The Economics of Dehydration and Oral Rehydration Therapy

Joseph P. Fuhr Jr.  Ph.D.
1. Introduction

Our current healthcare system is not sustainable as we approach 20 percent of GDP being spent on healthcare. A major public policy initiative is to achieve better outcomes and at the same time decrease costs. This has led to the concept of the triple aim, which is improving the population’s health, the patient experience and decreasing per capita costs. As Professor Porter has stated “value is added by care that produces the best outcomes at the lowest cost over time.” (Porter) One way of doing this is to decrease preventable healthcare incidences such as physician and emergency department visits as well as hospital admissions and readmissions. Comparative effectiveness can achieve these goals by replacing less efficient costly interventions with lower cost more efficient interventions. Further, an important way to achieve better population health and lower healthcare costs is to prevent diseases.

Many people think of dehydration as a third world problem but it also takes a tremendous toll on people and systems in developed countries. Dehydration is a problem in all societies and all socioeconomic strata. Dehydration affects the entire population and can be especially detrimental to the young and the elderly. The prevalence and problems associated with dehydration in the U.S. have generally gone unnoticed. It is estimated that around 75 percent of Americans are chronically dehydrated. Increased awareness is needed about the threat to health from dehydration and the various other diseases associated with it. In the U.S each year due to dehydration considerable medical costs and lost productivity needlessly occur. Dehydration is the number 1 cause of midday fatigue and can lead to about a 20-30 percent decrease in work productivity. Thus, billions of dollars can be saved by better knowledge of the causes and prevention of dehydration.

According to World Health Organization (WHO) 80 percent of dehydration cases can be treated with oral rehydration solution (ORS). However, in the U.S. only around 20 percent of dehydration cases are treated with ORS. This paper will examine the potential benefits of ORS and measure the potential cost savings to the U.S. healthcare system resulting from the increased use of ORS. It will also examine other benefits of ORS such as the decreases in deaths, increases in quality of life of both for the patient and caregivers and increased workplace productivity. As the healthcare crisis continues medical providers are looking for ways to decrease costs and at the same time increase the quality of care. ORS can achieve both goals. The paper will also examine the benefits that can occur from one specific type of ORS that of DrIpDrop. Increased use of DripDrop for prevention and treatment of dehydration will lead to a win-win situation that is lower medical costs and better medical outcomes which increase the quality of life of consumers.
2. Incentives for Cost Containment

The U.S. spends by far more on healthcare than any other country but outcomes do not seem to be better for these expenditures and there is no universal access. (Blackstone 2016) The U.S. spends more on healthcare than the next highest 10 countries combined. (Mercola) A look at various measures shows the U.S. is nowhere near the top of World Health Organization’s (WHO) health measures in such categories as infant mortality or life expectancy.

Over 10 years ago in Crossing the Quality Chasm, the Institute of Medicine stated, “In its current form, habits and environment, American health care is incapable of providing the public with the quality of care it expects and deserves.” (Institute of Medicine) Former CMS administrator Donald Berwick states that the U.S. is “still struggling to make highly reliable and safe health care a norm rather than an exception” (Berwick) Berwick speaks of three goals for healthcare which he refers to as triple aim: “improving the experience of care, improving the health of population, and reducing per capita costs of health care.” (Berwick) In some cases the goals conflict for example, new technology can improve outcomes but increase costs. In other cases, they are complementary cutting costs and increasing quality. “There is increased focus on improving clinical outcomes, improving safety, reducing costs, and maximizing patient safety in today’s health environment.” (Goff) Better treatment and management of dehydration can help achieve these goals.

It is difficult to get physicians to change their habits. Physicians and hospitals need incentives to decrease costs by sharing in the cost savings. The growth of Accountable Care Organizations, encouraged by the ACA, where providers earn higher profits for cutting costs, would seem to encourage the use of ORT products. It will be shown that the expanded use of ORT will help achieve the triple aim.

