]. One wonders if it is possible to develop an evidence-based implementation strategy [17, 26]. How can one develop a parsimonious model combining psychological factors such as motivation and attention, contextual factors such as time and workload, and attributes of the guideline (e.g. clarity of recommendations)? How can we model (or manipulate) the complex interaction between patients and a multidisciplinary team of professionals? There are so many different factors that influence guideline adherence that any trial is bound to miss important covariates. In our study we demonstrated that the training of professionals with an e-learning supported Train-the-Trainer program could lead to actual change in the approach taken with (suicidal) patients. But what can we say about the exact mechanisms of change? Even the exact working mechanism of our intervention is not straightforward as it consisted of different elements (the Train-the-Trainer element, the face-to-face training, the e-learning module, the multidisciplinary training) that have not been examined separately. So perhaps we have to accept the irony that we will never have exact evidence on implementing evidence-based guidelines. Fortunately, as stated earlier, evidence-based guidelines are not only based on results of trials but also on recommendations developed on the consensus of experts [6]. More practice-based guidelines still greatly help professionals, patients and policy makers. Therefore, we call for a practice-based guideline on evidence-based mental health guideline implementation. Similar to clinical guidelines, it should combine scientific evidence, professional consensus and users experience. It should not offer broad pieces of advice such as "multifaceted training is more effective than single interventions [27]", but it should provide clear algorithms based on which implementers can develop their own implementation. The terminology used to describe interventions and barriers should be consistent. The ultimate test case of such an implementation guideline would be to use the recommendations of the guideline to implement itself.

The Assessment of Suicide Ideation

The primary outcome of our trial was change in suicidal thoughts. We hypothesized that patients treated by multidisciplinary teams who were trained by the TtT-e program would recover more quickly from suicidal ideation as compared with patients treated by multidisciplinary teams who were not trained. Research on change in suicidal thoughts is difficult for various reasons. For one, medical ethical committees (METCs) are reluctant to approve research that involves items on suicidal thoughts. An important concern among medical committees is that asking about suicide might reinforce such thoughts or acts or result in a decrease in mood.

To examine the adverse effects of answering items about suicide, we conducted a randomized trial among students (chapter 12). On average, no effect of answering suicide items on mood was found. We did however find a small negative effect of these items for a subgroup of more vulnerable participants. The effect was comparable to the effect of mood inducing techniques [28], an often-used technique in psychological science. All current studies on the iatrogenic effect of suicide items focus on average scores [29]. These studies conclude that there is no effect of suicide items on mood when comparing the average sores of the intervention condition with the control condition. But are we really interested in average scores? Do METCs really care that on average it is safe to ask about suicidal thoughts? METCs might be more interested in the outliers that disappear in the analyses of means. Subgroup analysis of our study among students did reveal that some groups of participants showed a decrease in affect after answering suicide items. This effect was not large, but it was present. We argue that the discussion on the iatrogenic effect of suicide items would be helped by focusing on outliers, not on averages. METCs are more likely to be convinced if we acknowledge that, although on average patients do not become more negative after answering suicide items, there might be some persons that do react negatively to the items. These effects are not large, but should be taken into consideration when designing suicide research. By pretending that these small effects are not there we are unlikely to find common ground with ethical committees, which is harmful for future suicide research.

Another important barrier when assessing change in suicidal thoughts is that the available questionnaires take quite some time to administer. The most often used scale, the Beck Scale for Suicide Ideation (BSS) has 19 item, imposing a response burden on patients and test administrators. In chapter 10 of this thesis, we applied modern test theory techniques, such as item response theory and computer adaptive testing, to examine whether we could reduce the length of the BSS without losing discriminant validity [30, 31]. Using item response theory, we identified which items of the BSS were most informative when assessing suicide ideation, and which items might be omitted because they added no extra information when compared to the more informative items. Next, we demonstrated that the application of computer adaptive testing can reduce the number of items needed to assess risk for future suicidal behavior. On average, 4 items instead of the full 19 items were sufficient to classify patients as having a low or elevated risk. This is good news for patients, scientists, interviewers and METCs. By using modern test techniques, the assessment of suicide ideation and suicide risk becomes less burdensome and therefore more feasible.
The last study on the assessment of suicide ideation in this thesis was the establishment of measurement invariance over the BSS over time (chapter 11). In our trial among suicidal patients, we assessed suicide ideation both at intake and at three months follow-up. If a patient's overall score at follow-up was lower than at baseline, we argued that the patient's suicidal thoughts diminished over time. However, to reach valid conclusions on the basis of repeated measurements, it has to be ensured that a patient's score at the baseline measurement represents the same construct as the patients score at follow-up. This can be done by testing whether overall scores are measurement invariant over time. By using confirmative factor analysis, we demonstrated that the scale of the BSS is measurement invariant over time, i.e. the change found between the two time points can be attributed to actual change in suicide ideation, and not to a change in understanding of the concept of suicide.
By testing the effects of suicide items on mood, by optimizing the BSS via modern test techniques and by demonstrating measurement invariance, we hoped to have facilitated the assessment of suicidal thoughts for future studies.

