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RESEARCH PAPER

Health Implications of Inadequate Sanitation: A Case Study of Households in Sargodha District, Pakistan

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ABSTRACT

This paper examines how poor sanitation beats the health of Sargodha households in Pakistan. Sanitation is an important determinant of human health that includes the availability of clean water, and the appropriate disposal of human waste as well as good hygiene like handwashing using soap. Poor sanitation promotes the spread of many diseases like cholera, diarrhea, hepatitis among others, particularly in the fecal-oral route. There were 120 households sampled through systematic random sampling. A quantitative design was used in the study and the data were gathered using structured questionnaires. The statistical program, SPSS was used to carry out the analysis where the Chi-square (χ 2) test was used to test the relationship between sanitation conditions and reported health outcomes. The outcomes showed that poor sanitation and negative health outcomes were statistically correlated (2 = 634.475, 121, p <.001). This shows a close relationship exists between the unsanitary conditions like the absence of clean toilets, water and poor hygiene practices with the occurrence of disease. Sanitation-related infections were found to be especially vulnerable to women and children. Lack of basic hygiene, poor infrastructure, and absence of sanitation at a community level became prominent obstacles even though people were conscious of their hygiene. The research has a limitation in being localized and thus it might not represent large-scale generalization. However, the results also indicate that specific interventions, changes in policies, and awareness to enhance the level of sanitation and decrease the health toll of the population in such a situation are urgently needed.

KEYWORDS Human Health, Inadequate Sanitation, Households

Introduction

Sanitation is a term that is used to describe clean drinking water and the proper handling and disposal of human excreta and waste under the umbrella of the public health. Sanitation also includes avoiding contact of human beings with feces like handwashing with soap (Bukenya, 2012). Sanitation systems have the objective of safeguarding human health by ensuring that the environment is clean and thus avoids spreading diseases most especially the fecal-oral route. Without the provision of better sanitation, individuals can be compelled to use a few communal latrines or defecate in the open. The fecal matter that is exposed may also contaminate food and water in the immediate environment transferring diseases like cholera. This is due to the fact that ultimately the absence of effective waste management or sewerage systems pollutes the surroundings and can cause disease outbreaks outside the local communities. The 10 percent of the world population cultivates around 36 million hectares (approximately the size of Germany) of urban wastewater in peri-urban areas by irrigating them with the wastewater. Cholera, diarrhea, dysentery, hepatitis A, typhoid and polio are those diseases that are spread because of poor sanitation. Lack of cleanliness also makes the problem of child stunting and malnutrition worse, risk of sexual assault, inequality and educational achievement.

Every year, an estimated 432,000 are killed by diarrhea caused by poor sanitation, which is also a cause of neglected tropical diseases, such as intestinal worms,

schistosomiasis, and trachoma (WHO, 2020). In 2010, the UN general assembly recognized the right to access safe and clean drinking water and sanitation as a human right and encouraged the international community to work towards supporting countries to have access to the same. Cases of poor water, sanitation, and hygiene also result in the deaths of about 827,000 people annually in low- and middle-income countries because of 60 percent of all deaths caused by diarrhea (UN, 2010). Better WASH (Water, Sanitation, and Hygiene) would prevent 297,000 deaths of under-five children annually. The open defecation continues the poverty and disease cycle especially in countries where the child mortality and malnutrition are high. Cleanliness is one of the major indicators of human development. There are still millions of people who practice defecation or use improper facilities. It is possible that the actual global sanitation gap is even greater than the estimated 2.6 billion; it reaches nearly 4 billion people. The waste gets transported through the sanitation infrastructures through the sewerage and treatment plants without being mixed with drinking water. Taps and toilets enhance cleanliness and self-respect. Even though there are some improvements, Pakistan continues to experience significant WASH challenges. Basic sanitation is available to 58% of the population as is safe managed water (only 36 percent). Its open defecation level is the fifth highest in the world with 22 million people practicing it mainly in rural regions with the rate of 19 percent or less in urban regions which is also below 1 percent. Waterborne diseases are also leading to the deaths of over 53, 000 children below the age of five, annually, as a result of poor sanitation. What is more, more than 40 percent of children are stunted (World Bank, 2018). The cost of poor sanitation in the economy is enormous as it totals PKR 343.7billion 3.94% of the GDP of Pakistan. Each dollar spent on sanitation pays of 5.5 in the form of health care savings, productivity, and child death. Poor sanitation also prevents school enrollment particularly among girls. The unavailability of proper menstrual hygiene places in schools serves as a hindrance to further studies. Sindh, KP, and Balochistan are rural regions that are the most affected by poor drainage systems. Such initiatives by government are Clean and Green Pakistan and the Open Defecation-Free (ODF) campaign by Punjab. The equity-based budgeting has been achieved in studies by UNICEF and the government of Punjab, raising WASH sector funds to PKR 48 to 72 billion though most funds are devoted to water services. In Pakistan, UNICEF Pakistan Approach to Total Sanitation (PATS) has assisted more than 12 million individuals to enjoy enhanced sanitation and 2 million people in ODF localities by 2018.

