



Jal Jeevan Mission And Rural Water Access: A Multidimensional Analysis Of Health And Gender Outcomes

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Abstract:

Access to safe drinking water is a key public health issue in rural India, where persistent disparity in water access affects socio-economic development. The Jal Jeevan Mission (JJM), launched in 2019, aligns with Sustainable Development Goal 6 and aims to provide universal safe drinking water in rural areas through Functional Household Tap Connections (FHTCs) by 2024. This study presents a multidimensional analysis of JJM's effects on health, gender, governance, and socio-economic outcomes, with a focus on water-stressed regions, such as Gujarat. By reviewing peer-reviewed studies, government reports, and global datasets, the paper assesses JJM's progress and ongoing gaps. Key findings show that JJM increased rural tap coverage from 17% in 2019 to 80.88% by mid-2025, benefiting 15.66 crore households. This infrastructure expansion correlates with a potential 24% decline in diarrheal diseases, a 7.4% improvement in childhood nutritional outcomes, and a 10% reduction in women's water-fetching burdens (NFHS-5). Despite these advancements, significant challenges remain: 42–44% of Gujarat's groundwater exceeds WHO fluoride limits, 12% of households experience intermittent supply, and marginalized communities face ongoing access inequities. Community-led initiatives like Village Water and Sanitation Committees (VWSCs) show promise but need additional resources and gender-sensitive training. The study recommends enhanced water quality surveillance in high-risk areas, intersectional policies to address caste- and gender-based disparities, capacity-building for VWSCs, and integration of JJM with health and sanitation programs. Long-term research is needed to evaluate JJM's sustained

socio-economic and health impacts. These insights aim to guide policies that convert water access into equitable health improvements and empowerment.

Keywords: Jal Jeevan Mission, rural water access, gender equity, groundwater contamination, diarrhea, sustainable development

I. INTRODUCTION

Access to safe drinking water is a foundational determinant of public health and socio-economic development. The World Health Organisation (WHO) identifies water as a key social determinant of health, and access to water is important to the health and socio-economic development of humankind.¹ The significance of safe access to drinking water as a fundamental determinant of public health was recognized as early as 1854 by John Snow in his examination of the cholera outbreak, which affected London. John Snow's identification of the contaminated water (pump) source of this cholera outbreak has substantiated the frameworks for waterborne disease and modern epidemiological studies.² According to WHO estimates, nearly 10% of the world's population lacked access to improved drinking water as of 2019. This remains a major barrier to progress on the UN Sustainable Development Goal 6: universal access to clean water and sanitation.³ Despite ongoing global efforts, approximately 1.7 billion people, primarily in low-and middle-income countries (LMICs), continue to rely on unimproved water sources.⁴

The UN General Assembly's 2010 resolution declaring water a human right reinforced its importance to development, equity, and well-being.¹ Contaminated water continues to contribute substantially to the global burden of disease, particularly among children under the age of five.^{4 5} UNICEF reports that approximately 1,200 young children die every day from preventable illnesses linked to poor water quality.⁶ Additionally, limited access to safe water is closely associated with higher rates of malnutrition, reduced educational achievement, and persistent social and economic inequalities.⁵

In India, rural areas continue to experience disparities in water access, intensifying cycles of poverty, gender inequality, and preventable diseases. Despite the decline in under-five mortality to 28 per 1,000 live births, waterborne diseases remain a significant concern.⁷ The National Health Policy (2017) underscored 'access to safe water and sanitation for all' as a pillar of universal health coverage.⁸ Government initiatives, including the National Rural Drinking Water Programme (NRDWP, 2009) and later Jal Jeevan Mission (JJM, 2019), have aimed to close the water access gap.