3. Comparative Effectiveness Research

The purpose of comparative effectiveness research (CER) is to provide information that helps clinicians and patients choose the best medical treatment option. (Blackstone 2012) The Department of Health and Human Services (HHS) defines CER as “the conduct and synthesis of research comparing different interventions and strategies to prevent, diagnose, treat and monitor health conditions in ‘real-world’ settings” to improve health outcomes.” (HHS 2009).

CER is a concept that has been around since the 1970s under various names. The American Recovery and Reinvestment Act (ARRA) of 2009 provided $1.1 billion in new public funds for CER and sparked a series of activities, including the development of federal CER priorities and efforts to enhance the nation’s research infrastructure to conduct CER in “real world” settings.

An essential element of CER is to understand the benefits and harms of different possible interventions. A major obstacle to the success of CER is that changing the
The behavior of patients and physicians is difficult, that is people are creatures of habit and physicians are often reluctant to change. For example, 10 years after publication of the first efficacy studies for percutaneous coronary intervention (PCI), less than a third of hospitals were performing PCI within 90 minutes of diagnosis and there has also been a 25-year lag between known effectiveness of beta blockers for myocardial infarction and prescribing for patients. (Naik)

Additionally, patients often expect and want a prescription for antibiotics even when it is unnecessary and harmful for the general population by increasing antibiotic resistance. Further, patient compliance with a prescribed therapy and the impact on health outcomes is another major issue. On average, one drug may be more effective than another but patients experiencing side effects or for other reasons such as taste may decrease compliance and even cease to take the medicine. Thus, the more effective treatment becomes a less effective treatment. This real-world example is illustrated by WellPoint's retrospective outcomes study in patients with mild and severe asthma (Tan). The results indicated that the best outcomes were achieved by members who were compliant with inhaled corticosteroids. However, the study also found that patients taking inhaled corticosteroids were less compliant than those taking oral medications. (Tan) As a result, the oral medication may have better real world outcomes due to increased patient compliance.

If applied properly CER can result in considerably better health outcomes and lower overall healthcare costs. Both private and public payers could save hundreds of billions of dollars through the reduction of ineffective treatments. (Marko) One example of applying CER is the use of ORS for mild and moderate dehydration which will be shown to be more effective and less costly than IVT. Also, most people would prefer to simply drink their medicine rather than have an IV stuck into them, especially if the patient is a child.

4. Prevalence of Dehydration

Dehydration is a major issue causing millions of children's deaths each year in underdeveloped countries. However, there is the misconception that dehydration is only a problem in developing countries. Unfortunately, each year a few hundred children die needlessly of dehydration in the U.S. It is estimated that up to 75% of the U.S. population is chronically dehydrated.

People often do not realize that they are dehydrated. For example, a study of firefighters in Orange County California showed that "over 90% of participants were categorized as dehydrated prior to commencing the drills." (Espinoza) For firefighters to enter a fire already dehydrated can be extremely dangerous. The combination of extreme heat and heavy clothing can lead to a loss of a liter of fluid in 20 minutes or less. (Hydration) This can lead to extreme dehydration which can cause confusion and loss of consciousness. The probably of these occurring is even greater when a firefighter is dehydrated going into a fire.
Dehydration is preventable and treatable and easy to reverse. Dehydration is a major but often overlooked problem in the U.S. with billions of dollars being spent each year needlessly on medical expenditures related to it.

Dehydration hospitalizations are preventable and considered an ambulatory care sensitive condition because they can potentially be avoided with timely effective outpatient or home care. “Preventable hospitalizations occur when persons are admitted for treatment into a hospital for a medical condition which could have been avoided had they received proper outpatient care earlier.” (Office of Statewide)

“Children and the elderly are the populations most vulnerable to dehydration.” (Adan) Pediatrics dehydration/gastroenteritis is the second most common cause of admissions accounting for 15% of all hospitalizations of children. (Shanley) Dehydration is the most common fluid and electrolyte problem among the elderly. Also, dehydration is listed as a side effect in nearly half of the top 25 most-prescribed drugs in the U.S. (Right Diagnosis) Reducing all preventable care especially hospitalizations is important to achieve the triple aim.