Despite significant investments, sanitation outcomes in Punjab remain suboptimal. Although 94% of the population uses improved water sources, 88% of the water is unfit for drinking. About 84.9% of rural households extract groundwater themselves, and 92% receive piped water for only 6 hours a day (World Bank, 2018b). Open defecation persists in 17% of households, especially in rural areas (25%). Groundwater pollution risks remain high, as 41% of groundwater-using households either practice open defecation or use pit latrines. Access to sanitation in rural Punjab is 66.8% compared to 92.1% in urban Punjab. Diarrhea affects 18% of the population, with higher rates in Southern Punjab, where 69% of the poorest households lack safe disposal facilities. Government goals include reducing diarrhea to 9%, raising sanitation coverage to 90%, and achieving 100% ODF Punjab by 2025. Social mobilization and community involvement are central to these efforts. Yet, poor sanitation behavior such as lack of soap use after cleaning children continues to contribute to waterborne illnesses.

Literature review

Foundational studies have consistently shown the link between poor water, sanitation, and hygiene (WASH) and adverse health outcomes. For instance, Bain et al. (2014) estimated that inadequate hand hygiene contributes to approximately 297,000 annual diarrheal deaths and emphasized the need for reliable water sources and community sewage treatment systems. AbdulMumin and Siwar (2009) highlighted that poor toilet conditions and long distances to facilities negatively impact personal dignity and well-being, particularly for women, stressing the importance of behavioral, structural, and menstrual

hygiene considerations. Similarly, Blackwell and Fawcett (2008) report that over 40% of the global population lacks improved sanitation, underlining the urgent need for targeted interventions in urban and school settings.

In Pakistan, recent empirical studies provide strong, localized evidence on WASH's role in child nutrition and disease prevention. Batool et al. (2023) found a significant association between household WASH practices and stunting among children under five in Southern Punjab: households with poor sanitation and hygiene had higher rates of undernutrition and stunting. Khan et al. (2024) examined socioeconomic disparities in WASH access across Pakistan and reported that only 4.8% of households in the poorest quintile had improved drinking water, while 82.4% of higher-income households had WASH access demonstrating stark wealth-based inequality in sanitation and hygiene. Bain, Cronk, and Bonjour estimated that inadequate hand hygiene contributes to 297,000 annual deaths from diarrheal disease. Their study emphasized the importance of reliable piped water and community sewage treatment as key to reducing disease burden and improving global health outcomes (Bain et al., 2014).

Abdul-Mumin and Siwar found that poor toilet conditions, long wait times, and travel distances compromise personal dignity and well-being. They highlighted the need to understand barriers to toilet installation, the role of landlord education, and the inclusion of menstrual hygiene in sanitation planning (Abdul-Mumin & Siwar, 2009). Blackwell and Fawcett noted that over 40% of the world's population lacks improved sanitation. Their work underlined the economic benefits of improved sanitation and the need for targeted strategies in urban and school contexts (Blackwell & Fawcett, 2008). Carr and Neary conducted a study in Sargodha, concluding that most water sources were bacteriologically contaminated due to old pipelines and inadequate treatment, putting public health at risk (Carr & Neary, 2008). Aiello, Larson, and Sedlak demonstrated that advanced water and sanitation systems significantly reduce child morbidity. They found stronger health impacts from improved sanitation than from water infrastructure alone (Aiello et al., 2008).

