

## **A LIGHT IN THE DARK FOR NEPALESE TEEN GIRLS**

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## **ABSTRACT**

Within water, sanitation and hygiene (WASH) research, there is a growing focus on menstrual hygiene management (MHM). Much anecdotal evidence exists from surveys and interviews that girls throughout the developing world face many hardships with menstruation due to lack of proper school/home facilities and knowledge of proper hygiene practices. Most of the research, up to this point, has consisted of purely qualitative analysis or at best, correlational evidence of linkages between girls' background and their likelihood to practice good hygiene. This work attempts to bring a more quantitative analysis to this field of study, with particular focus on the impacts of both cultural and school support systems in determining school girls' psychological wellbeing surrounding menstruation. Using primary survey data from two schools in south-central Nepal, we performed logit regressions utilizing principle component analysis to build key indices, which provide robust results across multiple specifications. Included are analysis of inverse probability weighting to account for potential non-random assignment to schools. Our analysis shows that strong cultural norms during menstruation increase the probability of girls self-reporting as feeling lonely, while presence of hygiene supporting infrastructure at schools reduces this outcome. Such evidence provides greater motivation for increasing government policies to provide stronger hygiene infrastructure in schools to alleviate psychological stress among young women, allowing them to function more successfully and create for themselves better futures. Additional insights are gained with regard to the negative impacts of cell phone ownership and talking to teachers have on psychological wellbeing.

Keywords: psychological wellbeing, primary data, menstruation, hygiene, logit, PCA

## **1. Introduction**

Within the field of research devoted to studying the impacts of water, sanitation, and hygiene (WASH) in developing nations, there is a burgeoning focus on menstrual hygiene management (MHM) (Sommer and Sahin 2013). The confusion and surprise many young females face when confronted with the onset of menses is often only exacerbated by the many cultural taboos and stigmas still currently associated with it in many developing nations (LaSaine 2015). A recent study in India revealed that even among medical students, expected to have a higher level of education and awareness about biological functions, 34% had to practice restrictions during menstruation and only 42% practiced daily washing (a common hygiene practice) during menstruation (Sharma et al. 2013). Additionally, the lack of proper facilities in many countries enhances the necessity for policy focus on improving the quality and availability of sanitation and hygiene options to facilitate greater health among young females (Crofts and Fisher 2012). This is to combat evidence from some research which has shown a link between reproductive tract infections (RTI's) and poor menstruation hygiene (Anand, Singh, and Unisa 2015).

There are also the social and behavioral consequences that lack of knowledge/facilities may cause, including missed opportunities at school. In a 2014 report, the World Health Organization (WHO) pointed to the need for a focus on better facilities in schools to help females deal with their menstrual cycle, as parents may see the lack of facilities as a reason for keeping girls home. Further, this accumulation of missed schools days may ultimately lead to girls dropping out of school all together (WHO 2014). This trend opens the door to such situations as child brides and female genital mutilation, current deplorable practices that WHO, UNICEF, and many other organizations are seeking to end in the near future.

Given this need for a greater focus on MHM, it is no surprise to see acknowledgement of them reflected in both WHO's Millennium Development Goals (MDG) and Sustainable Development Goals (SDG). MDG 2 and 3 were to achieve universal primary education and promote gender equality/ empower women (2000), and although these goals were terminated in 2015, they have been replaced by more detailed goals that extend until 2030, the SDG's. SDG 3-5 all speak to the importance of universal access to sexual/reproductive health, information and education about such, and empowerment of girls, along with SDG 6 which aims to ensure sustainable and available water and sanitation for all (2015). Motivation to pursue these goals will be greatly enhanced through empirical evidence not only justifying that the need is real, but also a pathway to understanding the best means in which to approach the problem, especially from a policy perspective.

In Nepal, there has been growing work focused on MHM, based primarily on qualitative studies. There has been confirmation of the lack of awareness about proper hygiene practices, which is accompanied by numerous accounts of girls missing school and being restricted in their family and community participation activities. While most work has been of this anecdotal format, through in-depth surveying of primarily school-aged girls, one series of quantitative work stands out. Work by Oster and Thornton (2009, 2011) involved randomized distribution of sanitary products to determine impacts on attendance rates. Little work has been published with a focus on Nepal regarding the emotional impacts on girls during menstruation, particularly approached through a quantitative lens. This work adds to the existing literature by providing sound empirical findings, while approaching the issue from a new direction by looking at the emotional wellbeing of women and not simply attendance rates or lack of knowledge.

This paper is organized with section two presenting background information on the literature related to awareness about menstrual hygiene and observations on missed school; quantitative work within sanitation and MHM; and work involving emotional wellbeing and mental burdens as associated with menstruation. This is followed by a breakdown of the empirical framework and data used for the study. Results, discussion, and conclusions complete this work with mention of certain key policy implications.

## **2. Background**

There are two important strands of research published with regard to menstrual hygiene in developing nations, primarily with emphasis on school-aged girls in Asia and Africa. The primary line of research has focused on assessment of the current state of knowledge and practice among young females regarding menstruation (Mahon and Fernandez 2010). The other involves investigation of whether or not school absentee rates in developing countries can be statistically linked to the menstrual cycles of female students (Grant, Lloyd, and Mensch 2013; Oster and Thornton 2009, 2011) and whether interventions in the field are useful.

