

# “THE IMPACT OF UNDERWEAR ON SCHOOLING: EVIDENCE FROM TANZANIA”

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## **Problem Statement**

Diarrhea in children is defined as, three or more bowel movements (passage of loose stool) per 24 hours or watery stool that is different from normal (Gidudu et al, 2011). Worldwide, diarrhea is the second cause of death and morbidity among under five years children. Each year 525, 000 under five years children lost their lives due to avoidable diarrhea diseases (WHO/UNICEF, 2015), and globally, there are approximately 1.7 billion cases of childhood diarrheal case every year (WHO, 2017), and its a big problem, education is also a big problem, and no one knows the connection. Most deaths from diarrhea occur among children of less than 2 years of age living in South Asia and sub-Saharan Africa (Walker et al, 2013). Even though diarrhea related deaths in children have declined significantly worldwide due to socioeconomic development and implementation of child survival interventions, the morbidity of childhood diarrhea in developing countries has not decreased significantly. In developing countries, a child experiences three or more episodes of diarrheal disease per year (Black et al, 2010).

Menstruation is an integral part of a woman’s reproductive life, occurring naturally in pubescent girls and women. It is estimated that menstruation is experienced by about one-quarter of the global population, or about 1.8 billion women and girls of reproductive age between 15 and 49 years (African Development Bank, 2013). Menstruation signals the onset of puberty, which usually occurs first in girls aged between 11 and 14 years. Women spend a significant proportion of their lives menstruating. Thus, menstrual health and hygiene (MHH) of women is one of the critical public health issues. Despite being an important issue, MHH is often overlooked, especially in low-income countries (LICs) due to limited resources. Existing cultural factors, beliefs, myths and taboos also influence MHH to a significant extent. People have focused on this for girls, but it only happens 1 week per month for girls, and for all kids, diarrhea might be a big deal. Could diarrhea be a similar or even greater factor for girls (and boys) in preventing school attendance/engagement? To what degree can either challenge be mitigated by provision of underwear?

## **Scientific Contribution**

Diarrhea is a major health threat for children in developing areas. Despite reduced mortality with oral rehydration therapy, the morbidity has not declined and may be increasing (Bern et al, 1992; Victora et al, 1993; Kosek et al 2003). Murray and Lopez reported that diarrheal diseases are the second leading cause of global disability-adjusted life years (DALYs) lost (Murray and Lopez, 1997). Their 1997 calculations take into account the mortality from diarrheal illnesses yet limit morbidity estimates to the short-term morbidity associated with the acute phase of overt illness. The true long-term impact among those who live through repeated or prolonged diarrheal illnesses has not been defined and thus remains poorly recognized (Guerrant, 1998). However, recently, the number of episodes of early childhood diarrhea (ECD,

diarrhea between 0 and 2 years of age) has been associated with subsequent diminished performance on physical and cognitive tests as well as with impaired physical growth at 6 to 12 years of age among a cohort of children followed since 1989 in northeastern Brazil (Guerrant et al, 1999; Niehaus et al, 2002; Moore et al, 2000). These long- term developmental deficits more than double the global DALYs from diarrhea (Guerrant et al, 2002). In addition, studies in Brazil and Peru show that enteroaggregative *Escherichia coli* and cryptosporidial infections even without diarrhea predispose to growth shortfalls, especially in very young or malnourished infants (Checkley et al, 1998; Checkley et al, 1997; Steiner et al, 1998). Furthermore, effects of early childhood diarrhea and malnutrition on later cognitive function seen in the Brazil studies (Guerrant et al, 1999; Niehaus et al, 2002) have been extended in the Peru studies, which also show a strong association of early childhood malnutrition with impaired cognitive function several years later (Berkman et al, 2002).

In developing countries, the positive relationship between schooling and birth rates, health, income equality and the environment has been well documented (Bendahmane, 1994; Bledsoe, 1999). In northeastern Brazil, poor school performance has been associated with decreased socioeconomic potential, increased fertility and decreased gender equality (Lam and Levison, 1990). The age at which a child starts school (AASS), as a measure of school readiness, and age for grade (AFG), a measure of school performance, are among the most critical measures of academic functioning and predict future economic productivity.

