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A Pilot Study on Adolescent Mobile Phone Use, Indirect Mental Health Costs and Cultural Context Considerations – REPORT

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A Pilot Study on Adolescent Mobile Phone Use, Indirect Mental Health Costs and Cultural Context Considerations - REPORT



Submitted by:

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Fall 2019

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Executive Summary

Use of mobile-based health (mHealth) interventions is growing across the developing world, including in Nepal. Targeting adolescents, who represent 11.8% of the Nepali population, is one area of focus, particularly with aims to combat high bullying and suicide rates and accompanying mental health issues. However, there is evidence from across the developed world that too much use of mobile phones can have negative effects in of itself on mental health.

This study examines multiple domains of adolescent life surrounding each of these three topics: mental health, mobile phones, and mHealth intervention potential. Self-report surveys from over 700 adolescents in grades 10-12 were completed in and around the urban city of Siddharthanagar, in Province Five of Nepal. The average age of those adolescents surveyed was 17.6 with 95% of the sample falling between the ages of 15 and 19, with 54% female. Trained enumerators administered a survey which addressed topics relevant to the theoretical model which motivates this work: Basic Psychological Needs Theory (BPNT). Topics covered included adverse and protective/support factors in adolescents' lives; information about mobile phone use, frequency, and addictive tendencies; and mental health status evaluations, along with information useful for any future efforts to pursue mHealth interventions.

Evaluation of various adverse factors revealed that females do still face a gender bias when it comes to life expectations and experiences. While very few adolescents in school have children, close to 10% have been married, with rural females exhibiting the highest rates. Further, when it comes to arranged marriages, females feel the pressure to accept more than males. Females also continue to exhibit barriers in menstruation management, with close to 45% missing school, or knowing someone who has, during menstruation and over one-third having to miss cultural functions. Hygiene infrastructure is suffering with between 11-18% of respondents claiming no separate toilets at school for girls, and almost 60% of students say there is no soap in school restrooms. Discrimination is also still a concern, especially among urban females, where 53.3% claim males harass females in the community. Male adolescents appear to be less aware of this harassment and report lower rates of occurrence.

Family and peer pressure are also present in those adolescents surveyed. One-third of females agree that they have been physically hurt in their home, punished for bad exam or school grades, and that women should tolerate violence to maintain familial harmony, with higher rates reported by males. This would indicate that violence, in general, may play a larger role in the lives and minds of male. Parental oversight is higher for females, with 60.8% of females claiming their parents examine the contents of their phones. Peers' substance use is reported to be 10% higher among urban adolescents, with equivalent rates for tobacco, alcohol, and marijuana consumption. And, about 20-30% of urban adolescents appear to know someone who has hurt themselves, while under 10% of rural adolescents admit the same. Males, overall, report higher rates of knowing about self-harm behaviors.

School-pressure is the final major arena adverse factors investigated in this study, where we find elevated pressures to do well by females. Among males, 79% worry about exam score, but 85% of females do. Females also show a higher rate of belief that success in school will ultimately determine one's life success (83% versus 78%). Teachers are seen as too controlling by two-third of the study population, and school as extremely competitive by one-third. Bullying rates at school are over 10%, with higher rates reported in urban schools. Outside of school, rural females report the highest rates of bullying (13%), and females, overall, spend more time concerned over peer approval.

To combat the pressures faced in adolescent development, elements of support/protection may also be important. We queried adolescents on topics of parental support, social engagement, and personal soft skills/characteristics. There are fairly high rates of parental encouragement to complete school and having warm interactions between adolescents and parents. Parental encouragement of socializing with friends was lower overall, but rural adolescents appear to have the most positive inputs from parents.

Females are gaining social interaction from having a smaller group of friends than males, and they spend more time with family than friends. Males not only have more friends, but more friends who are female. Males also have easier access to socialization opportunities with higher rates of club memberships and higher rates of having a meeting place with friends than their female counterparts. However, less than 50% of adolescents appear to have a place to socialize, potentially limiting their abilities to form strong social connections and establish a stronger social network.

Social network engagement/presence is relatively high, but there is still room for improvement. Three-quarters of rural adolescents report that there is someone to borrow money from, stay with if there is a problem at home, confide in about violence, or assist during times of harassment. Only two-thirds of urban adolescents, however, claim to have access to these same social network supports. Soft skills/personal characteristics appear to mirror this situation, with rural adolescents exhibiting higher self-esteem and grit. Females also appear to have a distribution of grit scores shifted right (higher values) than males.

In terms of the surveying done on mobile phone usage, 82.6% of respondents own a phone, of which 89.8% have internet access. Females own mobile phones at a lower rate (15 to 20 percentage points lower than those of their male counterparts) and have owned them for a shorter period of time. Additionally, females have less privacy over their phones, with 32% of urban females sharing their phone with 2 or more other people. Rural males have the most apparent control with 77.3% claiming they are the only one that use their phone.

The mean phone and data plan costs for urban adolescents are much higher than those for rural adolescents, costing an average of 5,000-10,000 NPR more per phone purchase and monthly data plans close to 2x higher. Samsung Galaxy is the most popular brand, while in urban environments, adolescent phone owners appear to be more evenly distributed with owners of iPhones and Chinese-based Smartphones. Nepal Telecom dominates as the mobile carrier for rural cell phone owners, while NCell dominates in the rural locals. The vast majority of phones are operated in English and around three-fourths of adolescents report having a phone in good working condition.

Usage of mobile phones is concentrated towards tools and social-based functions. The four most commonly listed uses are Entertainment News, Music/Ringtones, Taking Photos, and Voice Calls. Males use their phones more intensely than females, based on a summation measure created for the purpose of this study. The majority of urban males are high (29.5%) or extreme (31.3%) users of their mobile phones, while urban females are more likely to be either low (30.5%) or extreme (25.4%) users.

Overall, females, regardless of location, are spending more time than their male counterparts using social media via their mobile phones, with urban females spending the most time. Urban females also spend more time texting than rural females. Rural females appear to spend a medium level of time on both voice calls and social media, while urban females appear to have an S-curvature to their usage with bunching at very low or very high usage times, and 11.7% of urban females (versus 6.4% of rural females) report having more than three social media memberships. Urban males spend markedly more time on the social uses of texting and voice calls than rural counterparts.

Motivations for both social media and overall phone use indicate that the most commonly chosen reasons for use are to get information, followed by keeping in touch. Rural and female adolescents appear to weight access to information more heavily than keeping in touch. For phone use in particular, 50% of adolescents claim that their primary motivation for use is for schoolwork or to find specific information. Rural adolescents particularly see mobile phones as a means to accomplish this, with 70.1% of rural females and 60.8% of rural males choosing information access as their primary reason for use. Urban adolescents, on the other hand, have notable rates of seeing mobile phone use as a means of relaxation/entertainment or as a source to ease loneliness.

Given the evidence of fairly high use and intensity of use of mobile phones, it is not surprising to find evidence of addictive tendencies in this population. Male respondents appear to have a higher tendency towards problematic phone use than their female counterparts, and urban adolescents overall show higher rates. As such, urban males have the most pronounced evidence of problematic use with a mean scale score of 91.83 (range is 27-135), versus the lowest average score for rural females of 83.21.

Mental health evaluations indicate that close to 21% of the overall sample have moderate to severe ratings of depressive symptoms and 24% have moderate to severe ratings of anxiety symptoms. Rural males appear to exhibit the largest percentage of respondents with no anxiety (46.6%), and the largest percentage of adolescents who do exhibit moderate and severe anxiety symptoms is among urban females (combined percentage across two categories of 32.2%). Overall, more females than males exhibit at least mild anxiety symptoms. In terms of depression, urban females show higher combined moderate and severe depression levels than urban males (28.9% versus 22%), and rural females show combined moderate and severe depression levels of 17.5% versus 13.6% for rural males, indicating that females also exhibit higher depression levels.

Driving some of these anxiety and depressive feelings/symptoms may be acknowledged pressures on adolescents. The most talked about worry between respondents and their closest friend is school pressures, followed by fights with other friends (rural males and urban females) and parental pressures (urban males and rural females). Overall, 10% of all respondents report discussing concerns over bullying and parental fights with their closest friend, recently.

To begin to tie the various strands of information together in this study, a series of two-way association tables and preliminary regressions were performed. Results of two-way tables show that adolescents with higher PMPU scores (or phone utilization) also tend to have higher BAI/BDI scores. (The correlation between these two measures of phone usage is 0.3614.) There is also support for a negative association between grit/self-esteem scores and mental health measures. The strength of this association appears to be slightly stronger for depression measures. Finally, we find a slight positive association between having more adverse factors and scoring higher on the BDI scale. Urban males appear to have the weakest association, with the flattest association line.

From preliminary estimation, we find initial insights into the types of adolescent who are more likely to own a cell phone, into the types of use most related to maladaptive use of mobile phones, and into those factors which most effect mental health measures. Results of robust logistic regression indicate females are less likely, while those from household led by a female and who have a higher socioeconomic status are marginally more likely to own a mobile phone. The lack of significance of all caste, location, and religion variables speaks to the ubiquity of mobile phone dispersion in Nepal. Tools and social uses appear to be those mobile phone functionalities most linked to PMPU and phone utilization measures. For females, the larger effect comes from social use, while it is tools use for males.

Bullying is shown to have a statistically significant, positive impact on depression and anxiety scores, with a stronger effect for females. Peer pressure is also found to have a statistically significant impact on higher depression measures. To buffer this, it appears that parenting support promotes improvements in grit and self-esteem measures, where those adolescents with higher grit and self-esteem are predicted to have lower depression and anxiety symptom scores. Further, social interactions have a positive effect on self-esteem.

In order to facilitate future mental health interventions, information about existing offerings and attitudes were also gathered. While between two-thirds and three-quarters of adolescents feel their school has mental health information available either through curriculum or a school counselor, almost all want more. Given this, urban adolescents would first look online for information about mental health, while rural adolescents would first seek out a public doctor or clinic, and teachers represent only the fourth most likely person to first approach if an adolescent wanted to talk about their mental health concerns. Mothers,

doctors, and friends are the more likely choices for people to first approach with concerns, and rural adolescents would more likely approach their mothers or friends. And, rural adolescents in our study also feel better about having access or knowing where to seek out resources for mental/emotional health support, with 76.4% agreeing they know where to find information (versus 68.8% in urban areas).

In terms of feasibility of implementing a mobile-based intervention, 60.4% of urban and 68.2% of rural adolescents say that they agree they automatically look to their phone to find the answers to questions that they have. Further, 71% of rural adolescents and 65.2% of urban adolescents actually trust the information that they find online. These mean that at least a portion of adolescents might be able to integrate mobile-based interventions into their existing patterns of behavior. Additionally, approximately 50% of the sample are willing to read texts from a number that they do not know. However, urban adolescents are more concerned about the privacy of their phone contexts (which makes sense given that they show higher rates of phone sharing). Additionally, close to 50% of adolescents agree that their phone is taken and others will look through it. These latter elements will need to be considered in implementing an appropriate mHealth intervention.

In summary, policy prescriptions would indicate that focus should be given to several key elements of adolescent life. Firstly, infrastructure in schools can be improved to facilitate more females remaining in school, despite menstruation pressures. Secondly, more opportunities for socialization between adolescents should be facilitated, and may include opportunities for school-work study groups/support. Also, there is a need to improve the health curriculum in schools, so that adolescents are more aware of when and where to get support/treatment, along with reducing the stigma/fear surrounding this topic of discussion. There is a need to pay particular attention in any future mental health interventions on urban females, but again, consideration of privacy concerns with mHealth approaches will need to be made. Further, bullying continues to be an area which deserves attention and novel ideas to combat its spread.

1. Background Information

There is a growing interest in using mobile-based mental health interventions to combat high suicide and bullying rates within adolescent populations in Nepal, where 11.8% of the population is estimated to be between 13-17 (WHO-SEARO 2017). While use of mobile technology is believed to be high among adolescent populations and offers a potential avenue for intervention, there is growing evidence from developed-world contexts of the negative mental health and wellbeing outcomes that can come from overuse of mobile/smartphones (Ha et al. 2008; Hong, Chiu, and Huang 2012; Ko et al. 2007; Takao, Takahashi, and Kitamura 2009; Vernon, Modecki, and Barber 2018). Thus, the overarching purpose of this study was to evaluate the potential risks and benefits of future mobile-based health interventions. In order to accomplish this, the study examined the presence and perceptions of various stressors and supporting elements in the lives of Nepali adolescents, along with mental health status evaluations. Further, we evaluated patterns and uses of mobile phones by adolescents in Nepal, which may have an impact on mental health.

2. Study Specifics

2.1 Implementation

Siddharthanagar, the central point for this study, has four other cities within one or two hours of driving distance (Butwal and Tansen in the north, Dang in the west, Chitwan in the east), and it is also a gateway city to an important tourist destination, Lumbini, the birthplace of Buddha and a world heritage site. A major zonal 135-bed hospital is also located within a half hour of driving distance from the city, in Butwal. The area boasts two medical schools, one eye hospital, one agriculture college, an engineering college, one science college, and several two- to four-year colleges, allowing access to older adolescent populations (over age 15). As such, this area provides a reasonable picture of an active urban area (outside Kathmandu) where technology development is expected to be relatively high, meaning mobile phone and particularly smartphone, ownership rates would be expected to be relatively high. Additionally, the easy access to rural localities nearby offers additional opportunities to be able to compare research outcomes across urban and rural areas, where the geographic diversity in the region contributes to trapping of local cultures across as small as a 20-mile distance.

Implementation of a survey was done through the support of enumerators. Enumerators were selected through personal interviews to take part in the survey, and were given training to ensure that all the enumerators were uniform in their understanding of the questions and in their language while communicating with students. While enumerators were there to answer questions if adolescents had concerns regarding any elements of the survey, as per the protocol, adolescents completed the survey in an “exam-style” set-up so that there was spacing between survey participants. We did not want participants to converse or interact with one another while completing the survey.

The survey administered was designed at the Nepal Study Center (Department of Economics, UNM) in English and was later translated into Nepali by the enumerators, following approval from the institutional board review (IRB) of the University of New Mexico, USA. A thorough literature review on the issues relevant to this study including adolescent mental health, mobile phone correlates with mental health, adolescent development, mobile phone penetration, and mobile-based health interventions was conducted before drafting of the questionnaire. An exploratory assessment was conducted through a focus group survey of 66 individuals from multiple stakeholder groups relevant to the research (adolescents, mothers, health professionals, and school administrators) in Rupandehi district prior to this study. Information about the state of mental health knowledge/awareness, current mobile phone practices/uses of mobile phones, and insight into those cultural/developmental burdens seen as most detrimental to the mental health of adolescents in the region was used to inform the development of this survey.

2.2 Sample Description

In Siddharthanagar, which lies in Province Number Five, adolescents from two large secondary schools (one public and one private) were surveyed (Saibaba Higher Secondary School and Bhairahawa Namuna Higher Secondary School). In the surrounding districts of Palpa, Gulmi, and Argankhachi, adolescents from five additional public secondary schools were surveyed (Bhairav Navadeep Higher Secondary School (Chahara), Shree Prithivi Higher Secondary School (Purkot), Shree Saraswoti Secondary School, Shree Mahendra Bidhya School, and Shree Sarvajanic Secondary School). There were a total of 743 students surveyed from grades 10-12, with 391 coming from the urban schools. The average age of those adolescents surveyed was 17.6 with 95% of the sample falling between the ages of 15 and 19. The sample was fairly evenly split by gender with 54% being female (in the rural localities, the percentage of sample female was 62%). Other socioeconomic characteristics can be found in Table 1.

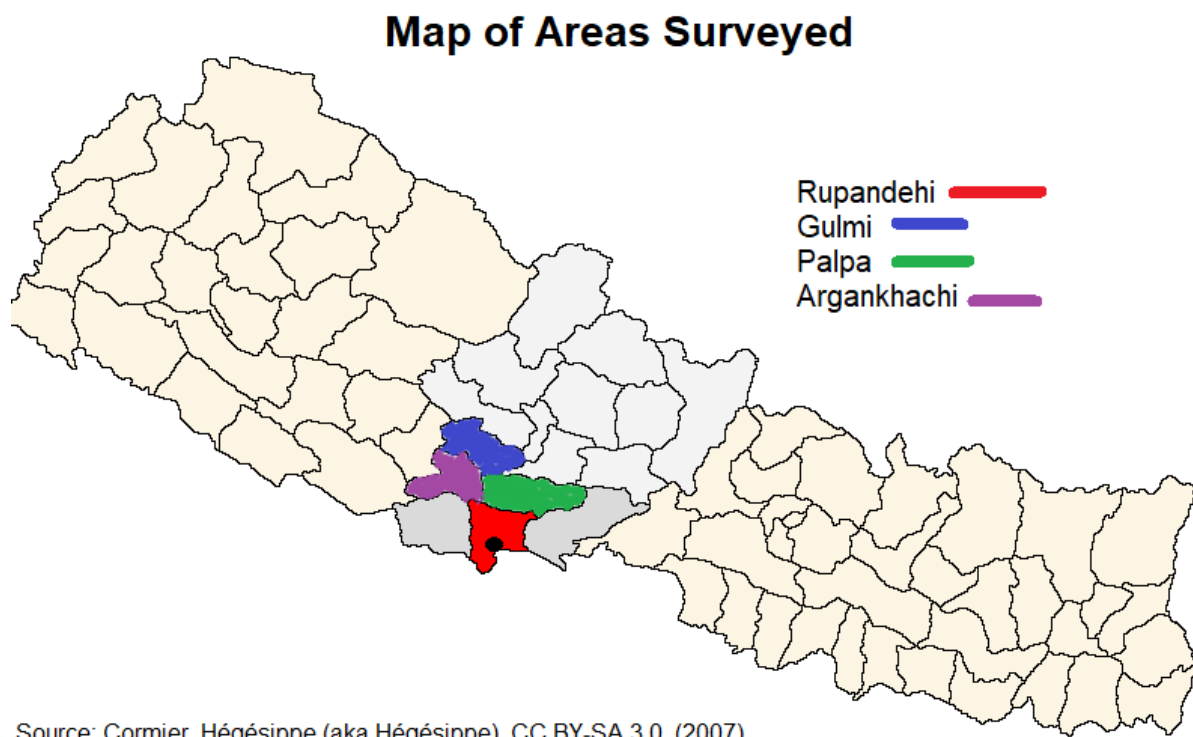


Table 1: Socio Economic Characteristics

| | Full Sample | | | Urban | | | Rural | | |
|-----------------------------|-------------|---------------|-------------|------------|---------------|-------------|------------|---------------|-------------|
| | <i>All</i> | <i>Female</i> | <i>Male</i> | <i>All</i> | <i>Female</i> | <i>Male</i> | <i>All</i> | <i>Female</i> | <i>Male</i> |
| Percentage of Sample | 100% | 54% | 46% | 53% | 46% | 54% | 47% | 62% | 38% |
| Average Age | 17.6 | 17.4 | 17.8 | 17.8 | 17.5 | 18.1 | 17.3 | 17.3 | 17.3 |
| Average HH Size | 6.4 | 6.4 | 6.4 | 6.5 | 6.1 | 6.8 | 6.3 | 6.5 | 5.9 |
| Have Migrant Parent/Sibling | 63.1% | 66.9% | 61.4% | 53.5% | 52.9% | 57.7% | 73.9% | 78.1% | 66.9% |
| <u>Religion</u> | | | | | | | | | |
| Hindu | 88.4% | 92.3% | 84.1% | 81.7% | 85.4% | 78.9% | 95.5% | 97.7% | 91.7% |
| Buddhist | 3.5% | 3.1% | 3.9% | 4.3% | 5.9% | 3.0% | 2.6% | 0.9% | 5.3% |
| Muslim | 6.8% | 3.6% | 10.2% | 12.1% | 7.0% | 16.1% | 1.1% | 0.9% | 1.5% |
| Other | 1.3% | 1.0% | 1.8% | 1.9% | 1.7% | 2.0% | 0.8% | 0.5% | 1.5% |
| <u>Ethnicity</u> | | | | | | | | | |
| Brahmin/Chhetri | 43.8% | 46.2% | 41.2% | 36% | 43% | 30% | 52.1% | 48.6% | 57.9% |
| Newar | 3.2% | 3.3% | 3.0% | 3.5% | 4.1% | 3.1% | 2.9% | 2.8% | 3.0% |
| Janajati | 16.4% | 19.7% | 12.4% | 9.2% | 12.2% | 6.6% | 23.9% | 25.7% | 21.1% |
| Dalit | 14.4% | 15.4% | 13.3% | 11.1% | 8.1% | 14.2% | 17.7% | 21.1% | 12.1% |
| Other | 22.2% | 15.4% | 30.1% | 40.2% | 32.6% | 46.1% | 3.4% | 1.8% | 5.9% |
| <u>Wealth Indicators</u> | | | | | | | | | |
| Cement Home | 61.1% | 59.5% | 65.0% | 81.1% | 84.5% | 83.1% | 38.9% | 39.7% | 37.6% |
| Own Land | 85.7% | 88.8% | 85.0% | 80.6% | 83.9% | 82.1% | 91.5% | 92.7% | 89.5% |
| Electricity | 89.4% | 91.9% | 89.5% | 85.9% | 89.7% | 87.6% | 93.2% | 93.6% | 92.5% |
| Landline Telephone | 26.9% | 27.2% | 27.5% | 33.5% | 35.6% | 33.8% | 19.6% | 20.5% | 18.1% |
| Computer | 30.1% | 28.0% | 33.8% | 40.7% | 43.1% | 41.3% | 18.7% | 16.0% | 22.6% |

Source: Nepal Study Center, 2019

2.3 Theoretical Underpinnings (BPNT)

Underpinning this work was the sub-theory of Self-Determination Theory (SDT), called Basic Psychological Needs Theory (BPNT), which claims that satisfaction and/or frustration of the three needs of autonomy, competence, and relatedness serve as mediators in other mental health or behavioral relationships (Ryan and Deci 2000). Absence of these three needs results in diminished wellbeing, where social contexts are the primary determinant of need-meeting. Low need satisfaction overtime can result in costs, but this deteriorating processes will be exacerbated when needs are actively “frustrated” (or thwarted). When needs are frustrated, there are two consequences: immediate costs of reduced well-being and chronic need-thwarting can result in development of coping strategies which include searching for “Need Substitutes” and compensatory behaviors. However, most evidence from literature indicates that coping strategies may ultimately be short-lived in producing feelings of need satisfaction, and can lead to (or include) further negative outcomes such as anxiety and substance abuse. This study hypothesized that the social/cultural context Nepali adolescent face can be seen as protective (meet) and adverse (frustrate) factors, which either meet or frustrate the set of 3 Basic Needs. Further, we hypothesize that mobile phones could be seen as a medium through which the types of coping strategies BPNT mentions are facilitated, indicating that they have the potential to exacerbate existing states of negative wellbeing.

