



POLICY AND PRACTICE INSIGHTS

Water insecurity, food insecurity: What community perceptions of WASH in Punjab reveal about maternal health, child nutrition, and rural resilience

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ABSTRACT

Across rural and peri-urban Punjab, Pakistan, water, sanitation, and hygiene (WASH) conditions remain poor: water scarcity and unsafe sanitation are endemic, and national data show that waterborne illness accounts for roughly 80 percent of disease burden and a third of all deaths nationwide. This brief is based on a cross-sectional survey of 156 residents across multiple districts that measured community awareness, lived experience, and willingness to act on WASH issues; it did not directly measure food security, maternal health, or child nutrition outcomes. The policy implications for these domains discussed below are therefore inferred from linkages established in the global WASH-nutrition literature, not from new evidence generated by this survey. Respondents demonstrated strong awareness that contaminated water threatens health, yet expressed persistent uncertainty and skepticism toward government monitoring, NGO assistance, and visible improvement in services; willingness to participate in solutions was high but conditional on credible institutional follow-through. Unsafe WASH conditions are established drivers of diarrheal disease and child stunting, women's unpaid water-collection labor, and reduced agricultural productivity, all core determinants of household food security, maternal well-being, and child development. This brief translates the study's evidence into actionable recommendations spanning government policy, agricultural water management, nutrition-sensitive programming, and community governance, arguing that closing Pakistan's WASH trust deficit is inseparable from achieving food security, gender equity, and sustainable rural transformation.

About the Survey Sample

The survey underlying this brief reached 156 residents across multiple districts and union councils in Punjab, Pakistan, spanning both urban and rural settings; 145 of these responses were valid for the reliability analysis reported below. Respondents spanned a range of age groups and both genders, with a predominance of younger adults aged 19-25, and varied education levels (undergraduate, graduate, and postgraduate) and occupations, including students, businesspeople, and other community members. The original study did not report a detailed tabulated breakdown by gender, exact age distribution, or district, a gap we flag explicitly in the Limitations section below, since it constrains independent assessment of how representative the sample is of Punjab's broader population.

Policy Context: The Broader Food Security Challenge

Food security depends far more than agricultural output. The four pillars commonly used to evaluate household nutrition outcomes (availability, access, utilization, and stability) make clear that household nutrition is shaped as much by WASH and health systems as by crop yields (Cumming & Cairncross, 2016). In Pakistan, waterborne illness accounts for an estimated 80 percent of disease burden and almost a third of all deaths (Qamar et al., 2022), so the food security implications of poor WASH conditions (Saddique et al., 2026) are immediate and severe. Diarrheal disease impairs the body's ability to absorb nutrients even when food is available (Humphrey, 2009; Cumming & Cairncross, 2016), while water-scarce agriculture in provinces such as Punjab directly constrains the volume and diversity of food that rural households can grow, sell, or consume.

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Why Maternal and Child Nutrition Matter

Maternal and child nutrition sits at the center of any food security agenda because the first 1,000 days of life, from conception to a child's second birthday, substantially shape lifelong cognitive and physical potential (Black et al., 2008). Women who are undernourished, anemic, or chronically ill from WASH-related infection are more likely to experience adverse pregnancy outcomes such as preterm birth and low birth weight (Padhi et al., 2015). Children under five are biologically most vulnerable to the nutrient losses caused by repeated diarrheal infections (Humphrey, 2009), a pattern directly relevant to a region where, as national data confirm, diarrhea accounts for a substantial share of child deaths.