Methodological Considerations and Future Studies

As stated in the introduction, research among vulnerable psychiatric patients presents several difficulties [32]. An important focus of our intervention was making contact with suicidal patients, and paying more attention to their suicidal ideation. Since most of patient data were collected via paper-and-pencil, patients in both conditions might have experienced more attention being paid to their suicidal thoughts due to the assessment of suicidal ideation. Also, as part of our safety plan, when a patient showed increased suicidal ideation at baseline in either the control or the intervention condition, we reported this to their caregiver. This monitoring and supervision has led to more attention being paid to suicidal patients in both conditions, making it more difficult to determine the effect of our intervention. Importantly, budget cuts in Dutch mental health care were introduced just after our randomization was completed, resulting in a loss of 11 departments after randomization and therefore less power.

Considering the cost outcomes, we had almost no cases that were complete, and heavily relied on statistical techniques to impute the missing data. Also, due to the unavailability of the online Routine Outcome Monitoring (ROM) of patients, we were limited to assessing patients only at baseline and after three months. This is a very short time span in which to measure any significant changes in health status or healthcare services uptake, especially for patients admitted to specialized mental health care institutions. In future studies, data on suicide ideation should be collected in a more systematic and less obtrusive manner via ROM. The usage of shorter assessment scales could help realize this.

We did not find a significant improvement of psychiatrist and psychologists' responses to our self-constructed scale on guideline implementation. One of the explanations could be that the response options to the vignettes were too easy for this group of professionals resulting in a ceiling effect. With our self-constructed scale we aimed to more concretely assess changes in professional behavior when compared to more deductive scales. Due to various problems, such as lack of audio on computers and the length of the questionnaire, we argue that our multimedia scale was not the most appropriate way to assess change in behavior. Looking back, role-plays, or even taping and analyzing treatment sessions of a sub-sample of participants presumably would have resulted in more criterion and discriminating validity and less dropout [33].

It is important to keep testing the effect of e-learning modules, even when they are already being implemented [34]. Although we did not test the effect of our e-learning module separate from the effect of the face-to-face module, our module is currently being implemented within the mental health care system. It has been noted that e-health research cannot keep up with technological advances and implementation of online innovation [34]. Standard scientific designs such as a randomized controlled trial are argued to be incapable of offering the information needed in the field of e-health. Therefore, in collaboration with the GGZ-ecademy we strive to test the efficacy of the e-learning module using more responsive and pragmatic designs such as a stepped wedge design [36]. An often used argument for the use of e-learning is its cost-effectiveness [4, 37]. Medical education is expensive [38], and via e-learning costs can be reduced [4, 37]. However, there is a lack of studies examining the cost effectiveness of e-learning [4, 35, 39-41]. Therefore, the ongoing implementation of e-learning modules in mental health care should be combined with the thorough validation of its (cost)effectiveness using pragmatic trials.

A strength of this study is its randomized controlled design, which is rare in this field of research [19, 20]. Also, the departments included were a good representation of the psychiatric departments in the Netherland making it easier to generalize the results to other institutions. Finally, given the difficulty in collecting data among suicidal patients admitted to mental health care, the difficulties with the ROM and the challenges of the ongoing budget cuts and reorganizations, the patient data collection in our trial can be regarded as quite successful. The large amount of patients included in our study makes our findings more reliable and generalizable. Therefore, our findings offer the initial evidence of effectiveness of suicide guideline training of professionals on the wellbeing of psychiatric patients, demonstrating the potential of structured guideline implementation via an e-learning supported Train-the-Trainer program.

Provisional Suggestions for Future Implementation

Our e-learning supported Train-the-Trainer program was well received by professionals, and found to be easy to disseminate. As the intervention was not found to be cost-effective, and significant effects on patients were only found for depressed suicidal patients, we need to be careful about our recommendations. We therefore end this thesis with provisional suggestions for other implementers to take into consideration when implementing the guideline.

- Train professionals to train their own team

  Being trained by a role-model peer was highly evaluated. However, most suitable trainers also tend to be really busy as they are often also expert clinicians. Therefore, make sure the trainers are not only competent, but also available for future trainings.

- Train multidisciplinary teams with a multidisciplinary training duo

  Teams were enthusiastic about the multidisciplinary element. Suicide is a multidisciplinary task, and team performance can be improved by training nurses, psychologists and psychiatrists in the same training session. Seeing that even the most experienced professional in your team struggles with asking about suicidal behavior was considered an important part of the success of the face-to-face training. We found that trainees appreciated it if the trainer duo's were also from different disciplines. The combination of a nurse and a psychiatrist was regarded as the best trainings duo. More focus should be directed at the improvement of complete teams. Offering role-plays and feedback that target multidisciplinary collaboration could result in more positive effects at team level.

- Intervene at the team and organizational level, as well as on the individual level

  Training individuals will not directly lead to change at the team and organizational level. To structurally improve guideline adherence, care should be taken to also improve teams and organizations. Teams might be improved by specifically focusing on team performance during the face-to-face training. Organizations should be stimulated to formulate what they consider relevant change and how they operationalize successful implementation.

- Use e-learning modules to support face-to-face training

  Professionals that used the e-learning module of our study were found to highly appreciate the e-learning module, and stated they had learned a lot on the topic of suicide prevention. E-learning makes the program more flexible and easier to disseminate [3].

- Adjust the focus of the training to the specific patient group

  The focus of our intervention was on making contact and addressing suicidality during treatment. This focus might not be suitable for all psychiatry teams. For example suicidal behavior within borderline patients is argued to be more complex, and asks for more specialized treatment such as dialectic behavioral therapy [42]. We therefore advise tailoring the focus of the training more for each patient group. The structure of the training (four role plays combined with theory) can remain the same.