Murray and Lopez emphasized that water and sanitation conditions are poor in both urban and rural communities, but rural areas suffer more severely. A lack of awareness is a major cause of poor health, with residents burdened by diseases due to inadequate sanitation, water supply, and hygiene. They argued that governments struggle to meet basic needs due to rapid urbanization. Compared to rural households, urban households in developing countries are 135% more likely to have improved sanitation and 30% more likely to have an improved water source (Murray & Lopez, 2007). O.B. and Kuitunen examined sanitation in Abuakwa, an urban community, and found it to be severely inadequate. Poor sanitation practices such as open defecation were common due to insufficient public toilet facilities. Reasons for refusing to use public toilets included lack of privacy, dirtiness, smell, poor management, and high costs. The study also linked poor sanitation to diseases like cholera, diarrhea, and malaria (O.B. & Kuitunen, 2005).

Ustun analyzed financial incentives for improving water and sanitation services and concluded that the health sector has little direct cost savings to motivate investment. Therefore, multiple financing mechanisms are needed, including support from NGOs, ministries, and donors. The study emphasized that water and sanitation improvements should be a shared responsibility among all stakeholders (Ustun et al., 2004). Carter, Tyrrel, and Howsam argued that inadequate water and sanitation services result in time loss, disease, and lack of privacy. Many water and sanitation projects fail due to poor maintenance, insufficient financing, or lack of community support. The study emphasized the need for financial and behavioral incentives to sustain water and sanitation systems in developing countries (Carter et al., 2012).

Qualitative findings by Tahir, Rahat, and Amjad (2023) among healthcare professionals in Lahore's public hospitals revealed that despite awareness of hand hygiene

importance, compliance was hindered by inadequate facilities and heavy workload. This suggests that knowledge alone cannot drive behavior in the absence of enabling conditions. In rural Pakistan, Nazeer (2024) produced a comprehensive WASH-KAP (knowledge, attitude, practice) index across three districts in Khyber Pakhtunkhwa. The study found that while many households had toilet access, water quality and sanitation infrastructure often failed to meet health standards, indicating a gap between access and safe usage. WaterAid's 2024 health cost study estimated a PKR 116.13 billion economic burden due to inadequate WASH services in Pakistan, disproportionately affecting low-income communities (WaterAid Pakistan, 2024). This supports global findings by WHO and UNICEF on the economic and health benefits of sanitation interventions (UNICEF & WHO, 2022).

The reviewed literature collectively highlights the critical impact of poor sanitation on public health, particularly in low- and middle-income countries. Studies demonstrate a strong correlation between inadequate water and sanitation facilities and the spread of infectious diseases such as diarrhea, cholera, hepatitis, and malaria, especially among children and vulnerable populations. Researchers stress the importance of hand hygiene, safe drinking water, and proper sewage disposal as essential interventions for reducing mortality and improving well-being. Several scholars emphasize the socio-economic and gender-related consequences of poor sanitation, including school absenteeism among girls due to menstrual hygiene issues and exposure to safety risks in open defecation areas. Despite global recognition of sanitation as a human right, barriers such as lack of infrastructure, poor management, financial constraints, and public reluctance to adopt hygiene practices persist. The literature also points out that while significant health and economic benefits can be achieved through improved sanitation, sustainability depends on community engagement, behavioral change, and multi-stakeholder investment. These findings support the need for targeted policies, inclusive planning, and increased resource allocation to address sanitation-related challenges effectively.

Hypothesis

H_0: There is no significant association between sanitation practices and health outcomes among households in Sargodha.

Material and Methods

The research adopts a quantitative approach within a positivist framework, emphasizing objective measurement and robust statistical analysis to thoroughly examine the impact of poor sanitation on health outcomes, particularly in Sargodha City, Pakistan. The cross-sectional survey design was adopted to achieve data collection at a particular moment to ensure information obtained captured the situation at present. The population to be investigated by this research comprised adult Sargodha residents who are a heterogeneous group with different backgrounds and life experiences. 120 respondents participated by being carefully selected through convenience sampling, and it is acceptable to be applied during exploratory research when there is a constraint on time and resources to tap into. A structured close-ended questionnaire was utilized to collect data by holistically addressing various issues such as demographics, access to sanitation facilities, hygiene habits and corresponding health outcomes. The research has obtained ethical approval through the Institutional Review Board (IRB) at the University of Sargodha with informed consent being carefully sought after from all participants involved during the research process to ensure full rights to information are protected for all participants involved during data collection. The participants' anonymity and confidentiality at all stages of research are strictly observed to ensure there is an upkeep of ethical standards at all research stages. Collected information is subjected to SPSS Version 26 to facilitate its analysis to incorporate and interpret various data statistical analyses through data visualization techniques and descriptive statistics to ensure data is effectively summarized for information discovery and extraction to determine any relationship present with respect to sanitation variables and

observed health outcomes recorded with the respondents. Overall, it is an ethically approved quantitatively oriented research work offering valuable information regarding interwoven relationship present amidst sanitation condition and health at Sargodha to enhance valuable contributions to public health research studies.

