
SAFE AND SANITARY LATRINES

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A report for the Asante Africa Foundation



Educating Children | Transforming Worlds

EXECUTIVE SUMMARY

There is an insufficient supply of school-based sanitation facilities to meet the demands of students in rural Kenya and Tanzania. Less than 50% of schools in Kenya and Tanzania have access to adequate sanitation. This leads to poor educational outcomes — especially in terms of attendance, enrollment, and retention — that are borne disproportionately by female students, especially during puberty. The effects of this latrine supply deficiency on educational outcomes manifest through several channels: (1) health, (2) menstrual health, and (3) behavioral, cultural and social channels.

An analysis the evidence of these barriers to education, and of interventions designed to overcome them reveals clear evidence that latrine construction has promising gains to deliver in terms of increased access to education for girls.

Along with latrine construction or improvement, we analyze hand washing stations and sanitary pads as complementary measures. Considering effectiveness, costs and sustainability, the potential gains of latrines alone must be weighed against the risk of increasing fecal contamination of children. We therefore recommend that latrine construction efforts provide rainwater capture and hand washing stations, as well as ensure adequate latrine-to-student ratio.

We find that sanitary pads can be expected to increase access to education for girls by facilitating comfortable and private menstrual hygiene management (MHM). We therefore recommend their provision, with careful attention to appropriate changing and disposal facilities.

TABLE OF CONTENTS

1. BACKGROUND.....	3
2. PROBLEM DEFINITION.....	4
3. ANALYTICAL FRAMEWORK AND EVIDENCE REVIEW.....	5
4. SAFE AND SANITARY LATRINES PACKAGE ALTERNATIVES.....	10
5. CRITERIA FOR THE ANALYSIS OF INTERVENTION PACKAGES.....	12
6. ANALYSIS OF INTERVENTION PACKAGES.....	14
7. RECOMMENDATIONS.....	18
REFERENCES.....	20
APPENDIX 1: Research Details.....	24
APPENDIX 2: Toolkits for latrine design.....	31
APPENDIX 3: Intervention Package Illustrations.....	34
APPENDIX 4: Expert Bio's.....	36
APPENDIX 5: Cost Assumptions.....	37

1. BACKGROUND

Asante Africa Foundation is a non-profit organization that aims to improve educational outcomes in East Africa. Its mission is to educate and empower the next generation of change agents, whose dreams and actions transform the future for Africa and the world.

Asante Africa Foundation's approach targets three key areas:

Access to Education – School infrastructure, girls' advancement, merit based scholarships, as well as student materials and resources.

Learning in the Classroom – Enhanced learning environments, as well as educator support and development.

Beyond the Classroom – Leadership development, income generation preparedness, girl-focused life skills, and locally led youth initiatives.

Asante Africa's school sanitation approach in rural Kenya and Tanzania includes both education and infrastructure components. Asante Africa seeks to assess the value of expanding the reach and depth of its girls' advancement programming by integrating a greater focus on safe and sanitary latrines.

2. PROBLEM DEFINITION

There is an insufficient supply of school-based sanitation facilities to meet the demands of students in rural Kenya and Tanzania. Less than 50% of schools in Kenya and Tanzania have access to adequate sanitation.¹ Latrine supply is likely to be much lower in Asante Africa's region of operation.² The consequences of this supply deficiency are poor educational outcomes — especially in terms of attendance, enrollment, and retention — that are borne disproportionately by female students. The World Bank estimates that pubescent girls lose as much as 10 to 20 percent of time at school due to the absence of clean and private sanitation facilities that allow for menstrual hygiene³; Asante Africa seeks research-based interventions to address this problem. Specifically, the foundation requires evidence regarding the impact of sanitation facilities on school retention and attendance of girls in rural Kenya and Tanzania. This report first presents a review of research on school-based sanitation interventions. This evidence is then analyzed to assess the rationale for the role of sanitary latrines in promoting girls' access to education. To supplement this research and analysis, this report contains a review of best-practice design features for the construction of school latrines.⁴

¹ (UNICEF 2014). In many cases, reported data do not include the quantity or quality of the sanitation services provided in schools and, similar to water supply coverage, data are not considered widely reliable. A few countries do consider adequacy criteria such as quantities, gender segregation, and access to “improved” facilities (based on the UNICEF/WHO Joint Monitoring Programme (JMP) definition), while others do not include aspects beyond the presence of a toilet, regardless of quantity or condition”

² Service provision is generally lower in rural areas relative to national averages. Interviews with local actors, including a District Water Engineer, indicate that sanitation services, i.e. the presence of improved pit latrines, are much lower in Asante Africa Foundation's region of that operation.

³ (World Bank 2005)

⁴ Asante Africa also requested an exploration of strategies for the maintenance of latrines in impoverished, rural communities of arid southwest Kenya and northeast Tanzania. However, we were unable to discover any evidence of existing successful maintenance strategies. We discuss maintenance in our analysis, but are unable to report on successful practices currently in place.

3. ANALYTICAL FRAMEWORK AND EVIDENCE REVIEW

3.1 Analytical Framework

To analyze the different interventions that we will present, we gather evidence on two types of linkages. First, we trace components of school sanitation⁵ to outcomes in health, menstrual health, and behavioral norms. After that, we trace pathways from effects of previous outcomes into improvement of educational outcomes measured as school enrollment, attendance and retention. This framework is shown in Figure 1.

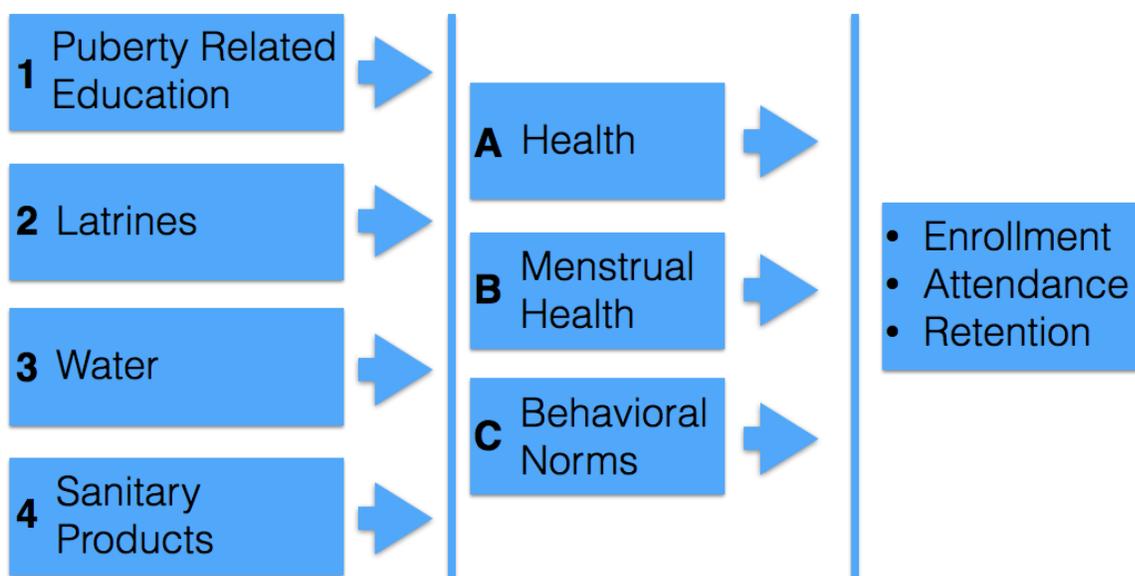


Figure 1. Analytical Framework

An intervention improves educational outcomes through behavioral norms if it:

- i. enables girls to go to the toilet in comfort, privacy, and without feeling threatened,
 - ii. gives parents the comfort that their girls are in a safe and dignified environment,
- or

⁵ We define sanitation as a state achieved via the provision of clean water, and adequate waste disposal – including clean latrines, hand washing facilities, and a reliable source of running water.

