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Exploring the Impact of Improved Access to Safe Drinking Water and Sanitation on Subjective Wellbeing of Adults in Punjab

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Abstract

Urban development including water and sanitation infrastructure is critical for mental health. Lack of access to water supply and sanitation can provoke unrest and conflict among the households. However, extant literature has not paid much attention to such association. This study uncovers the impact of improved access to safe drinking water and sanitation on the subjective wellbeing of men and women of the same households in the most populous province, Punjab, of Pakistan. The study extracted data from the latest multiple indicator cluster survey of Punjab and employed a two-level mixed effects logistic regression method due to data hierarchy. The results revealed a positive relationship between piped and bottled water access with the subjective wellbeing of adult men (OR=1.113 and OR=1.274, respectively) and women (OR=1.092 and OR=1.416, respectively). However, improved sanitation was found to have a positive association with the subjective wellbeing of just women (OR=1.169), implying that poor sanitation infrastructure is a particular source of mental stress for women. Improved sanitation was associated with higher self-reported life satisfaction among both men and women (OR=1.194 and OR=1.156 respectively). Our findings provide avenues for policymakers to intervene to improve household water and sanitation infrastructure, which has far-reaching impacts on the life satisfaction.

Key Words: Safe Water, Safe Sanitation, Gender, Subjective Wellbeing, Multi-level Mixed Effects Logistic Regression, Punjab, Pakistan

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1. INTRODUCTION

Urban development including water and sanitation infrastructure is critical for mental health. Globally, around 2.2 billion people lack access to safe drinking water and over half of the world's population lacks access to safe sanitation. Majority of these are residing in developing countries including Pakistan. In the era of rising global temperatures and accelerated

environmental degradation, environmental quality and its impact on the lives of individuals, has now become a cornerstone of international public policy. What was once considered a luxury is now regarded by many, as a public good, which must not only be protected but guaranteed to citizens regardless of race and socio-economic background.

Perhaps, the most alarming aspect of environmental neglect, however, is the possibility of a world without clean water access, a reality taken into consideration with the inclusion of goal 6 in the UNs SDGs. While the issue has been given serious attention in the developed world, a large portion of the world's population residing in 3rd world nation's still lacks access to safe and clean drinking water. According to the UN estimates, the number of people falling into this category amounts to roughly 2.2 billion (UNICEF, 2019). The issue is further compounded with the lack of access to safely managed sanitation services, which is still a rarity for an estimated 4.2 billion people worldwide. The lack of access to such basic human necessities is a major contributor to poor health outcomes, both physically and mentally.

Numerous studies have focused on the relationship between water related issues and physical health. Inadequate sanitation and contaminated water supply are the primary causes of illness in developing countries. However, given that health is defined as a state of total physical, social and mental wellbeing and not simply the absence of disease (WHO, 1948), ignoring the psychological impacts of inadequate water and sanitation on the lives of individuals has significantly understated the severity of the issue and the true health costs incurred. Indicators such as subjective wellbeing are increasingly being looked upon to assess general mental health as stress and anxiety are the determinants of life satisfaction and can thus contribute to low subjective wellbeing (Lombardo et al., 2018). Subjective wellbeing has been rarely used in relation to water and sanitation issues before. A study investigating the determinants of subjective wellbeing in rural communities of Ghana found water to be a significant variable of impact. Lack of piped water access among households in Nepal, was indicated to contribute to low subjective wellbeing if not counteracted through alterative water management techniques (Chindarkar et al., 2019). Similarly, a study, based in rural India, found that sanitation experiences may indeed impact mental health and that access to functional household latrine was associated with higher wellbeing scores (Caruso et al., 2018).

Pakistan is still a long way off from achieving its sustainable development target of providing clean water and sanitation for all. According to the UNICEF Pakistan, up to 17 million people in the country lack access to

clean and safe drinking water, and an estimated 2 in 5 people lack access to hygienic sanitation infrastructure. Water quality and its physical health repercussions have been studied extensively in Pakistan. However, the mental health repercussions of water related issues in the country have been given little attention. One of the few papers exploring the issue with respect to subjective wellbeing include a study by Nadeem et al. (2018); where , irrigation water scarcity was discovered to adversely impact the subjective wellbeing of farmers and their families in rural Punjab

This study aims to explore the impact of water access and sanitation on the subjective wellbeing of adults in Pakistan's most populous province, Punjab. The methodology involves a multilevel analysis to study the relationship with subjective wellbeing at the individual, household, and community levels. Furthermore, the study incorporates gender differences by examining men and women separately. This would allow policymakers to design more effective strategies, prioritizing the most vulnerable to the access of water and sanitation.