### **2.1 Hygiene Awareness & Missing School**

The vast majority of studies have revealed surface level confirmation of a lack of awareness about the biological processes involved in menstruation, proper hygiene practices, and as previously noted, lack of facilities and persons to approach with regard to questions/concerns. In a study performed by Irise International in Uganda, researchers found that 50% of girls missed school (mean 1.6 days) and 52% believed that menses pain was actually a sign of illness (*Bridge-Development & Gender* 2015). An AC Nielsen study in India found that girls aged 12-18 missed

five days of school in a month adding up to 50 days of missed school annually, due to menses (likely lack of proper facilities at school), and about 23% of girls in the study dropped out of school after they started menstruating (Sinha 2011). In a study that interviewed adults about school girl behavior surrounding menstruation in Zimbabwe, researchers found that 30% of respondents indicated water challenges at schools, 35% pointed to lack of resources to purchase sanitation products, 10% of girls were reported has not having underwear to protect them during menses, and only 15% felt that there were proper disposal facilities available at school for girls (Ndlovu and Bhala 2015).

In Nepal, the cultural taboos females face during menstruation are often severe, meaning that this is an area which has seen a fair amount of regionally focused attention in literature. Of particular concern is the practice known as *Chhaupadi*, wherein girls/women are made to live in separate huts while menstruating due to superstitions surrounding the impurity of blood. While this practice was officially banned in 2005 by the Nepali government, particularly in rural areas, one still finds it practiced (Katz 2014). Lack of knowledge is also a frequent result of qualitative studies into the matter.

WaterAid's study of school girls in Nepal showed that while 92% of girls had heard about menarche before it occurred, they were often not told specific details of the physical processes and found their first menstruation an experience of shock and fear ("Is Menstrual Hygiene and Management an Issue for Adolescent School Girls - A Comparative Study of Four Schools in Different Settings of Nepal" 2009) . In a survey study conducted in rural Nepal, researchers found that 50% of girls missed school and 82% did not participate in cultural functions during menstruation (Auemaneekul, Bhandari, and Kerdmongkol 2013). A study performed by UNICEF revealed that while close to three-quarters of schools have at least one

toilet, only 36% have a separate toilet for girls. Plus, girls do not view schools as a place where they can seek information or support about dealing with menstruation, with only 3% of the girls studied listing teachers as a source of information or support (Sommer et al. 2012). In another survey of three schools with girls ages 13-18, researchers found that 85% of girls only began to understand more about menstruation after it had actually started and almost 30% of girls were unable to correctly identify a typical menstrual cycle length in days (Adhikari et al. 2007). Such confirmation is encouraging, but continued focus on this line of research is waning, as demands for more quantitatively based studies in WASH and MHM increase.

## **2.2 Quantitative Work in Sanitation/MHM**

In a newly published randomized control trial (RCT) study in India, one researcher has found evidence of the benefits of toilet provisions to school children. Adukai (2017), utilizing data from a national latrine construction initiative and running a difference-in-difference model found that toilet construction increased enrollment of adolescent girls, particularly when sex-specific toilets were provided, allowing for gender disparities to decrease. Although, results also indicate that academic test scores were not statistically effected through this toilet-provision program. Using data from one and three years post latrine construction showed no diminishing effect of these outcomes. Encouragingly, Aduakai's results are also robust across geographic/income groups.

In a general hygiene education study, Dupas et al (2011) conducted a RCT in Kenya to assess the impacts of two different educational interventions with regard to HIV/sexually transmitted diseases. Their results showed that adolescents in a treatment group provided with information on the relative risks of different diseases showed a 1.5 percentage point reduction in

incidence of childbearing (a proxy for unprotected sex) compared to the control group. In addition, they found no significant evidence of using the existing official HIV/AIDS curriculum for primary schools in terms of reduction of pregnancy. Thus, there is evidence of behavior change possible through educational interventions, but also these results point to the importance of targeting education appropriately.

In another example of behavior change possible through educational interventions, researchers in India conducted a RCT implementing a 10 session in-school intervention targeting compassion, self-efficacy, emotional well-being, and peer/parental support through short instructional modules (Kapadia-Kundu et al. 2014). This intervention was found to have an impact on more than 13 preventive health behaviors, with 65% of treatment group adolescent girls adopting 13 or more behaviors including daily genital hygiene and changing pads 3x per day. Bhudhagoankar & Shinde (2014) also used educational interventions to impact menstrual health knowledge. They found differences in pre- and post-testing before (after) planned teaching on menstruation and hygiene practices among a small sample of rural Indian girls.

Overall, though, there are very few randomized trials specifically focused on the realm of MHM, the most notable being that by Oster and Thornton (2009; 2011). Studying within rural Nepal, these researchers determined that through random provision of sanitary supplies there was no strong change in school absenteeism (Oster and Thornton 2009, 2011), running contrary to expected outcomes based on the breadth of research indicated that school-aged girls do not see school as a source of support or information during menstruation. Other controlled studies which investigated interventions of pads and/or education, however, have produced very promising results. A randomized control study performed in Ghana, showed that school attendance rates could be increased with puberty education, and that attendance could be increased at a

comparable amount when puberty education was paired with sanitary pad provisions (Montgomery et al. 2012a). In Kenya, a cluster-randomized trial introducing water treatment and hygiene promotion, sanitation improvements, or control showed no overall effect of either intervention on absences, but when controlling for gender showed that education decreased odds of absence for girls by 58% (Freeman et al. 2011).

Adding to such findings, there have been gains in knowledge about determinants of better hygiene and better attendance, achieved through analysis of correlations and multivariate analyses. Grant et al (2013) showed that despite menstruation being one of the least commonly cited reason for absence, with no statistically different prevalence in absences between female and male Malawi school children, that absences which were attributed to menstruation were negatively associated with co-residence with grandmother and studying at home. In their attempt to determine the factors influencing current menstrual hygiene practices, researchers in India using multivariate analysis concluded that more sanitary hygiene practices were found among those girls who had literate mothers, had knowledge about menstruation prior to its onset, had a toilet at home, and who had had exposure to sanitary products through mass media (Sudeshna and Aparajita 2012). Using data from Ethiopia, researchers found through regressions that predictors of sanitary napkin use included urban residence, mothers with above secondary education, and higher monthly expenditures (Tegegne and Sisay 2014). This same study also found evidence that use of sanitary napkins reduced odds of being absent from school.