Below are sections detailing the descriptive statistics and findings regarding the state of both the adverse and protective factors measured in this study. Following those sections are information on findings with regard to mobile phone usage and potential addictive tendencies, along with a section on the

status of mental health among these older adolescents. These figures display differences and similarities across both locality (urban versus rural) and gender divisions, which may help better tailor future intervention policies.

3. Adverse Factors

KEY HIGHLIGHTS:

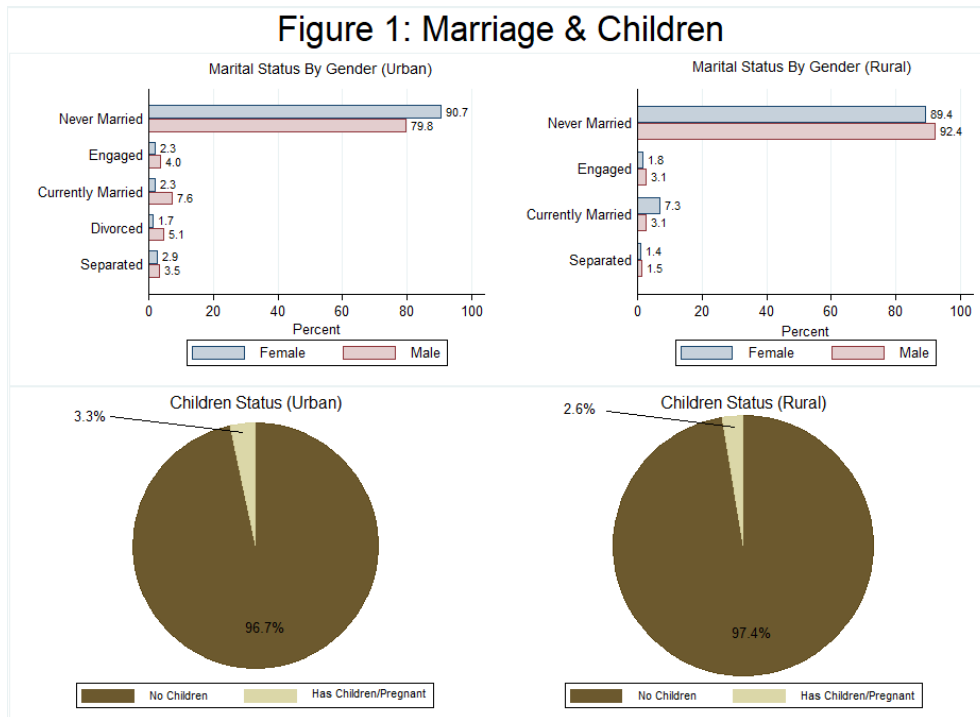
- Less than 5% of adolescents have children, but overall 10% have been married, with females showing higher rates in rural areas.
- In rural setting, 73% of both males and females say that it is acceptable for a boy to refuse an arranged marriage, while only 62% (females) and 65.9% (males) say it is the same for a girl's refusal.
- 45.4% of rural and 42.9% of urban adolescents report missing school (or know a female relative who has) during menstruation.
- Between 11 and 18% of respondents claim there is no separate toilet for girls at school, and close to 60% claim that their school bathrooms have no soap.
- More males than females agree that a woman's place is in the home.
- Urban females report the highest rates of male to female harassment (53.3%).
- About 1/3 of females & 40% of males agree that they have been physically hurt in their home, punished for bad exam or school grades, and that women should tolerate violence to maintain familial harmony.
- 60.8% of females and 53.6% of males claim their parents look through the content of their phones
- The percentage of adolescents who report substance use by friends is close to 10 percentage points higher among urban groups, with males more likely to be engaging in substance use.
- About 20-30% of urban adolescents appear to know about self-harm behaviors by others and 10% of rural adolescents admit the same.
- 85% of females and 79% of males worry about their school exam scores
- 83% of females and 78% of males believe that success in school will ultimately determine their success in life.
- 2/3 of adolescents agree that teachers are too controlling and 1/3 that the school environment is extremely competitive.
- Bullying is reported by 10% of adolescents, with higher rates in urban schools.
- Females, especially in rural areas, report rates of up to 13% of bullying outside of school.
- Females report worrying more than males about how they are seen by others.

3.1 Gendered Concerns

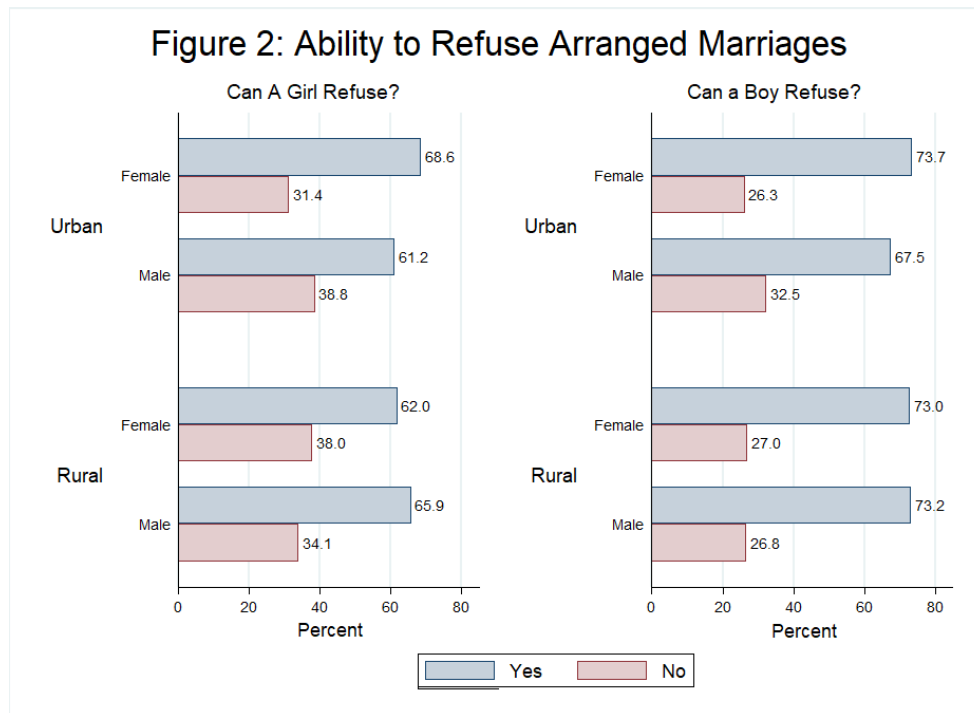
One area of potential pressure and concern for females in Nepal is early ages of marriage and childbearing (Adhikari et al. 2016; Maharjan et al. 2012), given cultural and religious pressures to delay sexual activity until after marriage. As shown in Figure 1, across both urban and rural setting, the percentage of adolescents with children (or pregnant) at the time of surveying was below 5%; however, the rates of marriage are somewhat higher, even for a population still in school and primarily under age 20. It appears that in urban settings, males are more likely to be married, while in rural settings, females are more likely to be married. Rates of broken unions also appear to be higher in urban settings, and there

is further evidence that marital pressures are a real concern, given the percentage distributions of those adolescents who feel it is acceptable to refuse arranged marriages.

In Figure 2, one sees that across the board, regardless of gender or location, more adolescents deem it acceptable for a boy to refuse an arranged marriage than a girl. Additionally, it appears that in rural settings, these opinions are more strongly felt. In rural setting, 73% of both males and females say that it is acceptable for a boy to refuse an arranged marriage, while only 62% (females) and 65.9% (males) say it is the same for a girl's refusal. In urban settings, it is interesting that boys hold more traditional beliefs for both boys' and girls' abilities to exercise right of refusal than their rural counterparts. However, urban females actually exhibit the largest percentages of approvals for marriage refusal, which may stem from more freedoms associated with urban living and easier socialization opportunities.



Source: Nepal Study Center, 2019

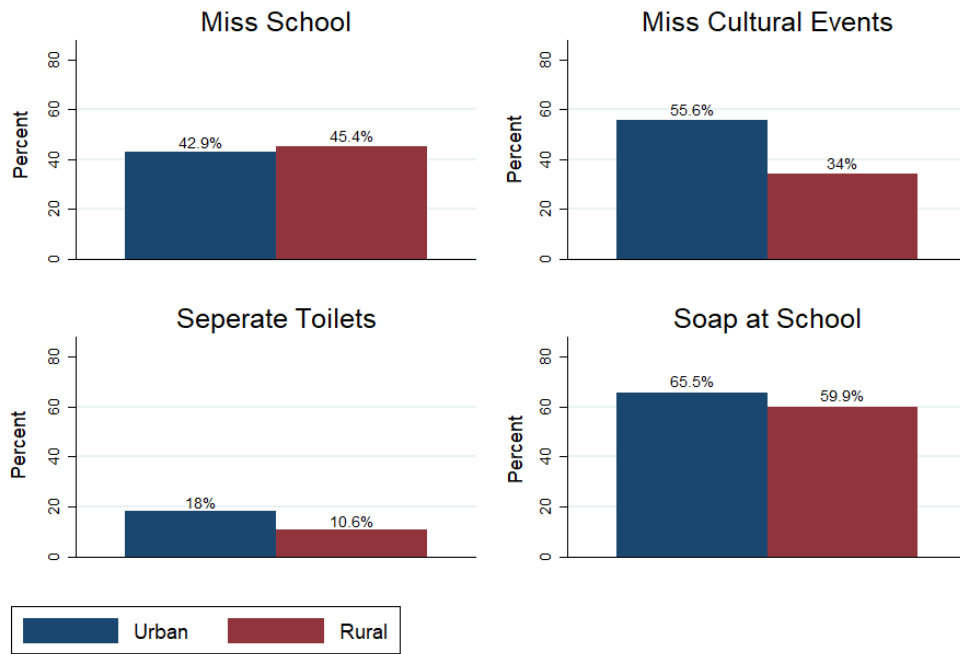


Source: Nepal Study Center, 2019

Another major concern for female adolescents, directly, revolves around menstruation. The confusion and surprise many females face when confronted with the onset of menses is often attributed to lack of knowledge (Sharma et al. 2013; WaterAid 2009; Sommer et al. 2012; Adhikari et al. 2007) and proper facilities (Crofts and Fisher 2012; Sommer 2010; BRIDGE 2015; Ndlovu and Bhala 2015). Such outcomes are exacerbated by the many cultural taboos/stigmas still currently associated with it in many developing countries (LaSaine 2015; Fatusi and Hindin 2010; Ssewanyana and Bitanirwe 2017), including Nepal. Of particular concern is the practice known as Chhaupadi, wherein females 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, one still finds it practiced, especially rurally (Katz 2014). As such, girls may still face reproductive health problems (Ranabhat et al. 2015) and even death associated with menstrual isolation (Gettleman 2018). As such, the impacts of female absences and infrastructure defaults could have impacts for males, as well as, females.

Figure 3 examines the realities of these pressures, across locality divisions. In both settings, close to half of respondents reported that they, themselves, have or they have known of female relatives who have had to miss school as a consequence of menstruation. The rates in rural localities are slightly higher (45.4% versus 42.9%); however, it appears that on other dimensions, rural residents are faring better with lower rates of having to miss cultural functions (34% versus 55.6%). While rural localities also exhibit slightly better hygiene-supporting infrastructure, the rates themselves, overall, speak to a need for more supporting infrastructure with between 11 and 18% of respondents claiming no separate toilet for girls at school and close to 60% claiming that their school bathrooms have no soap (regardless of location).

Figure 3: Menstruation Concerns



Source: Nepal Study Center, 2019

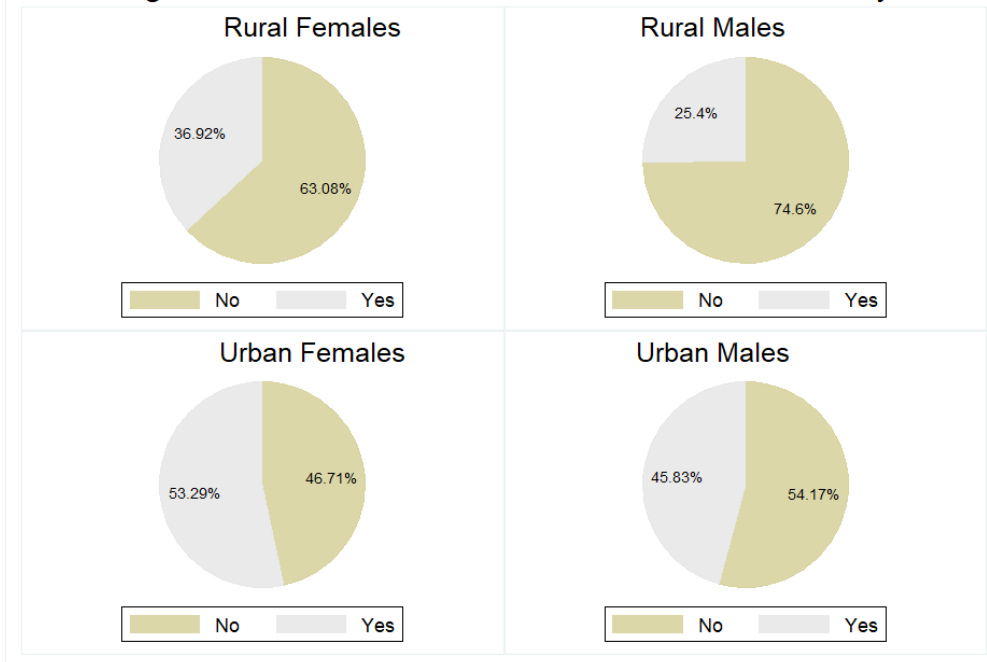
The pressures adolescent females face may also be exhibited in opinions on gender inequality and violence. Figure 4 presents levels of agreement/disagreement on three key statements across gender lines. Both males and females primarily agree that genders should be treated equally in thought, but in practice, it appears that such attitudes may not be entirely true. When it comes to a woman’s place as being in the home, more males than females seem to strongly agree on this premise, and more females than males strongly disagree. However, both genders are in fair agreement (and distribution) when it comes to the idea that men should defend their honor if insulted, insinuations that may lead to violence. Violence from men to women is evidenced in Figure 5, where one sees that adolescents report quite staggering rates of male harassment of females in their communities. The highest rate of harassment comes from urban females (53.3%), and it is not surprising that across both localities, more females than males report the harassment, with only 25.4% of rural males claiming that males harass females (compare that to 36.9% of rural females’ claims).

Figure 4: Opinions on Gender Norms



Source: Nepal Study Center, 2019

Figure 5: Males Harass Females in the Community

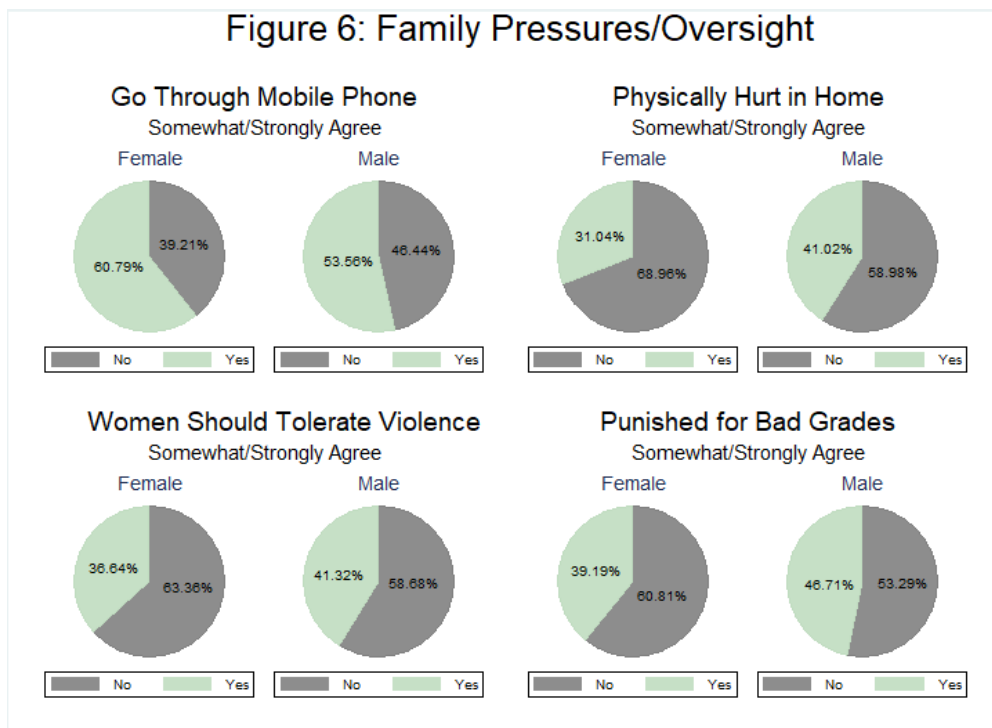


Source: Nepal Study Center, 2019

3.2 Family & Peer Pressures

Beyond the realms of gendered adverse factors, adolescent health is also strongly affected by social factors (Viner et al. 2012). Negative interactions/influences from peers and family have been shown to increase the likelihood of risky behaviors (Donovan 2004; Repetti, Taylor, and Seeman 2002; Williams et al. 2000; Bauman, Carver, and Gleiter 2001; Kretman et al. 2009; Overbeek et al. 2003) and poor mental health/ impaired development (Wang and Sheikh-Khalil 2014; Hasumi et al. 2012; Barber et al. 2005; Soenens and Vansteenkiste 2010; Chhabra and Sodhi 2012). Thus, this work also examined the perceived presence of such negative interactions among this sample of older adolescents, with family pressures seen in Figure 6 and substance use by friends in Figure 7.

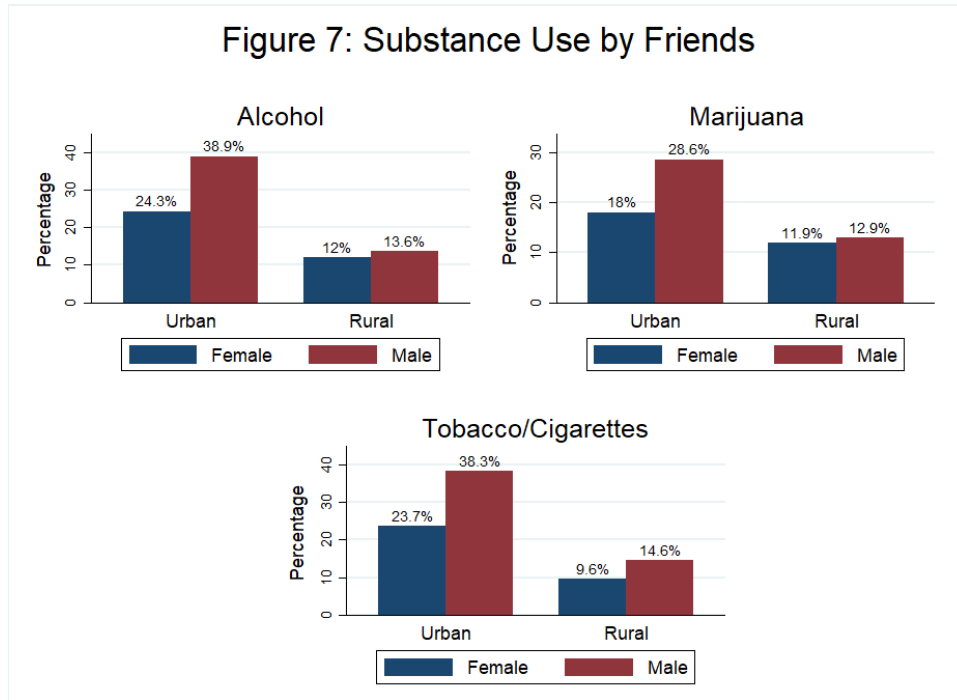
From Figure 6, one can see that the rates are fairly consistent within genders when it comes to their perceptions in the family domain. About one-third about females agree that they have been physically hurt in their home, punished for bad exam or school grades, and that women should tolerate violence to maintain familial harmony. Alternatively, males show around a 40% agreement with these three elements. This would indicate that violence, in general, may play a larger role in the lives and minds of male adolescents, with regards to the familial domain. When it comes to parental intrusion and oversight, it appears, though, that females are more likely to report having the contents of their mobile phone examined by their parents within the last month, at a rate of 60.8% versus 53.6% for males.



