BEHAVIOUR CHANGE STRATEGIES FOR SUSTAINING TOILET USE IN TAMIL NADU:
A SYSTEMATIC LITERATURE REVIEW

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ABSTRACT

Background: Despite the Swachh Bharat Mission's success in toilet construction, sustaining toilet use remains a challenge in Tamil Nadu, influenced by behavioural, sociocultural, and infrastructural factors. **Reviews:** Studies suggest that infrastructure is not enough for long-term use of toilets. Multi-faceted strategies combining subsidies, community mobilisation, behaviour change communication, and gender-sensitive approaches have been explored. Social norms and gender dynamics, particularly in rural areas, play a critical role. **Methodology:** This systematic review followed the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses and has been derived from 814 examined records from 5 electronic databases, including PubMed, Scopus, ScienceDirect, SpringerLink, and Google Scholar. After eliminating duplicates, a total of 265 studies were reviewed with 49 full text articles assessed for eligibility. Eighteen studies met the inclusion criteria, focusing on Tamil Nadu or similar Indian contexts, evaluating behaviour change interventions. The key dimensions which were covered in the review were: Toilet Construction and Promotion Sanitation Practices Social Norms Sanitation Policies Gender Disaster Resilience. **Results:** The findings show that government-led subsidies were insufficient without behaviour change efforts. Community mobilisation increased adoption, while gender-sensitive strategies proved essential. Social norms and gender barriers in particular for women played a pivotal role in determining the use of toilets. **Conclusion:**

Sustaining the use of toilets takes more than infrastructure and calls for integrated and gender-sensitive and context-specific approaches. Future interventions must address gender dynamics and disaster resilience to ensure long-term success.

KEYWORDS: Behaviour Change, Sanitation Sustainability, Gender Dynamics, Community Mobilisation, Swachh Bharat Mission.

INTRODUCTION

Access to improved sanitation is a basic human right and an important public health determinant; it is a challenge that continues to appear in many regions including Tamil Nadu on a regular basis in terms of maintaining toilet use. Despite substantial investments in toilet construction under national campaigns such as the Swachh Bharat Mission (SBM), behavioural resistance, sociocultural norms, and infrastructural deficiencies continue to hinder long-term adoption (Mehta, 2018). Open defaecation continues in rural and peri-urban areas which compromises health and worsens environmental contamination (Gupta et al. 2019). Despite having a relatively good sanitation coverage in terms of percentage coverage compared to other states in India, Tamil Nadu is also dealing with peculiar challenges in maintaining regular use of toilets, especially in the marginalised populations (O'Reilly et al., 2017).

The shift from building toilets to using them has to go beyond its infrastructure; it needs an understanding of the behavioural drivers and barriers. Studies have shed light on the fact that just because people have access to toilets, it does not imply they use them; habits, social perceptions and convenience are often the key factors in deciding whether to practice sanitation (Martin et al., 2018). For example, in households with access to toilets, some individual members may continue to engage in open defecation due to societal norms that have been ingrained in them or which they are uncomfortable with sharing with the rest of the household (Babbar et al., 2023). To add to this, insufficient maintenance, water shortage, caste-based exclusion add further complexity to the adoption of such systems (Kumar & Kharb, 2024). These factors make targeted behaviour change approaches around sanitation behaviour of great importance, taking into account its multifaceted nature.

Research gaps persist in understanding how contextual factors, such as gender dynamics, disaster resilience, and policy implementation, interact with behaviour change interventions in Tamil Nadu. While some research has been conducted on toilet promotion campaigns and

CLTS approaches, with communities themselves developing total sanitation through hard work and cooperation, little effort has been made to systematically assess their long-term effectiveness in sustaining use (Harter et al., 2020). In addition, the role of women as agents of change and the effect of climate-related disruptions on sanitation infrastructure have not yet been thoroughly examined (Chaplin, 2017). This review aims to meet these gaps with a synthesis of the evidence that can help understand what works, who it works and when/who it works and to provide a nuanced understanding of how toilet use is sustained over and above the initial adoption.