Relevant Sustainable Development Goals

This study's findings intersect directly with six Sustainable Development Goals:

- i. **SDG 1 (No Poverty):** medical costs of waterborne disease, estimated at PKR 112 billion annually, drain household and national resources that could otherwise support livelihoods (Qamar et al., 2022).
- ii. **SDG 2 (Zero Hunger):** water scarcity in agricultural areas such as Kamalia directly threatens crop production and household food availability, consistent with documented climate-driven yield losses in Punjab's wheat, cotton, and sugarcane belts (Ali et al., 2017; Ali et al., 2022).
- iii. **SDG 3 (Good Health and Well-being):** diarrheal disease remains a leading cause of child mortality and morbidity nationwide (Murtaza et al., 2021; Qamar et al., 2022).
- iv. **SDG 5 (Gender Equality):** water collection and caregiving during illness episodes fall disproportionately on women and girls (Graham et al., 2016).
- v. **SDG 10 (Reduced Inequalities):** rural and peri-urban households in this study reported persistently poorer institutional trust and service access than would be expected in well-served urban centers.
- vi. **SDG 13 (Climate Action):** worsening drought and groundwater depletion are compounding water-related food risks (Howard et al., 2016).

Relevance to Food Systems Transformation

Achieving resilient, inclusive food systems requires recognizing WASH as an upstream determinant of nutrition, not a separate sector. This study's evidence of strong public awareness paired with weak institutional trust signals where food systems transformation must begin not solely with agricultural technology or markets, but with rebuilding the basic service delivery and governance trust on which nutrition-sensitive development depends.

Key Findings

Finding 1: Persistent Water Scarcity Threatens Agricultural Livelihoods and Food Availability

Qualitative responses in this study describe declining household water supply hours and the direct toll of drought on staple and cash crops, including cotton, sugarcane, and wheat, in agricultural communities such as Kamalia, a pattern consistent with independently documented climate impacts on these same crops in Punjab.

- i. **Household food security:** when irrigation water becomes unreliable, smallholder yields fall, directly reducing the food and income available to farming households (Ali, M.A. et al., 2022).
- ii. **Women's well-being:** women in farming households often absorb the added labor and stress of water scarcity, walking further or working longer to compensate for shortfalls (Graham et al., 2016).
- iii. **Maternal nutrition:** reduced household income from poor harvests limits a mother's ability to access diverse, nutrient-rich foods during pregnancy and lactation.
- iv. **Child nutrition and food access:** falling farm income constrains a family's capacity to purchase animal-source foods, fruit, and vegetables critical for child growth.
- v. **Vulnerable rural populations:** smallholders and landless agricultural laborers, who lack water storage or irrigation alternatives, bear the heaviest burden.

Finding 2: High Disease Burden from Unsafe Water Undermines Child Growth and Maternal Health

National data indicate roughly 100 million diarrhea cases and 2.5 million deaths annually in Pakistan linked to contaminated water, with hundreds of thousands of school days lost to water-related illness (Qamar et al., 2022); a separate national analysis estimates 97,900 annual deaths from inadequate WASH, of which 54,000 are children under five (Murtaza et al., 2021).

- i. **Household food security:** recurrent illness diverts household income toward medical costs rather than food purchases (Qamar et al., 2022).
- ii. **Women's well-being:** mothers absorb the caregiving burden of sick children, often at the expense of their own rest, income-generating activity, and food intake.
- iii. **Maternal nutrition:** pregnant and lactating women exposed to contaminated water and poor sanitation face elevated risk of infection-related adverse pregnancy outcomes that can deplete the nutritional reserves needed for fetal growth and breastfeeding (Padhi et al., 2015).
- iv. **Child nutrition and food access:** repeated diarrheal episodes impair nutrient absorption, a well-established pathway to stunting that operates

independently of food availability (Humphrey, 2009; Cumming & Cairncross, 2016).

- v. **Vulnerable rural populations:** communities reliant on shallow wells or untreated surface water, with limited healthcare access, face compounding risk (Murtaza et al., 2021).

Finding 3: Awareness Without Trust Is a Governance Gap That Stalls Nutrition-Sensitive Action

Survey respondents in this study showed reasonably strong agreement that poor water quality threatens health (mean 3.46 of 5) and considered themselves well informed (mean 3.33), yet expressed pervasive uncertainty about government monitoring (mean 2.74), visible service improvement (mean 2.59), and NGO effectiveness, which received the lowest mean score in the entire instrument (2.38).