Menstrual hygiene management (MHM) at school is constrained by poor access to water and sanitation, lack of privacy and limited education about menstrual hygiene (Water Engineering and Development Centre, 2012) as well as social stigma and cultural restrictions on activities (McMahon et al, 2011). Menstruation poses a set of physical, sociocultural and economic challenges to adolescent girls that may interfere with their ability to attend school or to participate fully in classroom (Kirk and Sommer, 2006).

Girls' education has a long-term positive impact on personal welfare and health as well as economic and social development (United Nations, 2004), especially in low-income communities. Better-educated women are more likely to be healthier than uneducated women, participate more in the formal labour market, earn higher incomes, get married at a later age and have fewer children, potentially ensuring better health status and education for their children (World Bank Group, 2016) that can reduce poverty and contribute to a country's development. However, a number of small-scale, mostly qualitative studies have found that many school-age girls do not attend school during menstruation (McMahon et al, 2011; Mason et al, 2013; Tegegne and Sisay, 2014; World Health Organization, 2013) due to shame, fear of having visible stains on their clothing, absence of a private place to manage menstruation in school (McMahon et al, 2011; Tegegne and Sisay, 2014; Alexander et al, 2014; Long et al, 2013) or dysmenorrhoea (Dambhare et al, 2012; Zegeye et al, 2009). In an Ethiopian study, about 90% of girls stated that their academic performance or class rank declined after menarche (Tegegne and Sisay, 2014). However, little attempt

has been made to quantify the complex ways by which menstruation affects girls at school (Sumpter and Torondel, 2013).

Despite the money being spent on this issue, and the seeming media consensus on its importance, there is little or no rigorous evidence quantifying the days of school lost during diarrhea and menstruation or the effect of modern sanitary products on this time missed. There is a similar lack of evidence on the effect of diarrhea, which due to similar constraints – poor access to water and sanitation, lack of privacy and social stigma – may present related challenges to school participation. In this project we will provide the first rigorous evidence on (1) how much school boys and girls actually miss during their periods and diarrhea and (2) the causal effect of modern sanitary technology on school attendance

### **Research Questions**

This study will ask the following research questions:

- a) How much does diarrhea reduce school attendance and learning among boys and girls?
- b) How does lack of menstrual sanitary products affect school attendance and learning for girls?
- c) How does access to sanitary technology (normal underwear and specialized underwear for periods) help students to attend school on days of diarrhea and periods?
- d) How much underwear do students have?

### **Intervention Details**

The intervention will allocate approximately 10,000 pairs of underwear - to boys and girls. Girls will receive two types - normal, and those specially designed to absorb menstrual blood. Girls will be given 5 pairs of underwear per girl. 2 pairs will be normal underwears and 3 pairs will be the period designed underwears. Boys will also receive 5 pairs of normal underwear per boy.

### **Research Design**

This study will be conducted in junior and senior schools in low-income areas among a sample of boys and girls. Individuals will be randomized (at the individual-level) to the following treatment groups:

Control

Treatment 1 - underwear

Treatment 2 - underwear + panodol and anti-diarrhea meds

Treatment 3 - medication only (panodol and anti-diarrhea meds)

### **Target Population**

The target population is 3000 boys and 3000 girls between the ages of 12 years and 18 years from secondary schools in Kigoma and Mtwara region within the Demographic and Health Surveys system. Kigoma is the region with the highest prevalence of Diarrhea 21.5% (DHS 2022, Tanzania), and Mtwara is the region with the highest proportion of girls who missed school during menstruation 20% (UNICEF, 2021). 1500

boys will be in the control group and 500 boys will be in the treatment group 1, other 500 boys will be in treatment group 2, and the other 500 boys will be in treatment group 3. 1500 girls will be in the control group and 500 girls will be in the treatment group 1, other 500 girls will be in treatment group 2, and the other 500 girls will be in treatment group 3.

### **Data and Outcomes of Interest**

I will conduct early focus groups and a situational analysis. I will frame the study in 2 stages, focus groups and descriptive quantity, then the RCT. I will also measure spillovers, or the difference with quantity.

The outcomes of this study are suffering from diarrhea, school attendance, test scores, time use, anxiety, mental health, confidence, and participation of sports.

### **Policy Translation**

Ministry of Education, Science and Technology, The National Examination Council of Tanzania (NECTA), Ministry of Health, and Demographic and Health Surveys (DHS).