The importance of this research is that it could result in the formulation of policies and practices applicable in Tamil Nadu and the like. By identifying successful behaviour change strategies and their enabling factors, this review provides actionable insights for policymakers, implementers, and researchers. It also factors into wider debates on attaining Sustainable Development Goal (SDG) 6 which focuses on providing equitable and sustainable sanitation for all (Bartram et al., 2018). It is necessary to understand the interactions between infrastructure, behaviour and sociocultural norms, in order to design interventions that have a lasting impact.

Methodology

Review Protocol

This systematic review follows the guidelines of the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), following concepts of methodological rigor and transparency (Page et al., 2021). Five databases were considered of priority based on their relevance to public health and sanitation research: PubMed, Scopus, Science Direct, SpringerLink and Google Scholar. PubMed was chosen for its broad coverage of health-related literature, while Scopus and ScienceDirect were chosen for the interdisciplinary views of behavioural change interventions. SpringerLink provides access to peer reviewed social science research and Google Scholar is an add-on resource to catch any gray literature and regional studies.

The search strategy used a combination of keywords and Boolean operators specific to each of the databases. Key words such as "Sustaining Open Defecation Free Plus" (variations of this included ODF+, ODF++, "Tamil Nadu"), "social norms," "open defecation relapse," "consistent use of toilets," etc. were the fundamental terms. Exclusion filters were used to exclude reviews, surveys, and meta-analyses articles to focus on primary study research

articles. For example, in PubMed the search string used a combination of the MeSH terms and filters for title/abstract, and in ScienceDirect, results were limited to research articles.

Analytical Framework

The review is based on eight dimensions of research which is based on recurring themes in this sanitation literature. Toilet Construction and Promotion look at the quality of infrastructure and awareness campaigns, whereas the topic of Sanitation Practices and Behaviours investigates the habitual and contextual factors in the use of it. Social Norms and Sanitation measures people's attitudes to sanitation and peer influence, while Sanitation Policies and Programs measure the government and NGOs led policies and programs. Water, Sanitation, and Hygiene (WASH) in Specific Contexts brings to light the issues of schools, healthcare facilities, and disaster facing areas. Gender and Sanitation address the roles and barriers of women, and Disaster and Sanitation analyse the strategies for resilience. These dimensions together answer a holistic view of the assessment of behaviour-change strategies.

Criteria for Inclusion and Exclusion

Studies were included if they (1) focused on Tamil Nadu or comparable Indian contexts, (2) evaluated behaviour change interventions for toilet use, (3) were peer-reviewed primary research, and (4) published in English. The exclusion criteria ruled out studies that did not include empirical data, those not focusing on sustainability and non-English publication. Timeframe limitations were not put on capture of historical trends; however, emphasis was put on studies since 2010 to coincide with SBM's implementation of the SBM.