Launched in 2019, the Jal Jeevan Mission (JJM) aims to provide Functional Household Tap Connections (FHTCs) to all rural households by 2024, aligning with Sustainable Development Goal (SDG) 6.^{7 9} The Mission aims to close the gaps through a decentralized, community-led programme, focusing on water quality, universal access, and sustainability. Prioritizing the provision of FHTCs in quality-affected areas, villages in drought-prone areas, tap connections to Schools, Anganwadi centres, GP buildings, Health centres, wellness centres, and community buildings, ensuring sustainability of the water supply system. The mission provides 55 litres of drinking water per person per day (LCPD) to every rural household.⁹

This study evaluates JJM's multidimensional impacts on health outcomes, gender equity, and governance, with a focus on water-stressed regions like Gujarat, Rajasthan. By analysing peer-reviewed studies, government reports, and global datasets, the paper evaluates JJM's progress and persistent gaps.

II. METHODS

2.1 literature review methodology

Search Strategy and Data Sources

A comprehensive literature review was conducted to examine the relationship between water access and health outcomes in India and internationally. The review encompassed studies published between 2000 and 2025 to capture contemporary research and policy developments in this field.

Multiple databases were systematically searched to ensure comprehensive coverage of relevant literature, including:

- ScienceDirect
- PubMed
- Google Scholar

Additionally, reports from government agencies and international organizations such as the Ministry of Jal Shakti (India), World Health Organization (WHO), United Nations International Children's Emergency Fund (UNICEF), and the World Bank.

2.2 search terms and strategy

The search strategy employed a combination of keywords and Boolean operators targeting the following terms: "Jal Jeevan Mission," "rural water access," "public health," "groundwater contamination," "water governance," "diarrhea," "piped water," "sanitation," "sustainable drinking water," "fluoride contamination" and "women empowerment." These terms were selected to capture the multidimensional aspects of water access and its health, social, and governance implications.

Inclusion Criteria

Studies were included in the review if they met the following criteria:

- Examined the health benefits and disease reduction associated with improved water access
- Presented empirical data, statistical analysis, or policy evaluation related to health, gender, or governance outcomes
- Were published in peer-reviewed academic journals or as official reports by recognized governmental or international agencies
- Focused on populations in India or provided a relevant comparative international context

Exclusion Criteria

Studies were excluded from the review if they:

- Lacked methodological transparency or sufficient detail regarding study outcomes
- Did not provide adequate information for quality assessment or replication
- Failed to demonstrate clear linkages between water access interventions and measured outcomes.

This systematic approach ensured the identification and inclusion of relevant studies that could contribute to understanding the relationship between water access and health outcomes.

III. REVIEW OF LITERATURE

3.1 water access and public health

The relationship between water quality and public health represents one of the most pressing challenges in global development.¹¹ The scale of this public health crisis is staggering, with diarrheal diseases alone accounting for an estimated 1.7 billion annual cases among children under five worldwide.¹² Contaminated water serves as a primary transmission vector for four distinct disease categories: waterborne, water-washed, water-based, and insect-vector related illnesses.¹³ Waterborne diseases are more prevalent among rural elderly compared to urban, according to Longitudinal Aging Study of India (LASI) Wave-1 data.¹⁴ These highlight the diverse health challenges faced by elderly populations, including waterborne diseases and functional limitations.

Water, Sanitation, and Hygiene (WASH) interventions have shown significant impacts on reducing diarrheal infections among children in tribal and resource-limited settings.^{15 16} A quasi-experimental study in Palghar, India, demonstrated that a WASH intervention combining education and provision of WASH kits led to improved knowledge, awareness, and practices, a 6% reduction in diarrheal infections among children under five.¹⁵ Poor household and personal hygiene indices were significantly associated with higher diarrhea prevalence among children.¹⁶ Also, children with safe water access were 7.4% less likely to be underweight.¹⁷