2. METHOD

2.1. Data Collection

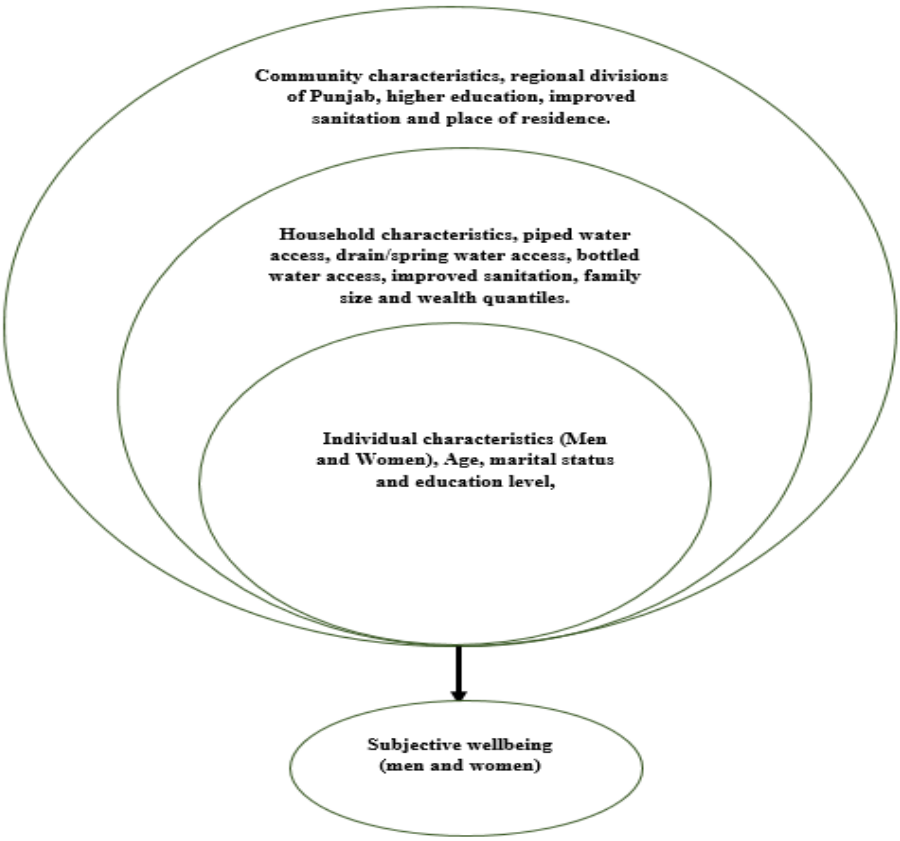
The data used in the study was sourced from the Multiple Indicator Cluster Survey (MICS) for the year 2017-2018. The MICS, which is funded through UNICEF, is the largest source of data on well-being indicators relating to women and children across the globe. The survey aims to facilitate policy makers and researchers in improving the livelihood and wellbeing of those most vulnerable, while enabling nations to meet the goals set forth by the 2030 sustainable development agenda.

The 2017-2018 MICS conducted in Punjab, Pakistan, covered 36 districts, with urban and rural areas defined as primary sampling strata within each district. Probability proportional to size was used within each stratum to decide upon a specific number of census enumeration areas (20 households). Data was gathered from 53,840 households through the aid of 2,692 sample clusters, with 799 being urban observations and 1893 being rural. The MICS (2017-2018) consists of 6 questionnaires in total. For our study, we utilized 2 of these questionnaires, one referring to households and other to women aged between 15 and 49. Sample collection for the questionnaires were gathered through multi-stage stratified cluster sampling.

2.2. Conceptual Framework

The study employed the three layers nested onion conceptual framework based on Bronfenbrenner's ecological theory (1979), which explains that individuals are nested within households and households are nested within communities. Moreover, the first internal layer consists of individual-level characteristics (age, marital status and education level), the second layer consists of household characteristics (piped water access, drain/spring water access, bottled water access, improved sanitation, family size and wealth quantiles), and the last layer consists of community characteristics (regional divisions of Punjab, higher education, improved sanitation and place of residence).