Source: Nepal Study Center, 2019

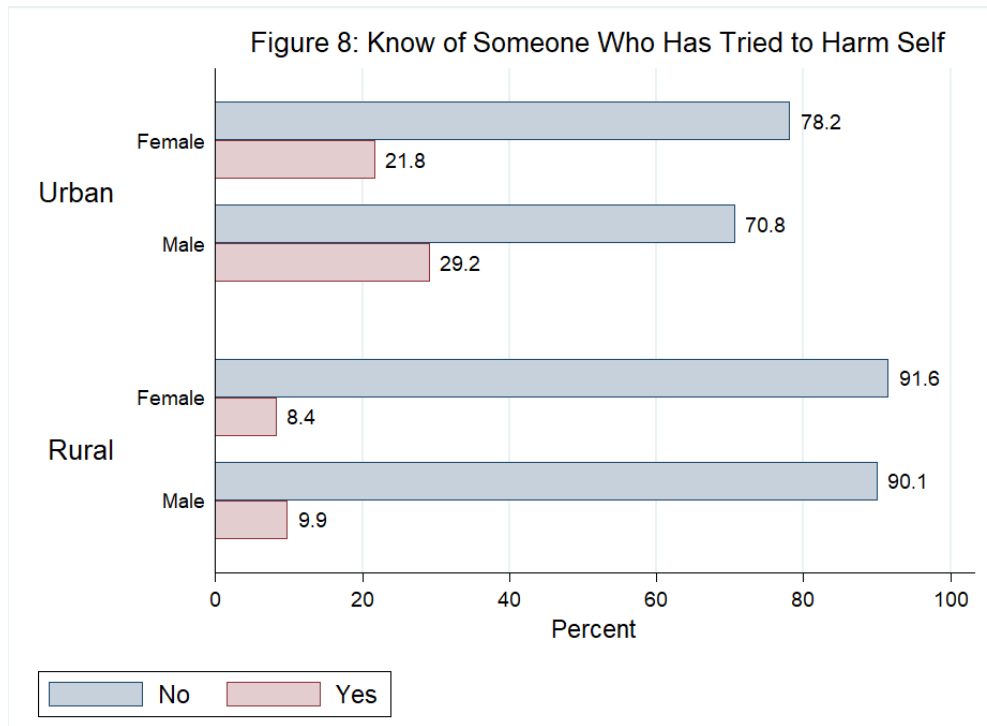
The patterns seen in Figure 7 reveal that problems with substance use may be of a bigger concern among urban populations. Regardless of gender, the percentage of adolescents who report substance use by friends is close to 10% higher among urban groups. Additionally, there is similarity in the rate of all three substances (Alcohol, Marijuana, and Tobacco/Cigarettes) within each gender-locality grouping. A final major takeaway from this figure is that regardless of locality, males are more likely to be engaging in substance use than females, with this difference more pronounced among urban adolescents. Substance

use is most problematic in its tendency to lead to overuse, where substance abuse is often associated with multiple deleterious outcomes, including self-harm (Repetti, Taylor, and Seeman 2002).



Source: Nepal Study Center, 2019

This potential connection is supported within the study sample, as can be seen in Figure 8, which shows the percentages of adolescent who report knowing someone who has tried to harm or kill themselves. About 20-30% of urban adolescents appear to know about self-harm behaviors, compared to under 10% of rural adolescents. Regardless of location, however, males are more likely to report knowing someone who has committed self-harm or suicide. Published data by WHO/CDC using data from the Global School-Based Student Health Survey (GSHS) in Nepal reported an attempted suicide rate of 10% for adolescents 13-17, which is consistent with what can be extrapolated from this work (WHO/CDC 2015).

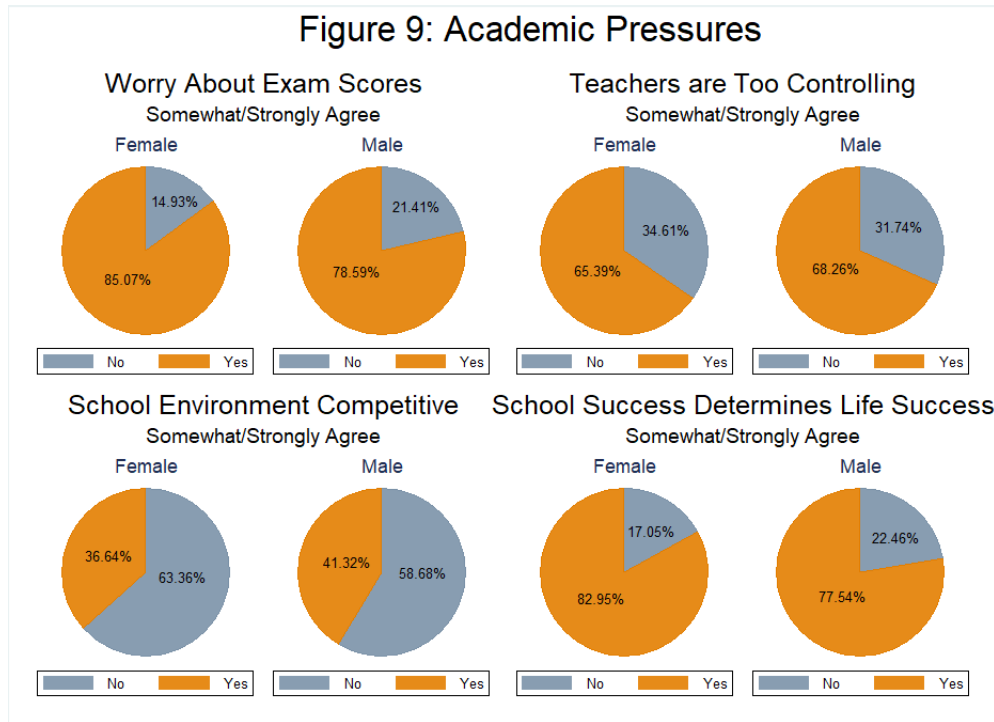


Source: Nepal Study Center, 2019

3.3 School-Based Pressures

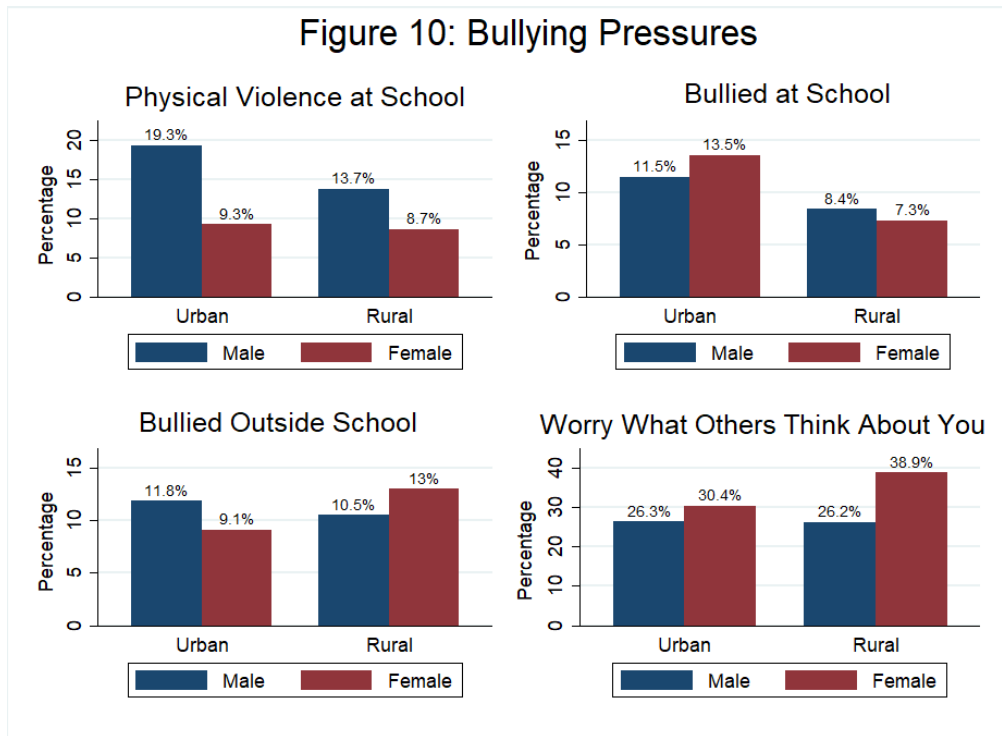
This study has also found results supporting the presence of bullying, among other pressures found in the academic environment. Pressure from the school environment has the potential to greatly influence adolescent mental health, given that it represents such a large portion of adolescent’s time endowment (assuming that they are enrolled in school and have not already dropped-out) (Miller, Esposito-Smythers, and Leichtweis 2015; Winfree and Jiang 2010; Deb, Strodl, and Sun 2015). Further, the presence and intensity of bullying, often found within the school environment, can be staggering, and have dramatic impacts on mental/physical health (Patton et al. 2008; Rudatsikira et al. 2007; Abdirahman et al. 2012; Lila C. Fleming and Jacobsen 2009; L. C. Fleming and Jacobsen 2010; McKinnon et al. 2016; Shapka et al. 2018). Prior statistics from GSHS data in Nepal found that around 51% of adolescents had been bullied within the prior month, with the rates higher for males than females (56% on average versus 46%) (WHO/CDC 2015). Summaries of our findings with regard to such concerns can be found in Figures 9 and 10.

Figure 9: Academic Pressures



Source: Nepal Study Center, 2019

Among our sample of older adolescents, there is evidence of high levels of perceived pressure within the academic environment to perform well academically, with females perhaps exhibiting larger concern. While 79% of males worry about exam scores, 85% of females do, and females also show a higher rate of belief that success in school will ultimately determine one’s life success (83% versus 78%). However, males appear to feel that the environment in school is slightly more controlling/competitive than do females, but overall two-thirds agree that teachers are too controlling and one-third that the school environment is extremely competitive.



Source: Nepal Study Center, 2019

In relation to bullying, both in and out of school, we see rates of bullying over 10%, on average. Males definitely experience more physical violence at school than females, and this difference is more pronounced in urban environments where there is a 10 percentage point difference (versus 5). Our sample reported higher rates on bullying within urban schools than rural; however, regardless of location, there are still modest reports of bullying outside school, with rural females reporting the highest rate of 13%. Associated with bullying are concern adolescents may have with how other peers perceive them, and females appear to worry more about this than males. In both rural and urban settings, about 26% of male respondents reported worrying about what others think, while 30.4% of urban and 38.9% of rural females said that they worry about their perceptions by others.

4. Protective Factors

KEY HIGHLIGHTS:

- Over 85% of adolescents agree their parents smile/laugh with them and encourage them to complete school, with higher rates for rural adolescents.
- Adolescents are encouraged to see friends at rates 10 percentage point below encouragement to complete school.
- Over 85% of females report good discussions with their parents, the rates for males are slightly lower.
- Rural females report highest rates of discussion about their daily activities (93.6%) and talks with their parents about their hopes and worries (90%).
- Females have smaller groups of “close” friends and less opposite gender friends than males.

- Females spend more time with family, and rural adolescents spend longer periods of times with family and friends than urban adolescents.
- Rural adolescents have higher social club/group membership rates.
- Males have easier access to socialization opportunities with higher rates of club memberships and higher rates of having a place to meet friends.
- Less than 50% of adolescents overall have a place to socialize.
- 3/4 of rural adolescents have social network support for times of trouble outside family connections, while 2/3 of urban adolescents report the same.
- Self-esteem is relatively similar between genders, however, there is slightly higher self-esteem among rural adolescents.
- Females exhibit higher grit scores.

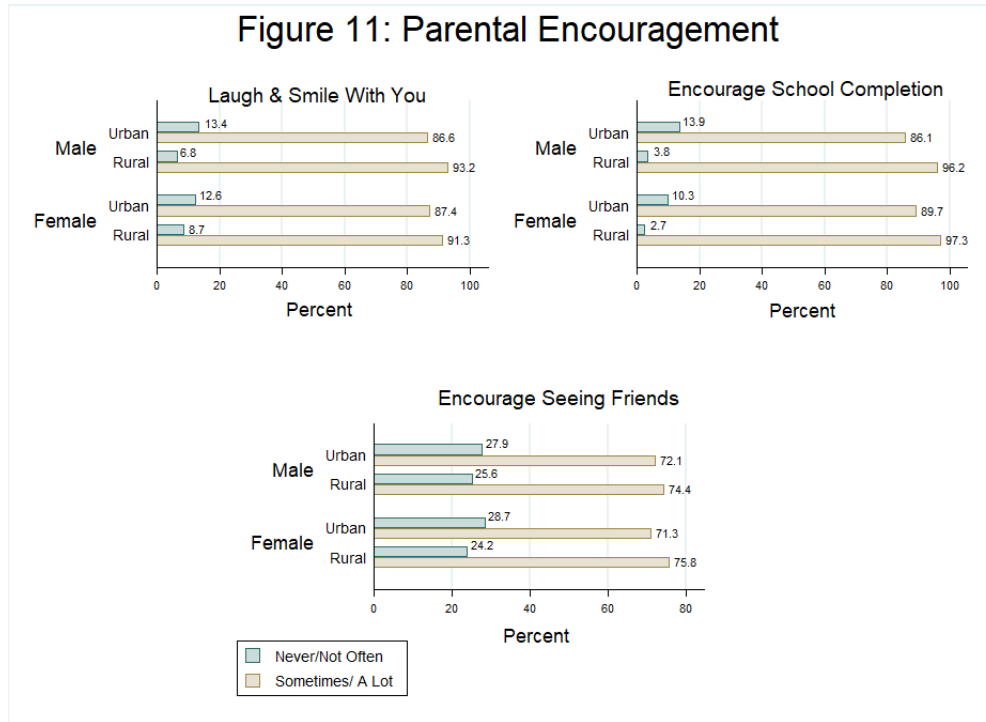
Despite the presence of a number of potentially stressful and perhaps damaging adverse factors in adolescents' lives, there is strong evidence that there can be buffering of stressful situations from strong social support (Cohen and Wills 1985; Miller, Esposito-Smythers, and Leichtweis 2015; Christian and Stoney 2006; Berkman and Glass 2000; McFarlane, Bellissimo, and Norman 1995). Given such findings, we also measured elements of parental support and integration/engagement with a social network, noting that these have previously been found to matter within a Nepali context (Brandon A. Kohrt and Worthman 2009).

4.1 Parental Support

The role that parents play in supporting the healthy development of adolescents has a very deep literature. Most of it points to the importance of nurturing with autonomy and engaging with adolescents to foster good awareness of what is actually going on with adolescents both physically and mentally (Viner et al. 2012; Marmot et al. 2008; Steinberg 2001; Barber et al. 2005; Abar, Jackson, and Wood 2014). As such, both encouragement and discussion appear to be key elements to measure the level of parental support that adolescents may possess (Acosta 2019; Hasumi et al. 2012; Cairns et al. 2014), and these elements are captured in Figures 11 and 12.

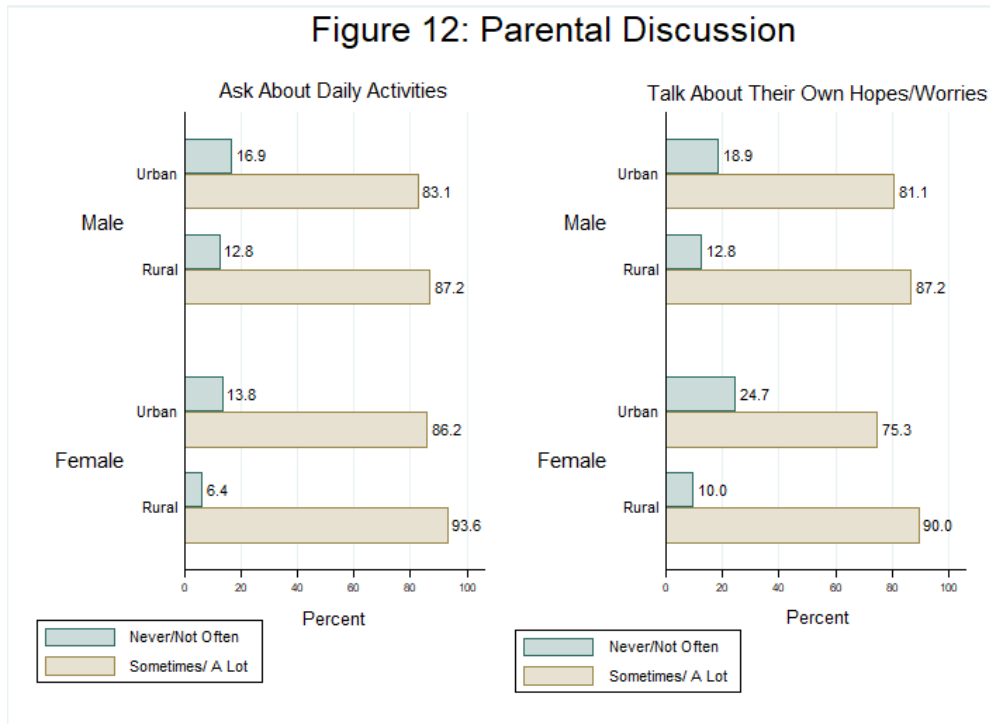
As seen in Figure 11, positive parental encouragement appears to actually be occurring at a relatively high rate. Over 85% of adolescents, regardless of gender or location, reported that their parents smile and laugh with them sometimes/ a lot and encourage them to complete school. However, there are slightly higher rates of these perceived positive actions among rural adolescents. The rates of perceived encouragement to see friends are about 10 percentage points lower across the board than they are for encouragement related to school completion. Here to, though, rural adolescents feel that their parents are more encouraging of seeing friends than their urban counterparts.

Figure 11: Parental Encouragement



Source: Nepal Study Center, 2019

Parental discussion and sharing of worries and troubles is depicted in Figure 12. Around 85% of male adolescents say that their parents ask about their daily activities, while for each respective location, females report higher rates of discussion. Rural females report the highest rate of discussion about daily activities at 93.6%. Similarly, rural females report the highest rate, at 90%, of parents who talk about their own hopes and worries with their children. Urban females report the lowest rate, and while urban and rural males both report intermediate levels, rural males report slightly higher rates of parental sharing (87.2% versus 81.1%).

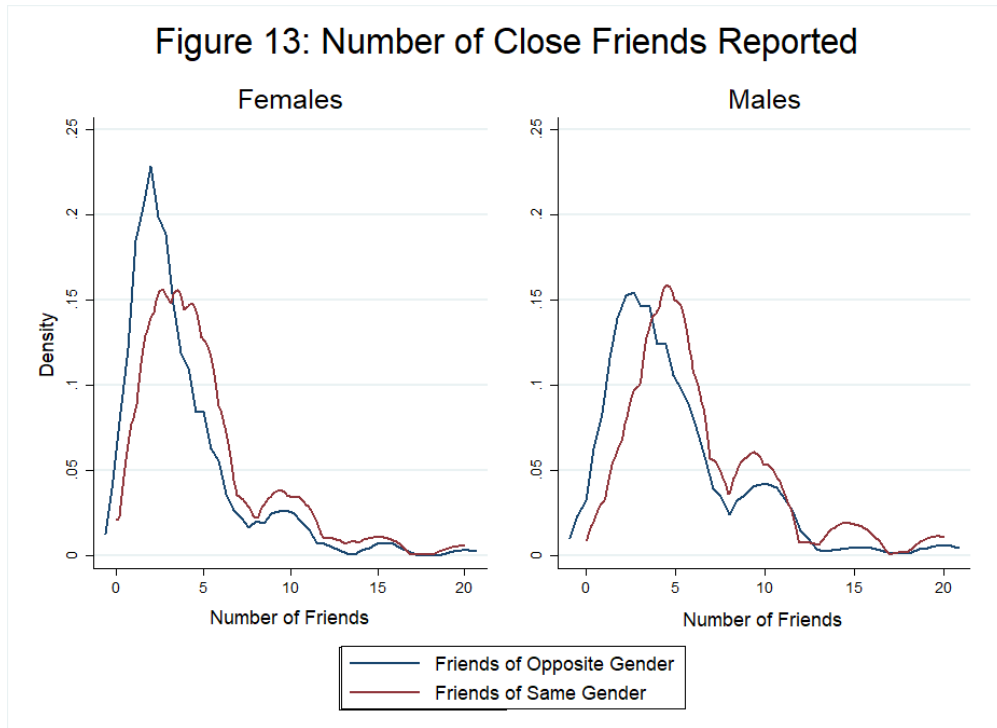


Source: Nepal Study Center, 2019

4.2 Social Engagement

Although parents play a very crucial role in appropriate adolescent development, overall social engagement/integration is expected to play another key role in adolescents’ abilities to manage the stressors of life as they enter into adulthood (Heaney and Israel 2015; Miller, Esposito-Smythers, and Leichtweis 2015; Pecchenino 2015). Part of the reason social connectedness is so important is that such ties give meaning to a person’s life by virtue of enabling for fuller/more complete participation in life and connection/commitment to community. Among adolescents, particular focus falls on their peer group to fulfill these needs, given that effective provision of support is likely going to come from people who are socially similar and experiencing similar stressors/situations (Thoits 1995; 2011; Lamblin et al. 2017). Thus, the following figures reflect multiple measures of social engagement/support.

Figure 13 shows the distributions by gender of the number of friends that respondents reported. Females appear more likely to report a smaller group of “close” friends than males, and certainly a much smaller group of opposite gender friends. This may stem from stronger cultural norms regarding cross-gender interactions for females than those experienced by males. Differences in time allocation to social interactions are also apparent between genders, as seen in Figure 14. Females consistently spend more time with family than their male counterparts, and rural adolescents report spending longer periods of time with family than urban adolescents. Further, urban adolescents also appear to spread their time between multiple social groups more so than rural adolescents.