- i. **Household food security:** distrust in institutions discourages households from engaging with extension services or nutrition programs that rely on the same delivery channels.
- ii. **Women's well-being:** women, who are frequently targeted by community health and nutrition programming, are less likely to participate where institutional credibility is weak.
- iii. **Maternal nutrition:** antenatal and nutrition counseling services often piggyback on WASH and health infrastructure; low trust undermines uptake of both.
- iv. **Child nutrition and food access:** caregivers skeptical of public health messaging may under-utilize child feeding and growth-monitoring services.
- v. **Vulnerable rural populations:** districts with historically weaker service delivery face a compounding trust deficit that is harder to reverse without sustained, visible investment.

It is worth noting that no subscale of the survey instrument met the conventional 0.70 Cronbach's alpha reliability threshold (Tavakol & Dennick, 2011); we discuss the implications of this limitation in detail below.

Finding 4: Conditional Willingness to Engage Signals an Opportunity for Women-Centered, Community-Driven Solutions

Despite institutional skepticism, respondents in this study showed the survey's highest willingness on any item to learn about water safety (mean 3.63) and notable willingness to pay for clean water (mean 3.41), alongside community-generated proposals for hand pumps, rainwater harvesting, solar-powered pumps, local filtration, and digital reporting mechanisms.

- i. **Household food security:** community-led water solutions, if implemented, free household time and resources for food production and purchase.
- ii. **Women's well-being:** women's documented willingness to learn and engage positions them as natural anchors for combined WASH-nutrition outreach, echoing evidence that women already bear most water-related responsibilities (Graham et al., 2016).
- iii. **Maternal nutrition:** trusted, locally delivered water safety education can be paired with maternal nutrition counseling at minimal additional cost.
- iv. **Child nutrition and food access:** community monitoring committees can extend naturally into child growth monitoring and school feeding oversight.
- v. **Vulnerable rural populations:** conditional willingness, contingent on visible, sustained institutional engagement, suggests that consistent follow-through, not one-off interventions, is what will unlock durable community participation.

Implications for Food Security

Although this study was not designed as a food security assessment, its findings map directly onto each of the pillars used to evaluate household nutrition outcomes (Cumming & Cairncross, 2016), and onto the women's empowerment and maternal-child indicators that increasingly accompany them. As throughout this brief, the connections below are policy-relevant inferences drawn from the literature rather than outcomes measured by the survey itself.

- i. **Food availability:** it is constrained where agricultural water becomes unreliable, as documented by households in Kamalia describing diminished irrigation and crop stress on cotton, sugarcane, and wheat; sustained drought and groundwater depletion across Punjab signal a worsening trajectory absent intervention (Howard et al., 2016; Ali et al., 2022).
- ii. **Food access:** it is undermined indirectly: households spending income on treating waterborne illness, estimated nationally at PKR 112 billion annually, have correspondingly less to spend on food, while distrust in service providers reduces uptake of subsidized inputs, cash transfers, or extension support that often travel through the same institutional channels that respondents distrust (Qamar et al., 2022).
- iii. **Food utilization (the body's ability to convert food into nourishment):** it is the pathway most directly threatened by this study's health findings. Diarrheal disease impairs nutrient absorption regardless of diet quality, meaning food security investments without complementary WASH investment will underperform (Humphrey, 2009; Cumming & Cairncross, 2016).
- iv. **Food stability:** it is jeopardized by the same drought and infrastructure unreliability respondents described, since erratic water supply for both agriculture and domestic use introduces unpredictability into production and consumption alike (Cumming & Cairncross, 2016).
- v. **Dietary diversity:** it suffers as falling farm income and rising medical costs crowd out spending on more expensive nutrient-dense foods, such as animal-source proteins, fruit, and vegetables, in favor of staple grains.
- vi. **Women's empowerment:** it is constrained by the unpaid burden of water-fetching and caregiving during illness episodes, time that could otherwise support income generation, education, or participation in community decision-making, the very domains where the survey identifies willingness to engage

if institutions become more credible (Graham et al., 2016).