Figure 1: Conceptual Framework



2.3. Construction of Variables

2.3.1. Dependent Variable

Since our study's objective is to examine the impact of water access and sanitation on the subjective well-being (SWB) of women and men, subjective well-being is our primary dependent variable employed in the model. From the MICS men and women questionnaires, we chose the variable that asked the individuals to rank their life satisfaction on a ladder scale of 0 to 10 with 0 being the worst and 10 being the highest life satisfaction, also known as the Cantril ladder. From this information, we constructed a binary variable where values ranging from 0 to 5 were classified as low life satisfaction and thus represented by 0, while all observations from 6-10 were classified as high life satisfaction and were denoted by 1. This SWB variable was prepared for both men and women analyses.

2.3.2. Independent Variables

Individual Characteristics

SWB is impacted by more than just resource availability, which is why certain socioeconomic variables of men and women have also been included in the model to provide balanced results. Three individual-level control variables included in our study are age, marital status, and level of education. Age was recorded as number of years completed. To record marital status, we created a dummy variable, in which married was coded as 1 while not married or previously married were coded as 0. Similarly, dummies were also used to record level of education with 4 levels of education (primary, secondary, and higher secondary) coded as 1, with the rest coded as 0.

2.3.3. Household characteristics

Variables sourced from the household questionnaire used in the model include, family size, access to various sources of water and improved access to sanitation infrastructure. Family size was recorded as the number of members in a household. Water access was broken down into 4 dummy variables, with each dummy coding access as 1 and lack of access as 0. The four sources include: piped water, borewell water, bottled water and rain/spring water. Households were also studied regarding their income levels, with 2 dummy variables created to indicate their position according to wealth quantiles. Households belonging to the upper wealth quantile was included in

the rich dummy variable, while those belonging to the middle wealth quantile were recorded in the middle dummy variable. Households of the lowest quantile (poor) was considered as a control variable.

2.3.4. Community Characteristics

This study covers the province of Punjab, which we have divided into three regions: south, central, and north Punjab. North Punjab which includes the district of Rawalpindi was allocated as a control category. Higher education and improved sanitation have also been taken as variables at the community level along with place of residence.

2.4. Econometric Method

The MICS data has a hierarchical structure in which individuals are nested within households and households are nested within clusters or communities. In such a data set, individuals may be more similar within the same community rather than with other individuals in the rest of the country, that belong to a different community. For this reason, a flat or one-level model can underestimate the coefficients and provide imprecise standard errors. This in turn, may affect the decision regarding the null hypothesis. Flat models also assume the independence of observations and equal variances across communities, which are assumptions that don't hold true when using MICS data.

Hierarchical structures are best utilized in Multi-level models, which take into account the lack of independence between cases (Kamanda et al., 2016). For this reason, the use of a two-level mixed-effects logistic regression model is best suited to estimate the effects of individual, household and community factors on individual's subjective well-being. Mixed-effects models estimate both fixed and random effects. The fixed effects are estimated directly and are similar to typical regression coefficients. Random effects on the other hand, are estimated indirectly and are usually presented according to estimate variances and covariances. Moreover, the random effects take into account the grouped nature of the dataset. Multi-level mixed effect logistic regression is used if the dependent variable is binary (Williams, 2018). The two models were fitted for this study. In the first model, the subjective well-being of women was taken as the dependent variable, while in the second model the dependent variable used was the subjective well-being of men. SWB was measured through life satisfaction which is a binary

variable. The independent variables incorporated in both models were the same. They included individual, household and community characteristics.