- iii. boosts confidence levels among menstruating girls (for example, by providing an environment that helps them maintain stain-free clothes).

3.2 Evidence

The evidence presented in this section includes a literature review and expert interviews, as well as interviews with current and former Asante Africa staff. Bios of the interviewed expert are presented in Appendix 4.

We focus on the effects latrine construction, water access, and sanitary pads. A brief of the main findings is presented in this section, and Appendix 2 presents a detailed description of the reviewed evidence.

2. Latrines and A. Health

Studies suggest that investments in child health can improve educational outcomes, since many school days are missed due to water-related illnesses. The latest evidence about this issue can be found in (Adukia 2014), who examines the effect of latrine construction on educational outcomes in India. She finds that access to school latrines has larger estimated impacts on primary school enrollment compared to upper-primary school enrollment, which suggest that latrines have important impacts through child health.

In a different study, (Greene et. al. 2014) authors find that the addition of latrines significantly increases the risk of *Escherichia coli* contagion among girls. This finding suggests that increased usage of latrines without uptake of hygiene behavior change (such as hand-washing) may pose a risk to children. According to Edward Miguel, professor of developmental economics at UC Berkeley⁶, and others there is an unanswered question as to the efficacy of improving educational outcomes through latrine construction in the absence of hand washing facilities, and a reliable source of clean, running water.

⁶ Edward Miguel is an Oxfam Professor in Environmental and Resource Economics, Dept. of Economics, and Faculty Director of the Center for Effective Global Action (CEGA) at the University of California, Berkeley.

2. Latrines and B. Menstrual Health

While many studies cite menstrual health related barriers to education (UNICEF and Mailman School of Public Health, Columbia University 2014, World Bank 2005, Fehr 2010, Grant et al. 2013, Sommer 2009, and Ngales 2007), evidence is mixed on the impact of latrine construction on girls' educational outcomes via menstrual health channels. One possible explanation of this could be the differences in latrines design. If only some designs are effective, this would imply that research using the wrong design would not find any evidence. For example, (Adukia 2014) finds that only sex-differentiated latrines improve attendance for upper primary school girls, while unisex latrines did not. Relevant latrine characteristics may include ease of maintenance and cleanliness, whether facilities are large enough to accommodate changing of MHM products and clothes, and whether latrines have water points for washing cloths, self and clothes.⁷

2. Latrines and C. Behavioral Norms

We find two different channels whereby latrine construction can generate behavioral changes, affecting school outcomes, and latrine design is relevant in both. First, (Adukia 2014) finds that sex-differentiated latrines improve attendance not only for upper primary school girls but also for female teachers, which can generate a difference in the educational experience of the students.

A second potential behavioral change is due to a cultural practice of the Maasai, an ethnic group of about 1,600,000 people in southern Kenya and Northern Tanzania. For the Maasai, men and women may not use a latrine that is under the same roof. If appropriate sex-separated facilities are not available in schools, this may impact educational outcomes by increasing girls' absenteeism.

3. Water and A. Health

Preventing communicable diseases is a major driver of school attendance (Miguel and Kremer 2004), and handwashing facilities are a very effective way of fighting them.

⁷ See Appendix 2: Toolkits for Latrine Design

There is ample evidence suggesting that handwashing stations improve school attendance, with a larger effect for girls (Patel et al. 2012, Blanton, et al. 2010, Nandrup-Bus 2009, Freeman et al. 2012, and Talaat et al. 2011).

3. Water and B. Menstrual Health

Although there is no evidence on the effects of water on menstrual health, where girls use reusable cloths, it is likely that the effect of latrines on menstrual health is limited without an appropriate source of water to clean the cloths. This leads us to presume, as proposed by (Sumpter and Torondel 2013), that water facilities can generate a positive effect through an improvement on menstrual health.

3. Water and C. Behavioral Norms

Beyond the absenteeism reduction through better health, (Garn et al. 2014) finds that the provision of a water supply, hygiene promotion and water treatment improve school enrollment, with a bigger effect among girls.

4. Sanitary Products and A. Health

Although provision of sanitary products and disposal facilities does not have an effect on general health because it is directly focused on menstruation, experience shows that there is a potential negative effect without adequate disposal facilities: without disposals, girls mostly throw the sanitary pads to the latrine pits, which will most likely collapse the latrine, leaving it unusable.

4. Sanitary Products and B. Menstrual Health

Most evidence shows a positive effect of sanitary pads over school attendance (Dolan et al. 2014, Sumpter and Torondel 2013). However, a randomized control trial in Nepal developed by (Oster and Thornton 2011) finds that moving from reusable cloths to sanitary cups does not improve attendance, mainly because reusable cloths solve the problem by itself, which is contrary also to qualitative evidence and international reports (UNICEF and Mailman School of Public Health 2014, World Bank 2005, Fehr 2010, Grant et al. 2013, Sommer 2009, and Ngales 2007). However, the applicability of this

study to the region where Asante Africa works may not be valid due to geographic and cultural differences, specially the availability of cloths and water to clean them.

4. Sanitary Products and C. Behavioral Norms

Beyond attendance, evidence shows that sanitary products improve girls' educational experience: they feel more comfortable and secure at the school, which can positively affect their performance. For example, (Dolan et al. 2014) finds that rural girls who received pads report to experience a reduction of "lack of self-confidence", "insecurity" and "difficulty concentrating".

4. SAFE AND SANITARY LATRINES PACKAGE ALTERNATIVES

There are multiple linkages through which improved school sanitation, including the construction of latrines, may impact girls' access to education. We analyze the following set of potential interventions:

1. **Status quo (SQ):** We define the status quo as the continued provision of Asante Africa's educational programming, in the absence of a sufficient supply of latrines⁸, water and hand washing facilities, and sanitary pads. All other intervention packages assume the additional provision of educational programming.

2. **Ventilated Improved Pit (VIP) Latrines:**⁹ Ventilated improved pit latrines don't need water to function. They consist of holes in the ground, covered with concrete slabs that can be sealed when full or emptied for re-use after a period of stabilization. The following are characteristics of the VIP latrines assumed in our analysis:
 - Sex-differentiation, with at least one latrine per 30 male students and one per 25 female students. Also, they should be in separated blocks.
 - Structure strong enough to ensure that it will not collapse.
 - Doors with inside locks, and walls that provide an adequate level of privacy, specifically for girls.
 - Girls' latrines have sufficient space for them to change their clothes. Also, they must have a mirror and shelves or hooks.

3. **Water and hand washing facilities**¹⁰: Water supply is essential for hand washing and for menstruation-friendly hygiene practices. Female students and staff need water to wash themselves, their hands and cloths. Given regional

⁸ The status quo assumes that the baseline supply of latrines is extremely low. Latrines are simple pit latrines, prone to collapse, not sex-differentiated, and student-to-latrines ratios are above recommended guidelines

⁹ See Appendix 2 for illustrations.

¹⁰ See Appendix 2 for illustrations.

context, we define the provision of water source as rainwater capture and hand washing stations in close proximity to the latrine.

- 4. Sanitary Pads¹¹:** Asante Africa has received Always sanitary pads from Procter & Gamble. We define sanitary pads as the type provided by Procter & Gamble. The provision of sanitary pads should also include disposal methods. Disposal methods can include burning and burying, or the provision of a bin inside the latrine to facilitate transportation of used pads to the disposal site.