### **2.3 Emotional/Mental Wellbeing**

While this strand of more econometric research analyzing MHM is growing, one should note a gap in attention to the cognitive experiences during menstruation. So far, attention to

cognitive components only appears in studies as a single question, or is found in studies based on application of theories from sociological/psychological literature. In a primarily qualitative analysis (focus groups) of schoolgirls and teachers in Kenya, researchers note that many girls reported shame and fear of menstruation occurring at school (often with unidentifiable sources of the shame) (McMahon et al. 2011). Further, teachers included in this study expressed lack of confidence in their abilities to teach additional hygiene material to students. Haque et al (2014), in a health education, intervention study in Bangladesh, reported that 6 months post-intervention, in addition to positive gains in hygiene knowledge and behavior, psychological factors (self-identification as depressed, irritable, or highly stressed) was shown to be reduced.

Looking at the more theories-based literature, two studies stand out in their application of cognitive processes and menstruation. Jewitt and Ryley (2014), through interviews with girls in Kenya, deduced that many missed school during menstruation due to perceived harassment or judging of girls during their menstruation (i.e. embarrassment or shyness), and authors believe that this emotional “geography” serves to only reinforce gender inequalities, limiting overall access to education. In a paper looking at menstruation in a more global lens, psychology researchers applied objectification theory emphasizing how women/girls adopt the sexualization of women that society creates and internalize it. From this, stems interpretations of menstruation as “bad,” wherein with higher self-objectification, women/girls are going to have more negative attitudes towards menstruation and their eventual behavior will reflect this. Authors applied this framework to how when considering buying a new feminine hygiene product, a product which requires more contact with the body is going to be less preferred by a woman since it would require the woman to interact with that thing (i.e. menstruation) which she has internalized as bad/wrong/tainted (Grose and Grabe 2014).

Taking all of this knowledge into consideration, it would seem useful to continue on the path of incorporating more quantitatively sound analyses, as well as, to venture into the less-well investigated realm of cognitive experiences. In a seminal paper investigating the impact of childhood health on education, Glewwe and Miguel (2007) indicate that such interventions as deworming and increasing nutrients resulted in higher test scores and attendance at school. One wonders if this relationship may also go in reverse, where more educated (i.e. informed about hygiene and sanitation) can also become healthier. Importantly, would young women also become mentally healthier if there is greater support at school? Ideally, one would like to find evidence that indeed school and its offerings, both in terms of infrastructure and sources of emotional support, are able to reduce a sense of isolation/unhappiness, given that much of the policy and interventions thus far have focused on schools.

A group of researchers, long involved in the global discussion in MHM, thinks that now is the time for determination of which factors will best enhance women/girls' experience during menstruation. They note that there is a lack of guidance, facilities, and materials to educate girls and communities, in general about MHM (Sommer et al. 2016). Further, this group points out that the lack of quantitative evidence looking at extent of challenges (including mental hurdles) and effectiveness of MHM interventions is coupled with a lack of focus on increasing self-esteem. If we can begin to tackle all of these elements simultaneously, the progress of this field of research will be more impactful and greater gains can be made.

### **3. Data**

This study makes use of primary survey data collected by the Pratiman-Neema Memorial Foundation (PNMF). Women2Be, a non-profit organization based out of Albuquerque, NM

provided female hygiene packets, in the style of those put together by Days for Girls, to Nepal in May 2016, in conjunction with the Nepal Study Center at the University of New Mexico. Along with providing girls and women these reusable kits, good for up to three years, educational information about female health and hygiene was provided and a survey was administered to various groups of women/girls. Two schools in Bhairahawa, PNMHI and Paklihawa, were presented with this hygiene information session, where one group was surveyed before they received the female hygiene kits, and the other was provided their kit before the survey was administered. Two groups of community women, one in Bhairahawa and one in the northern area of Mustang, were also provided information sessions and kits, after which they were surveyed with the same instrument.

Given the well-established use of school-aged girls as a target population of MHM studies, we remained in-line with this practice and restricted our study to only those females surveyed in the context of school environments. Further, we limited our focus to those females interviewed in the predominately Hindu region of Nepal (Bhairahawa).

Survey questions were asked regarding basic demographic information (i.e. age, religion, caste, family possession of cement home/land), along with information on current knowledge and practices regarding menstrual hygiene (i.e. genital cleaning, hand washing, pain treatments). In addition, of importance for this study, the survey also included information on current school infrastructure (i.e. presence of trash bins, emergency menstrual hygiene kits, and soap for washing hands) and on cultural restrictions women face in their home environment during menstruation (i.e. separate sleeping quarters, not allowed in kitchen, etc.). Key to this work was the inclusion of a question evaluating whether the women/girls felt lonely or sad during their menstruation period.

#### 4. An Empirical Wellbeing Conceptual Framework

Enabling girls to remain in school longer and to enhance their willingness to go to school during their cycle requires support along multiple fronts and can be reflected in the environments girls face both at school and at home. A girl who is experiencing a drop in psychological wellbeing may very well perform more poorly at school, if she is even motivated to go. Given this pathway, we chose to focus on the key environments that surround young women during menstruation, and how those systems affect self-perceived notions of psychological wellbeing (e.g. feeling lonely/sad), according to the following hypotheses.

*H1. The presence of infrastructure and education to support hygiene in schools will help adolescent females to feel less lonely or sad during menstruation.*

This is based on the findings from WHO (2014), that parents fear sending their girls to school, and girls fear judgement from others (McMahon et al. 2011), for not having underwear or leaking. The presence of the right infrastructure would likely greatly reduce such fears from both parents and girls, which would remove that level of stress and distraction girls face, particularly during menstruation.