The data was fitted into a two-level mixed effects logistic regression model expressed below:

$$\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_0 + \beta_1 I_{1ij} + \ldots + \beta_L I_{Lij} + \alpha_1 H_{1ij} + \cdots + \alpha_m H_{mij} + \gamma_1 C_{1ij} + \cdots + \gamma_n C_{nij} \quad \ldots (1)$$

$$\beta_{oij} = \beta_o + v_{ok} + e_{oij} \quad \ldots (2)$$

where,

Individual-level variables: $I_1, \ldots, I_L$
Household-level variables: $H_1, \ldots, H_m$
Community-level variables: $C_1, \ldots, C_n$

3. REGRESSION RESULTS AND DISCUSSION

3.1. Descriptive Statistics of Women

Table 1 consists of the descriptive statistics used to evaluate the subjective wellbeing of women in Punjab. Among the individual characteristics of women, their average age in the study sample is 29 years. The average age of women reporting low satisfaction is 30 years, which is higher than those reporting high satisfaction (aged 29). According to the t-test, the difference between the average age of women in both study groups is highly significant.

In terms of education, on an average, 65% of women had some degree of education. Women reporting low satisfaction were found to receive less education on average (52%), as compared to those reporting high satisfaction (70%). The difference between the two groups was found to be significant according to the t-test. As for marital status, 67% of women in the sample study were married. About 71% of women reporting low satisfaction were married, whereas just 65% of women reporting high satisfaction were married. Low satisfaction was thus found to be more common among married women than unmarried women. The difference between the two groups was statistically significant at 1%, according to the t-test. The average family size of women sampled in the study was 8 members per household. Women reporting low satisfaction belonged to a household of just 7 members on an

average, while those reporting high satisfaction averaged at around 8 members per household. Thus, family size tended to be smaller among women reporting low subjective wellbeing.

Among the four water access variables, on an average, an estimated 18% of women had accessed to piped water. Around 19 % of women reporting high life satisfaction were reported to have piped water access, whereas 15% of women reporting low satisfaction reported similar access. Thus, access to piped water was found to significantly contribute to the subjective wellbeing of women. Bottled water is another source providing similar results, with women reporting higher life satisfaction have greater access to bottled water. Bore well water access, on the other hand, stands out from other water access variables, in those women reporting higher life satisfaction also reported lower access to borewell water in comparison to those women with low life satisfaction. According to the t-test, the results were found to be statistically significant at 1%. Another notable variable is drain/spring water access, which was found to be insignificant in relation to the subjective wellbeing of women.

The variation between the two study groups in terms of improved sanitation infrastructure was found to be highly significant. The majority of women with high life satisfaction (72%) reported access to improved sanitation infrastructure whereas just 59% of women with low satisfaction reported similar access. Thus, improved sanitation access was found to be higher among happier women. In terms of economic background, belonging to a high-income class was associated with greater subjective wellbeing. As seen in table 1, 44% of women reporting high subjective wellbeing were classified as rich, compared to a mere 27% reporting low subjective wellbeing. The descriptive statistics of the middle-income variable show similar results.

The geographical distribution of households was also found to impact subjective wellbeing. A greater percentage of women identified as having high life satisfaction lived in urban areas. Interestingly, variation in subjective wellbeing was also reported based on region. A greater percentage of women living in south Punjab reports low satisfaction, whereas a greater percentage of women living in central Punjab reported high levels of satisfaction. Both variables were found to be statistically significant at 1%. At the community level, higher education was found to be statistically significant at 1%. A greater percentage of women reporting high life satisfaction was found to have completed their higher education. Access to improved sanitation facilities at the community level was also observed as highly significant.

Women with access to improved sanitation facilities reported higher subjective wellbeing than those who did not. The difference between the two groups was roughly 10%.

Table 1. Descriptive Statistics of Sample Women

Variables	Total (n=74,010)	High satisfaction (n_1=52,476)	Low satisfaction (n_2=21,535)
Women characteristics			
Age (years)	29.040 (9.558)	28.482*** (9.401)	30.402 (9.558)
Educational (levels)	0.648 (0.478)	0.700*** (0.459)	0.523 (0.500)
Marital status	0.668 (0.471)	0.651*** (0.477)	0.711 (0.453)
Household characteristics			
Household members (No.)	7.668 (3.753)	7.782*** (3.811)	7.390 (3.592)
Piped water access	0.177 (0.382)	0.187*** (0.390)	0.154 (0.361)
Bore well water access	0.671 (0.470)	0.652*** (0.476)	0.719 (0.450)
Bottled water access	0.004 (0.61)	0.004*** (0.065)	0.002 (0.49)
Drain/spring water access	0.002 (0.46)	0.000 (0.048)	0.002 (0.041)
Improved sanitation	0.682 (0.466)	0.722*** (0.449)	0.586 (0.493)
Rich	0.388 (0.487)	0.439** (0.496)	0.265 (0.441)
Middle	0.220 (0.414)	0.228*** (0.420)	0.200 (0.400)
Community characteristics			
Place of residence	0.296 (0.456)	0.313*** (0.464)	0.254 (0.435)
South Punjab	0.274 (0.446)	0.257*** (0.371)	0.316 (0.465)
Central Punjab	0.601 (0.490)	0.612*** (0.487)	0.576 (0.494)
Higher education	0.005 (0.069)	0.006*** (0.077)	0.002 (0.043)
Improved sanitation	0.493 (0.500)	0.533*** (0.499)	0.396 (0.489)