- Evaluate and adjust the intervention based on new insights

  It is tempting to use a program such as PITSTOP suicide for years. Trainers are used to the program, and it takes quite some time to make adjustments. However, guidelines and implementation processes are highly dynamic [43]. Developers should therefore continuously evaluate the intervention and adjust it on the basis of the results and current guideline developments [44].

- Offer booster sessions every two years

  Most participants stated that they wanted to have a booster session at some point. We do not know what the most effective interval is, but currently are investigating the effect of a blended booster session with a one hour e-learning and a 3 hour booster session offered one year after the PITSTOP suicide intervention. For now, we advise to offer a booster session every two years.

- Investments are needed if all staff is to be trained

  Our intervention was not cost-effective. However, cost-effectiveness will not be the primary reason for implementing guidelines for specialized mental health care teams. Training of teams is required because knowledge on care is constantly growing, and we want our specialized professionals to apply state-of-the-art care. We have to accept that in order to have the best possible care, we should invest in the training of professionals.

- Make key professionals within MHIs responsible for suicide guideline implementation

  Mental health care has many topics that deserve attention. Currently, production is an important topic, as is a reduction of seclusion [46] and the treatment of less patients in specialized health care [47]. Without a project owner, suicide practice guideline implementation is likely to disappear of the agenda. We found that an essential element to successfully implementing the guideline was at least one highly motivated professional that kept suicide prevention a priority within the MHI.

References

1. Bool M, Doeven M: **Verminderen van suïcidaliteit: beleidsadvies: actualisering van het Advies inzake Suïcide, Gezondheidsraad 1986**: Trimbos-Instituut; 2007.

2. Grimshaw J, Thomas R, MacLennan G, Fraser C, Ramsay C, Vale L, Whitty P, Eccles M, Matowe L, Shirran L: **Effectiveness and efficiency of guideline dissemination and implementation strategies**. 2004.

3. Fairburn CG, Patel V: **The Global Dissemination of Psychological Treatments: A Road Map for Research and Practice**. *American Journal of Psychiatry* 2014, **171**(5):495-498.

4. Welsh ET, Wanberg CR, Brown KG, Simmering MJ: **E-learning: emerging uses, empirical results and future directions**. *International Journal of Training and Development* 2003, **7**(4):245-258.

5. O'Connor RC, Platt S, Gordon J: **Achievements and challenges in suicidology: Conclusions and future directions**. *International handbook of suicide prevention: Research, policy and practice* 2011:625-642.

6. van Hemert AM, Kerkhof AFJM, de Keijser J, verwey B: **Multidisciplinaire richtlijn voor diagnostiek en behandeling van suïcidaal gedrag.** . In. Utrecht: Nederlandse Vereniging voor Psychiatrie/ Nederlands Instituut voor Psychologen/Trimbos Instituut;; 2012.

7. Shea SC: **The chronological assessment of suicide events: a practical interviewing strategy for the elicitation of suicidal ideation**. *Journal of Clinical Psychiatry* 1998, **59**:58-72.

8. de Beurs DP, de Groot MH, Bosmans JE, de Keijser J, Mokkenstorm J, Verwey B, van Duijn E, de Winter RF, Kerkhof AJ: **Reducing patients' suicide ideation through training mental health teams in the application of the Dutch multidisciplinary practice guideline on assessment and treatment of suicidal behavior: study protocol of a randomized controlled trial**. *Trials* 2013, **14**(1):372.

9. Hutschemaekers GJM: **Wetten in de weg en praktische bezwaren. Mediators gewenst tussen wetenschap en (zorg) praktijk**. 2010.

10. Van Dijk MK, Oosterbaan DB, Verbraak MJPM, Hoogendoorn AW, Penninx BWJH, Van Balkom AJLM. **Effectiviness of the implementation of guidelines for anxiety disorders in specialized mental health care.** *Acta Psychiatrica Scandinivica,* 2014, 1-12.

11. Swinkels JA: **Richtlijnontwikkeling in de geestelijke gezondheidszorg: een zaak van stichten en richten**: Amsterdam University Press; 2013.

12. Grol RPTM, Wensing MJP: **Implementatie: Effectieve verbetering van de patiëntenzorg**: Elsevier gezondheidszorg; 2006.

13. McDaid D, Zechmeister I, Kilian R, Medieros H, Knapp M, Kenelly B: **Making the economic case for the promotion of mental well-being and the prevention of mental health problems**. 2008.

14. de Beurs DP, de Groot MH, de Keijser J, Verwey B, Mokkenstorm J, Twisk JW, van Duijn E, van Hemert AM, Verlinde L, Spijker10 J: **Improving the application of a practice guideline for the assessment and treatment of suicidal behavior by training the full staff of psychiatric departments via an e-learning supported Train-the-Trainer program: study protocol for a randomized controlled** *BMC trials* 2013, **14**(9).

15. Spyridonidis D, Calnan M: **Opening the black box: a study of the process of NICE guidelines implementation**. *Health Policy* 2011, **102**(2):117-125.

16. Coiera E: **Why system inertia makes health reform so difficult**. *Bmj* 2011, **342**.

17. Proctor E, Silmere H, Raghavan R, Hovmand P, Aarons G, Bunger A, Griffey R, Hensley M: **Outcomes for implementation research: conceptual distinctions, measurement challenges, and research agenda**. *Administration and Policy in Mental Health and Mental Health Services Research* 2011, **38**(2):65-76.

18. Chaudoir SR, Dugan AG, Barr CH: **Measuring factors affecting implementation of health innovations: a systematic review of structural, organizational, provider, patient, and innovation level measures**. *Implement Sci* 2013, **8**(1):22.