Source: Nepal Study Center, 2019

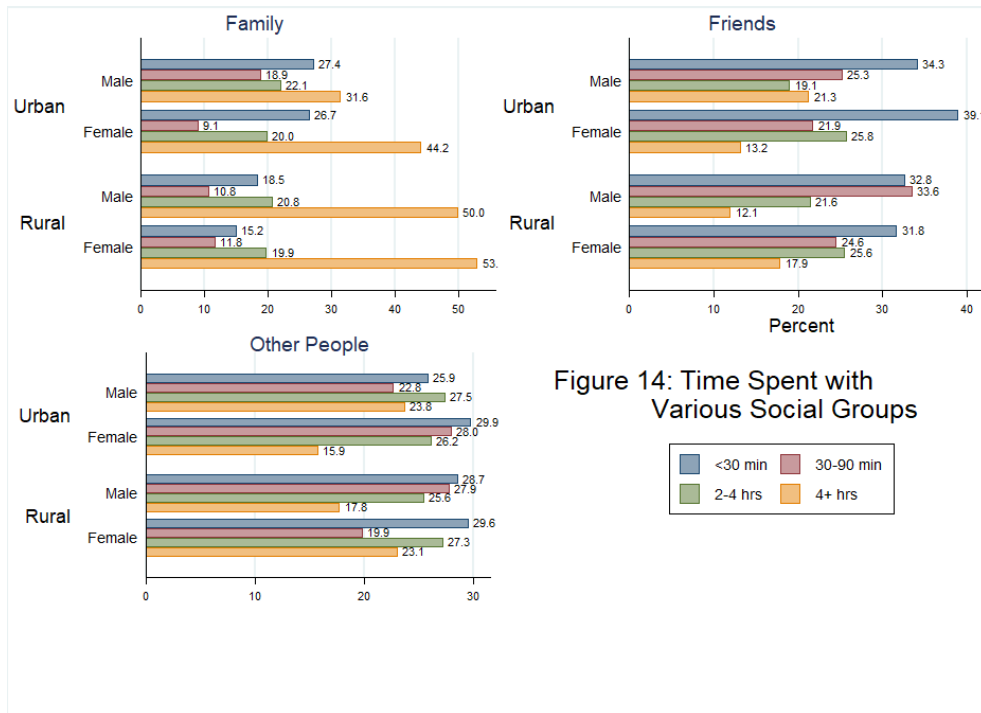
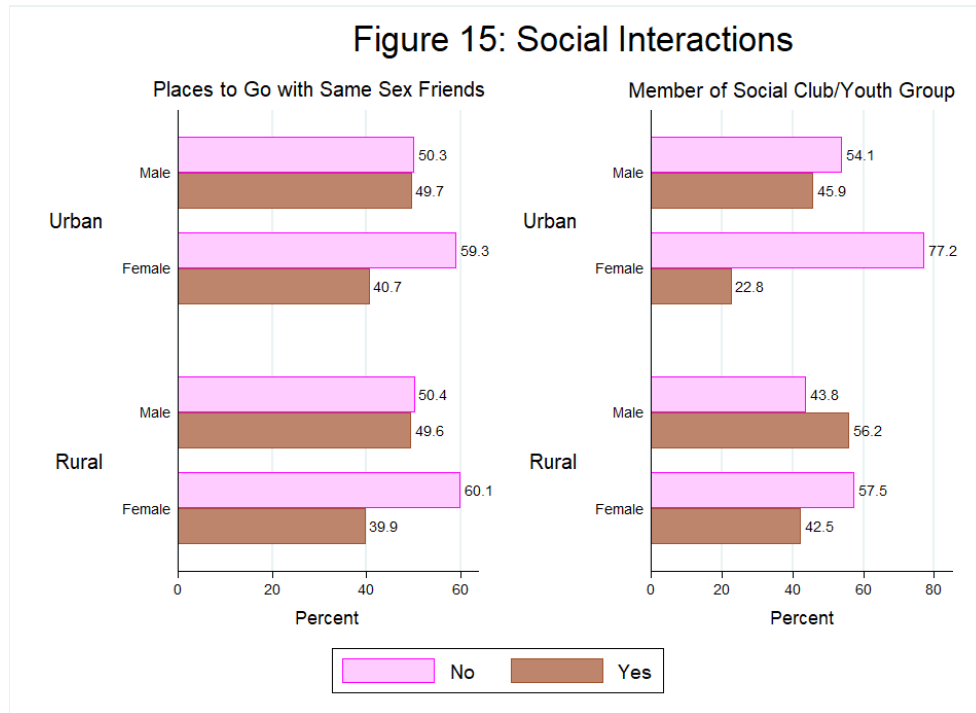


Figure 14: Time Spent with Various Social Groups

Source: Nepal Study Center, 2019

This finding is consistent with Figure 15, which shows that rural adolescents appear to have higher rates of membership in a social club/youth group, which would extend their time with one set of

people during such organized groups' activities. Urban females are the least likely to join such a formalized group with only 22.8% claiming membership. However, only 40.7% of these same females report that they have a place to go to meet same sex friends. Overall, males appear to have easier access to socialization opportunities with higher rates of club memberships and higher rates of having a meeting place with friends than their female counterparts. Strikingly, no more than half of adolescents have access to a place to socialize, potentially limiting their abilities to form strong social connections and establish a stronger social network.



Source: Nepal Study Center, 2019

Figures 16A and 16B take these ideas of social network formation further by investigating the perceived presence of sources of support outside their family environment, for times of trouble. Close to three-quarters of rural adolescents report that there is someone to borrow money from, stay with if there is a problem at home, confide in about violence, or assist during times of harassment; however, only two-thirds of urban adolescents claim to have access to these same social network supports. Such findings are perhaps reflective of the overall more community-inclusive nature of smaller-town living.

Figure 16A: Social Network Help (Rural)

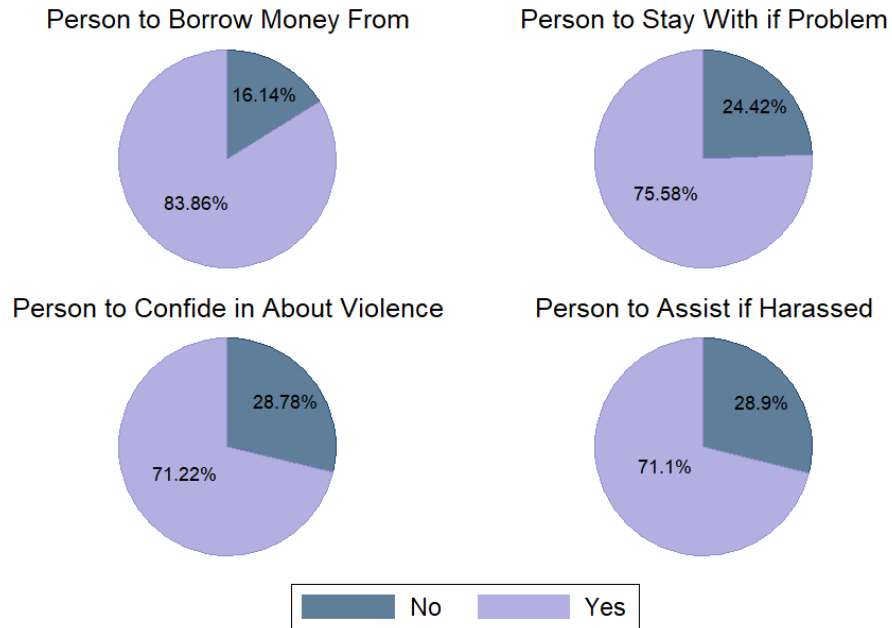
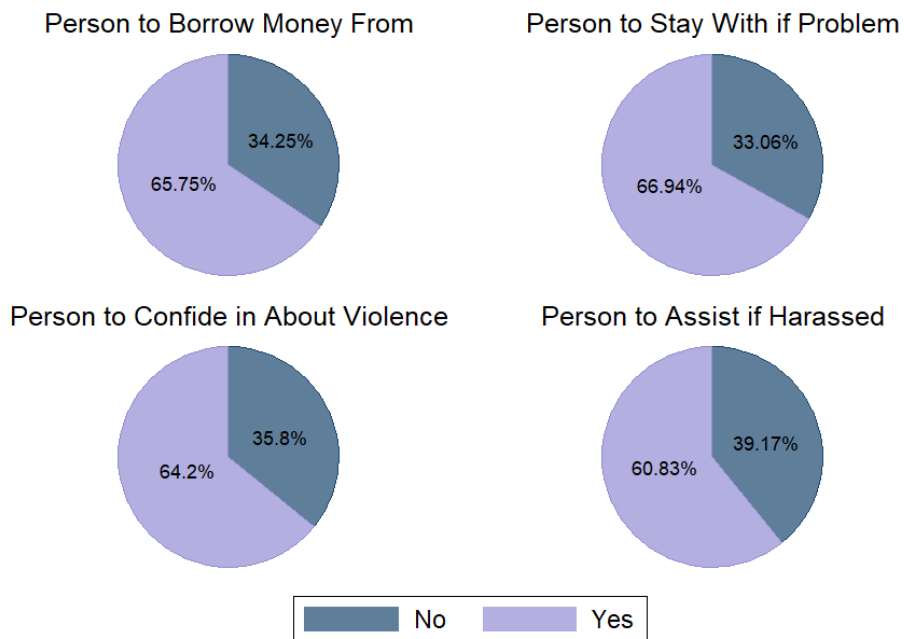


Figure 16B: Social Network Help (Urban)

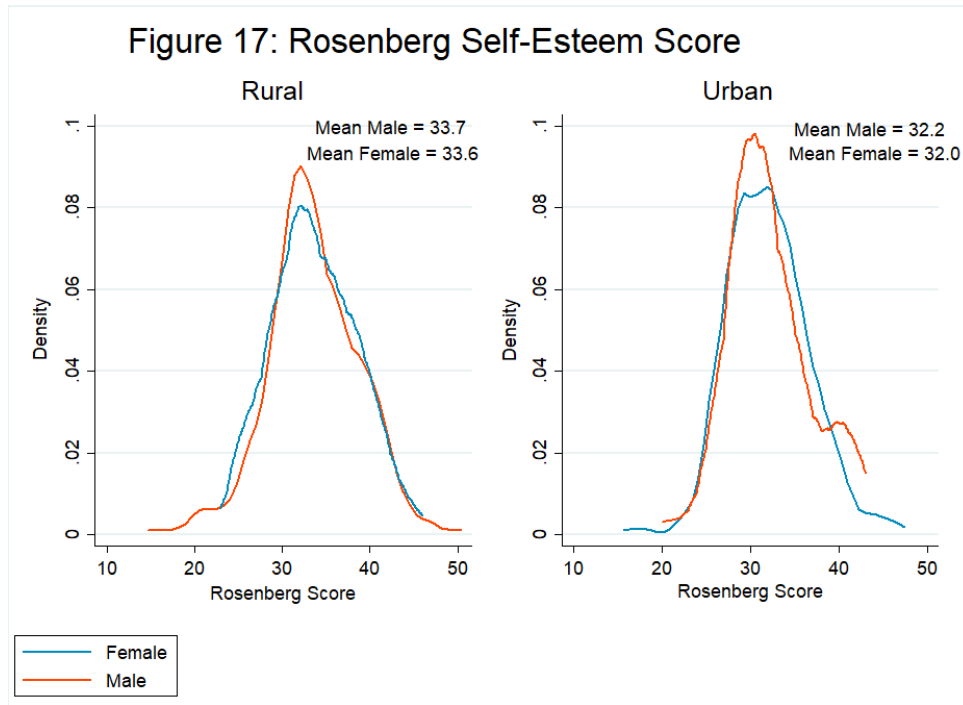


Source: Nepal Study Center, 2019

4.3 Personal Soft Skills

Presence and perceptions of external measures of support are mutually agreed to be important across disciplines, but more emphasis is also being placed on the importance of self-contained

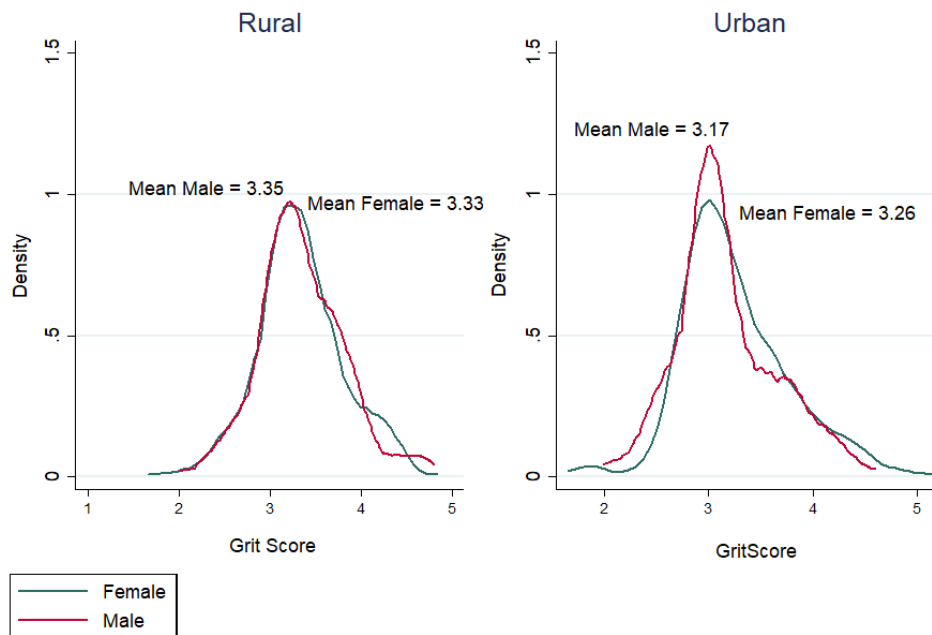
characteristics which social/familial support can aid in fostering. Personal resiliency is rooted in such personal characteristics as self-esteem and grit (Duckworth 2016; Hjemdal et al. 2007; Clough and Strycharczyk 2015), which may also pave the way for abilities to overcome/better cope with the many stressors adolescents in Nepal (or anywhere else) face. Such softer skills have also been frequently linked with lower rates of mental health issues (B. Chen et al. 2015). Using the Duckworth Grit Scale (Duckworth 2016) and the Rosenberg Self-Esteem Scale (Rosenberg 1965) to measure such attributes, the distributions of our sample are shown in Figures 17 and 18.



Source: Nepal Study Center, 2019

Both survey instrument scales have a score range from 10 to 50 (although Grit is divided by 10), where higher scores mean better self-esteem and/or grit. As the distributions show, self-esteem across gender is relatively similar, however, there is slightly higher self-esteem among rural adolescents, which a t-test of the difference of means confirms is statistically significant. Similarly, the t-test of mean differences in grit scores (Figure 18) of rural adolescents is significantly higher than for urban adolescents. One can also see that there is a difference in distribution along gender lines for urban adolescents, with more females having higher grit scores than males. Together this may indicate that rural adolescents have been able to develop better resiliency than urban adolescents.

Figure 18: Grit Scores



Source: Nepal Study Center, 2019

5. Mobile Phones

KEY HIGHLIGHTS:

- 82.6% of respondents own a phone and 89.8% of those have internet access.
- Females own phones less, got them at an older age, and have acquired them more recently.
- Urban adolescents share their mobile phones more, and 32% of urban females say at least 3 people use their phone.
- Rural males have the most control over their mobiles with 77.3% saying that only they, the owner, use the phone.
- Urban adolescents pay 5-10,000 NPR more per phone purchase and 2x the monthly data plans compared to rural adolescents.
- Samsung Galaxy dominates rural markets, while iPhones and Chinese Smartphones have more distribution in urban markets.
- Nepal Telecom dominates as the mobile carrier for rural cell phone owners, and Ncell for urban.
- 91% of phones are operated in English and around three-fourths of adolescents report having a phone in good working condition.
- The four most commonly listed uses are Entertainment News, Music/Ringtones, Taking Photos, and Voice Calls.
- Males use their phones more intensely than females, and urban adolescents use them more than rural.
- Majority of urban males are high (29.5%) or extreme (31.3%) users of their mobile phones, while urban females are more likely to be either low (30.5%) or extreme (25.4%) users.
- Tools-based and social purpose uses dominate female usage of mobile phones.

- Females spend more time than males using social media via their mobile phones, with urban females spending the most time.
- 11.7% of urban females (versus 6.4% of rural females) report having more than three social media memberships.
- The most commonly chosen reason for using social media is to get information, followed by keeping in touch.
- Rural and female adolescents appear to weight access to information more heavily than keeping in touch.
- 50% of adolescent say their primary motivation to use mobile phone is for schoolwork or to find specific information.
- Around 20% of both urban females and males see using their mobile phone as a source of relaxation/entertainment.
- Urban males and females also report using mobile phone to ease feelings of loneliness (15.2% and 14.1%, respectively).
- Males score higher on measures of problematic phone use than females.
- Urban males have the most pronounced evidence of problematic use with a mean scale score of 91.83, versus the 83.21 average score for rural females (lowest average).

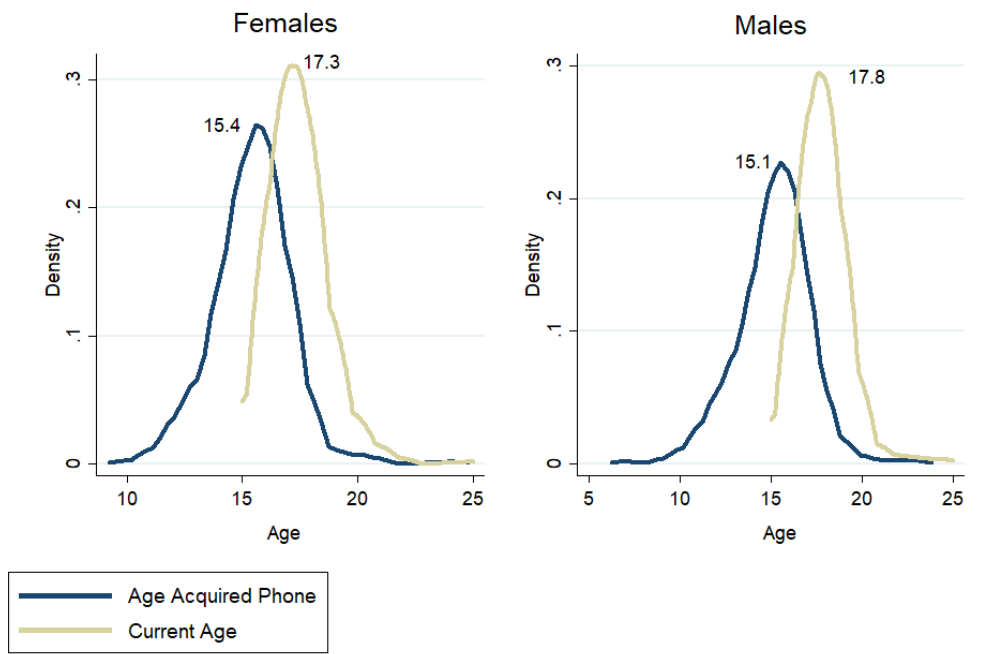
With the diffusion of mobile phones and internet-accessible smartphones across developing world countries, including Nepal (Amin et al. 2014; World Bank 2017), it is critical to understand how they are being used by adolescents. With preliminary evidence of maladaptive uses of mobile phones in developing world contexts (Davey and Davey 2014; Dixit et al. 2010; Doron 2012; Patel and Puri 2017), determination of whether or not the addictive tendencies quoted in developed world literature are going to also be a problem in the Nepali context will be important if future interventions continue to look at implementing mobile-based components.

5.1 Type of Uses

The following figures depict elements of phone ownership and summarize how mobile phones are being used by the adolescents surveyed in this study.

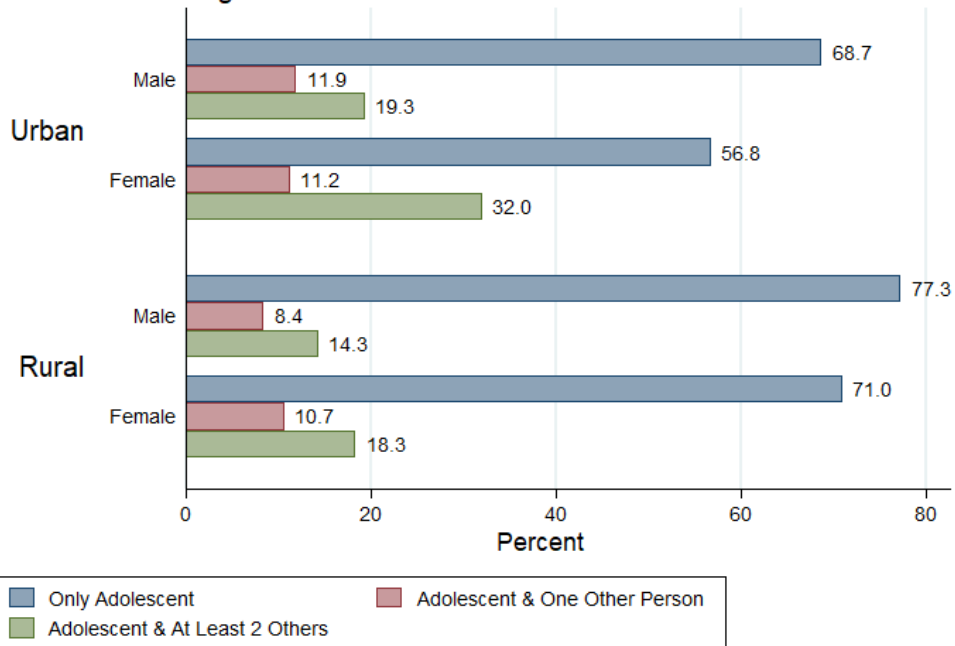
Figure 19 depicts how long phones have been owned and Figure 20 depicts how many people use their mobile phones.