The intervention packages that we analyze are listed in table 1:

Table 1. Intervention Packages

Intervention Packages	Educational Program	Latrines	Water	Sanitary Pads
1. Status quo (SQ)	✓	✗	✗	✗
2. Latrines (L)	✓	✓	✗	✗
3. Latrines + Water (LW)	✓	✓	✓	✗
4. Latrines + Sanitary Pads (LP)	✓	✓	✗	✓
5. Latrines + Water + Sanitary Pads (LWP)	✓	✓	✓	✓

¹¹ See Appendix 2 for illustrations.

5. CRITERIA FOR THE ANALYSIS OF INTERVENTION PACKAGES

The intervention packages described in the previous section aims to increase educational outcomes of primary school students in rural Kenya and Tanzania through the increased supply of school-based sanitation, with a focus on girls. We define improvement in educational outcomes in terms of retention, enrollment, and attendance.

To consider the relative merit of these intervention packages, the following criteria must be considered: (a) cost (b) effectiveness, and (c) maintenance feasibility.

A. Cost

i. One-time cost: Each intervention is weighed on its relative initial cost. Initial costs are expected to be less than lifecycle costs for all interventions. See Appendix 4 for cost assumptions. Numbers should be interpreted relative to each other, and not as absolute costs.

ii. Maintenance Costs - Intervention packages vary in terms of expected repair and maintenance costs, as a function of local capacity, environmental factors, materials, and technology. We analyze each intervention package's sustainability based on expected long-term costs.

B. Effectiveness

We analyze the effectiveness of each intervention package in terms of its potential to improve educational outcomes through the following three pathways: (i) health (ii) menstrual health, and (iii) behavioral norms.

i. Health: Sanitation inhibits the spread of communicable diseases and mitigates illness-related absenteeism on the part of both teachers and students. We analyze the effectiveness of intervention packages based on their expected impact on educational outcomes via the prevention of illness.

ii. Menstrual Health: Improper management of menstruation can result in severe discomfort and infection. We analyze the effectiveness of intervention packages based on their expected impact on educational outcomes via improvements in menstrual health.

iii. Behavioral norms: These are norms through which behaviors surrounding sanitation, menstruation, and other health factors interact with educational outcomes. An intervention achieves better educational outcomes via behavioral norms if it achieves any of the following:

- a) Enables girls to use the toilet comfortably and privately, without feeling threatened.
- b) Ensures parents that their girls are in a safe and dignified environment.
- c) Boosts confidence levels among menstruating girls by providing an environment that helps them maintain stain-free clothes.

C. Feasibility of Maintenance

Intervention sustainability also depends on behaviors and expected long-term adoption. We analyze sustainability based on expected behaviors surrounding the use of each intervention package.

6. ANALYSIS OF INTERVENTION PACKAGES

Table 2 below is used to structure and summarize our analysis. The colors in the table have the following meaning:

- Green is the least of a negative attribute, for example cost, or the most of a positive attribute, for example effectiveness.
- Yellow is 'medium' using the same rationale.
- Red is the most of a negative attribute or the least of a positive attribute.

Table 2. Main Findings

	Cost		Effectiveness			Feasibility of maintenance
	One time	Maintenance	Health	Menstrual health	Behavioral norms	
Status quo	Green	n/a	Red	Red	Red	n/a
Latrines only	Yellow	Yellow	Red	Yellow	Yellow	Red
Latrines & water	Red	Red	Green	Yellow	Yellow	Yellow
Latrines & sanitary pads	Yellow	Yellow	Red	Green	Green	Red
Latrines, water& sanitary pads	Red	Red	Green	Green	Green	Yellow

A. COST

One-time costs:

- The **status quo** is the least costly, hence green.
- **Latrines only** - Latrine construction for a school of 300 students costs \$4,654 per school,¹² and so yellow (more costly than status quo but less costly than at least one other option below).
- **Latrines and water** – Latrines with access to water are more costly. With respect to water, expert interviews suggest boreholes are extremely expensive to dig and maintain. Wherever possible, rainwater capture and other technology solutions are preferred. A typical rainwater catchment system for a primary school in Kenya costs \$3,000¹³, on top of the basic cost of a latrine, which makes this alternative red.

¹² See Appendix 4: Cost Assumptions. This figure does not include recurrent costs.

¹³ According to Waterlines, a non-profit organization with water projects in 15 developing countries

- **Latrines with sanitary pads** – Sanitary pads will cost an additional \$300 to 500¹⁴ for distribution. Disposal stays simple with burning or burial. Asante Africa has received a grant in 2015 including sanitary pads from Proctor and Gamble, there is no new expense from procuring the pads. Since this cost is not significantly different from the cost of latrines only, we mark this package yellow.
- The final alternative (with latrines, water and sanitary pads) is marked red.

Maintenance costs:

- Given the variation in levels of maintenance of the status quo (dirty to usably clean), a strict definition of maintenance costs does not apply here.
- **Latrines Only** - We estimate average latrine maintenance costs at \$2,635 / school / year¹⁵, but costs vary widely. Lifecycle cost analyses indicate that the recurrent costs of latrine maintenance exceed the costs of construction over a five-year period. We mark this yellow.
- **Latrines and Water** - Maintenance of rainwater systems costs an average of \$250/school/ year¹⁶ on top of the latrine maintenance cost (average expenditure on rainwater capture systems in Kenya was \$0.64 per student and \$0.17 per student for drinking water systems¹⁷). Hence the ‘with water’ latrines alternative is more costly than latrines alone
- **Latrines and Sanitary Pads** - For latrines with sanitary pads and disposal, maintenance costs of disposal facilities are likely to be minimal (however, there are costs associated with the risk of latrine back-up if pads are not disposed of properly). So this is yellow.
- **Latrines, Water, and Sanitary Pads** - The final alternative includes all costs and hence is marked red.

¹⁴ Asante Africa distribution past expense estimates

¹⁵ See Appendix 4: Cost Assumptions

¹⁶ See Appendix 4: Cost Assumptions

¹⁷ Financial Management of School WASH Programs, Understanding the recurring costs for maintaining a school WASH program. Sustaining and Scaling School Water, Sanitation and Hygiene Plus Community Impact. SWASH+. 2012. <http://www.washinschools.info/docsearch/title/178660>

B. EFFECTIVENESS

Status Quo - The status quo is not sufficient to overcome the barriers to education that have been examined in this report. We consider the status quo to be a baseline (all red) on the three aspects of effectiveness. The effectiveness of alternative packages is considered relative to this baseline.

Latrines Only

- Red on health: The provision of latrines increases enrollment and lowers dropout rates for both boys and girls across different ages through improvement in health outcomes (Adukia, 2014). However, evidence also suggests that latrines may lead to increases in the incidence of communicable diseases in the absence of running water and hand-washing facilities (Grant et. al. 2013).
- Yellow on menstrual health: As discussed in the evidence, the lack of lack of private sanitation facilities acts as a barrier to attending school for menstruating girls. The provision of sex-specific latrines might increase enrollment of pubescent age-girls' by addressing everyday concerns for health, privacy, and safety (Adukia 2014).
- Yellow on behavioral norms: Sex-specific latrines give girls the opportunity to use the latrine when they want to without feeling threatened by boys, and they reassure parents of the safety and dignity of their girl children.

Latrines and water

- Green on health: Running water/ hand-wash facility eliminates the fear of increase in spread of communicable diseases due to latrines.
- Yellow on menstrual health (assuming girls are not using any sanitary product/cloth): Though girls stand to gain from the ability to clean themselves with water, it is not a major change in their well-being insofar as menstrual health is concerned. However, if girls are using reusable cloth in a hygienic way then availability of water can lead to significant gains for menstrual health by enabling them to wash the cloth.
- Yellow on behavioral norms: Similar to latrines only.