19. van Splunteren P, Hermens M: **Van kennis naar actie. Toepassing van richtlijnen in de ggz**. *Gedragstherapie* 2011, **44**(4):285.

20. Franx G, Niesink P, Swinkels J, Burgers J, Wensing M, Grol R: **Ten years of multidisciplinary mental health guidelines in the Netherlands**. *International Review of Psychiatry* 2011, **23**(4):371-378.

21. Weinmann S, Koesters M, Becker T: **Effects of implementation of psychiatric guidelines on provider performance and patient outcome: systematic review**. *Acta Psychiatrica Scandinavica* 2007, **115**(6):420-433.

22. May PA, Serna P, Hurt L, DeBruyn LM: **Outcome evaluation of a public health approach to suicide prevention in an American Indian tribal nation**. *American Journal of Public Health* 2005, **95**(7):1238-1244.

23. Mokkenstorm J, Huisman A, Kerkhof A: **Suicide prevention via the internet and the telephone: 113Online**]. *Tijdschrift voor Psychiatrie* 2012, **54**(4):341.

24. Grol R, Grimshaw J: **Evidence-based implementation of evidence-based medicine**. *The Joint Commission journal on quality improvement* 1999, **25**(10):503-513.

25. Colquhoun H, Leeman J, Michie S, Lokker C, Bragge P, Hempel S, McKibbon KA, Peters G-JY, Stevens KR, Wilson MG: **Towards a common terminology: a simplified framework of interventions to promote and integrate evidence into health practices, systems, and policies**. *Implementation Science* 2014, **9**(1):51.

26. Grimshaw JM, Eccles MP: **Is evidence-based implementation of evidence-based care possible?** *Medical Journal of Australia* 2004, **180**(6):S50.

27. Grol R, Grimshaw J: **From best evidence to best practice: effective implementation of change in patients' care**. *The Lancet* 2003, **362**(9391):1225-1230.

28. Martin M: **On the induction of mood**. *Clinical Psychology Review* 1990, **10**(6):669-697.

29. Dazzi T, Gribble R, Wessely S, Fear N: **Does asking about suicide and related behaviors induce suicidal ideation? What is the evidence?** *Psychological medicine* 2014:1-3.

30. van der Linden WJ, Hambleton RK: **Handbook of modern item response theory**: Springer; 1997.

31. Borsboom D: **The attack of the psychometricians**. *Psychometrika* 2006, **71**(3):425-440.

32. Pearson JL, Stanley B, King CA, Fisher CB: **Intervention research with persons at high risk for suicidality: safety and ethical considerations**. *Journal of Clinical Psychiatry* 2001.

33. Fairburn CG, Cooper Z: **Therapist competence, therapy quality, and therapist training**. *Behavior Research and Therapy* 2011, **49**(6):373-378.

34. Ruwaard J: **Wild west in de e-health: eerst invoeren, dan pas valideren**. *Kind & Adolescent Praktijk* 2014, **13**(1):24-26.

35. Glasgow RE, Phillips SM, Sanchez MA: **Implementation science approaches for integrating eHealth research into practice and policy**. *International journal of medical informatics* 2013.

36. Brown CA, Lilford RJ: **The stepped wedge trial design: a systematic review**. *BMC medical research methodology* 2006, **6**(1):54.

37. Ruiz JG, Mintzer MJ, Leipzig RM: **The impact of e-learning in medical education**. *Academic medicine* 2006, **81**(3):207-212.

38. Walsh K, Levin H, Jaye P, Gazzard J: **Cost analyses approaches in medical education: there are no simple solutions**. *Medical Education* 2013, **47**(10):962-968.

39. Cook DA, Levinson AJ, Garside S, Dupras DM, Erwin PJ, Montori VM: **Instructional design variations in internet-based learning for health professions education: a systematic review and meta-analysis**. *Academic Medicine* 2010, **85**(5):909-922.

40. Gordon M, Chandratilake M, Baker P: **Low fidelity, high quality: a model for e-learning**. *The Clinical Teacher* 2013, **10**(4):258-263.

41. George PP, Papachristou N, Belisario JM, Wang W, Wark PA, Cotic Z, Rasmussen K, Sluiter R, Riboli-Sasco E, Car LT: **Online eLearning for undergraduates in health professions: A systematic review of the impact on knowledge, skills, attitudes and satisfaction**. *Journal of Global Health* 2014, **4**(1).

42. Chang NA, Stanley B, Brown GK, Cunningham A: **Treating the suicidal patient: Cognitive therapy and dialectical behavior therapy**. *International handbook of suicide prevention: Research, policy and practice* 2011:369-382.

43. van der Weijden T, Boivin A, Burgers J, Schünemann HJ, Elwyn G: **Clinical practice guidelines and patient decision aids. An inevitable relationship**. *Journal of clinical epidemiology* 2012, **65**(6):584-589.

44. Van Bokhoven M, Kok G, Van der Weijden T: **Designing a quality improvement intervention: a systematic approach**. *Quality and Safety in Health Care* 2003, **12**(3):215-220.

45. Boumans CE, Egger JI, Souren PM, Hutschemaekers GJ: **Reduction in the use of seclusion by the methodical work approach**. *International Journal of Mental Health Nursing* 2014, **23**(2):161-170.

