

HAWK'S EYES ON WATER SANITATION AND HYGIENE (WASH) SERVICES IN RURAL PUNJAB

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ABSTRACT

Access to safe water, adequate sanitation, and hygiene (WASH) is essential for public health. However, rural areas of Punjab continue to face significant challenges in WASH service delivery. This study uses an interdisciplinary approach to analyze the structural, behavioral, and institutional factors that contribute to WASH-related vulnerabilities in rural Punjab. Grounded in the Social Determinants of Health Framework, the Ecological Model of Health Behavior, and Governance and Policy Implementation Theory, the research investigates how socio-economic disparities, community norms, and governance inefficiencies collectively affect health outcomes and the effectiveness of WASH interventions. The findings reveal that WASH inequities are closely tied to poverty, gender disparities, education levels, and institutional fragmentation. The study emphasizes the need for integrated, equity-focused policies that go beyond infrastructure provision to include behavior change strategies, strengthened local governance, and increased community participation. Ultimately, the research calls for a comprehensive, multi-level policy response to enhance WASH services as a critical public health and development priority in rural Punjab.

Keywords: Hawk's eyes, WASH, Sanitation, Rural areas.

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INTRODUCTION

Safe water, adequate sanitation, and proper hygiene (WASH) are fundamental human rights and crucial for public health and sustainable development. Beyond preventing communicable diseases, WASH services significantly enhance quality of life, dignity, and livelihoods, particularly for marginalized groups. However, inadequate WASH provision remains a pressing issue worldwide, especially in low- and middle-income countries, where failing

infrastructure contributes to disease burden, malnutrition, and socioeconomic disparities. The World Health Organization has highlighted that insufficient access to water, sanitation, and hygiene is a major factor in global morbidity and mortality rates, particularly among children in vulnerable rural populations [1].

Inadequate WASH systems lead to not only immediate health issues but also long-term consequences such as poor nutritional status,

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stunted growth, and cognitive impairments in children, all of which hinder adult development. Women and girls are particularly affected; the lack of proper sanitation facilities often results in missed educational and economic opportunities and increases their vulnerability to gender-based violence. These challenges are most acute in rural and impoverished areas, where access to clean water and basic sanitation is severely limited. The WASH crisis poses a significant barrier to achieving the Sustainable Development Goals (SDGs) established by the United Nations, further complicating efforts toward sustainable development in these regions, in addition to presenting a public health emergency [2].

The interlinked framework of the Sustainable Development Goals (SDGs) has both direct and indirect relationships with Water, Sanitation, and Hygiene (WASH), with SDG 6 (Clean Water and Sanitation) being the most closely connected. This goal aims to ensure the availability and sustainable management of water and sanitation for all. SDG 3 (Good Health and Well-being) is also closely related, as inadequate WASH conditions significantly contribute to preventable diseases, maternal and child mortality, and undernutrition. Additionally, the economic and nutritional impacts of waterborne diseases and the time lost in water collection notably affect income generation, particularly concerning SDG 1 (No Poverty) and SDG 2 (Zero Hunger) in rural areas.

SDG 4 (Quality Education) suffers as well, since children, especially girls, often miss school due to the lack of toilets, menstrual hygiene facilities, and illnesses stemming from unsafe water. WASH is also tied to SDG 5 (Gender Equality) because women and girls disproportionately bear the burden of water collection, and inadequate sanitation increases their vulnerability to harassment. The productivity losses caused by WASH-related illnesses further impact SDG 8

(Decent Work and Economic Growth). Moreover, SDG 10 (Reduced Inequalities) is relevant due to the disparities in access to WASH services in both rural and urban areas and among different socio-economic groups. Finally, SDG 13 (Climate Action) and SDG 11 (Sustainable Cities and Communities) are pertinent as water resources face growing risks from climate change and urbanization, necessitating resilient WASH systems to mitigate these threats [3].

Investing in WASH is a moral imperative and a vital, cross-cutting strategy for achieving inclusive and sustainable development while meeting SDG targets. In developing countries like Pakistan, the WASH scenario is characterized by a complex interplay of infrastructural deficits, policy gaps, and social inequalities. While urban areas have seen improvements, rural regions, particularly Punjab—the country's most populous province—still encounter significant challenges. A large percentage of rural households rely on unsafe drinking water, lack access to improved sanitation, and often do not possess the knowledge or resources to maintain basic hygiene. These deficiencies contribute to high rates of water-related diseases, stunting, and infant mortality, ultimately hindering broader efforts toward health equity and rural and national development. Given its demographic significance and strategic importance in national development, Punjab presents a critical opportunity for targeted WASH interventions [4].