5. History of Oral Rehydration Therapy

Oral Rehydration Therapy (ORT) saves 3 million children’s lives a year and WHO and UNICEF have estimated that ORT has saved 60 million lives since it inception. (UNICEF) Oral Rehydration Solution (ORS) is recommended for treatment of mild to moderate dehydration by the AMA, American Association of Pediatrics, CDC, WHO and UNICEF. (Snyder) The first successful use of ORS was documented in 1945. (Santosham) ORT has been called “Potentially the most important medical discovery of 20th century.” (Lancet) However, that potential will not be achieved if it continues to be underused in the U.S. and other developed countries

In 1968 in Bangladesh it was found that adding glucose to water and salt in the right proportions could replace the lost fluids and salts by simply drinking the solution. In this case it costs almost 10 times more to treat dehydration with IV than ORT. In the 1970s many clinical studies were conducted in developing countries to document the safety and efficacy of ORT. (Santosham) In 1978, WHO adopted ORT as its principal strategy to prevent diarrheal deaths. ORT was also adopted by UNICEF and USAID, which resulted in millions of children’s lives being saved. In the 1980s a number of controlled trials in U.S. demonstrated the safety and efficacy of ORT. (Santosham) The American Academy of Pediatrics (AAP) endorsed ORT in 1985 and published guidelines concerning ORS in 1993 which were revised in 1996.

In November, 1996 a scientific symposium on ORT was held at Johns Hopkins University School of Hygiene and Public Health. The purpose of the conference was to review treatment protocols for diarrhea in U.S. which annually caused between 300 to 400 deaths among children, around 200,000 hospitalizations, 1.5 million outpatient visits and more than $1 billion in direct medical costs. Also, there are around 2600 deaths among the elderly directly attributable to dehydration. With
proper training concerning ORT, hospitalizations of children could be reduced by 100,000 per year. This would result in considerable cost savings. The consensus was that “ORT is grossly underused” and that IVT was overused, which prolonged dehydration by withholding ORT especially from children who are vomiting. (Santosham)

The AAP in March 1996 recommended ORT as a first line therapy for all children with mild to moderate dehydration. It also recommended that parents should be trained in the appropriate use of ORS. (Santosham) This would avoid the need for many doctor and ER visits. This quality of life of families would be enhanced as the anxiety of a child going for medical services would be reduced. It would also save the economic costs of providing the medical services and the indirect costs to parents in missing work to take their children for medical services. Additionally, the opportunity cost of going to the doctor and time spent at the doctor would be saved for those not missing work. It was also recommended that third party payers should reimburse healthcare providers when ORS is used and that appropriate provider codes for ORT should be established. (Santosham)

Despite all these benefits ORT is appropriately used in less than 30% of cases in the U.S. which is partially due to a lack of training among all categories of health providers and lack of knowledge by guardians of the benefits of ORT. It was recommended that ORT should be recognized as a simple cost effective way to treat diarrhea and that parent should keep a supply available at home to avoid the unnecessary cost of medical interventions. (Santosham)

6. ORT v. IV

In randomized clinical trials, ORT outperformed IV in all measured outcomes for the treatment of dehydration in children. (Atherly-John) It has been shown that there is no difference in treatment failures, that the cost of using ORT is less, that the length of stay is shorter with ORT and that there are more side effects with IVs. However, 4% of patients fail ORT and require IV. Thus, there is every reason to make ORT the first-line treatment for dehydration. (Bellemare) ORT is safe and effective for mild to moderate dehydration and can be administered in any setting by medical and non-medical personnel including patients or caregivers. IVs must be administered by specially trained staff and it is more expensive financially and in terms of human resources. The use of ORS decreased unscheduled follow up visits by 25%. (Duggan)