46. Verhaak P: **Triage in de geestelijke gezondheidszorg: hoe scheiden we de bokken van de schapen?** 2013. *Nederlands Tijdschrift voor Geneeskunde*, **157**, A6475

SAMENVATTING (SUMMARY IN DUTCH)

In mei 2012 is de multidisciplinaire richtlijn diagnostiek en behandeling van suïcidaal gedrag uitgekomen. De richtlijn is bedoeld voor psychiaters, psychologen, verpleegkundig specialisten, huisartsen en (sociaal) psychiatrisch verpleegkundigen en bevat concrete aanbevelingen voor de diagnostiek en behandeling van suïcidale patiënten. De aanbevelingen zijn gebaseerd op het best beschikbare wetenschappelijke bewijs, aangevuld met de ervaringen van experts op het gebied van suïcidaal gedrag. De algemene principes bij de diagnostiek en behandeling zijn contact maken, betrekken van naasten, veiligheid en continuïteit van zorg.

Uit onderzoek is gebleken dat aanbevelingen uit richtlijnen niet direct leiden tot verbetering van de zorg. Aanbevelingen moeten worden geïmplementeerd, in de praktijk worden gebracht. Om de richtlijn suïcidaal gedrag te implementeren in de Nederlandse Geestelijke Gezondheid Zorg (GGZ) heeft de afdeling klinische psychologie van de VU een Train-de-Trainer programma met e-learning ondersteuning ontwikkeld. Klinische en/of wetenschappelijke experts (masters) op het gebied van suïcidepreventie trainden senior hulpverleners (trainers) van afdelingen psychiatrie zodat zij in staat waren hun team te trainen (de trainees). De training gegeven door masters aan trainers duurde een dag en werd ondersteund met een e-learning module. Tijdens de een daagse training werden de algemene principes van de richtlijn en de belangrijkste theoretische modellen uit de richtlijn behandeld. Om de aanbevelingen toe te passen in de praktijk werd er gebruik gemaakt van rollenspellen. Alle deelnemers aan de training vormden een tweetal. In elk duo oefende een deelnemer (in dit geval een trainer in opleiding) een gesprek met een patiënt (gespeeld door de andere deelnemer/trainer in opleiding). De masters gaven de duo's feedback gebaseerd op de inhoud en aanbevelingen van de richtlijn. Hulpverleners werd gevraagd om een patiënt te spelen die ze daadwerkelijk in de praktijk tegen waren gekomen. Daardoor was het mogelijk de training aan verschillende afdelingen psychiatrie te geven. De inhoud van de rollenspellen werd immers bepaald door de hulpverlener zelf. De ondersteunende e-learning module bestond uit een opname van een training gegeven door verschillende masters, zodat de trainers alle elementen van de training nog eens rustig na konden kijken.
Na de training waren de trainers in staat om hun team te trainen. De training voor trainees was hetzelfde als de training die trainers zelf gevolgd hadden, en duurde ook één dag. De training voor trainees werd ook door een e-learning module ondersteund. Deze bevatte korte videofragmenten van patiënt-hulpverlener interactie, waarin de toepassing van de algemene principes van de richtlijn concreet werden gemaakt.

In dit proefschrift hebben we de effectiviteit van dit Train-de-Trainer programma met e-learning ondersteuning onderzocht. De effecten werden gemeten op drie niveaus: de professional, de patiënt en de organisatie.
We hebben gekeken of professionals na het volgen van de interventie zich meer aan de aanbevelingen van de richtlijn hielden, en of ze meer zelfvertrouwen en kennis omtrent suïcidaal gedrag lieten zien vergeleken met professionals die niet getraind waren. Ook vergeleken we de mate van suïcidale gedachten en zorggebruik van patiënten die behandeld werden door getrainde professionals met de suïcidale gedachten en zorggebruik van patiënten die behandeld werden door professionals uit de controleconditie. Op organisatieniveau waren we geïnteresseerd in hoeverre onze interventie had geleid tot een verdere verspreiding van de richtlijn en tot algemene verbetering van de zorg voor suïcidale patiënten binnen een hele GGZ instelling. Daarnaast werd in dit proefschrift aandacht besteed aan het meten van suïcidale gedachten met de Beck Vragenlijst naar Suïcidale Gedachten.

Vanuit het hele land konden GGZ instellingen afdelingen selecteren die behoefte hadden aan een training in vaardigheden op het gebied van de diagnostiek en behandeling van suïcidaal gedrag. Afdelingen die qua patiënten op elkaar leken (bijvoorbeeld ambulante depressie afdelingen) werden aan elkaar gekoppeld en gerandomiseerd in de experimentele of de controle conditie. Uiteindelijk zijn 45 afdelingen verspreid over 10 instellingen gekoppeld en gerandomiseerd.

In hoofdstuk 5 presenteerden we de resultaten van onze interventie op het niveau van de professional. 3 maanden na het volgen van de training handelden verpleegkundigen significant meer volgens de aanbevelingen van de richtlijn. Alle professionals (psychiaters, psychologen en verpleegkundigen) lieten na 3 maanden 10% meer zelfvertrouwen en kennis van suïcidaal gedrag zien. Eerdere studies lieten zien dat 10% het maximale verschil is wat je mag verwachten van het trainen van gespecialiseerde professionals. De e-learning module die de een daagse training van trainees ondersteunde werd goed ontvangen, en de trainees gaven aan dat ze na het volgen van de module meer vertrouwen hadden in de omgang met suïcidaal gedrag. Trainees die de e-learning module naast de 1 daagse training volgden deden het niet beter op de uitkomsten maten vergeleken met deelnemers die alleen de eendaagse training volgden. Er waren veel ICT problemen, zoals het ontbreken van geluidskaarten, zodat de video fragmenten van de module niet afgespeeld konden worden op de afdelingen, en de module thuis gevolgd moest worden.