***, **, * Significant at the 1%, 5% and 10% levels, respectively.

Note: Mean values are shown with standard deviations in parenthesis.

t test is used for continuous variables while chi square test is used for categorical variables to recognize the differences in mean values. Data Source: MICS (2017-2018.

3.2. Results for the Subjective Wellbeing of Women

Table 2 presents the econometric analysis of the variables used to gauge the subjective wellbeing of women in the study. Initially, the total variance in SWB is estimated in the empty model, which holds no variables. As shown in the table, the intra-cluster correlation (ICC) of the empty model is 16.2%, which explains the prevalence of sufficient variation between communities. Therefore, using flat/one-level model does not provide precise estimates. In model 1, among the four water sources included in the study, access to piped and bottled water were the only ones found to be significant (5% level of significance). Access to bottled water was especially impactful in determining wellbeing, as having access increases the probability of reporting high SWB by 1.4 times. With an odds ratio of roughly 1.1, piped water access indicates a similar probability but to a lesser extent. With piped water through much of the province being of sub-optimal quality (Aziz, 2005), it is not surprising that bottled water is more heavily linked to greater levels of happiness and relied upon for drinking purposes. Access to improved sanitation is highly significant at 1% level of significance and was found to raise the likelihood of women reporting high satisfaction by 1.2 times. Research has shown that lack of access to clean and safe sanitation infrastructure, results in lower health outcomes for women, putting them at risk of developing disease and being subject to harassment (Lal, 2013). Research conducted by Caruso et al. (2018) has also highlighted the direct relationship between women's sanitation experiences and their mental health. The results from their study showed that household latrine access was linked with higher wellbeing scores.

At the community level, regional variation was found to play a role in impacting women's subjective wellbeing in Punjab. While the results for central Punjab were insignificant, women from south Punjab were found to be 1.1 times more likely to report greater subjective wellbeing. This is evident from the odds ratio of 1.103 and a significance level at 10%. Improved sanitation and higher education were also associated with higher SWB with an odds ratio of 2.339 and 1.156 respectively. This supports the results at the individual level of SWB stated earlier.

Table 2. Regression Results for Women

Variables	Model 1	Empty model
Women characteristics		
Age	0.979*** (0.001)	-
Educational	1.388*** (0.031)	-
Marital status	1.135*** (0.029)	-
Household characteristics		
Number of household members	1.028*** (0.003)	-
Piped water access	1.092** (0.041)	-
Bore well water access	0.990 (0.032)	-
Bottled water access	1.416** (0.241)	-
Drain/spring water access	1.167 (0.265)	-
Improved sanitation	1.169*** (0.029)	-
Rich	2.517*** (0.080)	-
Middle	1.629*** (0.044)	-
Urban	0.740*** (0.032)	-
Community characteristic		
South Punjab	1.103* (0.065)	-
Central Punjab	1.019 (0.054)	-
Higher education	2.339*** (0.621)	-
Improved sanitation	1.156*** (0.049)	-
Random effects		
Cluster level variance	0.536	0.636
Variance (SE)	0.022	0.025
Chi-square test	2848.91***	-
Residual intra-cluster correlation (ICC)	0.140	0.162
ICC (SE)	0.004	0.005

***, **, * Significant at the 1%, 5% and 10% level, respectively.

Note: Odds Ratios are shown with confidence intervals in parentheses (Source: MICS 2017-2018).