In the top 5 list of emergency procedures to question the American College of Emergency Physicians (ACEP) includes "avoiding instituting intravenous(iv)fluids before doing a trial of oral rehydration therapy in uncomplicated emergency department cases of mild to moderate dehydration in children.” (Lee) ORT can prevent and treat dehydration by replenishing fluids and electrolytes.
Fonseca found that children treated with ORT have fewer adverse events and decreases in length of stay in the hospital. (Fonseca) Boyd estimates that the use of ORT decreased the rate of admission from 22.5% to 5.1%, nearly an 80% decrease and the mean time spent in hospital emergency rooms dropped from 7 hours 54 minutes to 2 hours 17 minutes. (Boyd) Also, when giving information concerning the benefits of ORT v. IVT, 80% of ER physicians agreed with the data. (Bender) However, for various reasons that we address later physicians are not adopting ORT.

Also patients have reported higher satisfaction with ORT. ORT avoids the pain of IV insertion and results in fewer adverse events. IVT can result in complications such as hospital acquired infections, thrombosis, and thrombophlebitis as well as seizures and deaths. (Atherly-John) Wolosin found that 58% of patients are not satisfied with venipuncture. (Wolosin) It is often difficult to insert IVs into children. One study found 42% successful insertions on the first attempt, 72% had at most 2 and 28% at least 3. It is time intensive and requires skill. This is consistent with other studies of around 50% first time failures. There are more attempts for children under 5 and even more for children under 2. (Goff) Also, dehydration makes it more difficult to administer IVs.

It was estimated that based on salaries at the time and 30% benefit rate, an average 37 minutes to insert an IV in pediatric patient and one RN and 2 ED technicians at a wage rate of $32 for RN and $15 for each ED technician that labor cost would be approximately $50 including benefits for each attempt. ($81x37/60). Given it takes on average 2.2 attempts the estimated labor cost would be $110 for one patient which does not include the saline and needle. (Mace) There is also the opportunity cost of nurses being taken away from other duties.

Also, it is a traumatic experience for a sick child to be punctured several times with needles instead of simply having to drink. ORT will spare dehydrated children from pain and the potential complications of IV. Parents other things being equal would rather have a child drink something than have an IV especially when the clinical outcomes are the same. From a comparative effectiveness perspective the use of ORT is completely justified since it achieves the same if not better outcomes at a significant lower price. Thus, ORT would increase the quality of life for child and parents.

In 2014 hospitals faced a shortage of IV solutions and this continues today. This has increased the price of IV solutions. This higher price of saline has made ORT even more desirable from a comparative effectiveness prospective.

7. Barriers to uptake of ORT

"Fewer than 30% of American physicians surveyed comply with AAP guidelines for use of ORT." (UNICEF) “There is no evidence to support the ongoing use of IV therapy for the first line management of most causes of childhood gastroenteritis. Practitioners who treat this condition need to address the obstacles, which currently
prevent a wider acceptance and use of ORT." (Fonseca) ORS can prevent and treat dehydration by replenishing fluids and electrolytes.

There are various barriers to entry to the use of ORS which include many physicians not having the knowledge of the benefits of ORS as a first line therapy for dehydration, physicians having a high tech bias, the problems of getting reimbursement for ORS and the perverse incentive that result in more profit for medical providers when they use IVs. Also, consumers lack of knowledge about the existence and benefits of ORS and the historically poor palatability of ORS.