### **Cost-Effectiveness Analysis**

My solution of providing secondary school students with reusable specialized underwear for periods instead of disposable sanitary pads has a potential greater impact per dollar because it saves the costs of buying sanitary pads every month. It is suitable for my project to include a cost-effectiveness analysis and I plan to provide students with diaries to collect data on diarrhea and menstruation.

### **Implementing Partners**

Softcare Sanitary products Tanzania and flothefixer Tanzania are partners in charge of delivering the intervention. EDI Global Tanzania are partners in charge of evaluating or conducting research on the intervention. Ministry of Health and Ministry of Education, Science and Technology are partners in charge of policy implementations.

### **Funding Sources**

I have no funding at the moment but I am planning to apply for the J-PAL's "Learning for All Initiative" pilot funding.

### **References**

African Development Bank. 2013. <https://blogs.adb.org/blog/menstrual-hygiene-management-taboo-must-be-broken>

Alexander K, Oduor C, Nyothach E, *et al.* Water, sanitation and hygiene conditions in Kenyan rural schools: are schools meeting the needs of menstruating girls? *Water* 2014;6:1453-66.

Bendahmane DB. The quiet revolution: Child survival comes of age. *Grassroots Development*. 1994;18:2-12.

Berkman DS, Lescano AG, Gilman RH, Lopez SL, Black MM. Effects of stunting, diarrhoeal disease, and parasitic infection during infancy on cognition in late childhood: A follow-up study. *Lancet*. 2002;359:564– 571.

Bern C, Martines J, de ZI, Glass RI. The magnitude of the global problem of diarrhoeal disease: A ten-year update. *Bull World Health Organ*. 1992;70:705–714.

Victora CG, Huttly SR, Fuchs SC, et al. International differences in clinical patterns of diarrhoeal deaths: A comparison of children from Brazil, Senegal, Bangladesh, and India. *J Diarrhoeal Dis Res*. 1993;11: 25–29.

Black RE, Cousens S, Johnson HL, Lawn JE, Rudan I, Bassani DG, et al. Global, regional, and national causes of child mortality in 2008: a systematic analysis. *Lancet* (London, England). 2010;375(9730):1969-87.

Bledsoe CH; US National Research Council, Committee on Population. *Critical Perspectives on Schooling and Fertility in the Developing World*. Washington, DC: National Academy Press; 1999.

Checkley W, Epstein LD, Gilman RH, Black RE, Cabrera L, Sterling CR. Effects of *Cryptosporidium parvum* infection in Peruvian children: Growth faltering and subsequent catch-up growth. *Am J Epidemiol*. 1998;148:497–506.

Checkley W, Gilman RH, Epstein LD, et al. Asymptomatic and symptomatic cryptosporidiosis: Their acute effect on weight gain in Peruvian children. *Am J Epidemiol*. 1997;145:156–163.

Dambhare DG, Wagh SV, Dudhe JY. Age at menarche and menstrual cycle pattern among school adolescent girls in Central India. *Glob J Health Sci* 2012;4:105–11.

Gidudu J, Sack DA, Pina M, Hudson M, Kohl K, Bishop P, et al. Diarrhea: case definition and guidelines for collection, analysis, and presentation of immunization safety data. *Vaccine*. 2011; 29(5):1053. <https://doi.org/10.1016/j.vaccine.2010.11.065> PMID: 21130754

Guerrant DI, Moore SR, Lima AAM, Patrick P, Schorling JB, Guerrant RL. Association of ECD and cryptosporidiosis with impaired physical fitness and cognitive function four–seven years later in a poor urban community in Northeast Brazil. *Am J Trop Med Hyg*. 1999;61:707–713.

Guerrant RL, Kosek M, Lima AA, Lorntz B, Guyatt HL. Updating the DALYs for diarrhoeal disease. *Trends Parasitol*. 2002;18:191–193. 11.

Guerrant RL. Why America must care about tropical medicine: Threats to global health and security from tropical infectious diseases. *Am J Trop Med Hyg*. 1998;59:3–16.

Kirk J, Sommer M. *Menstruation and body awareness: linking girls' health with girls' education*. Amsterdam, The Netherlands: Royal Tropical Institute (KIT), 2006:1–22.