Fluoride, nitrate, arsenic, and microbial contamination cause groundwater challenges with serious health risks. The Health Effects of Arsenic Longitudinal Study (HEALS) in Bangladesh revealed that 23.5% of deaths in their cohort were attributable to arsenic-contaminated water.¹⁸ According to the Central Groundwater Board Annual Report (2024), 19.8% of India's groundwater samples exceeded nitrate limits (45 mg/L), risking "blue baby syndrome".¹⁹ Widespread contamination is evident in drought-prone regions, with monitoring systems failing to keep pace with the crisis.²⁰ The studies show that Maharashtra has experienced a 60% decline in groundwater levels, combined with recurring droughts, which have further compounded water quality issues.²⁰ In Gujarat, this challenge is evident, as 42–44% of groundwater samples from Patan and Banaskantha districts exceed safe fluoride limits, threatening the health of about 1.3 million population.²¹ Chronic exposure to these contaminants is associated with severe health consequences including skeletal fluorosis, methemoglobinemia, and various cancers.^{19 22 23}

Chronic arsenic exposure presents particularly insidious health effects, including cancer, cardiovascular disease, and developmental disorders.²² Emerging research highlights how low-level, long-term exposure creates dual burdens of physical illness and psychosocial stress in affected communities.²⁴ Similarly, fluoride and nitrate contamination remain endemic in rural India, with western states like Gujarat showing particularly severe impacts. It's estimated that 7.3 lakh children and 46.7 lakh adults risk fluorosis in Mehsana district alone, with 42–44% of samples in Patan and Banas-kantha exceeding WHO standards.²¹

WHO (2024) data indicate approximately 1.7 billion annual cases of childhood diarrheal diseases, with systematic reviews demonstrating that reliable on-plot water access significantly reduces incidence compared to intermittent supply.²⁵ The Global Burden of Disease study attributes 30.9 million disability-adjusted life years (DALYs) to childhood diarrheal diseases globally, with LMICs continuing to bear disproportionate burdens.^{26 27} Research in rural Rajasthan demonstrates how water quality improvements correlate with reduced stunting, while longitudinal studies emphasize that sustainable benefits require ongoing quality monitoring and system maintenance.^{28 29} These findings collectively underscore that safe water access represents not merely an infrastructure challenge, but a complex socio-technical system requiring integrated solutions.

Infrastructure improvements have demonstrated measurable health benefits. Significant reductions in typhoid fever and diarrheal illness following upgrades to continuous piped water systems in urban India, particularly among economically vulnerable children.³⁰ The global burden of water-related diseases remains disproportionately borne by marginalized communities. Recent estimates attribute 432,000 annual deaths to diarrheal diseases and neglected tropical infections, with pathogens like *Shigella* and enterotoxigenic *Escherichia coli* (ETEC) causing 270,000 and 60,000 deaths, respectively.^{31 32} Beyond mortality, these conditions contribute significantly to childhood malnutrition and compromised educational attainment, creating cycles of disadvantage.^{17 32}

3.2 GENDER DIMENSIONS

Collecting water primarily falls on women and children in households, leading to significant physical and educational challenges. Women involved in water fetching suffer musculoskeletal injuries, including head and neck pain, back pain, joint pain, hip pain, and foot injuries.³³ Globally, women and girls spend an average of 200 million hours collecting water and its waste, of their valuable time.³³ In Asia, the numbers are 21 minutes and 19 minutes, respectively.³⁴ In Rajasthan, girls' school absenteeism is 3-8 times higher than that of boys due to water-fetching duties.³⁵

Women have higher water needs for hydration and hygiene during menstruation, pregnancy, and when caring for sick family members and young children.³⁶ The WHO data reveal that inadequate water, sanitation, and hygiene (WASH) services create devastating health consequences for women and men. While the inadequacy of the service will affect women highly both physically and is a source of psychosocial stress.³⁷ Studies also show that contaminated water sources can harbor *E. coli* strains that can cause urinary tract infections, which disproportionately affect women and can lead to serious complications during pregnancy, including kidney infections and preterm labour.³⁸ Altogether, these challenges limit their educational progress, economic opportunities, and overall empowerment.