There are some myths concerning the use of ORS. A study by Atherly-John debunks many of these myths. These myths include “the belief that ORT requires a longer duration of therapy, is ineffective in the presence of moderate dehydration, and requires additional staff time for patient care and that parents prefer IVT.” (Atherly-John) The authors report that in a random trial of children with moderate dehydration due to acute gastroenteritis it was actually found that the mean length of stay in emergency department was less for the ORT group v. IVT, (225 minutes compared to 358 minutes) that mean staff time was less (35.8 minutes compared to 65 minutes), and that twice the parents of patients reported that they were highly satisfied more with ORT than IVT. ORT performed better on all outcome measures. (Atherly-John)

In the U.S. and many other developed countries there is often a favoring in the use of high technology and not accepting reverse innovations even though they are more effective procedures. “Reverse innovation involves the United States borrowing new ideas and products designed for less wealthy countries in order to deliver health care more efficiently” (Bottles) This presents an obstacle since medical practitioners often believe that something so easy to administer will not be considered state of the art. Only 15% of ER doctors use ORT and among physicians that are aware of ORT only 25% use it. (Lee) Understanding healthcare providers’ attitude and lack of knowledge concerning ORT is critical in understanding why ORT is the underused simple solution. (Avery)

Conners reported that approximately half of physicians believed parents and or primary physicians expected the child to get IVT even though studies have shown parents having higher satisfaction with ORT. (Conners) The perceived reluctance from parents and patient can easily be overcome through education concerning the benefits of ORT v. IVT. (Lee) Also, the medical staff need to be educated to the benefits of ORT. (Lee)

Even with medical personnel having the knowledge of the benefits of ORS. There are still barriers to physicians changing their practices. As shown above, it often takes physicians a long time to adopt best practices. Studies have shown best practices can often take up to 15 years to adopt. Another barrier is that insurance companies in most cases do not reimburse for ORT. ORT is available over the counter and
Physicians often need to appeal for medical necessary to achieve reimbursement. So a major barrier to entry has been the difficulty in getting insurance reimbursement. Often the time physicians spend trying to get reimbursement is worth more than the reimbursement itself so this gives them the financial incentive to use IVs which will be reimbursed. (Lee) Also, under the current U.S. reimbursement system hospitals can make more profit on IV than ORT. (Lee)

Physicians recommend other OTC products so with more education consumers should be willing to pay out of pocket for ORS. People are willing to pay out of pocket to avoid medical interventions. Miller estimates that cancer patients would be willing to pay on average $62.12 to avoid going to a clinic and $110.05 to avoid going to the hospital. (Miller) Thus, providing consumers with the information concerning the benefits of ORS will allow them to choose to take it and pay for it out of pocket. This will avoid the pain and suffering of the illness, the indirect costs of lost productivity and the considerable medical costs.

The often poor palatability of ORS has been a major issue in U.S. and developed countries resulting in low compliance. Palatability correlates strongly with adherence. In a survey of North American pediatric ER physicians 45% believed that the poor taste of ORS resulted in 1 in 4 toddlers refusing to take it and in a UK telephone questionnaire taste was cited as the main reason for not using ORS. (Freedman) The best product for some ailments is the one that someone takes. The most efficacious medicine is not best if no one takes it so physicians must take taste into account. The efficacy of any ORT is directly related to the amount actually consumed and this is greatly affected by its taste. The bad taste of most ORS products is due to high salt content but salt is what helps one stay hydrated.

Acknowledging the importance of palatability to children and parents in patient-centered management will improve adherence and influence clinical outcomes. Taste has been commonly disguised by sugar but professional societies in EU and U.S. recommend against sugar and many other artificial sweeteners because they may be associated with adverse effects. However, some ORS products have been developed that are not bitter tasting.

8. Economic Benefits of ORT

Reducing hospitalization rates is key to controlling healthcare costs. Preventable hospitalizations are common and costly. Dehydration is preventable and reversible. The increased use of ORS can decrease medical costs but also indirect costs such as the opportunity cost of patients and caregivers including the time and cost of transportation and lost productivity.