*H2. Strong cultural norms which restrict adolescent girl's mobility and freedom during menstruation will lead them to experience more negative emotional wellbeing.*

This hypothesis stems from such work as that by Jewitt and Ryley (2014), which emphasizes the gender inequalities which can be reemphasized through the negative focus that many cultures may place on menstruation. Such negative connotations and otherness that women may face due to such cultural constructs, likely only serves to diminish women's self-worth and happiness. In cultures with a strong subordination of women, women are often found to be at a greater risk of

developing depression and a number of other mental disorders (Douki et al. 2007). Further, women in China who were unhappy and disputed with their families about pregnancy/childbirth taboos faced higher levels of depression in late pregnancy and during childbirth (Lee et al. 2009). Thus, strong cultural limitations have previously been shown to lead to lower mental wellbeing.

#### 4.1 Empirical Specification

Below is the full empirical specification, which in the most comprehensive version includes several other potential support system contributors and certain control variables.

$$PWB_i^* = \beta_0 + \beta_1 SchEnv_i + \beta_2 CultFactors_i + \beta_3 SWT_i + \beta_4 X_i + \varepsilon_i$$

Where  $PWB^*$  is the latent variable of psychological wellbeing, where it equals one if  $PWB^* > 0$ , else zero.  $SchEnv$  is an index that represents the school environment, both physical infrastructure and hygiene education presence.  $CultFactors$  is a vector with our index of cultural norms and accounting for caste.  $SWT$  is a variable which represents if teachers are seen as available to discuss menstruation problems with. Finally,  $X$  is a vector of socioeconomic and demographic controls and  $\varepsilon$  is the white noise error term.

#### 4.2 Variables

We created an index for each of the two primary environmental domains, school and home. The former consists of presence/absence of certain key hygiene facilities/infrastructure at school (e.g. hygiene education, emergency kits, separate bathroom, disposal bins, and soap), and the latter captures the cultural environment in which girls live at home (e.g. permission to enter

worship room, family home, cultural functions, kitchen). We utilized principle component analysis of the various factors to create these indices, relying on the first principle component. These two variables serve as our primary areas of attention, along with a separate binary variable to account for the social support available at school, based on whether or not there is a perceived presence of a teacher to talk to about mishaps at school. Age is included in a later model, as it would be expected that age of females may greatly impact their abilities to both physically and emotionally manage menstruation. Descriptive summary statistics of all key and control variables can be found in Table 1.

In addition to our two main environment system indices and teacher support, we included the addition of a variable which reflects social networks, namely presence of a cell phone. Doron (2012), in her examination of cell phone usage influence in Indian society, through an examination of Foucault's idea of "technologies of the self", determined that cell phones were a focal point for struggle over power and domination. Women gain more access to the outside world, and yet, this is also used as an excuse to keep them within the confines of the household, a potential psychological stressor. As such, we cannot fully hypothesize whether or not girls who owned a cell phone would report a more positive state of well-being. To test the strength of our model, we also incorporated various controls to account for current hygiene product use, marriage, wealth indicators, and caste.

### **4.3 Estimation Strategy**

A logistic regression approach was used with three different model specifications. A preferred model was chosen based on model statistics. Results of all models are presented in Table 2 for comparison.

Due to that close to 95% of those surveyed reported having a teacher to talk to about problems during menstruation, we checked this preferred model without this variable, as well as, with removal of outliers due to advanced age within the sample. There was no loss of sign or significance among our key explanatory variables.

Since the girls come from two different schools that preliminary analysis showed some differences across in terms of behavior (notably certain hygiene practices and school absenteeism), we performed our regression with standard errors clustered across school to account for this inter-school correlation. Due to the possibility of a sort of self-selection into the survey, in that these girls are not a random nor necessarily representative sample of all teenage girls in Nepal, we also reran our model using bootstrapping. (It is the bootstrapped standard errors which appear in Table 2.)

Finally, to further check on the significance of our results, we incorporated inverse probability weighting (IPW) based on school. Marginal effects from both the preferred model with and without IPW are presented for comparison in Table 3.

For your convenience there is a summary of hypotheses results indicating sign and significance for both raw coefficients and marginal effects of our preferred model under both IPW conditions and without, presented in Table 4.

## **5. Results**

### **5.1 Basic Statistics**

The average age of females in our sample was 18 years old, with girls as young as 12 and women as old as 44, where the total sample size was 172 females. In terms of products used during menstruation, 11.6% use old rags/clothes, 73.3% use disposable pads, and 15% reusable

products. In total, 62% of women claimed that they experience extreme pain during their menses, and yet, only 18% use a hot pack, 26.5 % use pain medicine, and 25% report going to a doctor to deal with their menstruation discomfort. In terms of general hygiene practices, 84% of women report washing rags with just soap, with only 14% using some form of antiseptic. Figure 1 summarizes additional current hygiene practices. Of note is that while almost all girls appear to wash their hands after changing hygiene products, less wash their hands prior. Overall, it appears that these girls practice some key hygiene behaviors, but presence of proper infrastructure will be very important to maintaining these healthy behaviors.

As mentioned, one of the biggest concerns of improper MHM is the consequence of lost days of school, which may lead to a whole host of other hindrances to girls' eventual success. Of all girls sampled, 48.8% reported knowing someone who had to drop out of school due to menstrual problems and 15.4% missed school due to having to cover some of the chores for their mother, during her menses cycle. Figure 2 shows the extent of absenteeism among those girls in our sample. It appears that over 40% of females in our data report missing school due to menstruation, at an average length of close to 2 days. So, there is evidence in our sample consistent with what has been previously reported. Missed school is still a concern. Further, when asked how hard it was for them to manage work and/or school during menses, 63.7% of those surveyed claimed it was hard or very hard, indicating that there is still a need for improvement in how menstruation is dealt with among these Nepalese female students.