Study Selection Process

The screening processes are shown in the PRISMA flowchart (Figure 1). Initial database searches returned 814 records which were narrowed down to 265 after removing duplicates. Title/abstract screening excluded 169 irrelevant studies and the full text screening of the 49 remained showed 31 that were excluded for ineligibility. Eighteen studies met all the criteria and were included in the synthesis. Quality assessment included evaluation of the study design, representativeness of samples and management of bias with higher weightage on longitudinal and mixed-methods research.
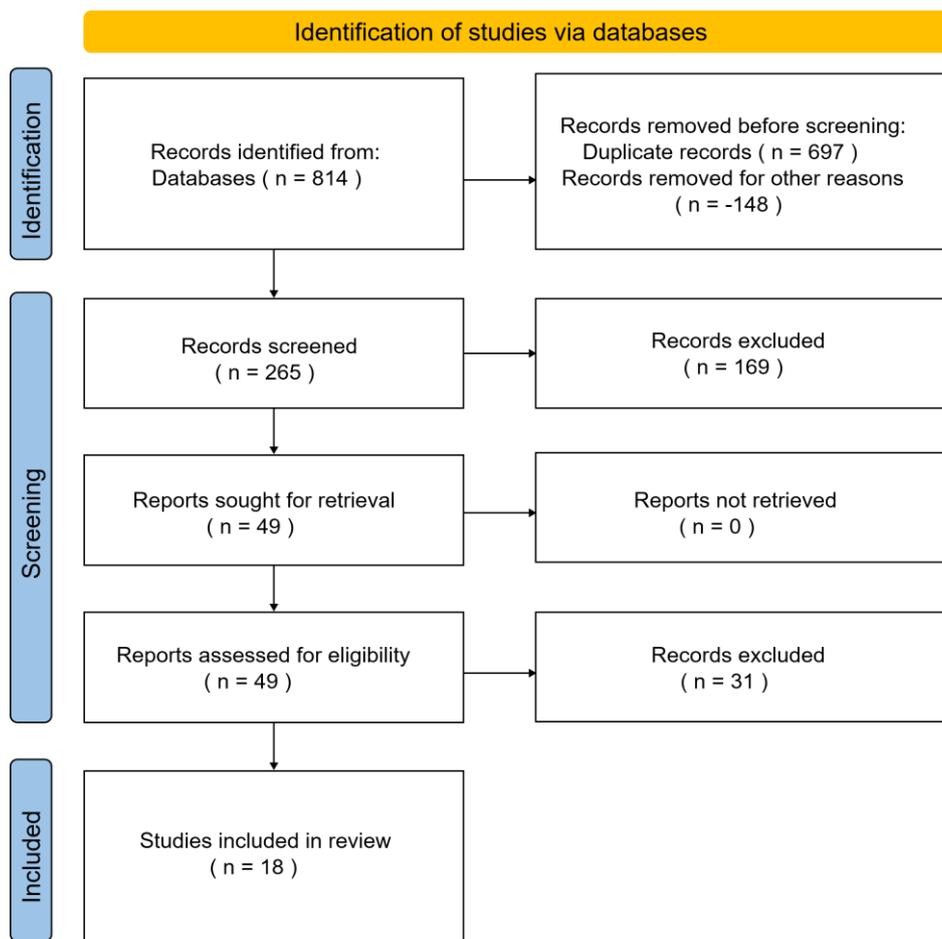
Figure 1. PRISMA flowchart of study selection process.

Limitations include the possibility of geographic bias (due to the overrepresentation of studies conducted in city settings versus those that examined rural settings) and the use of self-reported data on behaviour in some studies. Nevertheless, the rigorous screening process reduced major problems of selection bias.

RESULTS
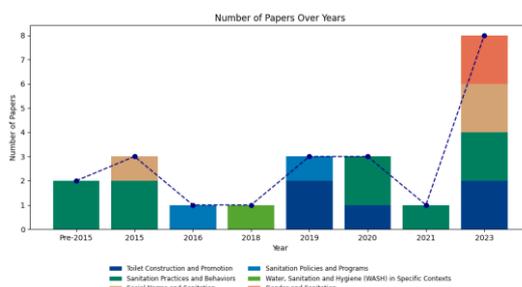
Research Trends

Figure 2. Research Trends of Behavior Change Strategies to Sustain Toilet Usage in Tamil Nadu.

Research interest in toilet-use sustainability surged after 2015, coinciding with the Swachh Bharat Mission in India. Only two studies before 2015, where 2015 and 2020 had three and in 2023, there were five studies highlighting the increasing recognition of behavioural factors in the adoption of toilets. Sanitation practices have been continuously investigated since before 2015 all the way to 2023 to demonstrate the importance of habitual factors in sustained usage of toilets. Toilet Construction and Promotion became a theme for 2019, as SBM had shifted from focusing on building to focus on toilet use. Social Norms and Sanitation became focus in 2015, 2023 and has shown more interest into the collective behaviour. Gender and Sanitation have only been seen in 2023, so again it is the influence of gender that seems to have been recently highlighted. The lack of Disaster and Sanitation studies is disclosed a gap, especially in Tamil Nadu given its vulnerability of climate. This distribution indicates a move from infrastructure-related research to social and behavioural determinants research.