It has been estimated that caregivers of young children hospitalized with flu lost 73 work hours at a cost of $1456, ER visits had parents missed 19 hours at a cost of $383 and outpatient clinics visits resulted in 11 work hours missed at a cost of $222.
Out of pocket expenses were $178, $125 and $52 for inpatient, ED, and clinic, respectively. (Ortega-Sanchez) A generic cost to charge ratio non-occupation specific hourly wage of $17-22 was used as reported in 2007-09 National Compensation Survey from BLS. (Ortega-Sanchez)

There are approximately 99 million incidents of diarrhea each year and approximately 50% of those patients restrict their activities at least a day resulting in an estimated $20 billion in lost productivity. Approximately 250,000 cases are hospitalized with estimated medical cost of $560 million. Total cost to society is more than $23 billion annually. (Garthright)

Also, dehydration is the primary cause of midday fatigue resulting in 20-30 percent decrease in productivity. (Survey of 3003) At 2% dehydration there is a 20% decrease in physical performance. Dehydration can adversely affect worker productivity, safety and morale. A 23% decrease in reaction time has been shown with 4% dehydration. In contrast a blood alcohol of .08 decreases reaction time by only 17%.

Thus, by decreasing the incidence of dehydration not only will individual productivity increase but the productivity of the economy as a whole. Patients and caregivers can decrease the opportunity cost of going for unnecessary medical services. The number of medical services being used for dehydration can be drastically reduced by the use of ORT at home which also decreases the direct medical costs. Providing ORS to families during office visits can substantially reduces the need for unscheduled follow up visits. (Duggan) This not only reduces healthcare cost but the cost of patients and caregivers in the form of travelling and obtaining medical services. It also reduces missed work.

9. Medical Problems Associated with Dehydration

Dehydration is preventable and can lead to preventable physician and ER visits as well as hospitalizations and death. “Although mild dehydration can be easily corrected and is principally associated with impaired physical performance, it may be linked with common public health disorders if left chronically untreated.” (Cheuvront)

Dehydration can affect blood pressure, circulation, digestion, kidney function as well as contributing to other problems including fatigue, joint pain and weight gain. Dehydration signals can be interpreted as hunger, and people will eat more often binging sometimes on junk food.

Dehydration can result in decreased ability to concentrate and short –term memory problems, adversely affect metabolic rates. (Bennett) Dehydrated patients are twice as likely to develop pressure ulcers. (Taniguchi) Dehydration can result in mitral valve prolapse, pneumonia, uncontrolled diabetes, gastroenteritis and some forms of
cancer. (Xiao) Acute Ischemic stroke patients with dehydration have higher infection rates, worse discharge BI, worse mRS, and higher hospital costs by over $500 on average than those patients without dehydration($2470.80 compared to $1901.20). (Liu) Dehydration leads to longer recovery after illness and extended length of stay. Dehydration is an important predisposing factor in stroke recurrence. Dehydration is a common indication for readmission among cancer patients.

Taniguchi has shown that fasting before an operation which is recommended can lead to dehydration. European countries have revised the practice guidelines for preoperative fasting for the oral intake of clear fluids. “The results suggest that ORT is superior to current use of IV and should be considered as an alternative for preoperative fluid and electrolyte management.”(Taniguchi) Pash shows that there are higher costs and length of stay for patients with post admission dehydration having total cost of $33,945 compared to $22,380 and they are twice as likely to get pressure ulcers. (Pash)

The elderly often experience the negative effects of hospitalization including hospital acquired conditions. Dehydration is associated with longer stays in rehab facilities and increased mortality among hospitalized older adults.

Dehydration can result in more accidents both at home and in the workplace. It increases the risk of falls due to increased dizziness and fainting. It can also result in more vehicle accidents. These increased accidents can result in considerable costs to the healthcare system.

There are various benefits to proper hydration. Drinking water helps us eat less, gives us more energy, improves mental clarity and lowers stress, aids the digestive system and flushes toxins. Hydration helps to fight off colds and flus. Hydration is one of most important preventative measures for urinary stone recurrence (Manz) and increased water consumption decreases heart issues.

All of these factors can have a substantial effect on healthcare costs that are not directly related to dehydration. Patients that are admitted to a hospital for something other than dehydration but with dehydration as comorbidity have been shown to have higher costs than patients without dehydration.