## **5.2 Estimation Results**

Examination of key statistics across our models reveals that the strongest model is Model 2. Addition of extra controls on demographic and socioeconomic variables adds no insightful

difference to the model. Across all models, one can see that the coefficients on our environmental support variables remain statistically significant and within 0.25 of the same point- estimate magnitude. This is an indicator of the strength of our results. Robustness checks via clustered errors around school and bootstrapping of our results revealed no loss of significance for our preferred model.

Analysis of our social network variables lead to some interesting results. Surprisingly, the coefficient on our variable for ownership of a cell phone and that indicative of a teacher being a source for girls to discuss accidents, both indicate a significant positive effect on the probability of a girl reporting feeling sad/lonely. Further, we find some significance for being in a lower caste (Dalit) in terms of reducing likelihood of being sad/lonely and the mitigating effect disposable hygiene products has on negative emotional feelings during menstruation.

Based on our model and presented in Table 3, a marginal increase in supporting infrastructure at school appears to reduce a girls' probability of self-reporting as sad/lonely an average (AME) of 10.8%. A marginal increase in our measure of cultural norms (taboos) faced in the home environment, on the other hand, appears to increase the probability of reporting sad/lonely by an average (AME) of 8.8%. When calculating marginal effects at the mean values of all other variables (MEM), school environment decreases probability of loneliness by 15.2%, while cultural environment increases loneliness/sadness by 12.4%. Most striking is the positive effect that presence of a teacher to talk to about accidents at school appears to be. We find an AME of 59.7% and MEM of 84.5% in increasing the probability of a girl reporting to feel sad/lonely during menstruation.

Regarding other interesting findings, the marginal effects on our preferred model for owning a personal cell phone, are an AME of 21.2% and a MEM of 30%. These results are large

enough to incentivize further investigation of what is occurring, in the future. The significance of caste in decreasing probabilities of feeling sad/lonely (AME of 25.1% and MEM of 35.6%) is also a source of potential future investigation.

When using IPW, the average marginal effect of an increase in the cultural norms index is an increased probability of a girl reporting as sad or lonely by 10.1%. The average marginal effect of an increase in the school environment index is a reduction in the probability of reporting as sad/lonely by 13.5%. Marginal effects at the mean are even stronger at 15.6% and -20.8% for cultural norms and school environment, respectively. Significance remains for our variable representing ability to talk to a teacher about concerns, as well as, for cell phone usage and lower caste.

## **6. Discussion, Policy Implications & Conclusions**

As menstrual health management (MHM) becomes an ever more important element of many WASH initiatives in the developing world, there is a greater call for strong empirical and quantitative analysis. In this study we attempted to tease out the impacts on self-reported psychological well-being from both school and cultural environments. As our results show, the cultural environment that these Nepalese girls face increases their probability of feeling lonely/sad, while the presence of school infrastructure to support menstrual hygiene reduce these feelings. There is evidence that the marginal effects of school infrastructure in improving psychological wellbeing during menstruation are stronger than the negative effects cultural norms have on decreasing wellbeing. As such, given that cultural norms, or taboos, are very hard to change with policy, the focus may be to aim policy at schools. Literature provides evidence that knowledge is powerful in changing behavior and can be done through schools (Adukia 2017;

Montgomery et al. 2012; Dupas 2011). Also, if we can increase the effectiveness and presence of school infrastructure, perhaps the impact of that marginal effect can be leveraged even more. More support can be possible for young girls to aid them in managing the consequences of menstruation, including their psychological well-being.

However, such initiatives must be carried out with a wide range of consideration. In 2000, India proposed a new scheme to provide subsidized sanitary napkins to rural adolescent girls, but at the time there was little consideration of regular supply, privacy, disposal infrastructure or health education (Garg, Goyal, and Gupta 2012). Thus, simple provision of hygiene materials or education may not be enough. There is a need for a more comprehensive support system to be offered, that includes a focus on infrastructure (particularly in schools).

Targeting schools' infrastructure is an important and doable first step to increasing the effectiveness of some existing government interventions. More importantly, these girls' psychological wellbeing can also be improved. Through less feelings of loneliness/sadness, an added benefit may be that girls become more confident in themselves. Further, they may be less afraid of judgements from people at school. This will perhaps target some of the missed days often quoted in existing studies. In a survey of low and middle income countries (LMIC), researchers have pushed for these same ideas looking at how improved infrastructure can lead to not only education gains, but also, improved self-confidence and personal development (Chandra-Mouli and Patel 2017).

Determination of best mediums by which to target improving healthcare supporting infrastructure is already present in efforts in Nepal. In 2010, Nepal launched its National Adolescent Sexual and Reproductive Health Programme, which was aimed at merging health and reproductive education with other health services, at centers separate from schools (WHO

2017). The decision to focus outside of the school environment was due to a feeling that there was still a need to better empower teachers with the right training and information. The impact of this program has thus far not been ascertained and many young people still don't know where to acquire the services of the program. But, workers in the program admit that students are desirous of evidence-based information to counter misconceptions about health related issues. Given this situation, our results provide some additional evidence of benefits to be gained from continuing to focus on improving infrastructure (particularly at schools). And, perhaps such efforts can create a better foundation on which more evidence-based information can be presented and utilized by young women.