Despite various government and non-government initiatives to improve WASH infrastructure, challenges remain. These include poor implementation, insufficient community participation, ineffective institutional coordination, and inadequate funding. Furthermore, current policies do not incorporate WASH services into population health planning, leading to a lack of synergy in interventions and ultimately making

efforts counterproductive. According to the Pakistan Bureau of Statistics, only 64% of rural households have access to improved drinking water sources, while 40% lack access to improved sanitation facilities. Although open defecation has decreased, it still occurs in certain marginalized communities. Additionally, inadequate wastewater disposal and poor drainage systems heighten environmental health risks. Awareness of hygiene practices is low, particularly among women and children. A UNICEF report from 2022 states that only 58% of rural households wash their hands with soap at critical times. These deficiencies in WASH infrastructure and behavior significantly contribute to waterborne diseases, with Punjab reporting high rates of diarrheal diseases, hepatitis A/E, and typhoid, particularly among children under five.

Given the critical nature of this issue, urgent policy and infrastructure reforms are essential to address these persistent WASH gaps and enhance public health outcomes in the province. This study aims to examine the state of WASH services in rural Punjab and their impact on national health and socio-economic development. By combining empirical data collection with stakeholder perspectives, the study identifies system gaps and formulates policy recommendations for more effective, integrated, and equitable WASH programming. Ultimately, the analysis underscores the need to view WASH improvements not merely as technical upgrades but as necessary policy interventions to alleviate disease burdens, build human capital, and achieve the Sustainable Development Goals (SDGs) [5, 6].

This study holds significant academic and policy relevance, especially in the context of Pakistan, where efforts are underway to provide equal and sustainable Water, Sanitation, and Hygiene (WASH) services. In rural Punjab, many residents still lack easy

access to clean water, sanitation, and hygiene facilities, leading to far-reaching health and socio-economic consequences. Poor WASH conditions are directly linked to high rates of waterborne diseases, undernutrition, and child mortality, yet local studies exploring these interconnections are limited. This research aims to address critical knowledge gaps by systematically evaluating the current state of WASH and its impacts on public health and development. It will also highlight the socio-economic dimensions of WASH access—an area often overlooked by policymakers but crucial for inclusive development. Furthermore, the study will assess the effectiveness of existing policies and identify implementation challenges, ultimately developing viable, evidence-based recommendations to improve WASH governance. The resulting data will support local governments, public health organizations, and development agencies in creating a more responsive and sustainable WASH approach, promoting better health, alleviating poverty, and contributing to the Sustainable Development Goals (SDGs) in rural Punjab [7-9].

The main objectives of this study are: 1. To assess the current status of water, sanitation, and hygiene (WASH) infrastructure and practices in rural Punjab, Pakistan; 2. To identify key health outcomes, particularly the prevalence of waterborne diseases linked to inadequate WASH services among rural populations; 3. To evaluate the effectiveness and implementation gaps in existing WASH-related policies and programs at both provincial and local levels; and 4. To propose evidence-based policy recommendations for improving WASH service delivery, thereby enhancing public health and achieving sustainable development in rural Punjab.

SOCIAL DETERMINANTS OF HEALTH FRAMEWORK

This empirical research adopts an interdisciplinary theoretical approach that

integrates public health theory, social determinants of health, and governance theory to comprehensively examine WASH (Water, Sanitation, and Hygiene) in rural Punjab. This framework facilitates a thorough analysis of the relationship between access to WASH services and the overall well-being of the population by combining these perspectives. The multi-dimensional approach promotes the integration of coordinated and comprehensive policy interventions that go beyond physical infrastructure, addressing social, behavioral, and governance-related challenges to sustainable WASH access [10].