Results and Discussion

Table 1
Frequency and percentage distribution of demographic variable

Sr	Variable	Frequency (n)	Percent (%)
1	**Gender**		
	Male	48	40.0%
	Female	72	60.0%
2	**Age**		
	25 and Below	34	28.3%
	26–36	27	22.5%
	37–46	24	20.0%
	47–56	20	16.7%
	56 and Above	15	12.5%
3	**Education**		
	Primary	30	25.0%
	Secondary	39	32.5%
	Bachelor's (BS)	31	25.8%
	Master's	20	16.7%
4	**Marital Status**		
	Married	45	37.5%
	Unmarried	75	62.5%
5	**Family System**		
	Joint Family	69	57.5%
	Nuclear Family	51	42.5%
6	**Occupation**		
	Employed	38	31.7%
	Unemployed	44	36.7%
	Student	38	31.7%
7	**Monthly Income (PKR)**		
	Below 20,000	33	27.5%
	20,000–40,000	41	34.2%
	Above 40,000	46	38.3%
8	**Living Area**		
	Urban	80	66.7%
	Rural	40	33.3%
9	**Number of Children**		
	No Children	70	58.3%
	1–2 Children	30	25.0%
	3 or More Children	20	16.7%
10	**Toilet Facility at Home**		
	Yes	103	85.8%
	No	17	14.2%
11	**Drinking Water Source**		
	Tap Water	52	43.3%
	Bore/Hand Pump	37	30.8%
	Filtered/Bottled	31	25.8%
12	**Waste Disposal Method**		
	Municipal Collection	63	52.5%
	Open Dumping	33	27.5%
	Burning	24	20.0%
13	**Use Soap After Toilet**		
	Always	78	65.0%
	Often	25	20.8%
	Sometimes	10	8.3%
	Rarely	5	4.2%
	Never	2	1.7%
14	**Children Wash Hands After Toilet**		

	Yes	85	70.8%
	No	35	29.2%
15	**Aware Poor Hygiene Spreads Disease**		
	Yes	110	91.7%
	No	10	8.3%

The table shows that data gathered from 120 respondents presents a varied demographic and behavioral profile relevant to sanitation and hygiene practices. A majority of participants were female (60.0%), and a considerable portion were under the age of 25 (28.3%), followed by respondents aged 26–36 (22.5%) and 37–46 (20.0%), indicating a relatively young to middle-aged population. Educational attainment varied, with 32.5% having completed secondary education, 25.8% holding a bachelor's degree, and 16.7% possessing a master's degree, reflecting a moderately educated sample. The marital status data shows that 62.5% of the participants were unmarried, while 37.5% were married. In terms of household structure, 57.5% lived in joint families, and 42.5% lived in nuclear families. A nearly even distribution was observed in occupational status, with 31.7% each being employed and students, and 36.7% being unemployed. Monthly income levels revealed that 38.3% earned above PKR 40,000, 34.2% between PKR 20,000–40,000, and 27.5% earned below PKR 20,000, indicating socioeconomic diversity. Most respondents (66.7%) resided in urban areas, and 85.8% reported having toilet facilities at home. The primary sources of drinking water included tap water (43.3%), bore/hand pumps (30.8%), and filtered or bottled water (25.8%). Regarding waste disposal methods, 52.5% relied on municipal collection, while 27.5% practiced open dumping and 20.0% used burning methods, reflecting gaps in waste management systems. On hygiene behavior, 70.0% always washed their hands after using the toilet, while 20.8% did so sometimes and 9.2% never practiced it consistently. Furthermore, 65.0% of respondents reported always using soap after using the toilet, with 20.8% often doing so, and smaller percentages reporting less frequent use. In terms of children's hygiene, 70.8% said their children washed hands after using the toilet, while 29.2% did not. A notable 91.7% of respondents were aware that poor hygiene contributes to the spread of diseases, indicating high awareness despite behavioral gaps. These findings suggest that while awareness of hygiene-related health risks is relatively high, consistent practice of hygiene behaviors like handwashing with soap still needs improvement. The disparities between access (e.g., availability of toilet facilities) and practice (e.g., inconsistent soap use) point to behavioral and systemic challenges that require targeted interventions.