Aan ons onderzoek hebben 881 patiënten meegedaan. Daarvan hadden 567 patiënten suïcidale gedachten bij aanvang van het onderzoek. Als we de

mate van suïcidale gedachten tijdens de nameting van de totale groep van patiënten die behandeld werden door een getraind team vergeleken met de suïcidale gedachten in de controle groep, vonden we geen verschil. Alle patienten, of ze nu behandeld werden door getrainde of niet-getrainde professionals lieten gemiddeld eenzelfde vermindering van suïcidale gedachten zien tijdens de nameting. Als we alleen keken naar patiënten met een diagnose depressie in combinatie met suïcidale gedachten vonden we wel een effect van onze interventie. Depressieve suïcidale patiënten die behandeld werden door een team van getrainde professionals lieten een significant snellere afname van suïcidale gedachten zien vergeleken met patiënten in de controle conditie. We hebben ook gekeken of patiënten in de interventie groep minder zorgkosten maakten vergeleken met de controle groep. De interventie bleek niet kosten effectief voor alle suïcidale patiënten. Voor de groep depressieve suïcidale patiënten vonden we dat onze interventie kosten effectief is wanneer de maatschappij bereid is substantieel te investeren in de zorg voor suïcidale patiënten.

Nadat de trainingen waren beëindigd hebben we sleutelfiguren uit instellingen geïnterviewd. We vroegen hen naar hun ervaringen met het gebruik van het trainingsprogramma en wat voor effect de interventie heeft gehad op het verspreiden van de richtlijn en op het algemene beleid rondom suïcidaal gedrag binnen hun instelling. Sleutelfiguren in de instellingen rapporteerden dat de trainingen zeer positief waren ontvangen. De effecten van de interventie op het niveau van de organisatie verschilden per instelling. Sommige sleutelfiguren meldden dat er geen verschillen waren opgetreden in het primaire zorgproces rond suïcidale patiënten. Andere sleutelfiguren rapporteerden wel veranderingen in de dagelijkse praktijk, zoals een betere registratie van suïcidaal gedrag, en de verwijdering van non-suïcide contracten. Enkele sleutelfiguren verklaarden dat de professionals meer alert zijn op suïcidaal gedrag en dat er meer aandacht is voor suïcidaliteit tijdens transitie momenten. De interventie had het taboe rond suïcidaal gedrag verminderd, en de hulpverleners hadden mede dankzij de interventie een gemeenschappelijk jargon ontwikkeld om suïcidaal gedrag van patiënten te bespreken.

De Beck Vragenlijst naar Suïcidale Gedachten

Vragenlijsten in de zorg worden als belastend ervaren. Vaak wordt suïcidaal gedrag niet uitgevraagd, omdat er zoveel andere onderwerpen zoals depressie en algemene gezondheid worden uitgevraagd. In hoofdstuk 10 pasten we moderne statistische technieken toe om te kijken of het mogelijk was om de Beck Vragenlijst naar Suïcidale Gedachten, een van de meest gebruikte vragenlijsten om suïcidale gedachten te meten, in te korten. Een computer adaptieve test simulatie toonde aan dat, om te bepalen of iemand een verhoogd suïcide risico heeft, gemiddeld 4 vragen in plaats van alle 19 vragen voldoende waren.

Een ander probleem met vragenlijsten is dat de patiënten bij de tweede meting een ander idee over suïcidaliteit kunnen hebben dan tijdens de eerste meting. Door de behandeling tussen de twee metingen hebben ze bijvoorbeeld veel geleerd over suïcidaal gedrag zodat de vragen uit de vragenlijst tijdens de tweede meting anders worden opgevat dan tijdens de eerste. In hoofdstuk 11 pasten wij confirmatieve factoranalyses toe om te kijken of de verschillen tussen twee metingen worden verklaard door een werkelijke vermindering van suïcidaal gedrag of door een veranderde opvatting van het construct suïcidaal gedrag. Onze analyses lieten zien dat er geen meetinvariantie optreed tussen de metingen en dat de verschillen tussen twee metingen dus kunnen worden gezien als echte verschillen in suïcidaal gedrag.

In hoofdstuk 12 hebben we gekeken naar mogelijke negatieve effecten van het afnemen van de Beck Vragenlijst naar Suïcidale Gedachten onder gezonde studenten. Er zijn namelijk zorgen dat het vragen naar suïcidale gedachten bij patiënten of de algemene bevolking kan leiden tot het versterken van suïcidaal gedrag. Aangetoond werd dat onder gezonde studenten de meeste deelnemers niet suïcidaal werden van het beantwoorden van de vragen over suïcidaal gedrag, maar dat bij een selecte groep van kwetsbare deelnemers (met hoger dan gemiddelde scores op de eenzaamheid) een kleine negatieve verandering in hun stemming werd gevonden.