3.3. Descriptive Statistics of Men

Table 3 shows the descriptive statistics of the variables used to gauge the subjective wellbeing of men in the study. Among individual characteristics, all three variables (age, education, and marital status) were significant at 1%. Younger men were found to be happier on an average as opposed to those entering their thirties. This could be linked to the greater responsibility that comes with age, given that many men are married by thirty and have a family of their own to provide for. This may also add to the observation of a greater proportion of men reporting high satisfaction being unmarried. As seen in table 3, the average percentage of highly satisfied men who are married is 65%, whereas the average percentage of those reporting low satisfaction is higher (71%). Education was also observed to have a notable impact on the subjective wellbeing of men in the study. On an average, 83% of men in the study were educated. Around 85% of men reporting high life satisfaction were educated, whereas just 72% of men reporting low satisfaction was found to be educated.

In terms of household characteristics, a larger family size was associated with greater levels of SWB, with the average number of household members being 8 among highly satisfied men, and 7 among less satisfied men. As per the t-test, the results were observed to be highly significant at 1%. In relation to water access variables, more men reporting high satisfaction were found to have access to piped water and bottled water. From the two water sources, piped water was more commonly sourced with 18% of men in the study found to have access. On the other hand, access to borewell water did not follow the same trend. A greater percentage of men reporting low satisfaction (72%) were found to have access to bore well water as opposed to those reporting high satisfaction (64%). An overwhelming 66% of men had access to borewell water, meaning it was the most abundant out of all four water sources included in the study. Drain spring water access was rarely reported among the study groups, and unlike the other three water sources, its results were statistically insignificant. Improved sanitation was another variable found to be highly significant. Greater access to better sanitation infrastructure was reported among a greater number of men with high satisfaction (72%) as opposed to those with low satisfaction (62%).

Table 3. Descriptive Statistics of Men

Variables	Total (n=74,010)	High satisfaction (n_1=52,476)	Low satisfaction (n_2=21,535)
Men characteristics			
Age (years)	28.730 (9.781)	28.545*** (9.772)	29.139 (9.791)
Educational (level)	0.827 (0.378)	0.853*** (0.355)	0.772 (0.420)
Marital status	0.533 (0.499)	0.526*** (0.500)	0.546 (0.500)
Household characteristics			
Household members (No.)	7.627 (3.774)	7.699 (3.828)	7.468 (3.647)
Piped water access	0.177 (0.381)	0.190*** (0.392)	0.150 (0.357)
Bore well water access	0.664 (0.472)	0.640*** (0.480)	0.719 (0.450)
Bottled water access	0.064 (0.245)	0.071*** (0.257)	0.048 (0.214)
Drain/spring water access	0.002 (0.046)	0.002 (0.046)	0.002 (0.047)
Improved sanitation	0.685 (0.464)	0.716*** (0.451)	0.617 (0.486)
Rich	0.379 (0.485)	0.425*** (0.494)	0.276 (0.447)
Middle	0.219 (0.413)	0.226*** (0.418)	0.212 (0.401)
Community Characteristics			
Place of residence	0.299 (0.458)	0.317*** (0.465)	0.260 (0.439)
South Punjab	0.079 (0.269)	0.065 (0.246)	0.110 (0.312)
Central Punjab	0.160 (0.366)	0.160 (0.367)	0.159 0.366)
Higher education	0.008 (0.087)	0.009*** (0.094)	0.005 (0.070)
Improved sanitation	0.465 (0.499)	0.502*** (0.500)	0.383 (0.486)

***, **, * Significant at the 1%, 5% and 10% levels, respectively.

Note: Mean values are shown with standard deviations in parenthesis.

t-test is used for continuous variables while chi-square test is used for categorical variables to recognize the differences in mean values (Source: MICS 2017-2018).

The economic background of men was found to be a major determinant of WSB, with a greater number of men belonging to rich and middle-income backgrounds reporting higher subjective wellbeing. The difference was more notable among men identified as rich, with 43% of men

reporting high satisfaction falling into the category as opposed to 28% reporting low satisfaction. For men of middle-income background, the results were more significant but less notable, with the difference between the two groups, being just 2%.