- vii. **Maternal health outcomes:** these are placed at elevated risk by exposure to contaminated water and poor sanitation during pregnancy and lactation, a period of heightened vulnerability to infection-related adverse outcomes (Padhi et al., 2015).
- viii. **Child growth and nutrition outcomes:** these are the most consequential and best-documented endpoint of the WASH-nutrition pathway: repeated diarrheal infections in early childhood are strongly associated with stunting, a largely irreversible marker of long-term developmental harm that begins long before a child reaches a feeding program (Black et al., 2008; Humphrey, 2009; Cumming & Cairncross, 2016)

Limitations

Two methodological limitations should guide how the evidence in this brief is interpreted and used.

- i. First, this study is a WASH perceptions survey; it measured awareness, attitudes, and willingness to act regarding water, sanitation, and hygiene, not food security, maternal health, or child nutrition outcomes directly. Wherever this brief connects WASH findings to nutrition-related implications, it does so by drawing on an independent body of peer-reviewed literature documenting these pathways elsewhere (cited throughout), not on new evidence generated by this survey. Readers should treat the food-security and nutrition implications presented here as policy-relevant inferences grounded in independently published evidence, rather than as direct empirical findings of this study.
- ii. Second, none of the four Likert subscales in the survey instrument met the conventional 0.70 Cronbach's alpha reliability threshold (Section A = 0.505; Section B = 0.093; Section C = 0.466; Section D = 0.463) (Tavakol & Dennick, 2011). Low internal consistency indicates that items intended to measure a single underlying construct, such as awareness or willingness to act, may instead be capturing several distinct or loosely related ideas. In practice, this means the descriptive means reported for each section (for example, a mean of 3.46 for agreement that poor water quality threatens health) are best read as broad directional signals of community sentiment rather than precise, validated measurements, and comparisons across subscales for instance, concluding that awareness is meaningfully higher than trust in government should be treated cautiously. The qualitative, open-ended responses analyzed alongside the Likert data are not subject to this same limitation and provide a more robust evidentiary basis for several of this brief's contextual claims, including the Kamalia testimony on agricultural water scarcity. The recommendations below are accordingly weighted toward directional patterns and corroborating qualitative evidence rather than fine-grained numerical distinctions, and Recommendation 7 (Research and Monitoring Priorities) sets out concrete steps for revalidating the instrument before it is used for more precise measurement in future research.
- iii. Third, the sample of 156 respondents, drawn through non-probability methods and skewed toward younger adults aged 19–25, may not be fully representative of Punjab's broader population, and the original study did not report a detailed demographic breakdown by gender, exact age, or district (see About the Survey Sample, above). Findings should accordingly be read as indicative of patterns within the communities surveyed rather than as province-wide estimates.

Policy Recommendations

1. Government Actions

Establish an inter-ministerial WASH-Nutrition Coordination Cell linking the Ministry of Climate Change, provincial Public Health Engineering Departments, and nutrition authorities to jointly plan investment, closing the fragmentation this study identifies between institutions. Mandate public, district-level reporting of water quality testing results and infrastructure repair timelines to directly address the trust deficit reflected in low confidence scores for government monitoring. Expected outcome: improved institutional credibility, higher uptake of nutrition and health services, and more efficient allocation of WASH investment toward areas of greatest need.

2. Agricultural Policy Measures

Prioritize climate-resilient irrigation investment including solar-powered pumps and rainwater harvesting, both proposed directly by surveyed communities in drought-affected agricultural districts such as Kamalia. Expand groundwater monitoring and regulate extraction in areas where aquifer depletion threatens long-term production (Howard et al., 2016). Integrate water-efficient cropping guidance for staples such as wheat, cotton, and sugarcane into extension services, drawing on documented climate-yield relationships for these crops in Punjab (Ali et al., 2022; Ali et al., 2017). Expected outcome: stabilized smallholder yields, protected household food availability, and reduced rural income volatility tied to water shortages.