Latrines and sanitary pads

- Red on health: Similar to latrines only.
- Green on menstrual health: While evidence of impact on Reproductive Tract Infections and Bacterial Vaginosis infection rates via improved Menstrual Health Management (MHM) is weak, access to disposable pads allows for increased comfort and privacy given ease of changing during the day without leaving school. This offers a major improvement in the ability of girls to manage menstruation with dignity and safety.
- Green on behavioral norms: In addition to the benefits from just latrines, sanitary pads can significantly reduce the chances of girls staining their uniforms. Girls are more likely to stand up and participate in class if they feel comfortable and confident given their sanitary product.

Latrines, water, and sanitary pads

- Given the analysis of previous packages, this will be green on all three dimensions of effectiveness.

C. FEASIBILITY OF MAINTENANCE

The feasibility of maintenance of latrines depends largely on the administrative capacity of the school. We posit that maintaining clean latrines is easier when water is available than when it is not. As for the maintenance of rain water systems, according to the Director of Dig Deep, rainwater capture systems are relatively easy to maintain with locally available skills and materials, given minimal training. Disposal of sanitary pads is again a function of the administrative capacity of the school, once girls dispose of pads into designated bins. Given this, we mark all packages without water as red on this criterion and all packages with water as yellow (since administrative capacity cannot be forecasted).¹⁸

¹⁸ As with maintenance costs, we do not rank order status quo due to the vast variation in the existing levels of maintenance of the status quo.

7. RECOMMENDATIONS

Should we build latrines? UNICEF and other major actors investing in water, sanitation, and hygiene have embraced recent evidence from an evaluation of a national school-latrine construction initiative in India (Adukia 2014). There is clear and convincing evidence that latrine construction has promising gains to deliver in terms of increased access to education for girls. These gains are achieved through improved health, and menstrual health conditions, as well as through behavioral, cultural and social channels.

Given the lack of access to water that characterizes schools in Asante Africa Foundation's region of operation, these potential gains must be weighed against the risk of increasing fecal contamination of children. This risk is higher when student-to-latrine ratios are above recommended guidelines. Therefore, we recommend that latrine construction efforts adhere to these guidelines. To minimize this risk, efforts should be made to explore low cost options for hand washing facilities. Rainwater capture will improve access to water during parts of the year. These systems can be expensive to install, but maintenance can be handled locally. Soap for hand washing and washing of reusable cloths must be purchased. There exist several established funding models reviewed in the WASH literature, though they are outside the scope of this report.

Prior to construction efforts, attention must be given to plans for latrine maintenance, as well as maintenance of water point infrastructure. Like any infrastructure, latrines require maintenance. Evidence suggests that the recurrent costs of latrines can exceed the initial costs of construction over the latrine's lifetime (WASHCost 2012). The same is true for rainwater capture installations and other water access improvements. There is a great deal of expertise available regarding effective latrine construction, and a wide variety of options. Key design characteristics from a best practice analysis are presented in the appendices, together with references to comprehensive toolkits.

What about sanitary pads? At present, Asante Africa Foundation is set to distribute Always sanitary pads to schools in its region of operation. Evidence has established that

sanitary pads can be expected to increase access to education for girls by facilitating comfortable and private MHM where existing strategies are insufficient. However, without appropriate changing and disposal facilities, sanitary pads may be ineffective. Girls may still feel uncomfortable changing pads if they are unable to wash their hands afterward. In the absence of appropriate disposal facilities or mechanisms, such as incinerators or pits for burning or burying, the provision of sanitary pads may cause latrine backup and failure. Thus, when providing sanitary pads, we recommend that bins be placed in latrines, and careful attention be paid to disposal management prior to distribution.

REFERENCES

- Abrahams, N., Mathews, S., & Ramela, P. (2006). Intersections of “sanitation, sexual coercion and girls’ safety in schools”. *Tropical medicine & international health*, 11(5), 751–756.
- Adukia, A. (2014). Sanitation and education. Harvard Graduate School of Education.
- Birdthistle, I., Dickson, K., Freeman, M., & Javidi, L. (2011). What impact does the provision of separate toilets for girls at schools have on their primary and secondary school enrolment, attendance and completion? A systematic review of the evidence. EPPI Centre, Social Science Research Unit, Institute of Education, University of London. London, UK.
- Blanton, E., Ombeki, S., Oluoch, G. O., Mwaki, A., Wannemuehler, K., & Quick, R. (2010). Evaluation of the role of school children in the promotion of point-of-use water treatment and handwashing in schools and households—Nyanza Province, Western Kenya, 2007. *The American journal of tropical medicine and hygiene*, 82(4), 664-671.
- Dolan, C. S., Ryus, C. R., Dopson, S., Montgomery, P., & Scott, L. (2014). A Blind Spot in Girls’ Education: Menarche and its Webs of Exclusion in Ghana. *Journal of International Development*, 26(5), 643–657. Retrieved from <http://dx.doi.org/10.1002/jid.2917> doi: 10.1002/jid.2917
- Dreibelbis, R., Greene, L. E., Freeman, M. C., Saboori, S., Chase, R. P., & Rheingans, R. (2013). Water, sanitation, and primary school attendance: a multi-level assessment of determinants of household-reported absence in Kenya. *International Journal of Educational Development*, 33(5), 457–465.
- Fehr, A. (2010). Stress, menstruation and school attendance: effects of water access among adolescent girls in South Gondar, Ethiopia. Summary report for CARE Ethiopia, 29.
- Freeman, M. C., Greene, L. E., Dreibelbis, R., Saboori, S., Muga, R., Brumback, B., & Rheingans, R. (2012). Assessing the impact of a school-based water treatment, hygiene and sanitation programme on pupil absence in Nyanza

Province, Kenya: a cluster-randomized trial. *Tropical Medicine & International Health*, 17(3), 380-391.

- Garn, J. V., Caruso, B. A., Drews-Botsch, C. D., Kramer, M. R., Brumback, B. A., Rheingans, R. D., & Freeman, M. C. (2014). Factors Associated With Pupil Toilet Use in Kenyan Primary Schools. *International journal of environmental research and public health*, 11(9), 9694-9711.
- Grant, M. J., Lloyd, C. B., & Mensch, B. S. (2013). Menstruation and school absenteeism: Evidence from rural Malawi. *Comparative education review*, 57(2), 260.
- Greene, L. E., Freeman, M. C., Akoko, D., Saboori, S., Moe, C., & Rheingans, R. (2012). Impact of a school-based hygiene promotion and sanitation intervention on pupil hand contamination in Western Kenya: a cluster randomized trial. *The American journal of tropical medicine and hygiene*, 87(3), 385-393.
- Hellström, A., Hanson, E., Hansson, S., Hjalmas, K. & Jodal, U. (1991) Association between urinary symptoms at 7 years old and previous urinary tract infection. *Archives of disease in childhood*, 66(2), 232–234.
- House, S., Mahon, T., & Cavill, S. (2012). Menstrual hygiene matters: a resource for improving menstrual hygiene around the world.
- Lundblad, B. & Hellström, A.-L. (2005). Perceptions of school toilets as a cause for irregular toilet habits among schoolchildren aged 6 to 16 years. *Journal of School Health*, 75(4), 125–128.
- Mensch, B. S., & Lloyd, C. B. (1998). Gender differences in the schooling experiences of adolescents in low-income countries: The case of Kenya. *Studies in Family Planning*, 167–184.
- Miguel, E., & Kremer, M. (2004). Worms: Identifying impacts on education and health in the presence of treatment externalities. *Econometrica*, 72(1), 159–217.
- Ministry of Education, Republic of Kenya. (2009). Water, Sanitation and Hygiene Promotion on the School Compound and the National School Health Policy 2009. Primary School Design. Retrieved from <http://washinschoolsmapping.com/projects/pdf/KenyaTechnicalManual.pdf>