3.3 COMMUNITY PARTICIPATION AND POLICY INTEGRATION

Beyond technical and infrastructure solutions, the successful governance of water supply relies significantly on community engagement and effective local management. A cluster-randomized controlled trial of Villages et Ecoles Assainis (VEA) program in the Democratic Republic of the Congo demonstrated substantial improvements in WASH access and governance. The intervention increased access to improved water sources by 33 % and improved sanitation facilities by 26%. Also, significant improvements were observed in water governance, water satisfaction, handwashing practices, and sanitation practices.³⁹

JJM emphasizes grassroots governance through Village Water and Sanitation Committees (VWSCs), ensuring local ownership.⁴⁰ Beyond technical and infrastructure solutions, the successful governance of water supply relies significantly on community engagement and effective local management. The mission emphasizes the involvement of community participation in various stages of the mission. The establishment of the Village Water and Sanitation Committees (VWSC)/ Pani Samiti, supporting agencies, and NGO is crucial for ensuring participation in the decision-making process and the maintenance of the water supply system.^{40 41} Critical governance gaps highlight the advocating for institutional reforms that strengthen bureaucratic accountability and community engagement to achieve gender-responsive water management. These findings collectively suggest that successful water interventions must simultaneously address contamination, infrastructure reliability, and participatory governance.

IV. FINDINGS AND DISCUSSION

4.1 health outcomes

Introduction of Jal Jeevan Mission (JJM) has expanded rural tap coverage in India from 17% to 81%, benefiting 15.66 crore households.¹⁰ By ensuring the supply of 55 litres per capita per day (LCPD), JJM not only improves the water access but also reduces the time burden on women, prevents waterborne diseases, and fosters socio-economic development.^{10 42 43} Children in households with intermittent water access had higher diarrhea rates than those with a reliable supply. With the reliable supply of water, a reduction in child diarrhea is also prevalent in rural households. Combined water, sanitation access reduced under-five diarrhea by 24% in rural India.^{12 44} Also, improved on-plot water access shows a significant correlation with enhanced nutritional outcomes and reduced childhood stunting and wasting.

WHO and UNICEF estimate that universal tap access could save 5.5 crore women-hours daily in India, based on time-use surveys and JJM coverage data.⁴² Similarly, WHO (2019) projects that safe water access could prevent approximately 400,000 annual diarrheal deaths, aligning with JJM's health impact goals. Bringing water to households improves health and hygiene in marginalized villages and protects the environment by reducing contamination. With less time needed to collect water and fewer illnesses, rural families can focus on education, work, and well-being.^{42,43} A reliable and long-term supply of water will be enabled through the involvement of public institutions, such as Grama Panchayats, schools, health centres, and wellness centres, which will allow communities to take ownership of, implement, and maintain their water supply systems. This initiative has shown that improved water services in these underserved communities help close socio-economic gaps while safeguarding health.⁹

According to the report by WHO (2023), progress on household drinking water, JJM's piped water could reduce incidence by 24% in rural India. Also, it's shown that continuous piped water in urban India has reduced typhoid by 32% and diarrhea by 18% in low-income households.³⁰ Also, piped water uses reduced stunting in rural areas of the country.²⁸ However, research emphasizes that health outcomes depend critically on supply reliability, water quality assurance, and proper household disposal practices.⁴⁴