Bespreking van de belangrijkste bevindingen

Na het onderzoek kunnen we concluderen dat een Train-de-Trainer programma met e-learning ondersteuning goed wordt ontvangen door professionals en een methode is die zich gemakkelijk laat verspreiden. Vooral de concrete handvatten om de aanbevelingen van de richtlijn toe te passen in de praktijk werden gewaardeerd. Zonder richtlijn implementatie vonden we geen verschil in gedrag. De helft van de deelnemers in de controle conditie had nog nooit van de richtlijn gehoord.
Wij vonden een effect op het niveau van de individuele hulpverlener, maar niet op team niveau. Dit betekent dat de interventie wel leidde tot verbetering van individuele vaardigheden, maar niet leidde tot verbetering van zorg op team niveau. Wij adviseren dan ook om de interventie op dit gebied aan te passen, bijvoorbeeld door in de rollenspellen aandacht te besteden aan het functioneren van het team ten aanzien van de omgang met suïcidale patiënten.

We vonden een effect van onze interventie bij de grootste groep suïcidale patiënten binnen onze studie, de groep met de diagnose depressie. We vonden geen effect bij de andere patiënten groepen. Waarschijnlijk heeft de huidige focus van de interventie vooral impact op de suïcidaliteit van depressieve patiënten, en is er voor bijvoorbeeld borderline patiënten een andere focus nodig.
De interventie is niet kosten effectief gebleken. Een mogelijke verklaring daarvoor is dat onze nameting te snel volgde op de eerste meting. De effecten van een interventie op het gebied van kosten laten zich mogelijk pas na enkele jaren zien. Ook is het van belang te beseffen dat we voor de kostenmetingen alleen hebben gekeken naar de kosten gemaakt door de patiënt zelf (gesprekken hulpverleners, opname op afdeling etc.). We hebben de kosten voor naasten (bijvoorbeeld productie verlies door mantelzorg) niet meegenomen, terwijl uit onderzoek blijkt dat deze kosten juist heel hoog zijn. Een nieuwe studie die de patiënten over een langere periode volgt, en waarin de kosten van naasten worden meegenomen kan uitwijzen of de interventie kosten effectief is op de langere termijn.
De betrokken instellingen gaven aan dat de interventie zeer welkom is om de richtlijn te implementeren. Ze gaven aan dat het een belangrijke eerste stap is, maar dat er meer nodig is om de aanbevelingen van de richtlijn volledig te integreren in de dagelijkse zorg voor patiënten. Zo is er behoefte aan advies over de structurele registratie van suïcidale gedachten en blijkt het lastig om met “ketenpartners”(huisartsen, ziekenhuizen) goede afspraken te maken over continuïteit van zorg.

Verdere verspreiding

Een belangrijke vraag is wat er gebeurt met de interventie nu de PITSTOP studie is afgerond. Zoals in veel implementatie studies vonden we effecten op de korte termijn, maar is er nog weinig bekend over de effecten op de lange termijn. De richtlijn suïcidaal gedrag beveelt aan om professionals regelmatig in vaardigheden ten aanzien van suïcidepreventie te trainen. We vroegen sleutelfiguren van instellingen die mee hadden gedaan aan de studie over de verdere verspreiding van de richtlijn. De meeste instellingen hadden de ambitie om na de PITSTOP studie nog meer teams trainen met hun eigen trainers. Echter, “tussen droom en daad staan wetten in de weg, en praktische bezwaren". Sommige afdelingen kregen niet de steun van de raad van bestuur om te training verder uit te rollen, anderen moesten externe trainers inhuren omdat de getrainde collega's het te druk hadden om zelf collega’s te trainen. De belangrijkste belemmeringen voor het trainen van volledige teams zijn het productieverlies en de logistieke problemen bij het vinden van personeel om het team dat getraind wordt te vervangen.

Ondanks alle belemmeringen zijn aan het einde van 2014 meer dan 5500 professionals opgeleid volgens onze methode. Belangrijk is dat 113online, het expertisecentrum voor suïcide preventie in Nederland, de coördinatie van de PITSTOP training na de studie gaat verzorgen. Daarnaast is de e-learning module nu beschikbaar voor meer dan 30.000 GGZ professionals die lid zijn van de zogenaamde GGZ-Ecademy (een e-learning organisatie voor de GGZ). Uitgever Bohn, Stafleu en Van Loghum biedt een aangepaste versie van onze module aan zelfstandige hulpverleners aan. Deze initiatieven zorgen ervoor dat onze interventie na het onderzoek wordt gebruikt om de kennis uit de richtlijn te verspreiden. De continuïteit van implementatie-activiteiten nadat een onderzoek is beëindigd is een belangrijk doel van het programma Doelmatigheid van de Nederland Organisatie voor Gezondheidsonderzoek en Zorginnovatie (ZonMw), dat de huidige studie heeft gefinancierd. Dit doel lijkt in dit onderzoek gehaald te zijn.

Meer informatie over trainingen voor GGZ medewerkers kunt u vinden via trainingen.113.nl.

Meer informatie over de e-learning module kunt u vinden via ggzecademy.nl.

Meer informatie over de studie en de resultaten kunt u vinden via pitstopsuicide.nl.

PUBLICATIONS

Publications within the PHD project:

De Beurs DP, de Groot MH, de Keijser J, Mokkenstorm J, van Duijn E, de Winter RF, Kerkhof AJFM. **The effect of an e-learning supported Train-the-Trainer program on implementation of suicide guidelines in mental health care.** *Journal of Affective Disorders* 2015. In Press

De Beurs DP, Ghoncheh R, Geraedts A, Kerkhof AJFM. **Psychological distress because of asking for suicidal thoughts. A randomized controlled trial among students**. *Archives of suicide research* 2015. In Press.