The study employs the Social Determinants of Health (SDH) Framework, as defined by the World Health Organization (WHO), to evaluate how broader social, economic, and environmental factors in rural Punjab influence health outcomes. The SDH models emphasize that health is shaped not only by individual choices or access to healthcare services but also by the environments in which individuals are born, grow, live, work, and age. In rural Punjab, chronic shortages of clean water, inadequate sanitation facilities, and low hygiene awareness are not merely technical or behavioral challenges; they are deeply rooted in a complex web of structural inequalities. Factors such as poverty, low education levels, gender disparities, and community marginalization are primary social determinants that contribute to WASH-related vulnerabilities. These conditions result in a high burden of communicable but preventable diseases, undernutrition, poor maternal and child health, and overall low well-being. By utilizing the SDH framework, this paper critically examines how WASH inequalities are closely linked to socio-economic disparities, educational attainment, and gender power relations. This perspective enables the formulation of equity-based, context-sensitive policy recommendations

aimed at addressing the root causes of health disparities and fostering inclusive development through improved WASH services [11].

ECOLOGICAL MODEL OF HEALTH BEHAVIOR

This study explores how the Ecological Model of Health Behavior influences hygiene-related individual behaviors, such as handwashing with soap. The model posits that individual actions are not formed in isolation but are influenced by a broader social and structural ecosystem, which consists of five interconnected levels: individual, interpersonal, community, institutional, and policy levels. An analysis of hygiene behavior in rural Punjab indicates that addressing barriers and facilitators to effective WASH practices must occur at multiple levels. At the individual level, factors like knowledge, beliefs, and attitudes toward hygiene are critical. The interpersonal level focuses on family dynamics, peer pressure, and caregiving relationships. Organizational and cultural practices, along with regional leadership and traditional customs, play significant roles in shaping behavior. Institutional factors include the availability and quality of health and education infrastructure, while policy-level factors encompass government strategies, resource allocation, and the enforcement of health and education regulations. This study employs the ecological model to emphasize that enhancing hygiene culture in rural Punjab requires more than awareness campaigns; it necessitates a comprehensive approach that engages community leaders, strengthens institutional capacities, and fosters a supportive policy environment. This systemic perspective is essential for developing culturally sensitive and sustainable behavior change interventions that can effectively reduce WASH-related health risks [12-15].

GOVERNANCE AND POLICY MAKING

The study also applies the theory of Governance and Policy Implementation to critically analyze the institutional and administrative dimensions of WASH service delivery in rural Punjab. WASH services are deeply embedded in public policy systems and are primarily defined by the effectiveness of service delivery mechanisms and inter-agency collaboration, as well as the capacity of local actors. Governance theory highlights the importance of accountability, transparency, decentralization, stakeholder coordination, and community partnerships in the successful execution of public service policies. These elements are particularly relevant in contexts where service failures have been linked to shifting responsibilities, ineffective regulation, insufficient citizen engagement, and inadequate resource allocation in WASH [16]. By utilizing this theoretical framework, the study aims to examine the gap between policy and practice, where ambitious provincial WASH plans are often compromised during local implementation due to bureaucratic delays and a lack of skills or coordination among departments. This framework also provides a basis for assessing the effectiveness of decentralization policies, the responsiveness of local governance structures, and the role of community-based monitoring in achieving accountability. Integrating Governance and Policy Implementation Theory, this paper argues that effective governance systems must support technical interventions. To ensure that WASH improvements are sustainable, equitable, and developmentally effective, it is crucial to strengthen institutional arrangements, enhance participatory mechanisms, and secure political and administrative commitment.

CONCEPTUAL FRAMEWORK

The conceptual model of this research illustrates the connections between key

factors influencing Water, Sanitation, and Hygiene (WASH) services in rural Punjab, Pakistan, and their impacts on public health and sustainable development. This framework considers a range of factors and helps identify how WASH interventions can improve health and socio-economic conditions in rural areas. Key issues addressed include access to clean water, the reliability of water sources, and the availability of sanitation and hygiene facilities. Additionally, it examines social determinants affecting the population, such as socio-economic status, gender roles, equity, community participation, and collective action in WASH activities.

The enhancement of WASH services—safe water, sanitation, and hygiene—in rural Punjab is the primary focus of this framework. Improved WASH services lead to better health outcomes, including reduced incidence of waterborne diseases and lower rates of underweight children and child mortality. The framework recognizes that social and economic factors, gender dynamics, and community involvement significantly influence WASH infrastructure and health outcomes. Furthermore, effective policy and governance structures are crucial for the successful implementation and sustainability of WASH interventions. Behavior change initiatives, particularly in hygiene practices, are essential for achieving positive health outcomes and reducing disease burden.