- Ministry of Health Education and Water and Energy, Ethiopia, in collaboration with UNICEF. (2011). Design and construction manual for water supply and sanitary facilities in primary schools. Retrieved from [http://www.unicef.org/wash/schools/files/WASH in Schools Design Manual.pdf](http://www.unicef.org/wash/schools/files/WASH%20in%20Schools%20Design%20Manual.pdf)
- Nandrup-Bus, I. (2009). Mandatory handwashing in elementary schools reduces absenteeism due to infectious illness among pupils: a pilot intervention study. *American journal of infection control*, 37(10), 820-826.
- National Scientific Council on the Developing Child. (2007). The timing and quality of early experiences combine to shape brain architecture: Working paper no. 5.
- Ngales, M. (2007). Sanitation provision in Ethiopia's regional schools. A girls' and women's experiences. *Waterlines*, 25(3), 11–13.
- Organization, W. H., UNICEF, et al. (2004). Meeting the mdg drinking water and sanitation target: A mid-term assessment of progress, 2004. Geneva: WHO.
- Oster, E., & Thornton, R. (2011). Menstruation, sanitary products, and school attendance. Evidence from a randomized evaluation. *American Economic Journal: Applied Economics*, 91–100.
- Patel, Minal K., Julie R. Harris, Patricia Juliao, Benjamin Nygren, Vincent Were, Steve Kola, Ibrahim Sadumah et al (2012). Impact of a hygiene curriculum and the installation of simple handwashing and drinking water stations in rural Kenyan primary schools on student health and hygiene practices. *The American journal of tropical medicine and hygiene* 87(4), 594-601.
- Sommer, M. (2009). Ideologies of sexuality, menstruation and risk: girls' experiences of puberty and schooling in northern Tanzania. *Culture, health & sexuality*, 11(4), 383– 398.
- Sommer, M. (2010). Where the education system and women's bodies collide: The social and health impact of girls' experiences of menstruation and schooling in Tanzania. *Journal of adolescence*, 33(4), 521–529.
- Sumpter, C., & Torondel, B. (2013). A systematic review of the health and social effects of menstrual hygiene management. *PloS one*, 8(4), e62004.
- SWASH (2012). Financial Management of School WASH Programs. Retrieved from <http://www.ircwash.org/sites/default/files/Gallo-2012-Understanding.pdf>

- Talaat, M., Afifi, S., Dueger, E., El-Ashry, N., Marfin, A., Kandeel, A., Mohareb, E. & El-Sayed, N. (2011). Effects of hand hygiene campaigns on incidence of laboratory-confirmed influenza and absenteeism in schoolchildren, Cairo, Egypt. *Emerg Infect Dis*, 17(4), 619-625.
- Taylor, P. (2000). Managing constipation in children. *Drug Therapy Bulletin*, 38, 57–60.
- UNICEF and Mailman School of Public Health, Columbia University. (2012). Wash in schools empowers girls' education: Proceedings of the menstrual hygiene management in schools virtual conference 2012.
- UNICEF (2014). Snapshot of WASH in Schools in Eastern and Southern Africa. Retrieved from http://www.unicef.org/wash/schools/files/Snapshot_of_WASH_in_Schools_in_Eastern_and_Southern_Africa.pdf
- United Republic of Tanzania. (n.d.). Toolkit no.2: Technical options for school wash part 1 of 2 options and operation and maintenance. Retrieved from <http://www.washinschoolsmapping.com/projects/pdf/TanzaniaToolkit2Pt%20Technology.pdf>
- Vernon, S., Lundblad, B., & Hellstrom, A. (2003). Children's experiences of school toilets present a risk to their physical and psychological health. *Child: care, health and development*, 29(1), 47–53.
- WASHCost (2012). The cost of sustaining sanitation services for 20 years can be 5-20 times the cost of building a latrine. Retrieved from <http://www.ircwash.org/sites/default/files/IRC-2012-Cost.pdf>
- Watkins, K. (2006). Human development report 2006-beyond scarcity: Power, poverty and the global water crisis. UNDP Human Development Reports (2006).
- WHO, U. (2013). Progress on sanitation and drinking-water-2013 update. Geneva: World Health Organization.
- World Bank (2005). Toolkit on hygiene sanitation and water in schools: Gender roles and impact.

APPENDIX 1: Research Details

Literature Review

- (Adukia 2014). Using a large school-latrine-construction initiative in India in 2003, the author examined how improving the health, privacy, and safety of the school environment through sanitation influenced the educational decisions of both boys and girls across different ages. She found that access to school latrines had larger estimated impacts on primary school enrollment compared to upper-primary school enrollment. The study suggests that unisex latrines were mostly sufficient at younger ages with relatively smaller additional gains from sex-specific latrines. At older ages, however, separate latrines became crucial. Pubescent-age girls benefited little from unisex latrines, and their enrollment increased substantially after the construction of separate sex-specific latrines, which suggests that privacy and safety concerns may be central to older girls' decision-making.

As an additional potential mechanism through which sanitation impacted education, the author examined whether latrines affected students through increased female teacher attendance. She found that school-latrine construction increased the share of female teachers at schools, especially when sex-specific latrines were built, which may disproportionately benefitted female students and encouraged their enrollment.

- (Blanton et. al. 2010). This team evaluated the role of school children in the promotion of point-of-use water treatment in Kenya, as well as the impact of hand washing on pupil absenteeism. Water stations utilizing a flocculent/disinfectant were installed and teachers and students received training on hygiene as well as instructional books. Student absenteeism rates decreased after implementation by twenty six percent.
- (Dolan et. al. 2014).i A sample of 120 schoolgirls between the ages of 12 and 18 from four villages in Ghana participated in a non-randomized trial of sanitary pad

provision (including underwear) with education. Before the intervention, girls reported an important negative effect of menstruation over a set of daily activities, especially in rural locations. The primary outcome was school attendance. After 3 months, providing pads with education significantly improved attendance among participants, in both rural and peri-urban locations. After 5 months, puberty education alone improved attendance in peri-urban locations to a similar level. The study also found that providing pads and puberty education reduced the percentage of girls who experienced “lack of self-confidence”, “insecurity” and “difficulty concentrating” during their periods.

- (Fehr 2010). A study of 156 subjects in Ethiopia (95 percent school going girls, 44 percent post menarche) via survey, focus group discussions, free listing and ranking activities found that of the girls who had reached menarche, 90 percent said that their school did not have a place to adequately maintain their hygiene while menstruating and 43 percent reported missing school during menstruation.
- (Freeman et. al. 2012). The study used multiple intervention components involving water treatment, hygiene promotion, and sanitation to assess their impact on pupil absence. Schools were randomized to one of three study arms including water treatment and hygiene promotion (WT and HP), water treatment, hygiene promotion, and sanitation (WT, HP, and Sanitation), and a control group. A chlorine based disinfectant was used for point-of-use WT, HP incorporated a 3-day teacher training education component, as well as provision of handwashing and drinking water containers, and the sanitation component involved the provision of latrine facilities. Assessment of the effect on pupil absence was followed up at 2 years. However, the study was affected by the breakout of violence in the post-election period from January-March 2008. The study found no overall effect of the intervention on absenteeism (possibly due to the break out of violence). However, among schools in two of the geographical areas not affected by post-election violence, those that received WT and HP showed a 58 percent reduction in the odds of absence for girls. In

the same strata, sanitation improvement in combination with WT and HP resulted in a comparable drop in absences among girls, although results were marginally significant.