As for community characteristics, the results show that men from urban areas reported greater subjective wellbeing than those living elsewhere. Despite just 30% of the men in the study residing in urban areas, the results were found to be statistically significant at 1%. Furthermore, a greater proportion of men residing in south Punjab report low satisfaction, whereas in central Punjab, the proportion of men reporting low satisfaction is near equal to those reporting high satisfaction. Unlike the results of the women's data, both community division variables were found to be statistically insignificant. Higher education at the community level; however, was found to be significant at 1%. With a greater percentage of men with higher education reporting high satisfaction as opposed to low satisfaction. Similarly, improved sanitation at the community level was found to be highly significant and impactful in determining the subjective wellbeing of men. As seen in table 3, 50% of men reporting high satisfaction had access to improved sanitation facilities, whereas just 38% of men reporting low satisfaction had similar access.

3.4. Results for the subjective wellbeing of men

Table 4 shows the results of our regression with the dependent variable being subjective wellbeing of men. Initially, the total variance in SWB is estimated in the empty model, which holds no variables. As shown in the table, the intra-cluster correlation (ICC) of the empty model is 24.9%, which explains the prevalence of sufficient and significant variation between communities. Therefore, using flat/one-level model does not provide precise estimates. In model 1, the four socio-economic variables age, education, marital status and family size were found to be significant at 1% level. Among the four water sources included in the study, access to piped and bottled water were the only ones found to be significant, at 10% and 1% level of significance, respectively. Access to bottled water had the greatest impact in determining SWB, as having access increased the probability of reporting high satisfaction by 1.3 times. With an odds ratio of roughly 1.1, piped water access indicates a similar probability but to a lesser extent. With piped water through much of the province being of sub-optimal quality (Aziz, 2005), it is not surprising that bottled water is more heavily linked to greater levels of SWB and relied upon for drinking purposes.

Table 4. Regression Results for Men

Variables	Model 1	Empty model
Men Characteristics		
Age	0.990***	-
	(0.002)	
Educational	1.422***	-
	(0.60)	
Marital status	1.170***	-
	(0.052)	
Household Characteristics		
Number of household members	1.020***	-
	(0.005)	
Piped water access	1.113*	-
	(0.068)	
Bore well water access	0.934	-
	(0.050)	
Bottled water access	1.274***	-
	(0.088)	
Drain/spring water access	0.860	
	(0.20)	
Improved sanitation	1.039	
	(0.045)	
Rich	2.272***	
	(0.20)	
Middle	1.548***	
	(0.071)	
Urban	0.813***	
	(0.071)	
Community Characteristics		
South Punjab	0.682***	-
	(0.064)	
Central Punjab	1.064	-
	(0.075)	
Higher education	0.849*	-
	(0.082)	
Improved sanitation	1.194***	-
	(0.073)	
Random effects		
Cluster level variance	0.996	1.089
Variance (SE)	0.052	0.055
Chi-square test	705.35	-
Residual intra-cluster correlation (ICC)	0.232	0.249
ICC (SE)	0.009	0.009

***, **, * Significant at the 1%, 5% and 10% level, respectively

Note: Odds Ratios are shown with confidence intervals in parentheses.

(Source: MICS 2017-2018).

Access to improved sanitation is an insignificant factor in relation to the SWB of men. This may be due to men having greater freedom in regards to open defecation or urination in comparison to women as referenced in the works of Sweetman & Medland (2017). Economic class or the wealth quantiles from which the men in the sample belonged to was found to be a significant factor in determining their subjective wellbeing.

At the community level, location of household was found to have an impact on men's SWB. The results in the table indicate that men from urban areas were 0.8 times less likely to report high SWB. Regional variation in subjective wellbeing was also observed. While the results for central Punjab were insignificant, men from south Punjab were found to be 0.7 times more likely to report greater subjective wellbeing at 1% level of significance.

4. CONCLUSION AND POLICY RECOMMENDATIONS

In Pakistan, the reasons for a lack of clear commitment towards achieving this goal 6 of the UNs SDGs are many, but one is general unawareness regarding the far-reaching impacts of water and sanitation issues. By assessing the impact of water and sanitation access on the subjective wellbeing of adults in Punjab, this study aims to change this. The goal of this study was to uncover the link between water and sanitation access and overall life satisfaction among the adult population of Punjab. By studying the impact on adult men and women individually, the analysis also revealed the gender disparity among those affected.