Kosek M, Bern C, Lozano R, Bryce J, Guerrant RL. The magnitude of the global burden of diarrheal disease from studies published 1992– 2001. *Bull World Health Organ*. 2003;81:197–204.

Lam D, Levison D. Age, experience, educational status, and differences in income: The United States and Brazil. *Pesqui Planej Econ*. 1990;20: 219 –255.

Long J, Caruso BA, Lopez D, *et al*. *WASH in schools empowers girls' education in rural Cochabamba, Bolivia: an assessment of menstrual hygiene management in schools*. New York: United Nations Children's Fund, 2013.

Mason L, Nyothach E, Alexander K, *et al*. 'We keep it secret so no one should know' – a qualitative study to explore young schoolgirls attitudes and experiences with menstruation in rural western Kenya. *PLoS One* 2013;8:e79132.

McMahon SA, Winch PJ, Caruso BA, *et al*. 'The girl with her period is the one to hang her head' Reflections on menstrual management among schoolgirls in rural Kenya. *BMC Int Health Hum Rights* 2011;11:7.

MooreSR,LimaAA,ConawayMR,SchorlingJB,SoaresAM,Guerrant RL. Early childhood diarrhoea and helminthiasis associate with long- term linear growth faltering. *Int J Epidemiol*. 2001;30:1457–1464.

Moore SR, Lima AA, Schorling JB, Barboza MS, Soares AM, Guerrant RL. Changes over time in the epidemiology of diarrhea and malnutrition among children in an urban Brazilian shantytown, 1989 to 1996. *Int J Infect Dis*. 2000;4:179 –184.

Murray CJL, Lopez AD. *The Global Burden of Disease: A Comprehensive Assessment of Mortality and Disability From Diseases, Injuries, and Risk Factors in 1900 and Projected to 2020*. Cambridge, MA: Harvard University Press; 1997.

Niehaus MD, Moore SR, Patrick PD, *et al*. Early childhood diarrhea is associated with diminished cognitive function 4 to 7 years later in children in a northeast Brazilian shantytown. *Am J Trop Med Hyg*. 2002;66:590 –593.

Steiner TS, Lima AAM, Nataro JP, Guerrant RL. Enteroaggregative *Escherichia coli* produce intestinal inflammation and growth impairment and cause interleukin-8 release from intestinal epithelial cells. *J Infect Dis*. 1998;177:88 –96.

Sumpter C, Torondel B. A systematic review of the health and social effects of menstrual hygiene management. *PLoS One* 2013;8:e62004.

Tegegne TK, Sisay MM. Menstrual hygiene management and school absenteeism among female adolescent students in Northeast Ethiopia. *BMC Public Health* 2014;14:1118.

United Nations, World Population Monitoring 2003. *Population, education and development, in United Nations publication, 2004.*

Walker CL, Rudan I, Liu L, Nair H, Theodoratou E, Bhutta ZA, et al. Global burden of childhood pneumonia and diarrhoea. *Lancet* (London, England). 2013;381(9875):1405-16.

Water Engineering and Development Centre. Developing knowledge and capacity in water and sanitation: menstruation hygiene management for schoolgirls in low-income countries, 2012. [http://wedc.lboro.ac.uk/resources/factsheets/FS007\\_MHM\\_A4\\_Pages.pdf](http://wedc.lboro.ac.uk/resources/factsheets/FS007_MHM_A4_Pages.pdf)

WHO. Diarrhoeal disease. Factshhet update may 2017. Access on [<http://www.who.int/mediacentre/factsheets/fs330/en/>]. 2017.

WHO/UNICEF. WHO and Maternal and Child Epidemiology Estimation Group (MCEE) estimates 2015. Accessed on [<https://data.unicef.org/topic/child-health/diarrhoeal-disease/>] 2015.

World Bank Group. Education Global Practice: Smarter Education Systems for Brighter Futures, 2016. <http://documents.worldbank.org/curated/en/212341467999691082/pdf/98450-REVISED-PUBLIC-WB-EGP-Reaching-Girls-040816-final6-web.pdf>.

World Health Organization. *Progress on sanitation and drinking- water – 2013 update*, 2013.

Zegeye DT, Megabiaw B, Mulu A. Age at menarche and the menstrual pattern of secondary school adolescents in northwest Ethiopia. *BMC Womens Health* 2009;9:29.