Figure 19: Length of Phone Ownership



Source: Nepal Study Center, 2019

Figure 20: Who Uses Owner's Mobile Phone?



Source: Nepal Study Center, 2019

In developing world contexts, it is not uncommon for females to suffer a gap in ownership and privacy (GSMA 2015; Doron 2012; Jouhki 2013), and our data supports these findings. Females appear to have owned their phones for a shorter period of time than males, and to have acquired them at an older

average age (15.4 versus 15.1 years). Additionally, when comparing males to females, more females indicate that more than one person is using/sharing the mobile phone, with this difference more striking among urban adolescents with 32% of urban females saying at least 3 people use their phone. Rural males appear to have the most control over their mobiles with 77.3% saying that only they, the owner, use the phone. Overall, urban adolescents exhibit more phone sharing behavior, which may reflect proximity or cost components. Such speculation is supported by Table 2 which displays numerous other cell phone descriptive statistics.

As can be seen, the mean phone and data plan costs for urban adolescents are much higher than those for rural adolescents, costing an average of 5-10,000 NPR more per phone purchase and monthly data plans close to 2x higher. Additional note should be made that similar to other findings, females own phones at a rate 15 to 20 percentage points lower than those of their male counterparts. Across the whole sample, 82.6% of respondents owned a phone, of which 89.8% had internet access. In rural localities, Samsung Galaxy is the most popular brand, while in urban environments, adolescent phone owners appear to be more evenly distributed with owners of iPhones and Chinese-based Smartphones. Nepal Telecom dominates as the mobile carrier for rural cell phone owners, while NCell dominates in the rural locals. The vast majority of phones are operated in English and around three-fourths of adolescents report having a phone in good working condition.

Table 2: Mobile Phone Descriptives

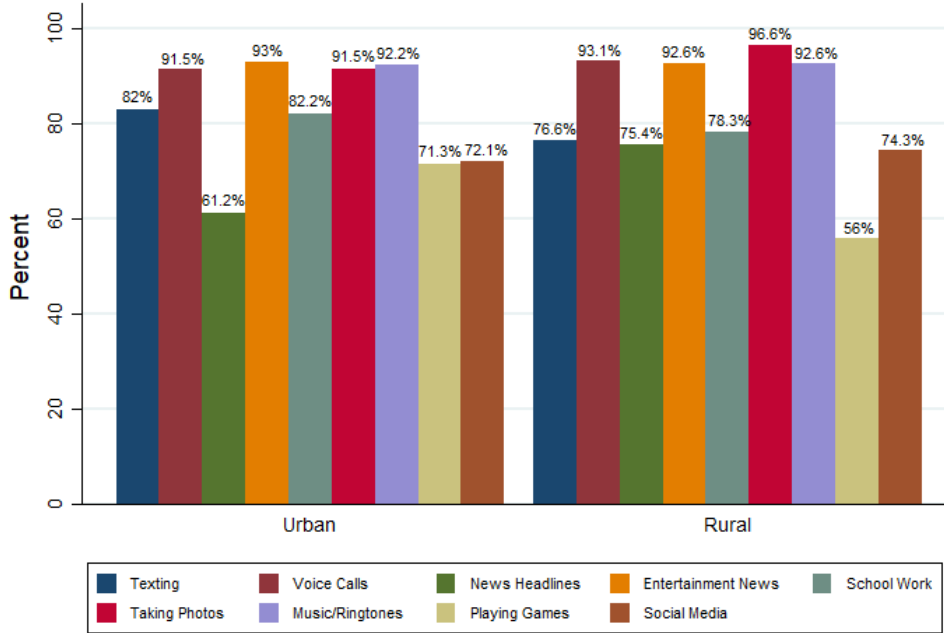
| | Total | Rural Males | Rural Females | Urban Males | Urban Females |
|-----------------------------------|--------|-------------|---------------|-------------|---------------|
| Own Cell Phone | 82.6% | 90.2% | 79.9% | 88.6% | 74.1% |
| Internet Access | 89.8% | 92.5% | 85.7% | 90.5% | 91.5% |
| Phone Type | | | | | |
| <i>Basic Phone</i> | 6.4% | 6.0% | 7.5% | 6.7% | 4.7% |
| <i>I-Phone</i> | 10.2% | 12.1% | 1.9% | 14.5% | 12.5% |
| <i>Samsung Galaxy</i> | 57.1% | 62.9% | 78.3% | 40.2% | 50.8% |
| <i>Nokia Lumia</i> | 5% | 5.2% | 1.2% | 7.3% | 5.5% |
| <i>Chinese Smartphone</i> | 8.1% | 5.2% | 2.5% | 11.2% | 12.5% |
| <i>Other</i> | 11.9% | 7.8% | 6.2% | 19.6% | 12.5% |
| <i>Don't Know</i> | 1.3% | 0.8% | 2.5% | 0.6% | 1.6% |
| Mobile Co. | | | | | |
| <i>Nepal Telecom</i> | 52.2% | 85.7% | 78% | 25% | 24.8% |
| <i>NCell</i> | 42.1% | 13.5% | 16.2% | 67.1% | 67.4% |
| <i>Other/Don't Know</i> | 5.7% | 0.8% | 5.8% | 7.9% | 7.8% |
| Mean Phone Cost (NPR) | 19,348 | 17,831 | 14,151 | 21,216 | 24,068 |
| Mean Data Cost (NPR/Month) | 723.40 | 490.87 | 456.42 | 859.04 | 1,269.90 |
| Data Plan Type | | | | | |
| <i>Subscription/Prepay</i> | 32% | 51.8% | 35.7% | 26% | 17.6% |
| <i>Pay-Per-Use/Postpay</i> | 15.5% | 21.9% | 10.7% | 20.1% | 10.4% |
| <i>Don't Know</i> | 52.6% | 26.3% | 53.6% | 53.9% | 72% |
| Phone Language | | | | | |
| <i>Nepali</i> | 8.6% | 10% | 10.9% | 6.7% | 7.8% |
| <i>English</i> | 91.2% | 90% | 88.6% | 93.3% | 92.3% |
| Phone Condition | | | | | |
| <i>Good</i> | 70.7% | 73.3% | 66.9% | 65.7% | 80.5% |
| <i>Wear & Tear</i> | 25.6% | 23.3% | 32.6% | 27% | 17.2% |
| <i>Significant Damage</i> | 1.5% | - | - | 3.9% | 1.6% |
| <i>Not Working</i> | 2% | 3.4% | 0.6% | 3.4% | 0.8% |

Source: Nepal Study Center, 2019

*Percentages are based on total sample size within respective group; For all rows below the first, percentages reflect portion of cell phone owners from respective group.

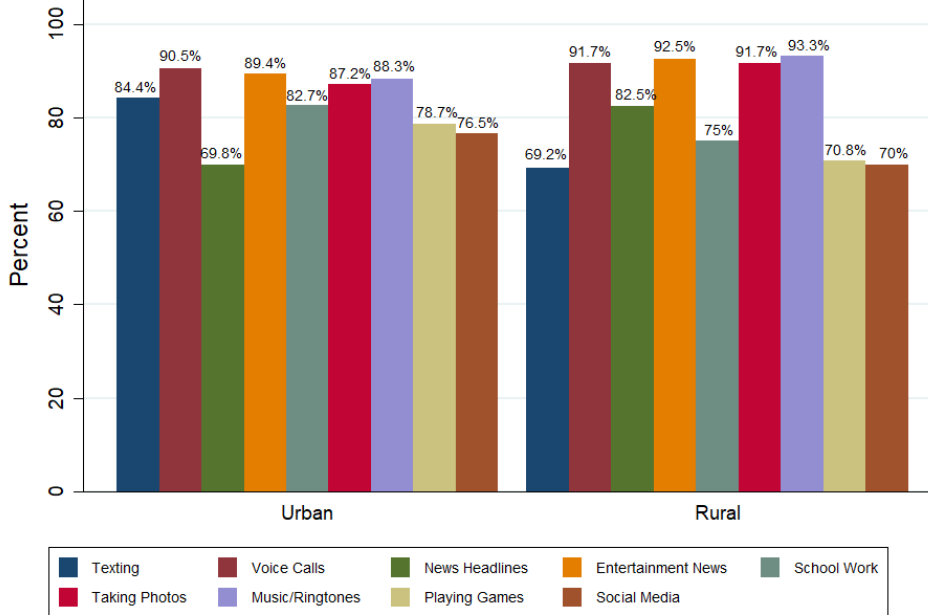
When it comes to actual uses of mobile phones, Figures 21A and 21B show the breakdown of uses for each gender, according to location. The four most commonly listed uses for urban females are Entertainment News (93%), Music/Ringtones (92.2%), Taking Photos (91.5%), and Voice Calls (91.5%). For Rural females, while the top four are the same, their order is slightly different: Taking Photos (96.6%), Voice Calls (93.1%), Entertainment News (92.6%), and Music/Ringtones (92.6%). Playing Games is the least common use for a mobile phone among rural females (56%), while it is News Headlines for urban females (61.2%). Among male mobile phone owners, the top four uses are the same as for females, but while News Headlines is the least commonly cited use for phones among urban males (69.8%), Texting is the least common among rural males (69.2%). Overall, though, it appears that all adolescents surveyed are doing multiple things on their phones; however, it is the frequency of time spent doing the various activities which may be more telling.

Figure 21A: How Females Use Their Mobile Phones



Source: Nepal Study Center, 2019

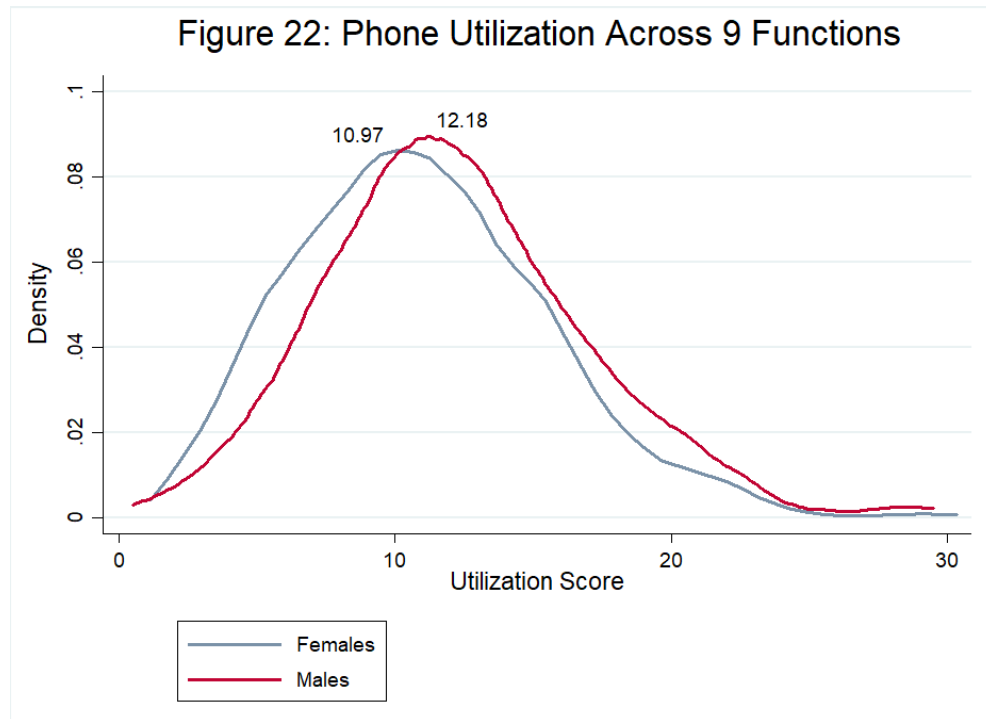
Figure 21B: How Males Use Their Mobile Phones



Source: Nepal Study Center, 2019

Figure 22 depicts the distributions of phone utilization by gender. This phone utilization measure is the sum of uses among all nine surveyed uses, weighted by the intensity of use, and is based off of work previously done in literature examining intensity of mobile phone usage (Haenssgen 2018). One can

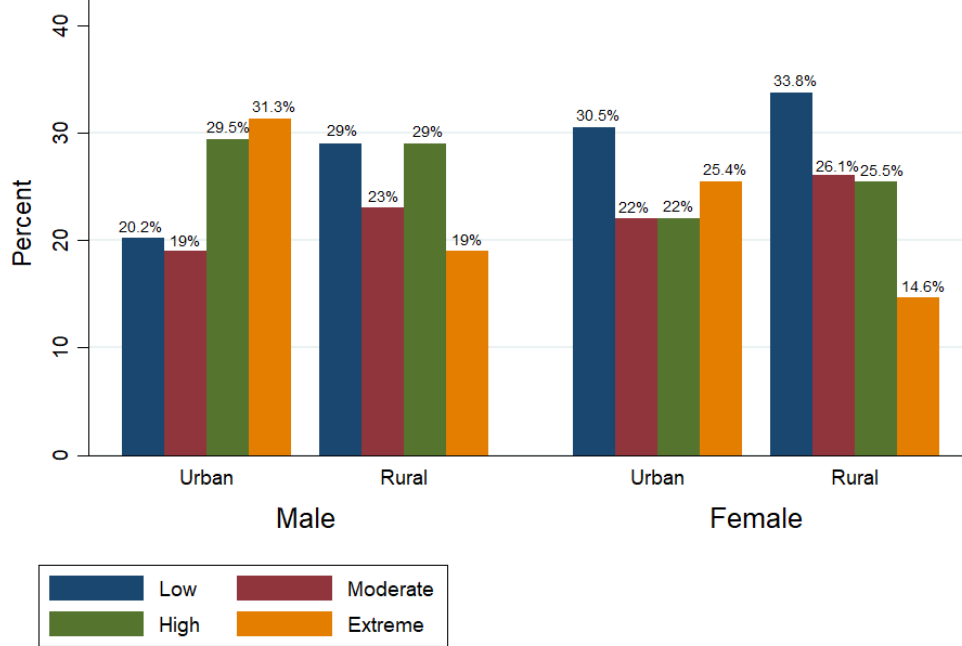
see that males appear to use their phones more intensely than females (average score of 12.18 versus 10.97), and a t-test of mean difference significance rejected a null hypothesis of a difference of zero.



Source: Nepal Study Center, 2019

To gain a more nuanced picture of how utilization may differ, Figure 23 examines how the four quartiles of the phone utilization measure are distributed across location and gender divisions. One can see that the majority of urban males are high (29.5%) or extreme (31.3%) users of their mobile phones, while urban females are more likely to be either low (30.5%) or extreme (25.4%) users. Rural adolescents show the lowest rates of extreme use, although males still make up a larger portion of the high and extreme users than do females. So, overall, males and urban adolescents spend more time on their mobile phones.

Figure 23: Quartile Distribution of Phone Utilization



Source: Nepal Study Center, 2019

5.2 Frequency of Uses

While a lot of time spent on mobile phones can be linked to susceptibility for addictive tendencies towards mobile phone use, many argue that it is the precise forms of use in large amounts which may amount to the strong correlations seen in literature. Much literature has focused on the negative outcomes of social media use and its use via mobile phones as having a connection to negative mental health outcomes (Lin et al. 2016; Kross et al. 2013; Lup, Trub, and Rosenthal 2015; Moreno et al. 2013; Reid Chassiakos et al. 2016; Heffer et al. 2019; Riehm et al. 2019). As such, a common delineation of mobile phone uses is along social/non-social uses of phones or even to consider informational, tools, and social uses (Elhai and Contractor 2018; Elhai, Levine, et al. 2017). Using this pattern, Figures 24 and 25 breakup frequency of use along gender and locality lines looking at the “information-based”, “tools-based”, and “social-based” uses of mobile phones.

Figures 24A, 24B, and 24C look at the time distributions of mobile phone usage for female respondents. In terms of tools-based usage, music/ringtone downloads are where both rural and urban females spend the most time. Urban females appear to spend more time on games and taking photos than their rural counterparts. Similarly, urban females spend more time looking at entertainment news on their phones than rural females, while rural females focus more on news headlines. The amount of time spent on school work is fairly consistent across both groups of female adolescents. With social uses of mobile phones, we see that urban females spend more time texting. While rural females appear to spend a medium level of time on both voice calls and social media, urban females appear to have an S-curve to their usage with bunching at very low or very high usage times.

Figure 24A: Phone Tool Use (Females)

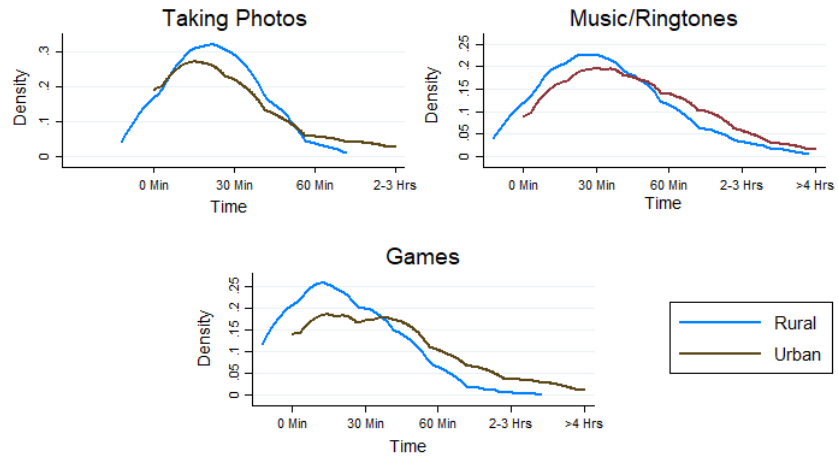


Figure 24B: Informational Use (Females)

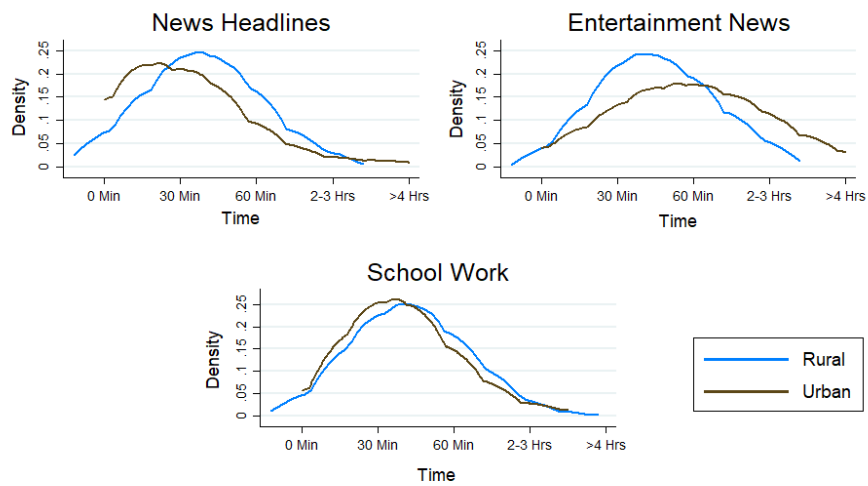
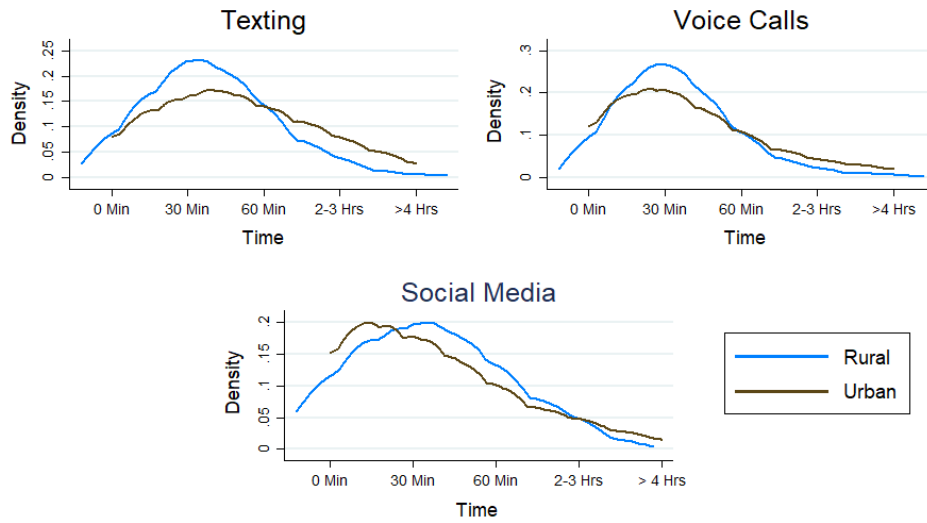


Figure 24C: Social Activity Use (Females)



Source: Nepal Study Center, 2019

The time distributions of use for male respondents are found in Figures 25A, 25B, and 25C. Lots of time spent using tools is more common across the board for urban males. Like what was found with females, there is a pattern of more time spend looking at entertainment news by urban versus rural male adolescents; however urban males are also more likely to spend extended amounts of time looking at news headlines (contrary to rural females spending more time than urban females). There is slightly more time spent on school work by rural males than urban. Urban males spend markedly more time on the social uses of texting and voice calls than rural counterparts, but there is about even time use distributions when it comes to social media use.