The study uncovered a positive relationship between piped and bottled water access and the subjective wellbeing of both adult women and men in Punjab, with an increase in piped and bottled water access having been found to increase the likelihood of them reporting higher subjective wellbeing. The impact of improved sanitation on self-reported life satisfaction was found to follow a similar trend. However, the subjective wellbeing of men at the household level was not found to be associated with improved sanitation.

The results of the analysis also found that wealth played a crucial role in determining life satisfaction, as men and women from middle- and rich-income backgrounds reported higher subjective wellbeing. Education at both the individual and community levels was also found to be highly significant, holding a positive relationship with the subjective wellbeing of adults in the Punjab province for both genders.

Given that water and sanitation access was found to be linked to the life satisfaction of adults in Punjab, policymakers in the regions must keep in mind when tackling the issue. Access to bottled water was the greatest determinant of high reported life satisfaction, followed by piped water access. Since access to bottled water is limited in many parts of the province, particularly in rural areas and is also unaffordable in low-income households, this is a problem. Policy makers can increase reliance on piped water by investing in water purification infrastructure. The aim is to make people feel conformable using piped water and ensure that the water source is not detrimental to their health. Distribution is another aspect of water access that must be given attention. Alternative water sources must be explored and invested in. Rainwater harvesting for example is an innovative solution to water poverty in many parts of the world but has yet to be adopted at a large scale in Pakistan. While the technology is costly, it is among the most sustainable solutions to the provinces high water stress issues.

Policies regarding sanitation should continue to follow Pakistan's approach to total sanitation (PATS) but should place particularly emphasis on women. Girls' schools and higher education institutions should take intuitive in providing hygienic sanitation infrastructure while also leading awareness campaigns regarding proper sanitation habits. Tehsils should be motivated to achieve total sanitation targets through monetary incentives. PATS already endorses incentives for tehsils to achieve sanitary outcomes, but separate targets focusing on women may be needed. Lastly, the relationship between subjective wellbeing and water scarcity and/or sanitation is an area of research that needs greater attention. Facilitating research in the area can help policy makers gain a deeper understanding on how life satisfaction and similar wellbeing measures are influenced by water scarcity and sanitation. Studying the issues across different income segments of society and incorporating other socio-economic variables can aid in the development of more efficient and effective polices.

REFERENCES

Aziz, J. A. (2005). Management of source and drinking-water quality in Pakistan. *Eastern Mediterranean Health Journal*, *11*(5), 12.

Bronfenbrenner, U. (1979). The ecology of human development. Harvard university press.

Caruso, B., Cooper, H., & Torondel, B. (2018). *The association between women's sanitation experiences and mental health: A cross-sectional study in Rural, Odisha India*. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6077264/.

Chindarkar, N., Chen, Y. J., & Gurung, Y. (2019). Subjective Well-Being Effects of Coping Cost: Evidence from Household Water Supply in Kathmandu Valley, Nepal. *Journal of Happiness Studies*, *20*(8), 2581–2608.

Kamanda, M., Madise, N., & Schnepf, S. (2016). Does living in a community with more educated mothers enhance children's school attendance? Evidence from Sierra Leone. *International Journal of Educational Development*, *46*, 114–124. https://doi.org/10.1016/j.ijedudev.2015.09.008.

Lal, B. S. (2013). Economic Impact of Inadequate Sanitation on Women's Health: A Study in Warangal District. *International Journal of Environment and Development*, *10*.

Lombardo, P., Jones, W., Wang, L., Shen, X., & Goldner, E. M. (2018). The fundamental association between mental health and life satisfaction: Results from successive waves of a Canadian national survey. *BMC Public Health*, *18*(1), 342. https://doi.org/10.1186/s12889-018-5235-x

Nadeem, A. M., Cheo, R., & Shaoan, H. (2018). Multidimensional Analysis of Water Poverty and Subjective Well-Being: A Case Study on Local Household Variation in Faisalabad, Pakistan. *Social Indicators Research: An International and Interdisciplinary Journal for Quality-of-Life Measurement*, *138*(1), 207–224.

Sweetman, C., & Medland, L. (2017). *Introduction: Gender and water, sanitation and hygiene: Gender & Development: Vol 25, No 2*. https://www.tandfonline.com/doi/full/10.1080/13552074.2017.1349867.

Williams, R. (2018). *Multilevel/ Mixed Effects Models: A Brief Overview*. 1–15.