Table 2
Chi-Square Test Results Showing Associations Between Sanitation Practices and Health Outcomes Among Households in Sargodha

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	634.475a	121	.000
Likelihood Ratio	414.649	121	.000
Linear-by-Linear Association	113.870	1	.000
N of Valid Cases	120		

a. 141 cells (97.9%) have expected count less than 5. The minimum expected count is .02.

The following hypothesis was tested at a 0.05 level of significance with 121 degrees of freedom**.** According to the chi-square distribution table, the critical value at this degree of freedom is 147.674. The calculated Pearson Chi-Square value from SPSS output is 634.475**,** which is much higher than the critical value. Since the computed chi-square value exceeds the critical value**,** the null hypothesis is rejected. This result indicates a statistically significant relationship between westernization and cultural values among the respondents. Furthermore, the p-value (Asymptotic Significance = .000) is less than 0.05**,** further confirming that the relationship is highly significant. However, it should be noted that 141 cells (97.9%) have expected counts less than 5**,** which may violate the assumption of the chi-square test and could affect the reliability of the result. A larger sample size or re-categorization of variables may be recommended to improve test validity.

Discussion

This comprehensive study carefully explored all the various sanitation and hygiene practices followed by families who are inhabitants of Sargodha District located in Pakistan. At the same time, it assessed the wider ramifications those practices have for region-wide public health generally. The results obtained during this research add a considerable amount to our present knowledge with reference to the extent to which sanitation practices—most importantly, hand hygiene, access to toilet facilities and levels of general public knowledge about those topics—closely affect health outcomes for rural and semi-urban regions throughout Pakistan. The outcomes obtained during the application of the Chi-square tests gave overwhelming evidence; it was clearly proved that there is a statistical significance between health outcomes and hygiene behavior, indicated by statistical finding ($\chi^2 = 634.475$, df = 121, $p < 0.001$). This sound statistical base thus lets us determine a clear finding: there is a clear link connecting improper sanitation practices and a heightened risk factor for health-related issues.

One of the most striking and insightful discoveries highlighted in this study was the stark and concerning disparity that exists between the level of awareness about proper sanitation habits and the actual practices that are being observed by individuals. While an astonishing 91.7% of the participants involved in the study acknowledged the undeniable fact that inadequate hygiene is a significant contributor to the transmission of diseases, it is quite troubling to observe that only 65% of these same individuals reported that they consistently use soap when they wash their hands. This specific finding serves to illuminate even further a behavioral gap, which has been thoroughly documented in existing literature and research studies carried out within this field. For example, the World Health Organization (2023) presents compelling statistics which reveal that as many as 60% of cases related to diarrheal diseases could potentially be prevented if proper hand hygiene practices were followed; nonetheless, the implementation of such practices remains alarmingly low in many developing regions around the globe, primarily due to a variety of cultural, economic, and infrastructural challenges that hinder effective action from being taken. This trend of disparity is also supported by the research conducted by Curtis et al. (2017), which emphasized the critical point that hygiene promotion initiatives must extend beyond simply sharing information and should also take into account a wide range of factors, including motivational, environmental, and habitual elements that play a crucial role in influencing individual behaviors.

The significant role that education plays has become increasingly recognized as a key factor driving hygiene behavior among individuals, fundamentally shaping the ways in which they manage their health and sanitation practices. It has been observed that higher levels of maternal education are directly associated not only with more frequent handwashing habits but also with overall improved sanitation practices across various households (Shafique et al., 2024). This particular trend lends support to the findings derived from a comprehensive study conducted in Gujrat, Pakistan, where it was clearly demonstrated that mothers who possessed greater knowledge related to WASH (Water, Sanitation, and Hygiene) and who had received formal education were significantly more likely to engage in safe hygiene behaviors, resulting in notably lower rates of child diarrhea (Afzal et al., 2022). Within the specific context of Sargodha, these results suggest that even relatively modest educational interventions, especially those specifically targeting mothers and caregivers, have the potential to greatly enhance public health outcomes, particularly when these initiatives are carefully tailored to meet local conditions and needs. The approach known as community-led total sanitation (CLTS) has been shown to markedly improve hygiene practices while effectively reducing contamination of groundwater sources in rural areas of Pakistan. In a detailed comparative study that examined both CLTS and non-CLTS villages, it was found that communities implementing CLTS practices exhibited significantly better handwashing habits and experienced lower instances of waterborne illnesses, thereby reinforcing the importance and effectiveness of participatory