10. Economic Estimates of Cost Savings and Increased Productivity from Lack of Use of ORS

There have been numerous estimates of the various costs of dehydration such as direct medical costs and indirect cost such as lost productivity and patients’ costs of visiting medical professionals. In this section we examine these costs. Some of the estimates vary due to the definition of preventable admissions and the time period in which they were estimated. However, with more use and education concerning
ORT the costs of dehydration can be greatly deceased since it is preventable and easily treatable.

A 1996 article by the subcommittee on Acute Gastroenteritis reported direct medical costs as a result of dehydration to be $2 billion for children and $5 billion for the population as a whole. (Acute Gastroenteritis) In a 1999 article Xiao estimated that economic burden for avoidable admissions for dehydration for the elderly to be $1.14 billion. This did not include any other medical cost such as emergency room or doctor visits. In 1997 Santosham reported that pediatric experts suggest that proper use and training concerning ORT could decrease hospitalization for children by 50% or 100,000 hospitalizations per year with potential healthcare cost savings of $1 billion.

The cost estimates also generally look at cost when dehydration is the primary diagnosis. However, a few examples will show that these estimates actually underestimate the cost of dehydration since dehydration can lead to an increased severity of a condition. For example, Pash has estimated that the cost of patients with post admission dehydration is around $11,000 higher than those without it ($33,945 compared to $22,380). The estimated total annual cost of treating pressure ulcers is $11 billion which is around $43,000 per case of pressure ulcer. (Institute for Health Improvement) According to the National Pressure Ulcer Long-term care study dehydration resulted in a 42% increase in risk of developing pressure ulcers in nursing homes. The number of pressure ulcers is increasing each year as the number of elderly increase. The use of IVs instead of ORS can lead to more PIC associated CRBSI. “Catheter-Related Bloodstream Infections (CRBSIs) are the most dangerous complication associated with I.V. treatment, increasing a patient’s risk of morbidity and death, prolonging hospital stays, and requiring additional treatments that raise healthcare costs. (Moreau) According to the CDC the average cost of CRBSI is $34,508. (Kokotis)

In the 1990s it was recognized that more than $2 billion could be saved from the use of ORS in hospitalization costs for both children and the elderly (over $1 billion each). We take this $2 billion and adjust for inflation by using the BLS medical inflation index. In 2014 potential medical costs savings are estimated to be over $3.5 billion. These numbers considerably underestimate the potential cost savings since the estimate is for only children and the elderly for hospitalizations. It does not take into consideration the outpatient costs for this population as well as other costs mentioned above. Also, it does not take into account the increased elderly population during this time period. Further it does not consider the possible savings from the age group 18 to 64. Also, the medical cost is underestimated in that the 90 million who did not go to the doctor spent some money out of pocket for remedies for the illness and the cost of transportation to and from medical services which is not included in the estimate.
Next, we examine the lost productivity due to dehydration. In 1985 Garthright estimates that there were 99 million acute cases of either vomiting or diarrhea in the United States annually. Half of which resulted in a full day of restricted activity. Physicians were contacted in 8.2 million cases and 250,000 patients required hospitalization which resulted in $560 million in medical costs and $200 million in lost productivity. There were 7.9 million non-hospitalized cases that resulted in $690 million medical costs and $2.06 billion in lost productivity. There were more than 90 million cases where physicians were not contacted that resulted in $19.5 billion in lost productivity. Garthright total estimate is a minimum of $23 billion direct and indirect cost of which $21.7 billion is for lost productivity. (Garthright)

We take the $21.7 billion that was estimated in 1985 and adjust for inflation by using BLS CPI for U.S. City average for all items. In 2014 it is estimated that the lost productivity is over $44.8 billion. This underestimates the lost productivity since it does not take into account other productivity losses due to other diseases as a result of dehydration. Also, this estimate does not take into account other losses in productivity due to dehydration such as lower productivity of people working with dehydration, loss productivity of caregivers and the increase in workplace and automobile accidents due to dehydration.