Toilet Construction and Promotion Strategies

Studies have brought out various ways of toilets being constructed and propagated in Tamil Nadu, ranging from government to private sectors. Government-based programs leverage subsidies in order to improve toilet coverage, although financial assistance is not enough to guarantee consistent toilet use (Das et al., 2020; Das et al., 2023). Households in receipt of subsidies often have seen toilets as assets not necessities. Community mobilisation through local leaders showed higher success rates in sustaining use when combined with behaviour change communication (Chauhan et al., 2020; Chauhan et al., 2019). Private models of construction have demonstrated possibilities with microfinance schemes and entrepreneurship (Talat et al.,2023; Dandabathula et al., 2019). Mass media campaigns ensured over health and dignity benefits of toilet (Talat et al., 2023; Das et al., 2023; Chauhan et al., 2019). Hybrid public-intended private partnerships have enabled innovation by introducing cheap designs, such as twin-pit toilets (Dandabathula et al., 2020; Schmidt et al., 2019). Table 1 summarises the important findings of these construction and promotion strategies.

Table 1. Toilet Construction and Promotion Strategies in Tamil Nadu.

Construction Approach	Promotion Strategy	Findings
Government-led construction (Schmidt et al., 2020; Das et al., 2023)	Subsidies and incentives	Increased coverage but faced challenges in sustained use due to asset perception
(Schmidt et al., 2020; Chauhan et al., 2019)	Community mobilization	Higher adoption rates when local leaders and groups were engaged

Private construction (Talat et al., 2023; Dandabathula et al., 2019)	Market-based approaches	Microfinance and entrepreneurship models enabled household investment
(Talat et al., 2023; Das et al., 2023; Chauhan et al., 2019)	Behavior change communication	Mass media and interpersonal messaging reinforced health benefits
Hybrid models (Dandabathula et al., 2019)	Public-private partnerships	Combined government support with private sector participation for better sustainability
(Schmidt et al., 2020; Dandabathula et al., 2019)	Technology innovation	Affordable and water-efficient designs improved acceptance

There is evidence that there is no single solution to ensure sustained use of toilets. Government subsidies alone are insufficient without accompanying behaviour change efforts, while private sector involvement can fill these gaps but requires scalable financing mechanisms. Hybrid models, especially the participation of community engagement and technological adaptation, are the most effective in overcoming the multifaceted barriers to sustained hygiene in terms of sanitation.

Determinants of Sanitation Practices and Behaviour

The sustainability of the use of toilets in Tamil Nadu is affected by deep-rooted sanitation practices that are resistant to change. Studies expose the dynamics of behaviours, socio-cultural norms and barriers that affect sanitation outcomes. Research has shown that 38-52% of households with toilets still practice open defecation, especially in rural areas with the men and older persons being the most defiant (Ashraf et al., 2020; Vasudevan et al., 2020). This is due to the ingrained habits, the perceived health benefits of open-air defecation and the discomfort with using enclosed facilities. Communities tend to link open defaecation with exercise and social interaction (Banda et al., 2007). Water scarcity also exacerbates this problem as households will prefer drinking water to flushing toilets and will abandon the facility (Kuberan et al., 2015).

Social norms have a strong influence on sanitation behaviour, especially when it comes to gender specific behaviours. Women have disproportionate obstacles when it comes to toilets due to privacy fears, potential safety threats and restrictive norms of mobility (Babbar et al., 2023). While 68% of the surveyed communities women have expressed a preference of toilet use, only 42% of women could access the toilets in their household or in the community consistently without harassment or disapproval (Babbar et al., 2023 and Manisha, 2015). These gendered dynamics make for paradoxical situations like women can enter the discourse

of toilet construction but are still unable to use one on a regular basis due to patriarchal control of sanitation choice. Table 2 shows the comprehensive behavioural determinants and the associated intervention strategies identified in the literature.

Table 2. Behavioral Determinants and Intervention Strategies for Sustaining Toilet Use.