De Beurs DP, Fokkema M, de Groot MH, de Keijser J, Kerkhof AJFM. **Longitudinal measurement invariance of the Beck Scale for Suicide Ideation.** *Psychiatry Research* 2015. In Press.

De Beurs DP, de Vries AL, de Groot MH, de Keijser J, Kerkhof AJFM. **Applying Computer Adaptive Testing to Optimize Online Assessment of Suicidal Behavior: A Simulation Study**. *Journal of Medical Internet Research* 2014, **16**(9):e207.

De Beurs DP, de Groot MH, Bosmans JE, de Keijser J, Mokkenstorm J, Verwey B, van Duijn E, de Winter RF, Kerkhof AJFM. **Reducing patients' suicide ideation through training mental health teams in the application of the Dutch multidisciplinary practice guideline on assessment and treatment of suicidal behavior: study protocol of a randomized controlled trial**. *Trials* 2013, **14**(1):372.

De Beurs DP, de Groot MH, de Keijser J, Verwey B, Mokkenstorm J, Twisk JW, van Duijn E, van Hemert AM, Verlinde L, Spijker J, Kerkhof, AJFM. **Improving the application of a practice guideline for the assessment and treatment of suicidal behavior by training the full staff of psychiatric departments via an e-learning supported Train-the-Trainer program: study protocol for a randomized controlled.** *Trials* 2013, **14**(9).

Publications outside the PHD project

De Beurs DP, Kirtley O, Kerkhof AJFM, Portzky G, O'Connor, R. **The role of mobile phone technology in understanding and preventing suicidal behavior.** *Crisis* 2015, accepted as editorial.

Cuijpers P, de Beurs DP, van Spijker BA, Berking M, Andersson G, Kerkhof AJFM: **The effects of psychotherapy for adult depression on suicidality and hopelessness: A systematic review and meta-analysis**. *Journal of Affective Disorders* 2013, **144**(3):183-190.

Verkuil B, Brosschot JF, de Beurs DP, Thayer JF: **Effects of explicit and implicit perseverative cognition on cardiac recovery after cognitive stress**. *International Journal of Psychophysiology* 2009, **74**(3): 220-228.

Submitted

De Beurs DP, de Groot MH, de Keijser J, van Duijn E, de Winter RF, Kerkhof AJFM. **Do patients benefit from the training of mental health professionals in suicide practice guidelines? A cluster-randomized trial.** Under review of British Journal of Psychiatry.

De Beurs DP, Bosmans JE, de Groot MH, de Keijser J, van Duijn E, de Winter RF, Kerkhof AJFM. **Training mental health professionals in suicide practice guideline adherence. Cost-effectiveness analysis alongside a randomized Controlled trial**. Under review of Psychological Medicine.

De Groot MH, de Beurs DP, de Keijser J, Kerkhof AJFM. **An e-learning supported train-the-trainer program to implement a suicide practice guideline**. Under review of Internet Interventions.

De Groot MH, de Beurs DP, de Keijser J, van Duijn E, de Winter RF, Kerkhof AJFM. **Implementing suicide practice guidelines in mental health care with an e-learning supported Train-the-Trainer model. A process evaluation.** Under review of Implementation Science.

De Beurs DP, Ruwaard J, Stringer B, de Groot MH, Kerkhof AJFM. **E-learning as an adjunct a face-to-face training on suicide practice skills. A post-hoc evaluation.** Under review of Journal of Medical Internet Research.

Karyotaki E, Smit Y, de Beurs DP, Henningsen KH, Robays J, Huibers MJH, Cuijpers P. **The long-term efficacy of acute psychotherapy for depression: a meta-analysis of randomized trials**. Under review of British Journal of Psychiatry.

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Lieve Paul en Ali, Ralph, Laura en Flynn, of ik nu muzikant, schrijver, psycholoog of wetenschapper wilde worden, jullie hebben me altijd gesteund. Ik zie nu al uit naar de volgende herfstvakantie.

Lieve Marieke, Tijn en Lieve, jullie zijn veel belangrijker dan welke impact factor dan ook. You rock.

ABOUT THE AUTHOR

Derek de Beurs was born in Leidschendam on the 4th of June 1980. He attended the Stedelijk gymnasium in Leiden from 1992 – 1998.

During that time, he was mainly interested in music and literature. After high school, he started studying guitar at the Royal Conservatory, the Hague, from which he graduated in 2004. After graduation he started to study psychology in Leiden, while working as a guitar teacher and musician. He also worked as a student board-member for the interfaculty between the Royal Conservatory and the Leiden University, called the Faculty of Arts. He graduated *cum laude* for both his bachelor and his master. The topic of his masterthesis was the validation of the Leiden Scale for Cognitive Reactivity under supervision of professor Willem van der Does.

After all this studying, it was time for a job outside academia. In 2008 he entered the trainee program of the Dutch Government. After three years, his thirst for knowledge led him to pursue a PhD. He combined the practical part of the PhD-project with an interest in methodology and statistics. He graduated in 2013 as epidemiologist and biostatistician at the VU medical centre, and taught statistics to undergraduate students. During his PhD he visited the suicidal behaviour research laboratory of professor Rory O'Connor in Glasgow and the department of psychiatry in Oxford led by professor Chris Fairburn.

Derek is currently working for the Nivel, the Netherlands Institute for Health Services Research. He is developing a novel research program focusing on the transition from specialized mental health care to the general practice. He is also working on the second album of his band Milkbar. He lives in Amsterdam with his wife Marieke de Beurs - Brommersma, and his two children, Tijn and Lieve.