11. DripDrop Benefits

Drip Drop is classified as medical food by the FDA. It is an advanced ORT and its blend of ingredients conforms to international standards of ORS. All the ingredients are generally recognized as safe (GRAS) and thus does not need FDA certification.

In a clinical study of athletes under conditions of strong exertion, DripDrop was shown to hydrate 34% more effectively than water and 20% more than sports drinks. DripDrop has 4 times the salt content of most sports drinks and 33% more than Pedialyte. It has 2-3 times the electrolytes of most sports drinks and 33% more than Pedialyte. It has no caffeine, has half the calories of sports drinks and 25% more electrolytes than pediatric drinks. It is the first medical grade hydration product that is palatable. DripDrop resembles WHO rehydration products but taste better.

The European Society for Paediatric Gastroenterology, Hepatology, and Nutrition (ESPGN) recommends that ORS have 60mEq/L of sodium for children in developed countries. AAP recommends 45 to 50 mEq/L can be used for maintenance and rehydration of healthy children. Drip Drop has 60mEq/L. DripDrop has 6% lower osmolality than pediatric alternatives and 33% lower than sports drinks. This improves the rate of absorption in the blood stream. ESPGN recommends between 220 and 250 mOsm/L in developed countries and DripDrop ranges between 220 and 235. The amount of citrate recommended is 30mEq/L and DripDrop has 160mEq/L. Magnesium deficiency exists in U.S. with as many as 80% of people not
meeting the daily requirement. DripDrop contains 166mg/L per dose which provides 24% of the daily requirement.

ORS is approved by WHO, AMA and AAP for dehydration. In a survey of 300 pharmacists 94% approved of DripDrop as an effective ORS. Also such hospitals as the Mayo Clinic and Stanford University Medical Center are using DripDrop for treatment and prevention of dehydration. The American Society of Health System Pharmacists and Utah Drug Information Services #1 recommendation “use oral hydration whenever possible.”

12. Conclusion

Ben Franklin once said “An ounce of prevention is worth a pound of cure.” Nothing is truer than in the case of dehydration. However, in the U.S. most people are unaware of the cost of dehydration. We estimate that in 2014 the minimum direct medical costs of dehydration to be $3.5 billion and minimum lost productivity to be $44.8 billion. Dehydration is preventable and can easily be remedied by staying hydrated and the use of ORS facilitates hydration. ORT is safe and effective for mild to moderate dehydration and unlike IVT, ORT can be administered simply by drinking. ORT has fewer adverse events and decreases hospital stays compared to IVs. Also, patients prefer ORT over IVs. These estimates do not take into account the increase in quality of life due to a decrease in dehydration.

References


Dr. Mercola” Why are Americans Getting so Little in Return for the Highest Medical Bills on the Planet, Mercola.com, Mar.16, 2013.

Institute of Medicine, Crossing the Quality Chasm, National Academies Press, Washington DC, March 2001.


Espinoza N, Contreras M, Orange County Fire Authority Hydration Study, August 2007.


Office of Statewide Health Planning and Development, California: Statewide and County Trends in Access to and Quality of Outpatient Care, Measured with Prevention Quality Indicators (PQIs), 1999-2008.


“Medications or Substances causing dehydration”, Right Diagnosis, July 8, 2014.


UNICEF, Pneumonia and diarrhea: Tackling the deadliest diseases for the world’s poorest children, 2010.


Ortega-Sanchez IR, et.al. “Indirect, Out-of-pocket and Medical Costs of Influenza-related Illness in Young Children”, Vaccine, 30, June 2012, 4175-81.


Survey of 3003 Americans, Nutrition Information Center, New York Hospital-Cornell Medical Center, April 14, 1998.


Bennett, JA “ Dehydation: Hazards and Benefits”, Geriatric Nursing,, 21, March-April 2000 84-86.


Institute for Health Improvement, Preventing Pressure Ulcers, 2014.