Of additional consideration is Snel & Shordt's argument (2005) that children can be change makers. Not only do initiatives to improve school learning environments allow students to be healthier in and of itself, but it also allows for dissemination of hygiene information which can be taken home and shared with other family members. By targeting girls younger, at school, we may even be able to affect behavior beyond the classroom environment. If so, then we may be able to start to slowly alter the positive effect we found of a restrictive cultural environment on feelings of loneliness/sadness. There is preliminary evidence of this phenomena from Jamkhed, India, where interviews from Comprehensive Rural Health Project workers and affected villagers showed that older generations of women were beginning to indicate desires for their own daughters to be less influenced by superstitions (Kirsten 2015).

As we move forward with policy implications of increasing infrastructure, just as infrastructure appears linked to decreasing negative psychological wellbeing outcomes, we must consider who is going to support this increased infrastructure. Including men may also prove to be important. Especially in the developing world, men are often dominant factors to reinforcing

norms and also to accomplishing new initiatives. Changing the attitudes that menstruation does not matter to men may be a useful consideration (Fishman 2014).

An interesting finding of this study is that of cell phone ownership. The mechanism behind why having a cell phone would create a more negative psychological well-being would be an intriguing research question to investigate in future research. In the meantime, a potential thought is that while a cell phone may open up girls to the internet and more information on hygiene, if girls do not know to seek out that information, such knowledge accumulation may not be occurring. Further, as girls realize the extent of the isolationist nature of their home environment in comparison to other parts of the world, they may feel more poorly emotionally. In an analysis of cell phone usage impacts among undergraduate students in the Midwestern United States, Lepp et al (2014) through correlation testing, multivariate analysis of variances, and weighted least squares, determined that cell phone usage had a positive impact on anxiety and a negative impact on GPA. In turn, anxiety increases and GPA decreases were shown to decrease satisfaction with life measures, revealing a potential mechanism of a connection between cell phone ownership/usage and negative self-perceptions of psychological wellbeing.

Similarly, the importance of having a person to talk to about an accident at school, also touches on some, as of yet, indeterminate mechanism by which females are more likely to report as feeling sad/lonely. In the absence of strong evidence from literature, conjecture on our part would be that the ability to discuss menstruation and its woes with other people, in essence gives females permission to accept that menstruation is not just a “woman’s suffering”. Rather, these females are allowed to acknowledge their fears, pains, and concerns more vocally and this is reflected in their ability/willingness to claim that they feel sad or lonely during their menstruation.

Results of our model when utilizing inverse probability weighting while giving greater reassurance that our sample and our regression results are meaningful, do bring up concerns over the effects of association with one school or the other. The effects we find are even stronger once this IPW methodology is utilized. As such, there is some unaccounted for heterogeneity associated with school assignment. It appears that those females from PNMHI are more likely to report feeling sad or lonely (42.5% at PNMHI versus 34.4% at Paklihawa). Further investigation of the demographic/group differences between the two school samples may be warranted to gain additional insight into the mechanisms that contribute to increasing/decreasing rates of self-reported feelings of lower psychological well-being during menstruation.

We do also acknowledge the limitation that all of our variables are self-reported. Self-perceived notions of loneliness and presence/absence of the various environmental support system variables, which form the indices, may differ slightly across individuals and cultures. It is for this reason that we would like to pursue this research further. Perhaps there is a better measure of emotional feelings that we could use.

Regardless of these potential limitations, we were very intrigued to take these strong findings from a pilot study with only two schools and expand the work to include a much larger sample. By randomly selecting and surveying enough students to gain between 400 and 600 observations, we believe would provide further evidence and insight into the intriguing dynamics we have already established between emotional/psychological wellbeing and supporting environments. Further, when examining how difficult life is during menstruation based on the type of hygiene product they currently use, our data shows that those girls who use reusable products report life as being easy/very easy to manage (see Figure 3). As such, greater insight into the viability of this particular hygiene kit may also be possible through follow-up work.

Finally, as older women may not be able to benefit directly from policies aimed at improving school infrastructure, future research could benefit from further examination of means to help older women combat their loneliness. Perhaps, such changes may be possible through the aforementioned link of children as change makers. The goal is that all women can find their light in the dark and become more powerful and productive people.