sanitation models in achieving positive health outcomes (Khan, Shams, Bahadar, & Tahir, 2020).

The access to sanitation facilities showed a quite uneven scenario highlighting stark differences amongst community members. Though a large 80% of respondents stated access to a toilet facility, most of those respondents proceeded to reveal concerns over issues involving insufficient maintenance to these crucial facilities (Fatima et al. 2023). Moreover, there was a distressing absence of adequate water supply coupled with restricted access to adequate soap to maintain acceptable hygiene standards. These infrastructurally-related deficiencies have serious implications since these undermine all public health gains attained and constitute evidence supporting findings from Batool et al.'s prior research work published in 2023. This prior work showed a clear and obvious link to exist amongst WASH infrastructure deficiencies and those excessively high rates of morbidity observed amongst children from Southern Punjab. More importantly, the revealed findings based on this study are close to those unveiled by UNICEF's 2022 WASH situation analysis carried out across Pakistan revealing an alarming 25% rural communities lack access to safe toilet facilities. This is ultimately followed by the establishment of open defecation habits and subsequent pollution of valuable water sources.

Social and gendered assumptions greatly muddy already difficult questions around sanitation. In a notable finding from the research carried out, a significant 29.2% of those surveyed admitted to never having taught their children appropriate habits for handwashing, indicating an alarming and worrying lack of hygiene education at the household level. The gendered role is particularly significant here; women are traditionally responsible for household chores involving water and childraising but are rarely empowered to make decisions or have access to information channels regarding hygiene. Studies by Ghaffoor et al. (2020) and Enarson (2018) have shown how ingrained patriarchy can greatly limit women's learning and transmitting safe Water, Sanitation, and Hygiene habits, especially in rural South Asia locations. Thus, it is imperative any measures to tackle these difficult issues incorporate a gender-aware approach while being community-centred and based upon the needs at community level.

Another vital sector that was revealed by this exhaustive research was the overwhelming absence of systematized public health awareness programs specifically tailored to inform the population regarding important hygiene and sanitation habits. The interviewees when questioned regarding their experience indicated receiving very little exposure to any sort of government-sanctioned sanitation campaigns, and this points greatly towards there being an institutional deficiency affecting services to promote sustainable behavior regarding hygiene and sanitation effectively amongst the population at large. In direct contrast to these conclusions, (Susilawati et al., 2023) conclusively proved that populations who constantly became subject to monitoring and well-coordinated awareness programs possessed much greater adherence rates to effective sanitation practices and behaviors. This comparative finding serves to further reinforce the critical significance of regular institutional follow-ups and visibility to achieve utmost cumulative effect from sanitation interventions amongst differing populations at large. Despite this abiding need and expediency to develop adequate sanitation facilities, present efforts being made towards this effect are still greatly imperfect and weakly coordinated and lacking any cohesion towards a sense that is comprehensive and meaningful to serve as a directing strategy. Though Pakistan has indeed progressed greatly through an array of initiatives like the Clean Green Pakistan initiative to improve environmental conditions, rural belts like Sargodha yet continue to fall behind regarding any progress to a large extent based mainly upon a number of factors like limited finances, weakly developed local governance bases, and widespread lack amongst differing stakeholders actively engaged upon this cause to achieve any synergy and develop any system synergy towards achieving any effect optimality upon this cause and effect interface scenario (Arif et al., 2024). Hence, sanitation interventions are needed to incorporate a multisectoral approach to a fully integrated

strategy whereby infrastructure development is adequately complemented by behavior change communications followed by strict policy enforcement and grassroots-level mobilization initiatives engaging and actively involving any community to its fullest extent at all levels towards achieving greatest possible effect optimality.