Figure 25A: Phone Tool Use (Males)

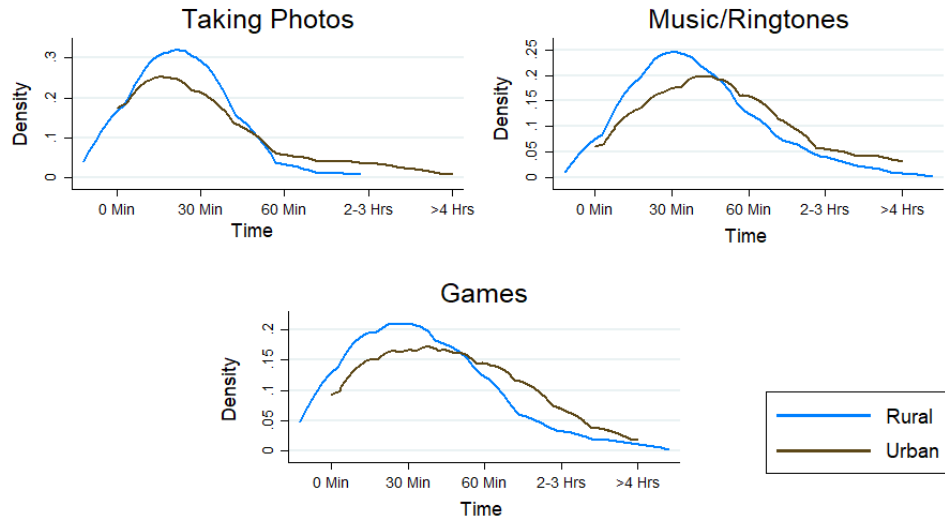


Figure 25B: Informational Use (Males)

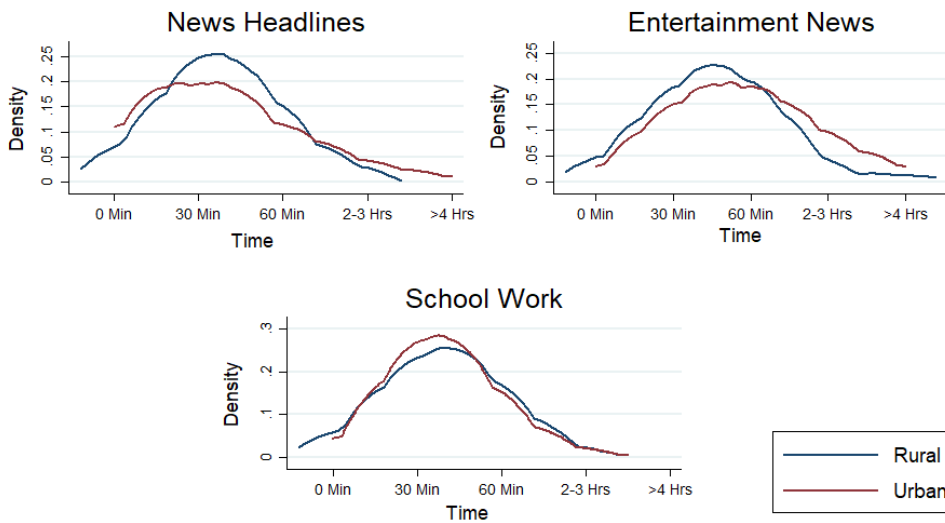
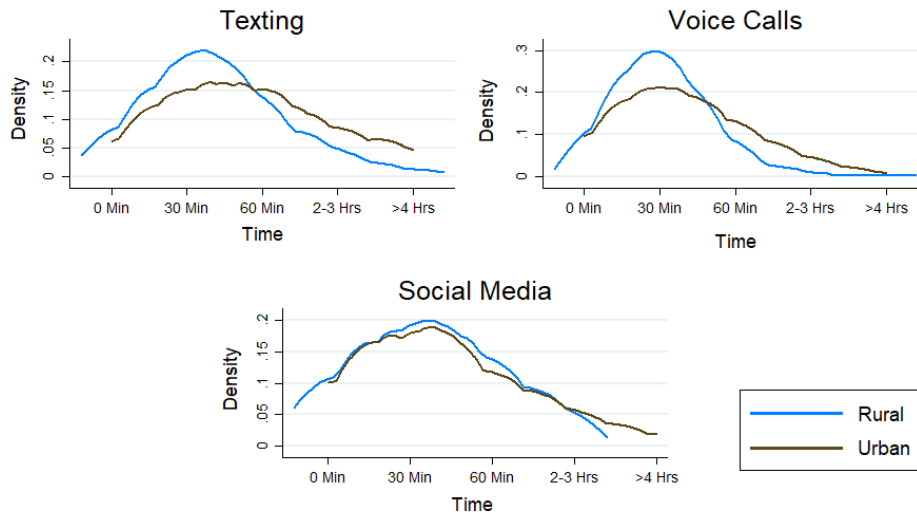


Figure 25C: Social Activity Use (Males)



Source: Nepal Study Center, 2019

Comparing across genders on social media use, it appears that females, regardless of location are spending more time than their male counterparts using social media via their mobile phones, with urban females spending the most time. That urban females spend the most time on social media is reflected in that 11.7% (versus 6.4%) of them report having more than three social media memberships. This and other elements surrounding motivations for social media and phone use are found in Table 3. The most commonly chosen reason for using social media is to get information, followed by keeping in touch. When broken down by gender and location, rural and female adolescents appear to weight access to information more heavily than keeping in touch. Rural adolescents also have a higher rate of sharing good things on social media than urban adolescents, although regardless of location, males are more likely to see sharing good things as a primary reason to use social media. Finally, rural adolescents do not see social media as a source to meet potential boyfriends or girlfriends, but a small percentage of urban adolescent claim that this is their main purpose for using social media.

In terms of why adolescents say that they use their mobile phones, in general, 50% claim that it is for schoolwork or to find specific information. Rural adolescents, particularly see mobile phones as a means to accomplish this, with 70.1% of rural females and 60.8% of rural males choosing information access as their primary reason for using their mobile phone. While the majority of urban adolescents see information access as the most important reason, around 20% of both urban females and males see using their mobile phone as a source of relaxation/entertainment. Males are more likely to see mobile phones' primary purpose as being for social interacting/communicating, but urban males and females also show fairly high rates of using mobile phone to ease feelings of loneliness (15.2% and 14.1%, respectively).

Table 3: Social Media & Motivations

| | Total | Females | | Males | |
|--|-------|---------|-------|-------|-------|
| | | Rural | Urban | Rural | Urban |
| Number of Social Media Memberships | | | | | |
| 0 | 30.6% | 30.1% | 37.5% | 26.5% | 28.7% |
| 1 | 28.5% | 37% | 23.4% | 27.4% | 25.8% |
| 2 | 18.8% | 17.9% | 14.8% | 23.9% | 18% |
| 3 | 12.7% | 8.7% | 12.5% | 14.5% | 14.6% |
| >3 | 9.5% | 6.4% | 11.7% | 7.7% | 12.9% |
| Reason Use Social Media | | | | | |
| <i>Keep in Touch</i> | 22.6% | 13.1% | 22.8% | 24.4% | 27.9% |
| <i>Find New Friends</i> | 5.9% | 2.3% | 5.5% | 6.7% | 9.5% |
| <i>Share Good Things</i> | 16.8% | 17.1% | 13.4% | 19.3% | 17.9% |
| <i>Share Bad Things</i> | 1.8% | 1.1% | - | - | 5% |
| <i>Get Information</i> | 32.7% | 43.3% | 28.4% | 37% | 23.5% |
| <i>Facilitate Schoolwork</i> | 6.9% | 11.4% | 7.9% | 5% | 3.4% |
| <i>Meet Potential Boyfriend/Girlfriend</i> | 0.8% | - | 1.6% | - | 1.7% |
| <i>Do Not Use Social Media</i> | 12.6% | 11.4% | 20.5% | 7.6% | 11.2% |
| Reason Use Mobile Phone | | | | | |
| <i>Need Something to Do/Pass the Time</i> | 9.2% | 4% | 14.1% | 5.8% | 11.2% |
| <i>For Relaxation/ Entertainment</i> | 16% | 8.1% | 20.3% | 10% | 23% |
| <i>To Feel Less Lonely</i> | 10.5% | 6.3% | 14.1% | 6.7% | 15.2% |
| <i>To Find Specific Information/Schoolwork</i> | 50% | 70.1% | 40.6% | 60.8% | 32% |
| <i>Social Interacting/Communicating</i> | 9.2% | 6.9% | 5.5% | 14.2% | 11.2% |
| <i>Don't Know</i> | 5.2% | 4.6% | 5.5% | 2.5% | 7.3% |

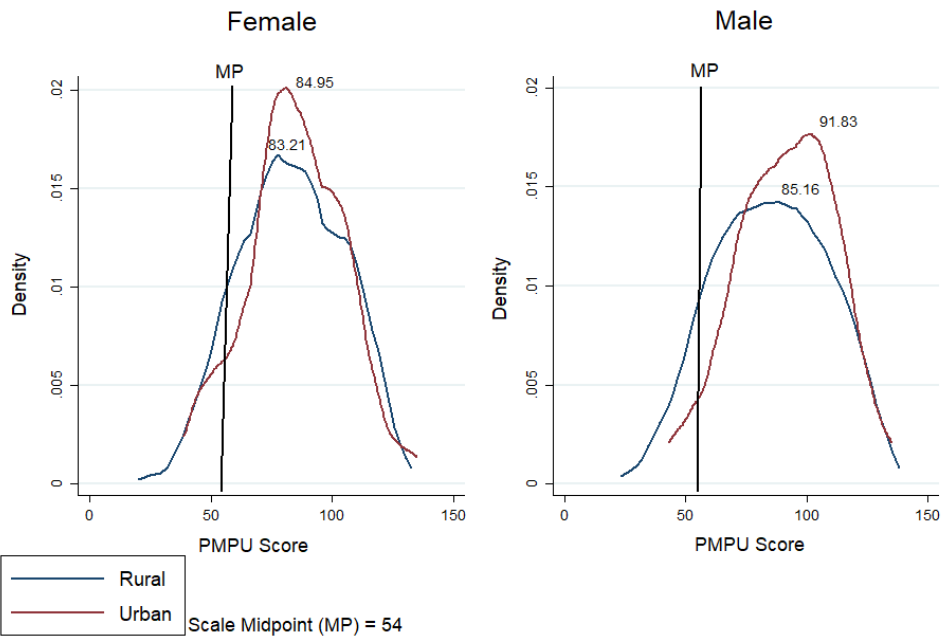
Source: Nepal Study Center, 2019

*Percentages represent proportion of respective group.

5.3 Addictive Tendencies

As mentioned, a key concern with extensive use of mobile phones, and particularly social media uses of phones, is that it may lead to (or reinforce) addiction-like dependency on mobile phones and the tools/apps that phones facilitate (L. Chen et al. 2016; Ha et al. 2008; Billieux, Van der Linden, and Rochat 2008; CommonSense 2016). Using a 27-item Problematic Mobile Phone Survey (Bianchi and Phillips 2005), we are able to capture the distribution of potentially unhealthy attitudes towards mobile phone use in our study sample, displayed in Figure 26.

Figure 26: Problematic Mobile Phone Use (PMPU) Scale



Source: Nepal Study Center, 2019

With a scale midpoint of 54, 91% of respondents fall above this midline and 57.9% scored in the upper quarter of potential scores. Male respondents appear to have a higher tendency towards problematic phone use than their female counterparts, with a mean different that is (marginally) statistically significant. A t-test of difference of means between urban and rural adolescents shows a strongly statistically significant difference, with urban adolescents showing stronger tendencies towards problematic use. Urban males have the most pronounced evidence of problematic use with a mean scale score of 91.83, versus the 83.21 average score for rural females (lowest average).

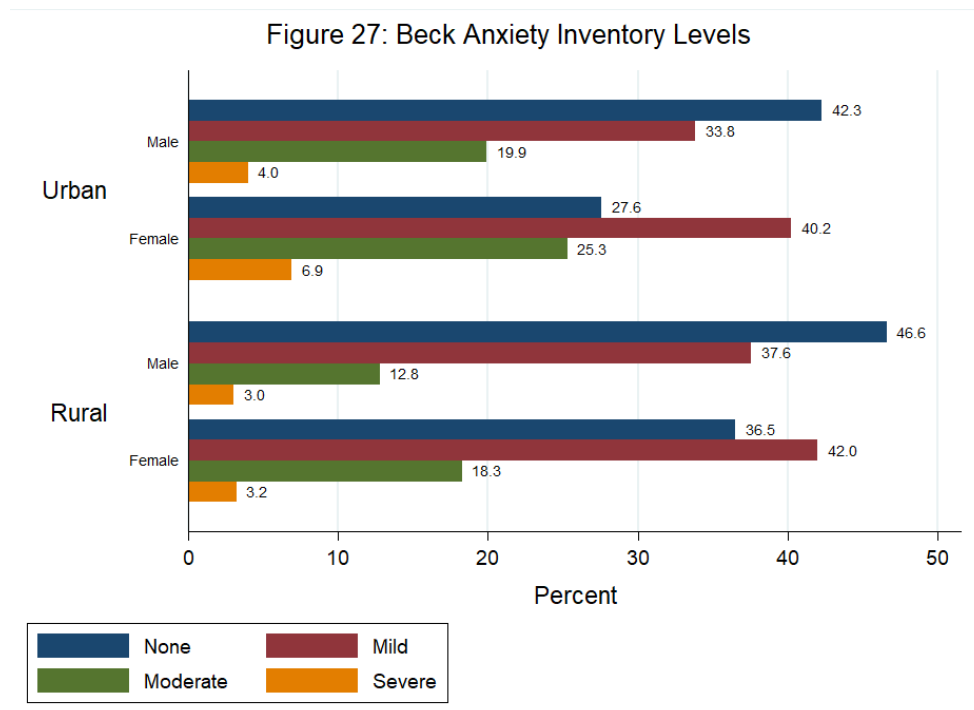
6. Mental Health

KEY HIGHLIGHTS:

- More females than males exhibit at least mild anxiety symptoms.
- Rural males exhibit the largest percentage of respondents with no anxiety (46.6%).
- Largest percentage of moderate and severe anxiety symptoms is among urban females (combined percentage across two categories of 32.2%).
- Urban adolescents suffer from more depression symptoms.
- Urban females show higher combined moderate and severe depression levels than urban males (28.9% versus 22%).
- Rural females show combined moderate and severe depression levels of 17.5% versus 13.6% for rural males.
- Most talked about worry with a close friend is school pressures, followed by fights with other friends and parental pressures.
- 10% of all respondents report discussing concerns with a close friend about bullying and parental fights.

There is strong evidence of potential mental health crises across the world’s adolescent populations (WHO 2014). There is also prior evidence of depression and anxiety tendencies within Nepali populations (Adhikari et al. 2016; Hagaman et al. 2017; Kamrudin 2009; Yamaguchi, Poudel, and Jimba 2013; Niraula et al. 2013). Thus, we measured depression and anxiety tendencies using two different survey instruments which have been widely used (Beck, Steer, and Carbin 1988; Beck et al. 1988) and validated within Nepali populations (B.A. Kohrt et al. 2003; Brandon A. Kohrt et al. 2002).

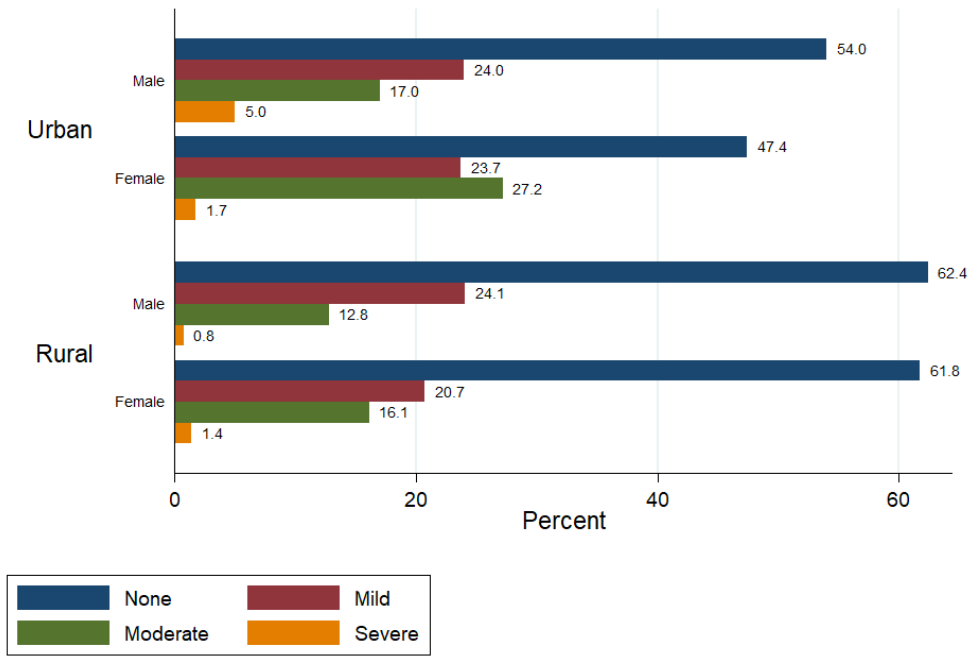
Figure 27 shows the anxiety-oriented scores for this adolescent population, while Figure 28 shows depression-related scores. Across both mental health measures, we have used the labels and score levels recommendation through the validation literature. In terms of anxiety, rural males appear to exhibit the largest percentage of respondents with no anxiety (46.6%). The group with the largest percentage of moderate and severe anxiety symptoms is urban females (combined percentage across two categories of 32.2%). Regardless of location, more females than males exhibit at least mild anxiety symptoms.



Source: Nepal Study Center, 2019

These findings are consistent with regard to scores for depression, too, where urban females show higher combined moderate and severe depression levels than urban males (28.9% versus 22%). Rural females show combined moderate and severe depression levels of 17.5% versus 13.6% for rural males. Compared to all rural adolescents, urban adolescents appear to suffer more depression symptoms.

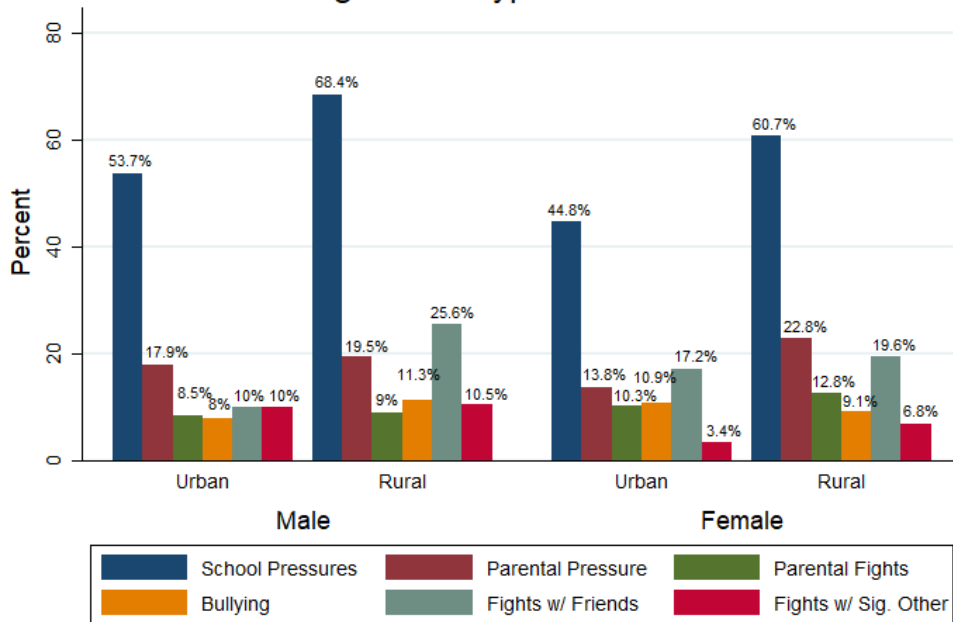
Figure 28: Beck Depression Inventory Levels



Source: Nepal Study Center, 2019

While measures of overall anxiety and depression levels may indicate a need for mental health attention and treatment, knowing where to focus that help is quite policy relevant. Figure 29 displays the worries which are most important to the adolescents surveyed, based on which topics they have discussed with their friends over the last two weeks.

Figure 29: Types of Worries



Source: Nepal Study Center, 2019

Across the board, the most talked about worry is school pressures, followed by fights with other friends and parental pressures. Second to school pressures for urban males and rural females is pressure from parents (17.9% and 22.8%, respectively), and for rural males and urban females, fights with other friends is the second most popular topic of discussion (25.6% and 17.2%, respectively). While not the most popular topic of discussion with close friends, across the board, close to 10% of all respondents report discussing concerns over bullying and parental fights, indicating that these are still relevant matters to Nepali adolescents, currently.