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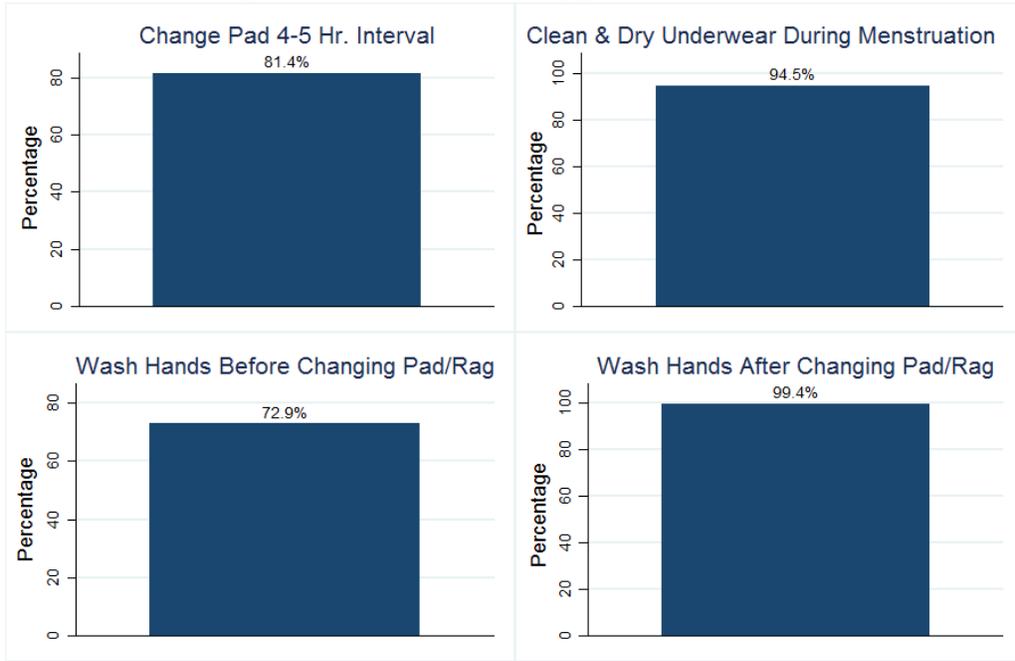
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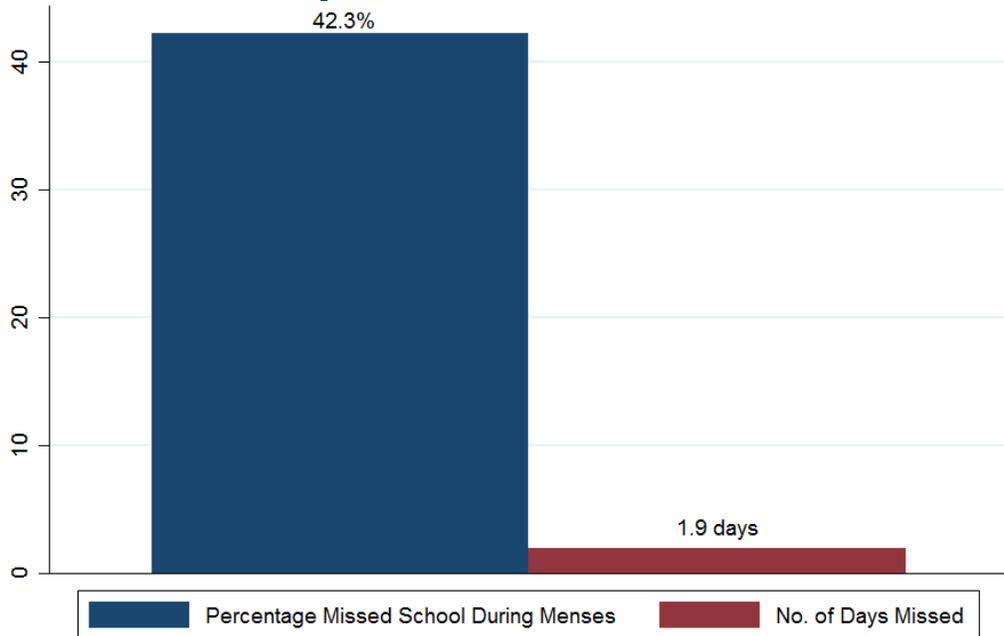
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### Figure 1: Menstrual Hygiene Practices



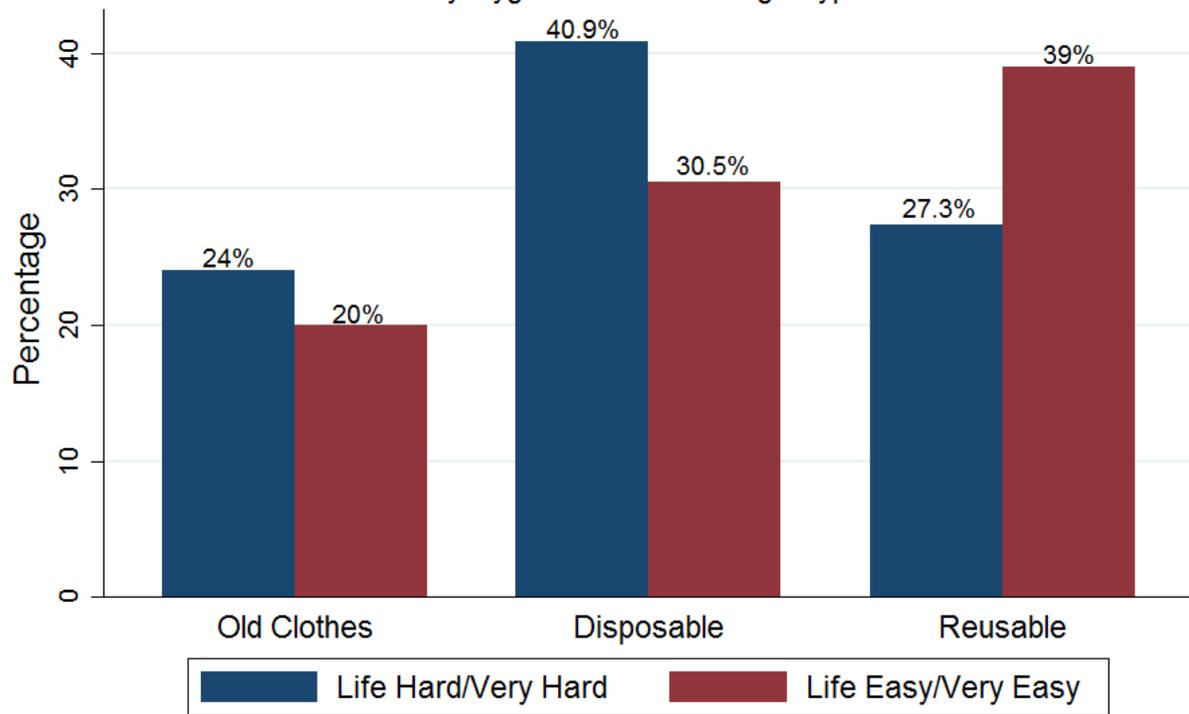
Source: Nepal Study Center, UNM. May, 2016