METHODOLOGY

This study employs a mixed-methods approach, integrating both quantitative and qualitative methods to thoroughly assess the current status, challenges, and policy implications of WASH services in rural Punjab, Pakistan. This design facilitates a nuanced understanding of the relationship between WASH services and public health outcomes, especially in under-resourced communities. The research will take place in

a **rural district** of Sahiwal selected purposefully to represent different levels of WASH infrastructure and socio-economic development.

For quantitative data collection, a multistage stratified random sampling strategy was utilized in the target areas. Household heads or primary caregivers were interviewed to gather primary information on water access, sanitation practices, hygiene behaviors, and child health indicators. A total of 100 households were surveyed. For qualitative data, a purposive sampling method was employed, resulting in eight Focus Group Discussions (FGDs)—two per district—with adult community members. Additionally, 12 Key Informant Interviews (KIIs) were conducted with local government officials, healthcare professionals, and NGO representatives to gain insights and validate the collected data [17].

For this study, a structured questionnaire was used to gather primary information from households. The research instrument consists of several sections. The first section addresses the demographic and socio-economic background of the participants. The second section explores existing drinking water sources, water quality, the availability and functionality of sanitation facilities, and hygiene practices in daily life. The third section includes an observational checklist to assess the physical WASH infrastructure at the household level, such as latrines, hand-washing stations, proximity to water sources, and cleanliness. The fourth section focuses on available health facilities, significant health risks, and health outcomes in the selected areas.

For qualitative data, the researcher employed semi-structured guides for focus group discussions (FGDs) and key informant interviews (KIIs) to capture participants' perceptions of WASH services, barriers to access, gender roles in WASH-related decision-making, community involvement,

and awareness of household and community-level policies. The collected data were analyzed using advanced statistical software, specifically the Statistical Package for the Social Sciences (SPSS). Various descriptive statistics, bivariate analyses, and multivariate regression techniques were employed to derive results. Thematic analysis was used for qualitative data to identify recurring patterns and key policy gaps [18].

RESULTS AND DISCUSSIONS

The demographic profile of the study participants offers several key insights for planning and implementing WASH (Water, Sanitation, and Hygiene) interventions in Sahiwal.

It was revealed that a significant majority (58%) of respondents were female, which is noteworthy as women often serve as the primary managers of household water and sanitation needs. The largest age group among respondents was 31–50 years (55%), followed by those aged over 50 years (30%). However, only 15% of respondents were younger adults (18–30), suggesting limited youth engagement in community planning processes.

These livelihoods are often vulnerable to seasonal variability and economic instability, which may restrict households' ability to invest in private sanitation infrastructure or afford improved water services.

It was presented the correlation matrix, highlighting the relationships between key demographic and WASH-related variables. These associations can guide targeted and effective interventions. Notably, education level has the most significant positive impact, showing moderate correlations with access to safe water (0.47) and regular handwashing practices (0.36). This indicates that higher education levels are associated with increased awareness and adoption of safe water and hygiene practices, emphasizing the need to incorporate WASH education into both formal and informal settings.

Gender shows a weak positive association with handwashing (0.17) and access to safe water (0.19), suggesting that female respondents, who typically manage household hygiene, are more engaged in these practices. WASH campaigns could further empower women as key agents of behavior change within households.

It was illustrated the interdependence of all study variables, revealing that female respondents constitute 58% of the sample, which underscores women's crucial role in water and sanitation responsibilities. Their participation is vital for effective community engagement and hygiene promotion. Most respondents are aged between 31 and 50 years, an age group typically responsible for managing household routines, including WASH (Water, Sanitation, and Hygiene) activities. The average household comprises nearly six members, suggesting that facilities such as toilets and water sources are shared among many, potentially hindering hygiene maintenance and increasing disease risk.

While tap water is the most common source for 44% of participants, many still depend on bore wells, hand pumps, or surface water, which can be unsafe or unreliable. The Safe Water Access Score indicates that many households lack consistent access to safe, potable water, raising concerns about exposure to waterborne diseases. Although 82.4% of households have toilets, some still practice open defecation or use unsafe alternatives, reflecting only partial success of sanitation programs. Among users, flush toilets are prevalent, but many still rely on pit latrines, which often lack proper containment. The Sanitation Score indicates that there is significant room for improvement in the quality and accessibility of sanitation facilities.