- (Garn et. al. 2014). Using a cluster randomized trial; this study measured the impact of WASH on pupil enrollment and gender parity in Nyanza Province, Kenya. The intervention included the provision of a water supply, hygiene promotion and water treatment, and sanitation improvement. Overall students' enrollment and the proportion of girls enrolled increase significantly among schools with poor water access during the dry season. The study found no impact on enrollment at schools with better baseline water access.
- (Grant et. al. 2013). Researchers examined correlates of menstruation-related absenteeism and tested five related hypotheses using data from Malawi. Two of these hypotheses were i. toilet availability and cleanliness and the convenience of a water source will be significantly and negatively associated with girls' reports of menstruation related absenteeism, and ii. in addition to school-level sanitation facilities, girls' comfort with school facilities (i.e., their reports of privacy of school toilets) will positively influence their attendance.
A total of 185 boys and 172 girls from fourteen to sixteen years old were surveyed. The authors found no evidence of a gender difference in the overall rate of absenteeism. They concluded "it is difficult for us to see improved toilets either in terms of numbers available or the degree of cleanliness as promising strategies for improving the daily school attendance of post pubescent girls."
- (Greene et. al. 2012). The trial examined whether a school-based water, sanitation, and hygiene intervention reduced *Escherichia coli* contamination on pupils' hands in western Kenya. A hygiene promotion and water treatment intervention did not reduce risk of *Escherichia coli* presence; the addition of new latrines to intervention schools significantly increased risk among girls, with a non-significant increase among boys. Efforts to increase usage of school latrines

by constructing new facilities may pose a risk to children in the absence of sufficient hygiene behavior change, daily provision of soap and water, and anal cleansing materials.

- (Nandrup-Bus 2009). Two schools in Denmark, comprising 652 students, were randomized into an intervention and a control group. The students at the intervention school were required to wash their hands before the first lesson, before lunch, and before going home. Students at the control school continued their usual hand washing practices. The estimated reduction in absenteeism due to the intervention was statistically significant at the 1 percent level. The reduction in absenteeism was more prominent for female students compared to their male counterparts.
- (Ngales 2007). The study collected evidence about the experience of menstruation in school for girls in Ethiopia, finding that it increase absenteeism. For example, one of the girls aged 18 stated: “if I experience menstrual pains, I ask permission to go home. I don’t tell the truth. I just say I have a headache or a stomachache. All our teachers are men”
- (Oster and Thornton 2011). A randomized-control trial conducted in four schools in the Chitwan District of Nepal tested provision of menstrual cups. Before the trial, 98 percent of the girls reported using menstrual cloths, and 75 percent used them exclusively. Results found that girls miss an average 0.4 school days per year because of menstruation, and the effect of the sanitary cup is, although statistically significant, not economically relevant.
- (Patel et. al. 2012). For Kenya, this study assessed the impact of a hygiene curriculum as well as hand washing and drinking stations on student diarrhea and acute respiratory infection rates. Hand washing and drinking stations provided treated water. Hygiene education was provided through instructional materials and training for teachers and students. Water stations were located

near latrines to improve hygiene practices. The results showed a decrease in the median percentage of students with acute respiratory illness, but no decrease in diarrhea.

- (Sommer 2009). This study collected qualitative evidence finding cultural limitations related to menstruation in Tanzania. For example, one of the testimonies states that “it may happen [changes in girls’ lives post-pubescence] because at home there are local beliefs – their parents/families tell girls they can now get married because they are grown up – then at school they have [menstrual] pain and are disturbed – so that may lead them to decide to listen to their families and leave the school.”
- (Sumpter and Torondel 2013). A meta-analysis of research on menstrual health management (MHM) examined results for 14 studies. Regions varied widely but included Tanzania, Uganda, Nigeria, and Pakistan. These studies generally characterize disposable sanitary pads as good hygienic practice. Reusable cloths were categorized as bad practice in the absence of water, but good when washed hygienically. Seven papers found association of good MHM and reproductive tract infection. Evidence of a relationship between MHM and bacterial vaginosis was mixed. The main conclusion is that “the body of evidence to support the link between poor MHM and other health outcomes (secondary infertility, urinary tract infections and anemia) is weak and contradictory.” The authors found four studies linking lack of proper MHM, including the availability of pads, privacy, and water with attendance.
- (Talaat et. al. 2011). This study assessed the effects of hand hygiene campaigns on the incidence of laboratory confirmed influenza and absenteeism in school children for Egypt. The study design was a randomized controlled trial involving sixty elementary schools. Children in the intervention schools were required to wash their hands at least twice during the school day for 45 seconds, followed by proper rinsing and drying with a clean cloth towel, and health messages were

provided through entertainment activities. An intensive campaign to promote hand hygiene was launched in the intervention schools to raise the awareness of students, teachers, nurses, and parents. The results showed a significant reduction in illness-related absenteeism. Infection rates for diarrhea, conjunctivitis, and influenza declined by forty, thirty, sixty seven and fifty percent, respectively.

- (UNICEF and Mailman School of Public Health 2012). One in ten school-age African girls do not attend school during menstruation or drop out at puberty because of the lack of clean and private sanitation facilities in schools. For example, in partnership with the Ministry of Health and Sanitation and the Ministry of Education, Science and Technology of Sierra Leone, researchers examined MHM in schools in six rural districts. A majority of female students interviewed believed that menstruation is a normal part of growing up, but 21.3 percent reported missing school during menstrual periods. The study also revealed a strong correlation between the lack of gender-separated latrines in schools and absenteeism among girls 9–14 years old. Also, a joint study by UNICEF and Nepal’s Department of Education in 2012 found that female students face particular menstrual health management challenges. Nearly three quarters of schools have at least one toilet, but only Thirty six percent have a separate toilet for girls. Thirty percent of girls in the upper levels of the school system reported missing class during menses due to a lack of sanitation facilities.
- (World Bank 2005). Menstrual related absenteeism is approximately four days every four weeks. The absence of clean and private sanitation facilities that allow for MHM may discourage girls from attending school when they menstruate. In addition, if a girl has no access to protective materials, or if the materials she has are unreliable and cause embarrassment, she may be forced to stay at home while menstruating. This absence of approximately four days every four weeks may result in the girl up to twenty percent of her school days. This study also highlight that female teachers face a similar problem. In the absence of clean and

private facilities, they may elect not to come to school while menstruating. In the likely absence of a replacement, this means that effective school times will be reduced by ten to twenty percent.

Expert Opinions

- **Edward Miguel, Oxfam Professor in Environmental and Resource Economics, Dept. of Economics, & Faculty Director of the Center for Effective Global Action (CEGA):** Professor Miguel has proven that preventing communicable diseases is a major driver of school attendance. He supports the construction of school latrines as a first step in establishing sanitation at school. He acknowledges that there are many challenges in making latrines work to mitigate the presence of communicable diseases at schools. According to him, there is an unanswered question as to the efficacy of latrine construction in the absence of hand washing facilities, and a reliable source of clean, running water. He also notes that in arid regions, some health hazards like intestinal worms are less threatening because the agents of infection do not survive well in dry environments.
- **Ben Skelton, Director, Dig Deep:** According to Mr. Skelton, there is a strong notion among school sanitation actors that the various components of sanitation – improved pit latrines, reliable access to safe water, and handwashing facilities – are limited in impact when not implemented simultaneously. However, he also noted the extreme difficulties in establishing access to water and hand-washing facilities in arid parts of Kenya and Tanzania. According to Mr. Skelton, 50 to 60 percent of boreholes dug in Asante Africa Foundation’s region of interest are not functioning. Boreholes are extremely expensive to dig and to maintain. Local capacity is simply insufficient. Therefore, Dig Deep prefers to focus on rainwater capture and appropriate technology solutions that can be maintained with local expertise. In the absence of running water and hand-washing facilities, latrines may lead to increases in the incidence of communicable diseases.