Focus Area	Findings	Intervention Strategies
Toilet Usage Patterns (Bauza et al., 2021; Banda et al., 2007; Jain et al., 2023)	Minimal change in latrine use despite infrastructure development	Need for behavior change beyond toilet construction
(Babbar et al., 2023)	Social norms significantly influence women's public toilet usage	Addressing gender-specific barriers through social norm interventions
Behavior Change Challenges (Ashraf et al., 2020)	Sustaining toilet use requires behavioral maintenance	Monetary subsidies combined with behavior change strategies
(Vasudevan et al., 2020; Manisha, 2015)	Open defecation persists despite toilet availability	Awareness campaigns and latrine promotion programs
Policy and Infrastructure Gaps (Kuberan et al., 2015; Jain et al., 2023)	Toilet coverage alone insufficient for improved sanitation outcomes	Need for multidimensional approaches combining infrastructure with behavior change
(Manisha, 2015)	Community toilets show success in some areas	Replicable models for sustainable sanitation

Behaviour change requires more than infrastructure provision, combining hardware solutions with community engagement, normative shifts and gender-sensitive programming. Studies in Tamil Nadu showed 32% higher toilet use when subsidies were paired with behaviour change messaging through women's self-help groups (Ashraf et al., 2020; and Babbar et al., 2023). Participatory approaches that engage men achieve greater outcomes than programs exclusively for women (Vasudevan et al. 2020). Research during the time of the pandemic noted that even though handwashing did improve for a short period of time, toilet usage did not change, indicating that modifications made in crisis situations need to be reinforced continually (Bauza et al., 2021). This brings the need of long-term engagement strategies rather than one off campaigns in particular, when it comes to rural sanitation practices.

The Role of Social Norms in Sanitation Behaviour

Social norms dictate sanitation practices, makes them stay and makes them go away. For example, it has been shown how collective attitudes and gender expectations have affected behaviour change interventions in Tamil Nadu. Research shows high correlation between

individual sanitation behaviour and social networks. The likelihood of adopting a latrine is predicted by latrine ownership of social contacts with norms being transmitted through community networks (Shakya et al. 2015). This effect is higher in rural areas where households show a similar sanitation practice to their neighbours. When toilets are adopted by community leaders it promotes larger adoption (Gauri et al., 2023). However, credibility and deep-rooted open defaecation continue to reinforce effectiveness as a non-use of toilets, and the use of toilets by women remains limited by safety issues (Babbar et al. 2023).

Table 3. Social Norms and Their Impact on Sanitation Behavior.

Social Norms Focus	Behavioral Influence	Findings
Public Toilet Usage (Babbar et al., 2023)	Gender-specific norms	Social norms shape women's public toilet usage, requiring targeted behavior change interventions for sustained use
Rural Latrine Adoption (Gauri et al., 2023; Shakya et al., 2015)	Community-level norms	Social norms influence latrine ownership and use, with individuals mirroring the behavior of their social contacts
(Shakya et al., 2015)	Network effects	Latrine ownership of social contacts significantly predicts individual latrine ownership

The studies reveal that normative shifts require more than just individual-level behaviour change. Community wide approaches that tackle the expectations of the community and peer influence show more promise in one's ability to sustain toilet use. For example, interventions that publicly acknowledge people who have adopted new behaviors or that enable people to discuss the benefits of using sanitation with peers have been found to be successful in changing people's norms (Gauri et al., 2023). However, such approaches have to be carefully developed with respect to local circumstances, since norms vary considerably by region and demographic groups in the country. In urban slums, for example, the lack of privacy in common facilities brings up different kinds of normative barriers as compared to those found in villages in rural areas (Babbar et al. 2023). These findings highlight the importance of multilevel interventions based on strategies that simultaneously address individual attitudes and community norms and structural constraints and create enabling environments to enable sustained behavioural change.

National Sanitation campaign and their Impact

The Swachh Bharat Mission (SBM) represents a shift in India's sanitation approach, emphasising behavioural change and sustainability. As a National sanitation campaign, SBM

has influenced the pattern of use of toilets in Tamil Nadu through demand generation and supply interventions. The program's bringing together of economic and behavioural strategies provides insights on sanitation transformations. SBM is both a public health and economic development effort. The campaign frames toilets with national progress and GDP growth, which makes it a story for all socio-economic classes (Ghosh 2016). This approach is carved in making sanitation as an enabler for dignity, productivity and sustenance. While these approaches have worked in the urban districts of Tamil Nadu, they have had a slower effect in the rural areas where norms and water shortage pose hurdles. The decentralised mode of governance of the program enables local authorities to tailor strategies to the region. In Tamil Nadu, this has facilitated innovations at the district level through women self-help groups and religious bodies. Despite this promise, problems exist with ensuring the quality of the programs, with different rates of toilet adoption across districts.