Seventy percent of respondents report regular hand washing, which is a promising behavior; however, the mean hand washing score reveals variability in practice quality,

likely due to the lack of soap or water at critical times. This gap underscores the need for active training programs beyond mere awareness campaigns. Alarmingly, 17% of households reported at least one case of diarrhea in the past two weeks, reflecting persistent WASH deficiencies. Furthermore, nearly 12% had at least one member who fell ill from water-related diseases in the last month, highlighting the urgent public health implications of inadequate WASH services.

This suggests that systemic barriers, such as discrimination, poor infrastructure, and exclusion from public health programs, must be addressed. It also underscores the need for equity-driven WASH policy and planning [19].

Improving Water, Sanitation, and Hygiene (WASH) services in rural Punjab is essential not only for public health but also for overall development. This study, based on data from 100 rural households, underscores the complex challenges of WASH in Punjab, where behavioral, infrastructural, and socio-economic factors converge to influence health and hygiene outcomes. Despite significant national efforts, many rural households still lack consistent access to safe drinking water and hygienic sanitation facilities. While a considerable number of households report having toilets, many still rely on basic or shared facilities, and over a quarter of the population continues to practice open defecation. Furthermore, access to safe water remains inconsistent, with many households dependent on bore wells, hand pumps, or surface sources that are often prone to contamination.

The regression analysis revealed a significant finding: education is positively correlated with handwashing behavior. Education plays a crucial role in promoting good hygiene practices, as a higher level of education enables participants to better understand disease transmission and the importance of personal hygiene, which in turn enhances

their health behaviors, particularly regular handwashing. Gender also emerged as a significant factor, with women demonstrating better handwashing practices than men.

This finding emphasizes the vital role of women in domestic hygiene and childcare, while suggesting a potential underrepresentation of men in hygiene-promoting activities. Policies should adopt a gender-sensitive approach, leveraging women as ambassadors for hygiene while also engaging men more actively in WASH campaigns. Another critical finding indicates that access to safe water significantly predicts improved hygiene behavior. Households with well-maintained water sources tend to practice frequent handwashing more than those without reliable water access, highlighting water availability as a key facilitator of healthy behaviors. However, infrastructure improvements alone are insufficient to resolve the issues [20].

Enhanced handwashing behavior contributed to the success of hygiene training and community WASH interventions that employed behavior change communication. Nonetheless, the limited coverage of such training represents a missed opportunity for substantial improvement. Social inequities further complicate the WASH landscape [21].

It is recommended: Integrate structured hygiene training into existing health and community platforms, tailoring programs for low-literacy audiences with visual, community-based approaches. Empower women as WASH ambassadors and encourage active participation from men. Gender-sensitive programming can enhance the effectiveness and sustainability of hygiene interventions. Treat WASH as an integral component of public health and disease prevention rather than a standalone sector. Strengthen coordination among health, education, and rural development departments. Establish community-led

monitoring systems for water quality, toilet use, and hygiene practices encouraging local governance bodies to actively oversee WASH improvements. Utilize mobile platforms, SMS alerts, and geospatial tools to disseminate hygiene information, track service gaps, and facilitate feedback from rural communities.

CONCLUSION

The WASH service scenario in rural Punjab illustrates both advancements and neglected areas that directly impact population health and human development. While some households benefit from improved infrastructure and increased sanitary awareness, a significant portion of the rural population still lacks access to safe drinking water, hygienic sanitation, and consistent hygiene education. This paper highlights how hygienic behavior and health conditions are influenced by education, gender, access to water, and social inequalities. To move forward, WASH services should be prioritized not only as a health intervention strategy but also as a means of promoting social justice and development. Policymakers must adopt a multifaceted approach that includes infrastructure development, comprehensive behavior change initiatives, and targeted support for marginalized populations. Access to toilets and hygiene education should be emphasized with a focus on equity and sustainability while ensuring water safety. Enhancing community participation, especially among women and underprivileged groups, is essential for achieving lasting change. Ultimately, quality WASH services must be accessible to everyone as a fundamental component of community health goals, reducing health burdens, and fostering a healthier and more sustainable rural Punjab.

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