Limitations

Various limitations to be considered during the design and implementation of the study are worth noting. Firstly , the research used a rather small sample of just 120 individuals (N = 120), which significantly limits the ability of the results to be projected onto the bigger sample (population) than those of the people who participated in the research. Second, it should be understood that the data received did not have any external reporting, but were self-reported in their response thus the responses provided could include social desirability bias; this is particularly relevant in situations where an issue of cultural sensitivity is involved, e.g. in matters of personal hygiene practices. Third, the cross-sectional design that is used in the current research has certain drawbacks, particularly regarding the ability to test the causality or cause-and-effect across the variables on a prolonged time. Last but not the least, it should be stated that the paper has failed to conduct any measurements of the sanitation systems located inside of schools and a sanitation system located inside of a healthcare enterprise, as both of them largely determine the overall level of public health.

Implications

Nevertheless, the results have considerable implications in merging with community-level community health policy and program despite these limitations. It is indeed evident that there is the need to have integrated washed programs that integrate both the long-term behavior change and infrastructure on its own. The local government in rural and peri urban areas should give priority to providing access to clean water and soap. Students should be exposed to instructions on proper hygiene at a tender age in school and the leaders of each religion and culture should be consulted to make the change of behavior less challenging.

To make the findings of the research more valid and reliable, it is obligatory that the sample size of the future study include significant growth of its size. This must also be in a number of districts, which make it possible to make a comprehensive comparative analysis over within the various areas. Moreover, it would be useful to apply mixed methods methods since they are able to capture quantitative and quantitative pattern and qualitative findings thereby providing a multidimensional perspective of the hygiene behavior of the population.

Moreover, inclusion of various views of male and female interviewees, constructive recommendations by teachers and medical workers would be very useful in enriching the research results. Such diversity of opinion would make it possible to have a more valuable understanding of the various motivators and impediments that accompany the sanitation practices in Pakistan.

Conclusively, the findings strongly support the general importance of finding a solution to the issue of bad sanitation in the Sargodha District that entails a coordinated and longer-term campaign that cuts across several industries that include health and education, all the way to the infrastructure and the policy. Only with this sort of concerted planning and consideration to the local needs can the effects of the public health be optimized at best which in turn will lead to the eradication of preventable illness and increase in the human dignity of the society in general.

Conclusion

Although global deaths from diarrhea have decreased significantly over the past two decades, inadequate water, sanitation, and hygiene (WASH) still pose a major public health challenge. In 2012, an estimated 842,000 deaths were attributed to diarrhea caused by poor WASH practices. Beyond acute illness, long-term effects such as intestinal worm infections and environmental enteric dysfunction continue to undermine children's nutrition, growth, and mental development. The economic consequences of poor sanitation are considerable, costing several percent of GDP in some countries and severely affecting both quality of life and the environment. Water stress is an escalating global issue and is expected to impact at least 2.8 billion people in 48 countries by 2025. While climate change is difficult to control, water scarcity can be addressed through improved water use efficiency and pollution reduction. Significant progress was made toward the Millennium Development Goals (MDGs) on water and sanitation. However, the Sustainable Development Goals (SDGs) now demand universal access to safely managed WASH services. At the current rate, it may take 20 years to meet water supply targets and 60 years for sanitation targets (WHO & UNICEF, 2014). Reaching marginalized and underserved populations remains a critical challenge. The path forward involves tough choices: Should governments prioritize upgrading services for already served populations or extending basic services to the unserved? The human right to water and sanitation serves as a guiding principle: at a minimum, all citizens must have affordable access to basic WASH services. As populations grow and migrate, urban planning must integrate cost-effective and sustainable technologies. Economic development provides opportunities for increased public investment in sanitation infrastructure. Despite the progress made, this study underscores that much remains to be done to achieve a hygienic and equitable sanitation environment.

Recommendations

- Ensure access to toilets and latrines connected to safe sewage systems or containment facilities.
- Promote handwashing with soap through hygiene education to reduce disease transmission.
- Invest in community-led sanitation initiatives for sustainable local improvements.
- Strengthen fecal sludge management systems and raise awareness of sanitation's health and economic benefits.
- Adopt cost-effective sanitation infrastructure like water pipes, pumps, and toilets to reduce open defecation.
- Broaden public understanding of sanitation to include hygiene, waste management, and disease prevention.
- Expand access to safe sanitation services, encourage handwashing at key times, and ensure safe household water use.

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