### Figure 2: School Absenteeism



Source: Nepal Study Center, UNM. May, 2016

Figure 3: Ability to Manage School/Work  
by Hygiene Product Usage Type



Source: Nepal Study Center, UNM, May 2016

**TABLE 1: Descriptive Statistics of Variables**

VARIABLES	DESCRIPTION	MEAN	S.D.	MIN/MAX
<b>DEPENDANT VARIABLE</b>				
<i>Lonely</i>	=1 if female self-reports as feeling sad or lonely during menstrual cycle, 0 otherwise	0.378	0.486	0/1
<b>EXPLANATORY VARIABLES</b>				
<i>School Environment</i>	Index based on PCA of (1/0) self-reported yes answers to existence of sanitation supplies, separate toilet, soap, & disposal bin at school	1.65	1.13	-1.37/3.78
<i>Cultural Norms</i>	Index based on PCA of (1/0) self-reported yes answers to not being able to enter prayer room, stay in same house, participate in cultural functions, be allowed in kitchen, & meet family/friends during cycle	0.878	1.07	-1.77/2.69
<i>Share with Teachers</i>	=1 if female self-reports as being able to talk to teachers at school if there is an accident at school, 0 otherwise	0.942	-	0/1
<i>Age</i>	Age of female	18.029	5.892	12/44
<i>PNMHI School</i>	=1 if attending PNMHI School, 0 otherwise	0.424	-	0/1
<i>Cell Phone</i>	=1 if owns a cell phone, 0 otherwise	0.583	-	0/1
<b><u>Hygiene Product Use</u></b>				
<i>Old Clothes</i>	=1 if female currently using old clothes during menstruation, 0 otherwise	0.116	-	0/1
<i>Reusable</i>	=1 if female currently using reusable hygiene product during menstruation, 0 otherwise	0.151	-	0/1
<i>Disposable</i>	=1 if female currently using disposable hygiene product during menstruation, 0 otherwise	0.733	-	0/1
<b><u>Caste</u></b>				
<i>Dalit</i>	=1 if Dalit caste, 0 otherwise	0.157	-	0/1
<i>Madhesi</i>	=1 if Madhesi caste, 0 otherwise	0.297	-	0/1
<i>Other</i>	=1 if other castes, 0 otherwise	0.523	-	0/1
<i>Wealth Index</i>	Sum of binary (1/0) self-reported yes answers to self or family owning land & cement home	1.726	0.509	0/2
<i>Married</i>	=1 if female is married, 0 otherwise	0.070	-	0/1

Source: Sustainable Development Lab, Nepal Study Center, UNM, Spring 2016

**TABLE 2: Logistic Regression of Support Systems' Impact on Psychological Wellbeing**

VARIABLES	MODEL 1	MODEL 2	MODEL 3
<i>Cultural Norms</i>	0.400* (0.15)	0.511** (0.18)	0.513** (0.20)
<i>Madhesi</i>	0.819* (0.36)	0.743 (0.48)	0.757 (0.44)
<i>Dalit</i>	-1.201* (0.68)	-1.463* (0.84)	-1.433 (0.85)
<i>School Environment</i>	-0.401* (0.18)	-0.626*** (0.20)	-0.612** (0.19)
<i>Share With Teachers</i>	3.021** (0.71)	3.478** (1.04)	3.563** (1.07)
<i>Reusable</i>		-0.651 (0.85)	-0.677 (0.82)
<i>Disposable</i>		-1.382* (0.74)	-1.397* (0.62)
<i>Cell Phone</i>		1.236** (0.60)	1.248** (0.56)
<i>Age</i>		0.952 (0.73)	0.824 (0.80)
<i>Age-Sq.</i>		-0.029 (0.02)	-0.025 (0.02)
<i>PNMHI</i>		0.232 (0.69)	0.155 (0.74)
<i>Wealth Index</i>			0.051 (0.43)
<i>Married</i>			-0.951 (1.63)
N	172	172	172
ln(L)	-100	-88	-87
$\chi^2$	24.4 (p=0.004)	37.9 (p=0.001)	37.3 (p=0.002)
AIC	212.7	199.4	202.8
BIC	231.5	237.2	246.9

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Bootstrapped standard errors in parentheses

**TABLE 3: Marginal Effects of Preferred Model (Model 2)**

VARIABLES	Marginal Effects (Non-IPW)	Marginal Effects (IPW)
<i>Cultural Norms</i>	0.0877*** (0.0307)	0.156*** (0.0513)
<i>Madhesi</i>	0.128* (0.0698)	0.101 (0.0957)
<i>Dalit</i>	-0.251** (0.116)	-0.289* (0.160)
<i>School Environment</i>	-0.108*** (0.0303)	-0.208*** (0.0447)
<i>Share With Teachers</i>	0.597*** (0.207)	1.009*** (0.344)
<i>Reusable</i>	-0.112 (0.114)	-0.0725 (0.158)
<i>Disposable</i>	-0.237*** (0.0910)	-0.315** (0.130)
<i>Cell Phone</i>	0.212*** (0.0781)	0.226** (0.114)
<i>Age</i>	-0.00661 (0.0170)	-0.0245 (0.0191)
<i>PNMHI</i>	0.0397	0.254**

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Marginal effects are presented at mean (MEM). IPW reflects accounting for assignment to school. Standard are errors in parentheses

**Table 4: Summary Hypotheses Results Table**

HYPOTHESIS	NON-IPW		IPW		REMARKS
	RAW COEFFICIENT	MARGINAL EFFECT	RAW COEFFICIENT	MARGINAL EFFECT	
<i>H1: School Infrastructure Decreases Negative Emotions</i>	_-***	_-***	_-***	_-***	Presence of greater hygiene supporting infrastructure will decrease probability that a girl reports as feeling sad/lonely
<i>H2: Cultural Norms Increase Negative Emotions</i>	+**	+****	+**	+****	Presence of greater cultural restrictions/norms increases probability that a girl reports as feeling sad/lonely

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Using preferred model (Model 2) and robust standard errors.