7. Preliminary Associations & Regressions

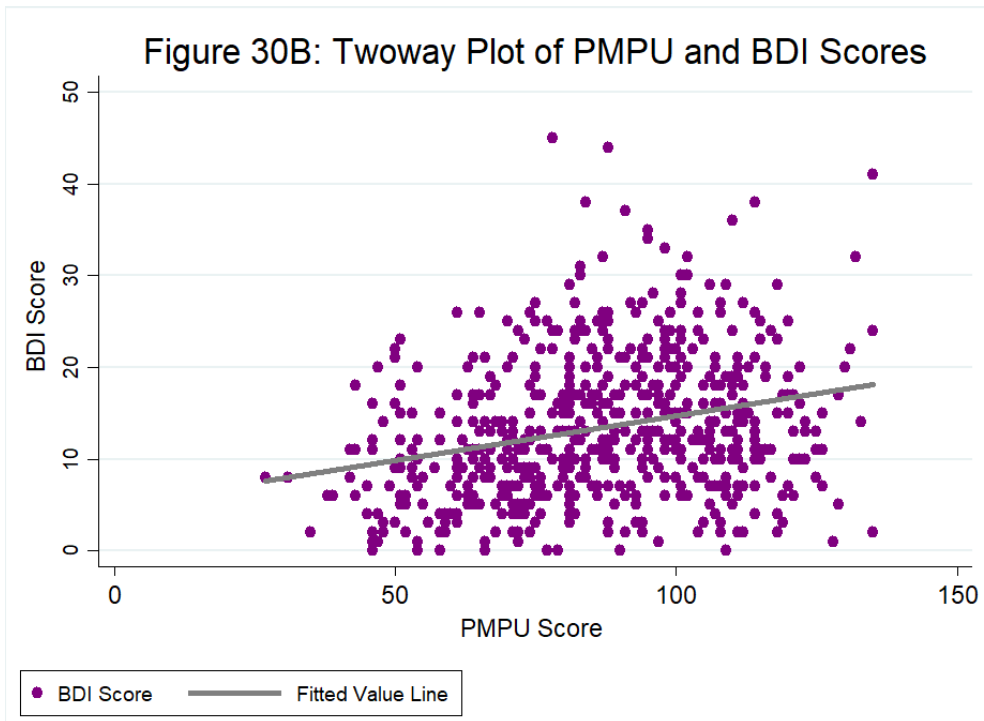
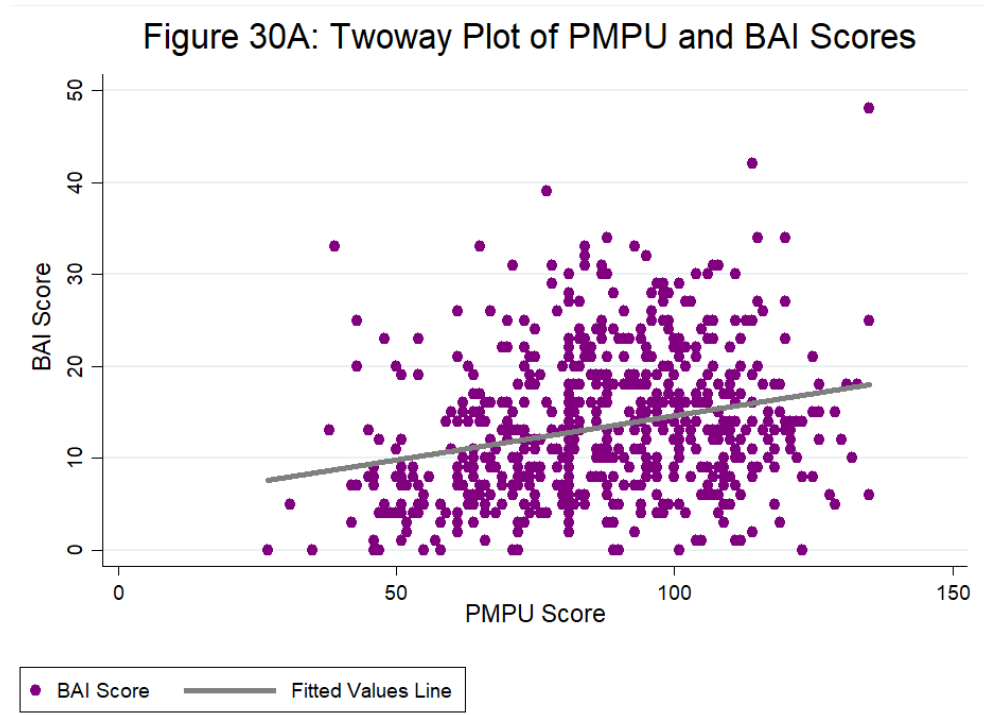
KEY HIGHLIGHTS:

- Those adolescents with higher PMPU scores trend towards having higher BAI/BDI scores.
- Those adolescents with higher phone utilization measures trend towards having higher BAI/BDI scores.
- Adolescents with higher grit & self-esteem scores trend towards lower scores on either depression or anxiety measures.
- A slight positive association seen between adverse factors and scoring higher on the BDI scale.
- Females are less likely, while those from household led by a female and who have a higher socioeconomic status are marginally more likely to own a mobile phone.
- There is a positive significant effect of both tools and social uses on PMPU scores.
- Females' problematic use of mobile phones is more strongly associated with social utilization, while for males it is tools use.
- Females, overall, have higher BDI scores, and rural adolescents have lower BDI and BAI scores.
- Bullying experiences/exposure is the only adverse factor which appears to have a significant effect on higher depression and anxiety measures for the entire sample.
- There is a significant effect of peer pressure on depression symptoms for females, only.
- Self-esteem and grit have a significant negative association with increased BAI and BDI scores.
- Parental support has positive association with grit and self-esteem measures.
- Social interactions have an even larger association with increased self-esteem.

7.1 Two-Way Tables

Beyond the value of these various descriptive findings, a first step towards making the full connections between protective/adverse factors, mental health, and mobile phone usage/addiction is looking at associations between these key variables. In the following section are a number of two-way tables with fitted value lines indicating the positive and negative associations to be found between certain variables, without regard for controlling factors.

Does Mobile Phone Use Diminish Mental Health?



Source: Nepal Study Center, 2019

Figures 30A & 30B show that a hypothesized positive connection between problematic use of mobile phones and mental health is supported. Both for BAI and BDI scores, there is a trend for those adolescents with higher PMPU scores to also have higher BAI/BDI scores. This same positive association

is found when looking at our phone utilization measure, and are shown in Figures 31A and 31B. The slopes of these associations appear to be quite similar, indicating that either measure may serve to represent mobile phone usage in further analyses.

Figure 31A: Tway Plot of Phone Utilization and BAI Score

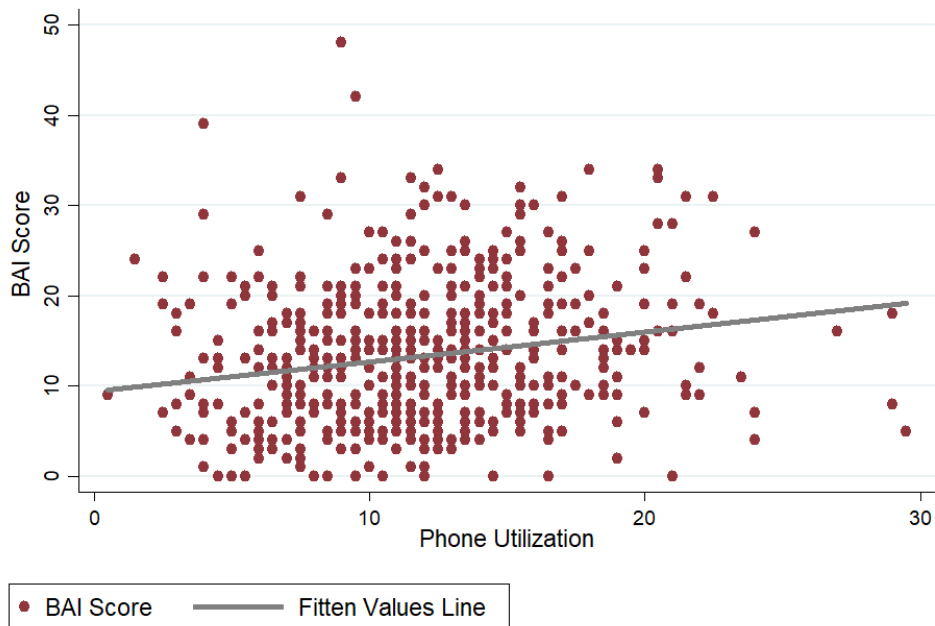
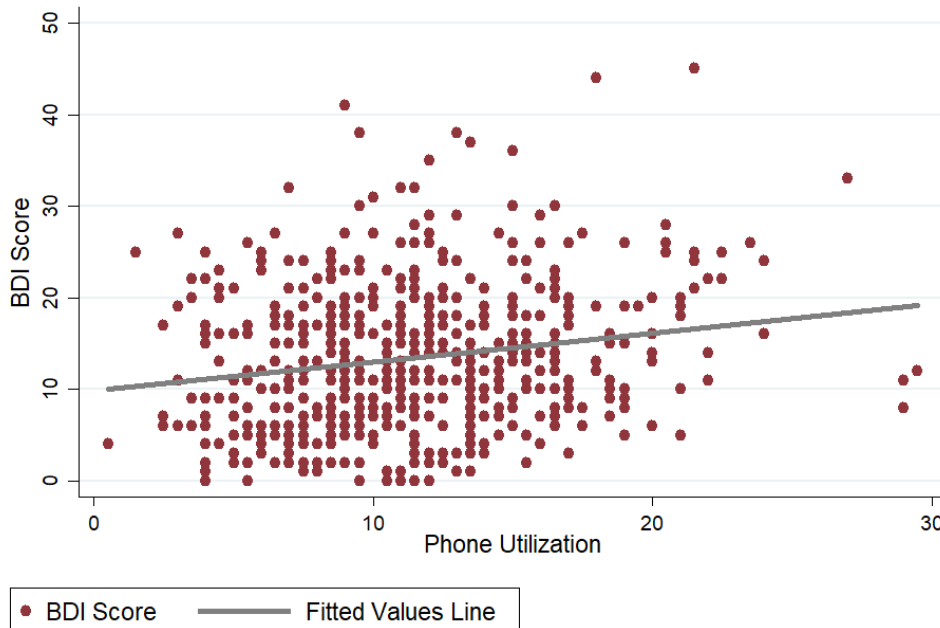


Figure 31B: Tway Plot of Phone Utilization and BDI Score



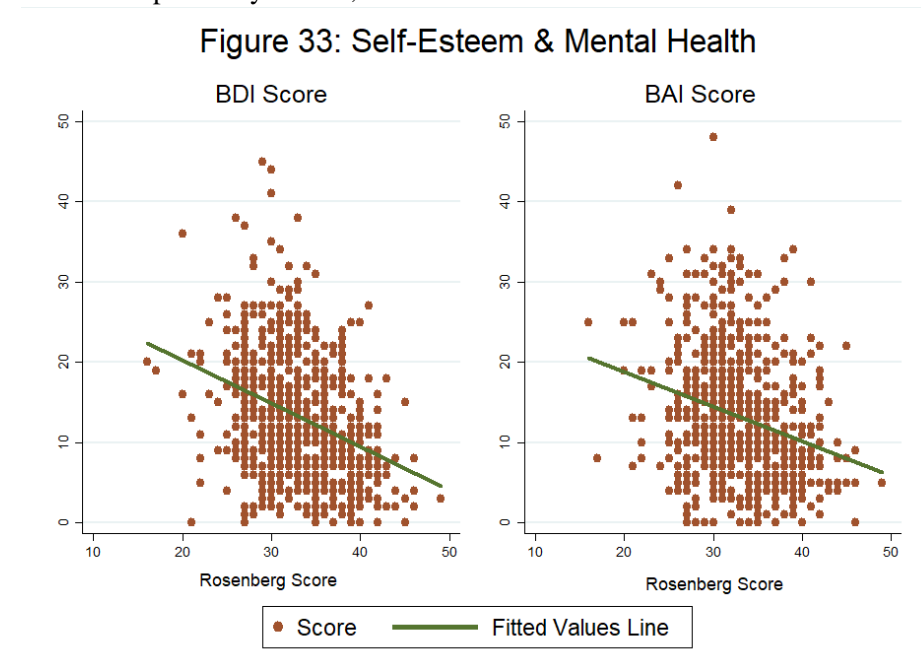
Source: Nepal Study Center, 2019

Do Protective Factors Improve Mental Health?

Another key hypothesis from this work is that the presence of protective factors, including soft skills such as grit and self-esteem will improve mental health. Figure 32 shows a two-way plot of the association between grit and the mental health measures. Figure 33 shows this association for self-esteem. In both cases, we find support for the hypothesis in that for higher grit/self-esteem scores, there is a trend towards lower scores on either depression or anxiety measures. The strength of this association appears to be slightly stronger for depression measures, shown by the slightly steeper negative trend line.



Source: Nepal Study Center, 2019

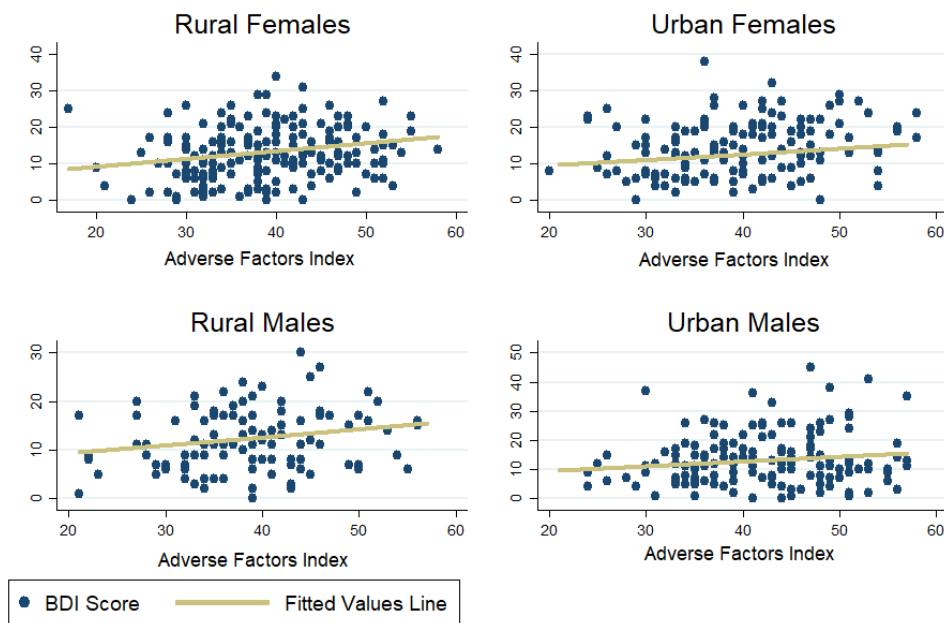


Source: Nepal Study Center, 2019

Do Adverse Factors Diminish Mental Health?

The final overarching hypothesis behind this work is that an accumulation of adverse factors will make mental health outcomes worse. Figure 34, thus, examines the primary association between the depression score and a measure which summarizes the presence of the various adverse factors described previously. As can be seen, there is a slight positive association for both genders, regardless of location, between having more adverse factors and scoring higher on the BDI scale. Urban males appear to have the weakest association, with the flattest association line.

Figure 34: Adverse Factors & Mental Health (BDI)



Source: Nepal Study Center, 2019

7.2 Regressions

Initial associations are encouraging to the research premises. However, to take initial analysis a step further, preliminary regressions have also been made to try and address several other underlying questions related to the overarching themes of this research.

What Type of Person Owns Phones?

As a primary estimation, we regressed a binary variable for mobile phone ownership ($CellPhone_i$) on demographic variables including gender ($Female_i$), location ($Rural_i$), age (Age_i), caste ($Caste_i$), religion ($Religion_i$), a wealth proxy ($Wealth_i$), and several other family-makeup variables (Fam_i).

$$CellPhone_i = \beta_0 + \beta_1 * Female_i + \beta_2 * Rural_i + \beta_3 * Age_i + \beta_4 * Caste_i + \beta_5 * Religion_i + \beta_6 * Wealth_i + \beta_7 * Fam_i + \mu_i$$

Results of robust logistic regression indicated statistically significant effects for gender (1%-level), wealth (10%-level) and gender of the household head (10%-level). It appears that females are less likely, while those from household led by a female and who have a higher socioeconomic status are marginally more likely to own a mobile phone. The lack of significance of all caste, location, and religion variables speaks to the ubiquity of mobile phone dispersion in Nepal.

For the remaining estimations, linear regression was performed using robust standard errors, which account for the effects of gender (*Female_i*) and location (*Rural_i*) on the key question, and control for age, caste, religion, and the wealth index summarizing familial possession of certain socio-economic representative items such as electricity, a computer, and owning their home. (These control variables are included in the vector *X_i*.) For each question, the regression estimation equation is shown and results are summarized.

Does Type of Use/Frequency effect PMPU?

$$PMPU_i = \beta_0 + \beta_1 * Info_i + \beta_2 * Tools_i + \beta_3 * Social_i + \beta_4 * Female_i + \beta_5 * Rural_i + \beta_6 * X_i + \mu_i$$

The dependent variable (*PMPU_i*) represents the summation of the PMPU score, as displayed in Figure 26. The key explanatory variables {*Info_i*, *Tools_i*, and *Social_i*} are the frequency utilization measure described in Figure 22, but restricted to the activities which fall into the three usage-type categories seen in Figures 24 and 25: information, tools, and social. When the sample includes all adolescents we see a positive significant effect at the 1% level for both tools and social uses, indicating that these types of uses are going to be more influential on problematic uses. However, when we examine the sample split separately for females and males, we find that at the 1% level, females' problematic use is positively affected by social utilization, but only by tools at the 10% level. Males, alternatively, show tools as significant at a 1% level and social at the 10% level. Which would indicate that the problematic uses of phones will be triggered by different purposes of use depending on gender. These outcomes are robust to the measurement of utilization as a sum or as quartile levels.

Which Adverse Factors Are Biggest Influence on MH?

$$MH_i = \beta_0 + \beta_1 * Adverse_i + \beta_2 * Female_i + \beta_3 * Rural_i + \beta_4 * X_i + \mu_i$$

Our dependent variable (*MH_i*) is represented by either the BDI score or the BAI score. To account for the adverse factors (the vector *Adverse_i*), we include seven different measures of adolescent pressure summarized throughout Figures 1-10. When estimated with the entire adolescent sample, the only adverse factor which appears to have a significant (1%-level) positive effect on mental health measures is bullying experiences/exposure. The significance of this effects falls to the 10% level when examining only males, and the 5% level for females. However, when estimating the effects of adverse factors on the female-only sample, we also find significance (5%-level) for peer pressure increasing measures of depression. The findings with respect to bullying are robust to specifying mental health as either the BDI or BAI score, and effect sizes are more pronounced for anxiety measures. Examination of gender and rural effects shows that being female has a statistically significant (1%) effect on increasing

BDI scores, and living in a rural location has a statistically significant (10%) negative impact on both BAI and BDI scores.

Which Protective Factors Are Biggest Influence on MH?

$$MH_i = \beta_0 + \beta_1 * Protective_i + \beta_2 * Female_i + \beta_3 * Rural_i + \beta_4 * X_i + \mu_i$$

The buffering effects discussed in Section Four, we believe may also influence mental health, by reducing depression and anxiety measures. As such, the vector *Protective_i*, includes both the soft skill measures of Grit and Self-Esteem and those summation measures of Parental Support, Social Interaction, and Social Network support described statistically in Figures 11-16. Again, our dependent variable (*MH_i*) is either the BDI or BAI score. Robust regression results indicate that only the soft skill factors appear to have a statistically significant negative effect on BAI and BDI scores, with self-esteem at the 1% level and grit at the 5%. The effects of reducing depression and anxiety symptoms from possession of grit disappears as significant in the male-only sample. Gender and location effects under this estimation show that being a (rural) female increases anxiety measures.

Do Social Engagement/Network Support Influence Soft Skills?

The outcome that none of the other social/network support measures appeared as significant in our fourth estimation was intriguing and counter to expectations from literature. As such, further investigation was done to determine if these social-based measured may have a more indirect effect through their impacts on improving the soft skills of grit and self-esteem. The equation below represents the estimation of effects of parental support (*ParentSupp_i*), social interaction (*SocialInt_i*) and social network support (*SocialNetw_i*) on grit and self-esteem (represented by *SS_i*).

$$SS_i = \beta_0 + \beta_1 * ParentSupp_i + \beta_2 * SocialInt_i + \beta_3 * SocialNetw_i + \beta_4 * Female_i + \beta_5 * Rural_i + \beta_6 * X_i + \mu_i$$

Estimation results, here, find a statistically significant positive effect (1%) of parental support on both grit and self-esteem measures, when estimating on the whole adolescent sample. Social Interaction appears to have a greater positive effect (1%-level) on self-esteem. When estimating on the female-only sample, the effects of parental support on both grit and self-esteem become highly significant, while it appears that for male adolescents in our sample, social support is not influential on their soft-skill scores. Rural adolescents appear to have higher grit and self-esteem, overall.