3. Nutrition-Sensitive Interventions

Co-locate water quality testing and treatment services with maternal and child health clinics so that improved water access directly reinforces antenatal care, growth monitoring, and micronutrient supplementation programs already reaching the same households, given the documented link between WASH conditions and adverse pregnancy outcomes (Padhi et al., 2015). Subsidize household-level filtration and purification, an intervention respondents indicated willingness to pay for, through targeted vouchers for pregnant women and households with children under five. Expected outcome: reduced diarrheal disease incidence, improved nutrient absorption, and measurable gains in child growth indicators within affected communities.

4. Women-Centered Development Programs

Recruit and train women as community water-safety educators and local water-monitoring committee leads, building directly on the survey's finding that willingness to learn about water safety scored highest of any item, and on evidence that women already carry most water-related labor in comparable settings (Graham et al., 2016). Pair this role with income-generating opportunities and nutrition leadership responsibilities to offset the unpaid time burden of water collection. Expected outcome: reduced time poverty for women, strengthened female community leadership, and more effective last-mile delivery of both WASH and nutrition messaging.

5. Child Food Security and Nutrition Strategies

Link school-based WASH upgrades to existing school feeding and nutrition education programs, addressing the reported loss of an estimated 670,000 school days annually to water-related illness (Qamar et al., 2022). Establish child growth monitoring at the same community access points proposed for water testing and filtration, allowing early identification of stunting and wasting alongside water service complaints. Expected outcome: reduced school absenteeism, earlier detection of child malnutrition, and stronger linkage between water service delivery and measurable child development outcomes.

6. Community-Based Approaches

Formalize the community-proposed local water monitoring groups and digital reporting mechanisms identified in this study, granting them a recognized role alongside local government and utility companies. Use participatory budgeting to allocate a portion of WASH funds directly to community-prioritized solutions such as hand pumps, filtration systems, and rainwater harvesting infrastructure. Expected outcome: rebuilt institutional trust through visible, community-validated action, and a sustainable mechanism for translating local knowledge into service improvement.

7. Research and Monitoring Priorities

Revise and re-validate the survey instrument used in this study, given that no subscale met the conventional 0.70 Cronbach's alpha reliability threshold (Tavakol & Dennick, 2011). Concrete next steps should include cognitive interviewing to check that respondents interpret each item as intended, piloting a revised instrument with narrower, more conceptually homogeneous subscales, and confirmatory factor analysis before the tool is used again for policy-relevant measurement. Commission longitudinal research explicitly linking household WASH access to maternal anemia, birth outcomes, and child anthropometric indicators in Punjab, building on the pregnancy-outcome pathways already documented in nearby South Asian settings (Padhi et al., 2015), since this study could not directly measure these links, and expand future sampling to capture a fuller demographic and geographic cross-section of Punjab's population than the present, younger-skewed sample. Expected outcome: a validated measurement instrument, more reliable and representative data, and a stronger, locally generated evidence base linking WASH security to nutrition outcomes for future policy design.

Conclusion

This study's central finding, a community that understands its water crisis and is willing to act, but distrusts the institutions meant to lead that action, carries weight well beyond WASH policy. Where unsafe water and unreliable irrigation persist, household food availability narrows, women absorb disproportionate burdens of labor and care, mothers face elevated nutritional and infection risk during pregnancy, and children suffer the most consequential and lasting harm through impaired growth and development. Addressing Punjab's WASH deficit is therefore not a sector-specific technical fix; it is a precondition for food security, gender equity, and human capital formation in rural Pakistan. The path forward identified by this evidence is clear: pair infrastructure investment with transparent governance, anchor service delivery in women's leadership and community trust, and treat water security as inseparable from nutrition security. Done well, these interventions can simultaneously advance food security, maternal well-being, child development, and sustainable, inclusive rural transformation across Punjab and similarly water-stressed regions of South Asia.

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