Anjali Adukia, Assistant Professor, University of Chicago, Harris School of Public Policy, Author of *Sanitation and Education*: acknowledges the availability of water as an important issue because of health and maintenance concerns. She mentions that girls fetching water for school adds another layer of complication to the problem and says that might be better to hire a third person in the community to fetch water, if possible.

APPENDIX 2: Toolkits for latrine design

There are several comprehensive latrine toolkits complete with technical drawings and material specifications¹⁹. School-based latrine design resources consistently emphasize the importance of water supply. Two challenges emerge particular to Asante Africa's stakeholder schools surrounding water supply

- The adoption of latrines and relevance to menstrual hygiene and girls' sanitation may be severely limited in the absence of a water supply.
- The maintenance and upkeep of latrines is undermined by the absence of a water supply for cleaning.

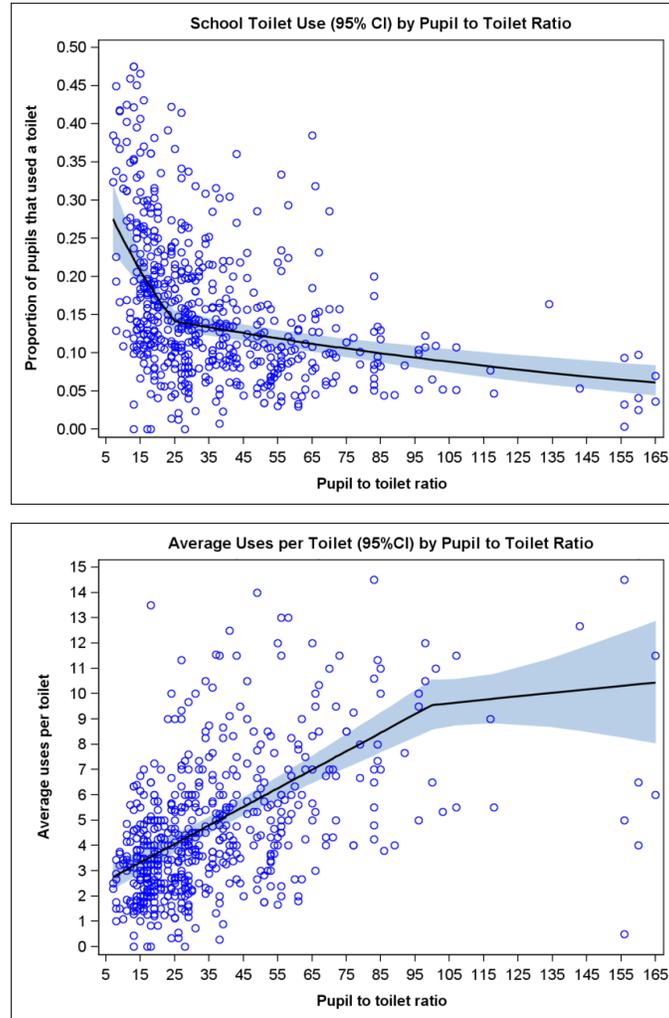
Review of Best Practice Design Features

- Specific design guidelines for pit size are readily available.
- Ratio of students to latrines: Recommended ratio of students to latrines is 25:1 for girls and 30:1 for boys (Ministry of Education, Republic of Kenya 2010). This is critical to latrine maintenance.
- Privacy and safety: In schools, there should be different facilities for schoolgirls and teachers.
- Ideally with a screen or wall in front of the doors.
- Locks on the inside of the doors.
- Water supply and hand- washing: Water supply is essential for a school to be menstrual hygiene-friendly. Schoolgirls and staff need water to wash themselves, their hands, their cloths and their clothing, and also to clean blood off latrine slabs. Ideally, there should be a water supply inside latrine units, whether from a tap or a bucket that is routinely filled.
- Latrine hand washing stations are in view of the school, and not behind the latrine.
- Options for water supply: There exist several comprehensive latrine construction toolkits with several technical options for water supply. These include
 - Rainwater harvesting

¹⁹ A few are: 1. (Ministry of Health Education and Water and Energy, Ethiopia 2011); (2) (House, Mahon and Cavill 2012); (3) (United Republic of Tanzania, 2010); (4) (Ministry of Education, Republic of Kenya 2010).

- Shallow wells
- Stand pipe (pipe scheme)
- Protected spring
- Boreholes
- Small dams (charco dams)
- Latrine size: Sufficient to accommodate changing of clothes, location of disposal bins inside the latrine, as well as water and soap sources.
- Disposal: Disposal of menstrual sanitation products, located inside latrine but separate from latrine, is critical as disposal in latrines leads to latrine back-up.
- Design considerations for used sanitary products:
 - Has a lid and is in a discrete location.
 - Easy to carry if it has to be transferred to the disposal site.
 - Washable and easy to clean.
 - Affordable and available in the local market.
- Maintenance and Upkeep: A review of empirical evidence and several toolkits for school latrine construction in East Africa and elsewhere reveals 2 major concerns for upkeep and maintenance.
 1. *Latrine Overflow*: If properly constructed following recommended user to latrine ratios, the pit should naturally reduce over time. If non-organic material is disposed of in the latrine, this can cause the natural rate to reduce and latrines can overflow. The disposal of menstrual sanitation products has received significant attention in the design of girl-friendly latrines. Solutions include incinerator designs and washable disposal bins.
 2. *Access to Water*: Availability of water and cleaning supplies. Ease of cleaning latrines is critical to maintenance, and access to water is directly related to the former.
- Empirical Evidence (Garn et. al. 2014): A longitudinal assessment of 60 primary schools in Nyanza Province, Kenya, measured facility conditions and pupils' use at specific facilities. Schools were randomized into three different arms: (1) a latrine cleaning arm, which received soap for hand washing, cleaning supplies for latrines, and training on maintenance, (2) a hand

