



MSF SWEDEN INNOVATION UNIT



Development of a Steam Sterilizer for Safe and Effective Surgical Activities

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Introduction

Many medical devices are reusable and have to be sterilized after use in order to prevent healthcare associated infections. Autoclaves, i.e. sterilizer machines using high-pressure saturated steam, are crucial to achieve effective and safe surgical activities in the field. With surgical activities in MSF requiring increasingly complex surgical instruments – e.g. tubular instruments – the demands on autoclaves continue to grow. Sterilization quality aside, autoclaves should use less water and energy per cycle, be more time-efficient, and be robust and easy to use and maintain in situations where technical support and training is lacking. This innovation project explores a new autoclave concept to complement current autoclaves in field settings where power supply is more reliable.



Sterilization expert Joost van Doornmalen performing tests with the 3M Electronic Test System (ETS). ©Andreas Larsson/MSF



Methods

The project includes multidisciplinary collaboration between several actors, with MSF Sweden Innovation Unit as coordinator and biomedical and infection control referents from the MSF Operational Centre in Brussels as problem owners. Interviews and questionnaires were used to gain insights into the needs of referents, surgeons, nurses, mobile implementation officers, and field workers. Sterilization experts with both field and research backgrounds were consulted to bring in the latest sterilization research findings along with complementary experiences from Ministry of Health (MoH) settings in resource-poor settings. Universities were involved to design new autoclave concepts and explore potential failure modes on existing heater elements. Finally, a manufacturer was brought in to do detail design and prototyping.

Partners

Sterimed, Lambda Projects, HEART Consultancy, 3M, TU Delft, KTH.



Parallel tests with a reference autoclave at Espace Bruno Corbé in Brussels. ©Andreas Larsson/MSF

Results

The project is in a prototype-testing phase, with the autoclave installed at the MSF's training and innovation centre in Brussels, Espace Bruno Corbé (EBC). Initial tests show that the prototype improves the water efficiency with at least 70% compared to reference autoclaves. Also, average cycle completion time has been reduced with at least 50%. Using an electronic testing system (i.e. 3M ETS) as a complement to Bowie-Dick tests, the sterilization cycle has been redesigned to achieve full steam penetration also in tubular instruments.



Tests with manufacturers, sterilization experts, academics and MSF staff. Photo: ©Andreas Larsson/MSF

Conclusion

Apart from the advantages regarding time and resource efficiency, a significant outcome is the improved understanding of sterilization quality that has evolved. Designing a machine that can promise the highest level of sterilization is obviously important, but the innovation project has also allowed the MSF Operational Centre in Brussels to more thoroughly assess its own protocols when it comes to sterilization. In May of 2016, the autoclave prototype will be shipped for field tests at the MSF hospital in Tabarre, Haiti.