4.2 gender equity and socioeconomic dimensions

Improving the accessibility of drinking water priority for achieving gender equality and empowering women and girls.³⁷ JJM's Functional Household Tap Connections (FHTC) has reduced water fetching time by 10%, yet intersectional disparities persist-Dalit women remain two times more likely to lack access.⁴⁵ The 5th round of National Family Health Survey (NFHS, 2019-2020) shows a 1.2% decline in households traveling 30 minutes or more to fetch water, reflecting improved access. Water development has the potential of an economic boost around the globe. Resource development plays a role in economic growth in the underdeveloped area through the construction and operational phases. Easy access to water enhances social harmony, economic development, education, and gender equity in rural communities. It also reduces household health expenditures by preventing waterborne diseases. Water infrastructure development stimulates economic growth, particularly in underdeveloped regions, by supporting agriculture, industry, and job creation.⁴⁶ It is estimated that JJM has the potential to generate approximately 5 million person-years of direct employment and 22 million person-years of indirect employment during the construction phases, as well as 1 million person-years in the maintenance phases of this mission.⁴⁷ This shows the impact of positive impact on society. This progress contributes significantly to India's National Water Mission target of creating 10 million water-sector jobs by 2030, as outlined in the Composite Water Management Index. The employment opportunities from JJM also highlight its positive societal impact.

Moderate attainment of JJM even at a very early stage, whereas the positive achievements are reflected only in terms of reducing the burden of water collection on women.⁴⁵ Moreover, a higher probability of wealth-related inequity favouring advantaged groups was found in the coverage of household water tap connections, both in the pre- and post-JJM period.⁴⁵ This research also suggested the need for grassroots strengthening of the water distribution system to ensure an equitable and sustainable outreach of the program nationwide.

4.3 governance and community participation

The Jal Jeevan Mission emphasizes the involvement of community participation in various stages of the mission. The establishment of the Village Water and Sanitation Committees (VWSC)/ Pani Samiti, supporting agencies, and NGO is crucial for ensuring participation in the decision-making process and the maintenance of the water supply system. This grassroots approach is mirrored in broader policy recommendations, a citizen-first strategy that links existing health platforms with water supply missions.⁴⁰ The same study finds that Village Water and Sanitation VWSCs improved local ownership but lacked funding in 40% of surveyed villages.

Gram Panchayats have shown proactive involvement in water management activities, awareness programs, infrastructure development, and community participation. Their efforts exemplify the potential of the JJM to bring about transformative change in providing access to clean and safe drinking water.⁴⁸ By addressing these challenges and building on the successes of proactive Gram Panchayats, the JJM can realize its goal of providing clean and safe drinking water to every rural household in India.

By leveraging decentralized governance systems, these studies show how community-based forums can foster a more inclusive approach to water management, ensuring that interventions are both sustainable and aligned with the needs of the populace. According to the India Water Security Report published by the World Bank (2022), decentralized governance models reduced non-revenue water losses by 18% in JJM-implemented districts. 20% of JJM projects in Rajasthan were delayed due to poor inter-departmental coordination. This can be reduced with the argument that improving water quality through strategic investments and rigorous maintenance of water systems is essential, especially in rural and underserved communities.^{41 49} Their review notes that advancements in water treatment translate into reduced public health risks, framing water quality improvement as a critical area for both research and investment.⁴⁹

V. CONCLUSION

JJM demonstrates the potential for transformative impact in rural water governance. By providing access to clean drinking water, the Mission paves the way for improved health, economic opportunities, and overall well-being in rural communities, ultimately contributing to the nation's progress and prosperity.⁴⁰ Within India, the relationship between water access, sanitation, and health outcomes is strikingly evident. Access to household tap connections under JJM has reduced the burden of water collection on women and girls in rural regions.⁴⁴ Supporting this, the Ministry of Jal Shakti's National Report of Functionality Assessment (2022) provides an on-ground snapshot: while most households enjoy nearly daily water access, significant gaps remain in terms of both daily supply duration and the quality of water sources, especially in water-stressed regions.⁵⁰ With synergies drawn from initiatives such as the Swachh Bharat Mission, the JJM is portrayed not merely as a public health intervention but as a comprehensive socio-economic development strategy poised to propel India towards becoming a high-income nation by 2047.

The Jal Jeevan Mission represents a transformative step toward equitable water access in India. By addressing public health and socio-economic empowerment, JJM can significantly improve health outcomes in high-risk states of the country. Future success hinges on sustained investment, community engagement, and interdisciplinary collaboration to ensure safe, reliable water for all.

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