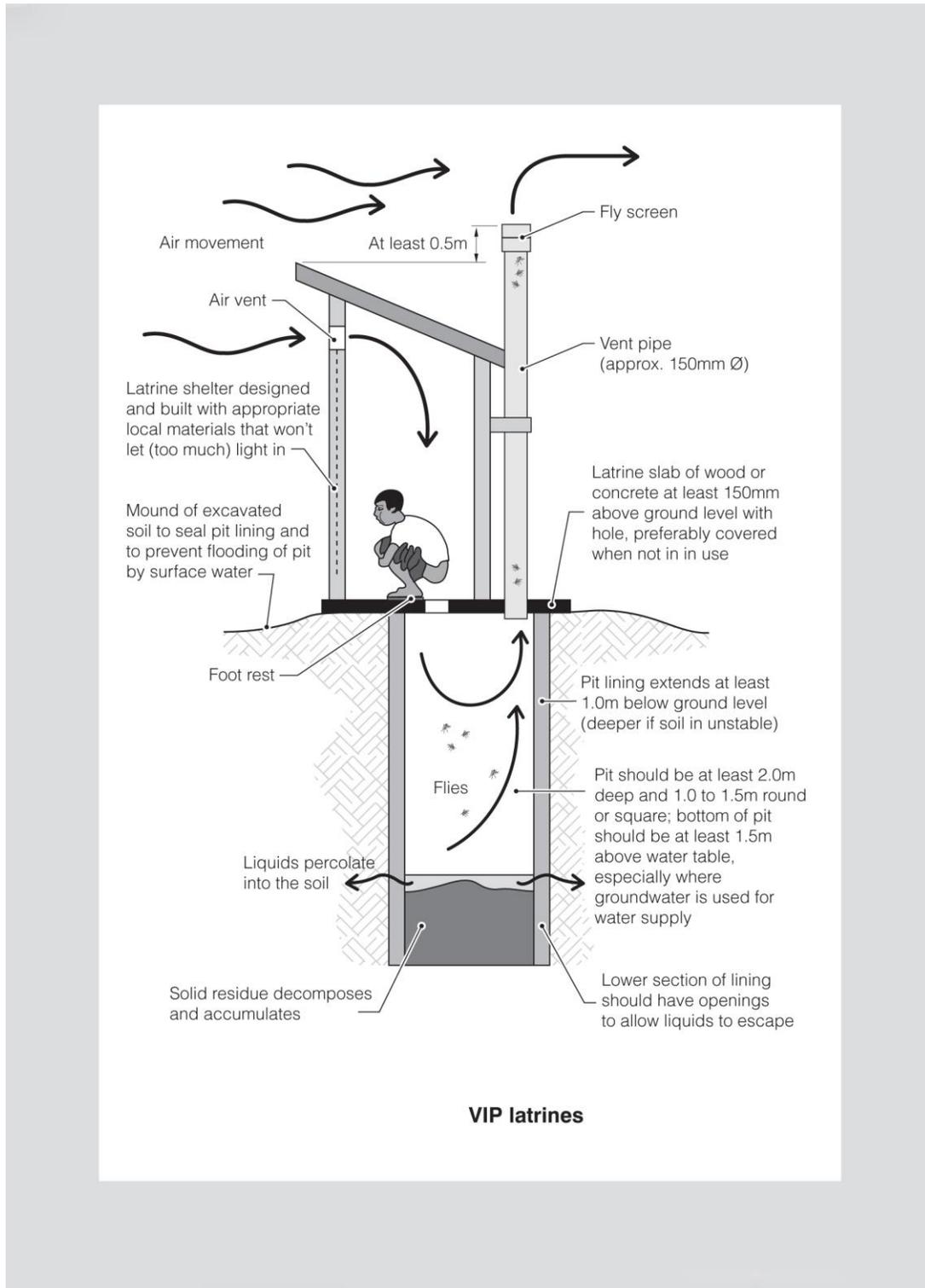
washing arm, which received soap only, and (3) a control arm, which received no intervention. The study found a significant relationship between decreasing pupil to toilet ration and increasing pupil toilet use. This study also found evidence that facility dirtiness may deter girls from use.²⁰



²⁰ The authors did not account for the provision of cleaning supplies in their analysis explicitly. However, the study found sufficient variation in latrine cleanliness to facilitate statistically significant findings. To the extent that the presence of water and supplies do increase latrine cleanliness, they also increase latrine use.

APPENDIX 3: Intervention Package Illustrations

1. Ventilated Improved Pit (VIP) Latrine



2. VIP Latrines with Rainwater Capture and Hand Washing Station

Rainwater is preferably collected from roofs made of metal sheets or tiles. The system consists of the roof of the building from where rainwater flows through gutters and downpipes into collection tanks. Normally water may be abstracted from the tank by one or several taps.



APPENDIX 4: Expert Bio's

Professor Edward Miguel is an expert in school sanitation. His work provided the evidential basis for the Deworm the World Initiative, which enables governments to eliminate the public health threat of worms through school-based mass deworming programs

Ben Skelton, Director, Dig Deep – Dig Deep works with rural communities in Kenya to access water and sanitation. They work with local partners to implement training and appropriate technologies to bring about sustainable improvements in health and education. Dig Deep has previously partnered with Asante Africa on addressing access to water. Mr. Skelton has been working in issues surrounding water and sanitation in Kenya for several years and has led Dig Deep for the last four years. He has extensive experience in and knowledge of the area of Kenya and Tanzania in which Asante Africa Foundation operates.

Professor Anjala Adukia Is an Assistant Professor at the University of Chicago Harris School of Public Policy. She completed her doctoral degree at the Harvard University Graduate School of Education, with an academic focus on the economics of education. Her dissertation was selected as the winner of the 2014 Association for Public Policy Analysis and Management (APPAM) Ph.D. Dissertation Award and the 2015 Association for Education Finance and Policy (AEFP) Jean Flanigan Outstanding Dissertation Award. Her research is focused on understanding factors that influence educational decisions and the potential role for institutions, such as government agencies and nonprofit organizations, to improve child outcomes, particularly at the intersection of education and health. Her current work examines how the provision of basic needs – such as sanitation, clothing, and transportation – can increase school participation in developing contexts.

APPENDIX 5: Cost Assumptions

The following assumptions are based on available evidence drawn from IRC WASHCost report (WASHCost 2012) based on findings from research in Burkina Faso, Ghana, Mozambique and the state of Andhra Pradesh in India. Assumptions are conservatively based on highest predicted costs.

Capital Expenditure

Latrines: \$4,654 / school

School population: 300

Latrine: VIP

Capital Expenditure per person:

- 300 students including 150 boys and 150 girls
- person-to-latrines ratios of 30 boys per latrine and 25 girls per latrine
- 30 students per teacher, 10 teachers total (sex ratio does not effect totals given ratio assumptions)
- 7 girls latrines and 6 boys latrines
- \$358 per latrine

Capital Expenditure Benchmarks for sanitation²¹

Cost component	Latrine type in area of intervention	Cost ranges [min-max] in US\$ 2011
Total capital expenditure (per facility)	Traditional pit latrines with an impermeable slab (made often from local materials)	7-26
	Pit latrines with a concrete impermeable slab, or VIP type latrines with concrete superstructures (with ventilation pipe and screen to reduce odours and flies)	36-358
	Pour-flush or septic-tank latrines, often with a concrete or bricked lined pit/ tank with sealed impermeable slab, including a flushable pan	92-358

²¹ WASHCost 2012

Recurrent Expenditure

Latrines: \$2,635 / school / year

School population: 300

Latrine: VIP

Capital Expenditure per person:

- 300 students and 10 teachers
- \$8.5 per person, per year.

Recurrent expenditure benchmarks for basic sanitation²²

Breakdown of recurrent expenditure*	Cost ranges [min-max] in US\$ 2011 per person, per year		
	Traditional pit	VIP type latrines	Pour-flush or septic-tank latrines
Operational and minor expenditure	0.5-1	1-4	1-4
Capital maintenance expenditure	0.5-1.5	1-3**	2-6**
Expenditure on direct support***	0.5-1.5	0.5-1.5	0.5-1.5
Total	1.5-4	2.5-8.5	3.5-11.5

Recurrent expenditure of WASH systems²³

System	Average School Expenditures, Ksh (USD)	Average per Student Expenditures, Ksh (USD)
All Water Collection:	18,210 (\$216.70)	62 (\$0.74)
<i>Rainwater Harvesting</i>	17,382 (\$206.85)	54 (\$0.64)
<i>Borehole</i>	10,596 (\$126.09)	40 (\$0.48)
<i>Water Purchase</i>	5,517 (\$65.65)	27 (\$0.32)
Drinking Handwashing Systems	4,936 (\$58.74)	14 (\$0.17)
Sanitation	9,935 (\$118.23)	24 (\$0.29)
Teacher/SMC Education School Health Clubs	866 (\$10.31)	2 (\$0.02)
All WASH Systems	33,903 (\$403.45)	103 (\$1.23)

²² WASHCost 2012

²³ SWASH 2012