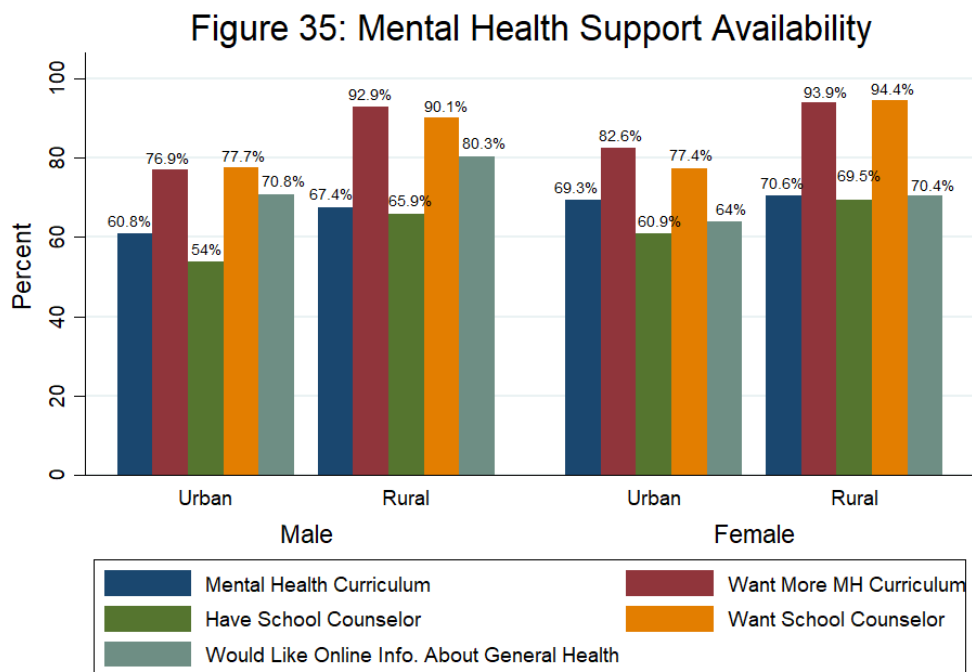
8. Intervention Considerations

KEY HIGHLIGHTS:

- Between 60 and 70% of adolescents say they have had education in school about mental health, but at least 15 percentage points more, per group, would like to see more such curriculum.
- More than 60% of adolescents would be interested in being able to find general information about health available online.
- Urban adolescents would first look online for information about mental health, while rural adolescents would first seek out a public doctor or clinic.

- Adolescents would first approach their mothers, friends, or doctors if they have concerns about emotional/mental health.
- 76.4% of urban and 68.6% of rural adolescents agree they know where to find information about mental health.
- 60.4% of urban and 68.2% of rural adolescents say that they agree they automatically look to their phone to find the answers to questions that they have.
- 65.2% of urban adolescents and 71% of rural adolescents actually trust the information that they find online.
- Over 50% of males and 45% of females are willing to read texts from a number that they do not know.
- Urban adolescents are more concerned about the privacy of their phones.
- Close to 50% of adolescents agree that their phone is taken and others will look through it.

Should initiatives be pursued to implement mobile- health (mHealth) interventions, according to the Diffusion of Innovations literature, having some background context on the feasibility and best approaches may be useful to ensure greatest potential success (Rogers 2003; Oldenburg and Glanz 2008; Greenberg 2006; Haider and Kreps 2004). As a part of our survey we included a module on current health and treatment options, which provides some initial guidance on such first steps towards implementation.



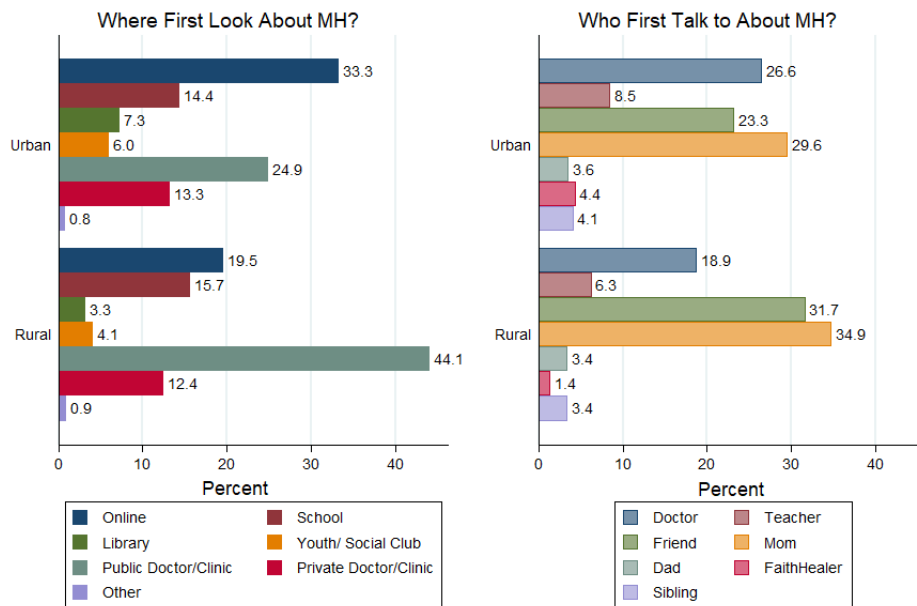
Source: Nepal Study Center, 2019

As seen in Figure 35, somewhere between 60 and 70% of adolescents surveyed claim that they have had education in school about mental health, but at least 15 percentage points more, per group, would like to see more such curriculum. The urban males and females attend the same schools, but yet there is a close to 9 percentage point difference in their reporting of mental health education, just as rural male and female respondents report the presence of mental health education differently. The same pattern is found for presence of a school counselor, where consistently, females report that there is one more

often than males, perhaps reflecting that they have sought out the services or paid more attention to the availability of offerings. Across the board, though, there is a high demand for both more mental health education and presence of a counselor at school, and more than 60% of any group would be interested in being able to find general information about health available online.

Currently, the sources of information for where and who to seek information (from) can be found in Figure 36. It appears that urban adolescents would first look online for information about mental health, while rural adolescents would first seek out a public doctor or clinic. Regardless of location, school represents the third most popular choice for where to seek out mental health information with 14.4% and 15.7% for urban and rural adolescents, respectively. Yet, for both groups of adolescents, teachers represent the fourth most likely person to first approach if wanted to talk about mental health concerns. Urban adolescents would first approach mothers (29.6%), Doctors (26.6%), or Friends (23.3%), and rural adolescent exhibit a similar pattern, but with a larger percentage reported mother (34.9%) or friends (31.7%). Despite conflict over western medicine versus faith-based healing, less than 5% of adolescent say that a faith healer would be their first choice of who to approach with mental health concerns.

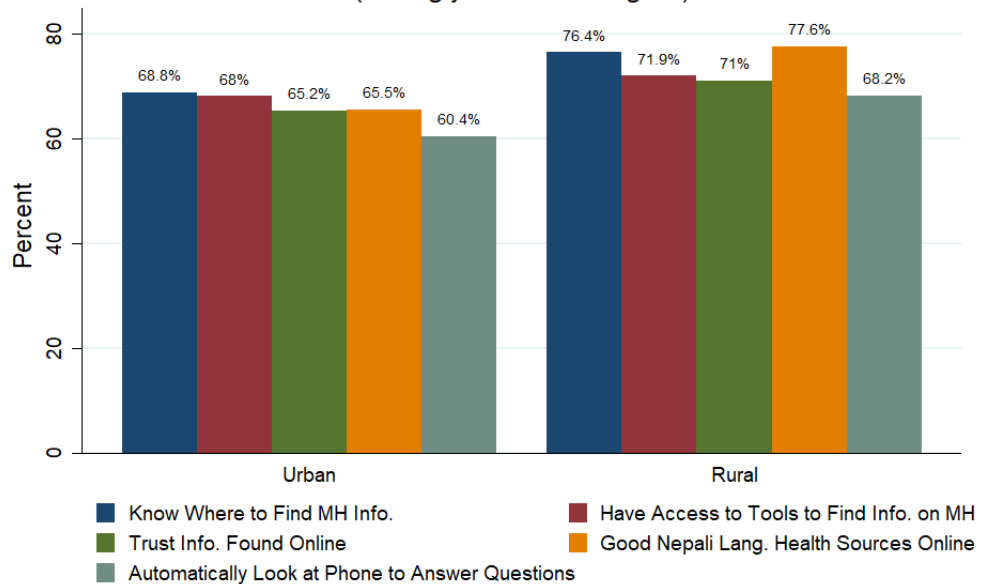
Figure 36: Source of Information About Mental Health



Source: Nepal Study Center, 2019

There is a noted lack of available mental health resources in Nepal from existing studies (Luitel et al. 2015). Figure 37, rather surprisingly, indicates that rural adolescents in our study actually feel better about having access or knowing where to seek out resources for mental/emotional health support, with 76.4% agreeing they know where to find information (versus 68.8% in urban areas).

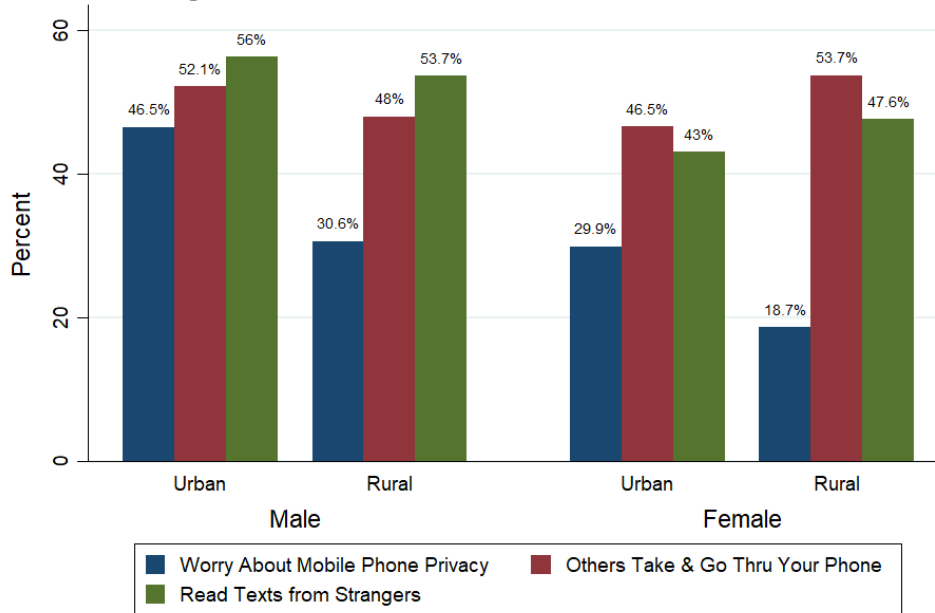
**Figure 37: Sources of Healthcare & Treatment
(Strongly/Somewhat Agree)**



Source: Nepal Study Center, 2019

A promising finding for policy makers interested in pursuing mobile-based approaches to mental health support for adolescents is that 60.4% of urban and 68.2% of rural adolescents say that they agree they automatically look to their phone to find the answers to questions that they have. Further, 71% of rural adolescents and 65.2% of urban adolescents actually trust the information that they find online. Figure 38, lays out some intervention considerations which would make the feasibility of mobile-based interventions potentially much higher. Over 50% of males are willing to read texts from a number that they do not know, at around 45% of females feel the same. However, urban adolescents are more concerned about the privacy of their phone contexts (which makes sense that they show higher rates of phone sharing). Additionally, close to 50% of adolescents agree that their phone is taken and others will look through it. Thus, applications for mental health may reveal that a phone user is struggling emotionally and create some level of stigma associated with its use. Such a situation may hinder the dispersion of an application and its ultimate effectiveness.

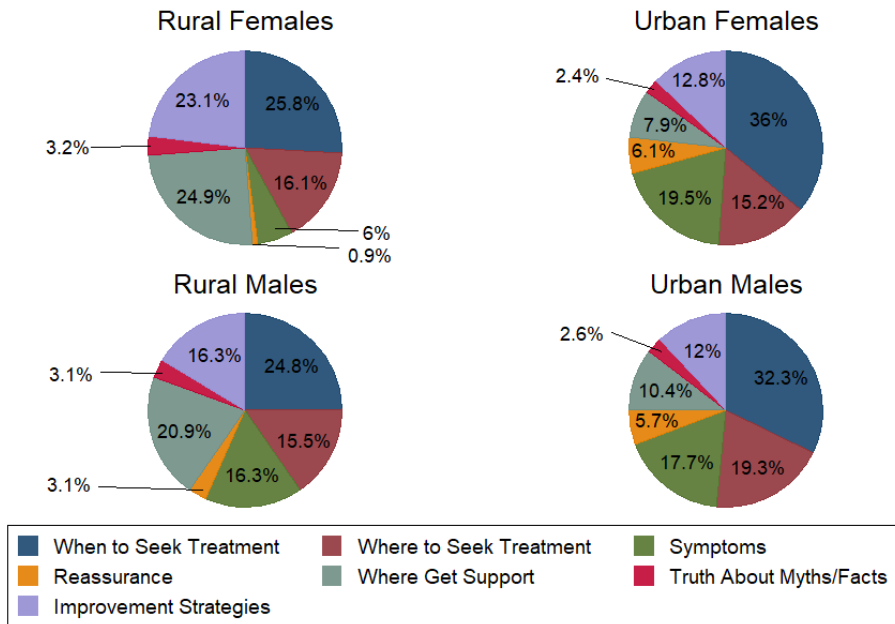
Figure 38: mHealth Interventions Considerations



Source: Nepal Study Center, 2019

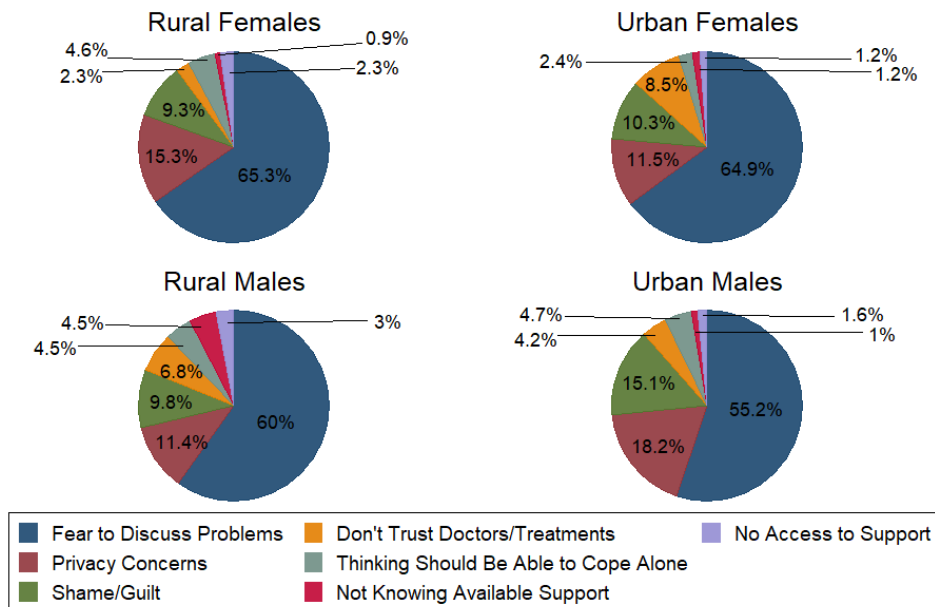
To further aid in any attempts to better target future mental health interventions, we also queried respondents on what they felt was the information that they most wanted to know about mental/emotional health (Figure 39) and what they say as the biggest barrier to seeking treatment (Figure 40). It appears that across the board, the biggest issue adolescents want to know is when to seek treatment. Where to seek treatment, symptoms, and improvement strategies are also fairly important. Close to a quarter of all rural adolescents want to have information about where to get support, with more respondents caring about support than treatment. There is very little concern about learning the truth between myths and facts about mental health or reassurance. The biggest barriers to seeking help is consistently fear to discuss problems, although females appear to see this as a bigger barrier than males. Privacy concerns is the second most cited barrier by all groups. Shame and guilt matters to between 9-15% of respondents, with higher ratings by urban adolescents.

Figure 39: Most Important Information About Mental Health



Source: Nepal Study Center, 2019

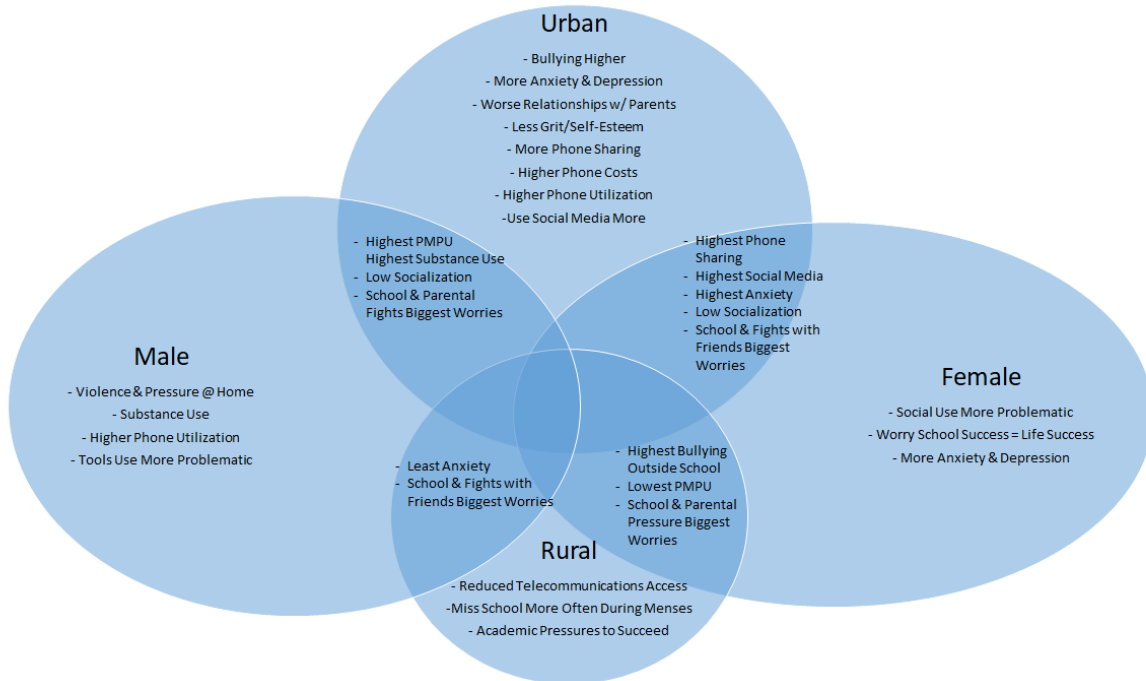
Figure 40: Biggest Obstacles to Seeking MH Treatment



Source: Nepal Study Center, 2019

9. Policy Recommendations

Below is a summary graphic of each of the four groups targeted in this study to aid in future potential targeting of interventions:



From such findings, what follows are some initial policy recommendations:

- 1) Beyond mental health concerns, this study reiterates the importance of insufficient hygiene infrastructure in schools. In order to better support female adolescents in their efforts to remain in school and thrive, efforts should be made to increase the presence of separate toilets for males and females. Additionally, to prevent the spread of all infectious diseases, soap should be made present at school toilets.
- 2) The evidence that and <50% of adolescents have access to socialization prospects might indicate a need to increase the ability and availability for adolescents to have places and opportunities to socialize. Particularly among urban youth, policies could seek to formalize more social groups which are youth-driven and foster mentoring/support. Additionally, given the pressure exhibited across the board to succeed in school, these groups could form/offer arrangements for study help/group talk on school matters.
- 3) Adolescents want information about when to seek treatment, which is fundamentally about knowledge enhancement. While students claim to have been exposed to information about mental health in school, they want more and the reality that they do not know when to seek treatment may indicate failures in the curriculum. Thus, one policy prescription would be to enhance public schooling education about emotional/mental health and include more information about when and

where to get support/treatment. By talking about mental health more openly (and more often), the barrier to seeking help of fear may seem less intense.

- 4) Urban females appear to be the hardest hit by mental health symptoms, and would be the group of Nepali adolescents who might benefit the most from mental health-oriented interventions. However, it will be important to consider that privacy is not universal for adolescents, and particularly for urban adolescents. As such, mHealth interventions will need to be cognizant of how they are packaged and presented to try and minimize the stigma attached to their use. Additionally, it may be useful to target mHealth apps to each group of adolescents based on their current practices, need, and desires.
- 5) Bullying is another concern, with a stronger effect for females. Efforts should be made policy-wise to reduce bullying both within and outside of school. Future work may wish to investigate the underlying reasons behind the bullying and target those based on group dynamics.

10. Further Analysis

While initial findings are useful, more rigorous analysis will be further undertaken to determine the direct and indirect effects of the protective and adverse life factors on mental health outcomes, along with empirically measuring the mediating effect of mobile phones on these relationships. This will be done using structural equation modeling (SEM). Particularly, there will be a full structural model created and analyzed, which includes measurement models for the various latent (unobserved) variables and will involve path and mediation analysis.

As a part of this plan, we are aware of the simultaneity concerns between mobile phone use and depression/anxiety, with many researchers arguing for a circular/bi-directional relationship (Ko et al. 2009; Kim, LaRose, and Peng 2009; van den Eijnden et al. 2008; Elhai, Dvorak, et al. 2017). As such, we anticipated the need for instrumenting for own phone use/problematic use, and we chose to use friends' use of mobile phones. For this approach to work, we need to establish that these measures significantly predict respondents' own use. Below is the "First-Stage" regression equation, to establish that we can meet the relevance condition for future instrumental variable approaches.

$$Util_i = \beta_0 + \beta_1 * FriendPMPU_i + \beta_2 * FriendUtil_i + \beta_3 * X_i + \mu_i$$

Under this set-up, $Util_i$ is either respondent's PMPU score or their utilization measure. $FriendPMPU_i$ represents an index of respondent's answer to queries on his/her closest friend's behaviors and attitudes surrounding mobile phone use, modifying six of the key questions from the PMPU survey instrument. Results from robust regressions indicate that this instrument does significantly predict respondent's own PMPU score, whether the instrument is represented as a pure sum or in quantile form. Estimation using summation of binary indicators for friend's use of the nine functions over the prior two weeks ($FriendUtil_i$), proved to not serve as a good instrument for own phone utilization measures. However, the instrument formed from modified PMPU questions, does appear to serve well to predict respondent's phone utilization score (robust to instrument definition as a sum or quartiles). As such, as this work progresses, there is the option to try and address the simultaneity issue. The hope is that the SEM analyses will be able to produce additional policy implications about the feasibility and targets of potential mHealth interventions aimed at improving the mental health of Nepali adolescents.

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