Table 4. Sanitation Policies and Programs in Tamil Nadu.

Policy/Program Focus	Features
National Sanitation Campaigns (Ghosh, 2016)	Behavior changes messaging for increasing toilet demand and supply
	Linking sanitation to economic sustainability and GDP growth

The economic aspect of SBM gives it a uniqueness from previous efforts to tackle sanitation issues, by making the construction of toilets an economic growth driver, attracting private sector engagement, and generating local employment. This framing has led to enduring commitment and investment in political efforts to meet the targets for construction, which have been criticized for using the targets for construction as a means to propel forward monitoring of usage as an activity. The behaviour change communication strategies in this program innovatively adopted media channels and celebrity endorsements. Tamil Nadu's "No Toilet, No Bride" campaign effectively leveraged social aspirations, demonstrating the potential of cultural messaging in promoting sanitation behaviour change. However, more studies must examine the degree to which these campaigns sustain normative changes. While mass media helps to raise awareness, it needs to be supported by interpersonal and community-based activities for sustained change to be affected. However, the problems in implementation remain, especially in sustaining behavioural changes. Some of the Tamil Nadu communities reverted to open defeccation after initial adoption. The ODF+ phase that focuses on waste management may strengthen the use of toilets by creating visible benefits

for the community but runs a risk of diluting the main goals of the program if not balanced with ongoing use promotions.

Wash Interventions in Institutional Settings

The effectiveness of interventions for Water, Sanitation, and Hygiene (WASH) in Government health facilities has become a very important factor for maintaining the usage of toilets and the sanitation outcomes in Tamil Nadu. Supportive supervision improves WASH facilities and practices with implications for behavioural change. Subramaniam and Selvavinayagam (2018) demonstrated how supportive supervision through UNICEF's RMNCH+A strategy had led to improvements in WASH facilities in government health centres with an emphasis on toilet maintenance, waste segregation and hygiene practices. Regular monitoring and capacity building helps to create mechanisms of accountability and sustain these improvements. Health facilities serve as behaviour change catalysts, influencing staff practices and community perceptions of toilet use.

Table 5. WASH Interventions in Institutional Settings.

Intervention Type	Focus Areas
Supportive Supervision (Subramaniam and Selvavinayagam, 2018)	Improving WASH facilities in government health facilities, toilet facilities, waste segregation

The institutional approach fills in the gaps of sanitation and in this way addresses settings which are normative reference points. Health facilities with high standards of WASH are able to role-model behaviours that patients could adapt at home. Improved toilet facilities led to reduced staff absenteeism and improved client satisfaction leading into a cycle where better infrastructure led to better use. However, to maintain these improvements, an institutionalised monitoring process needs to be in place through health management protocols. The success of the intervention provides lessons for schools and community centres. Infrastructure upgrades combined with behaviour change components proved more effective than single approaches, aligning with the literature on integrated hardware-software interventions. The fact that the study focused on the issue of waste segregation is an indication of the linking of toilet use and environmental sanitation to reinforce behavioural change. While the evidence provided by Subramaniam and Selvavinayagam (2018) is promising, there is more scope for conducting studies to understand how far the approach can be scaled across institutional contexts in Tamil Nadu. Comparative studies might be able to identify contextual factors in effectiveness while longitudinal might indicate whether changes are actually translated into

household-level toilet use in the long-term. These findings give indications on how institutional WASH interventions lead to changes in sanitation behaviour.

Gender Dynamics in Sanitation Behavior

The interfacing between gender and sanitation is a challenge in continuing the habit of using toilets in Tamil Nadu, India. Gender norms of sanitation access and practices are a factor that creates barriers for women and girls. Babbar et al. (2023) demonstrates how the gendered social norms limit women from using public toilets in urban slum areas. Women give a preference of using toilets but are faced with barriers, including safety issues and absence of privacy. These constraints are experienced by menstruating women in need of reliable menstrual facilities who fall short of public toilet facilities. Behavioural change interventions must address these normative barriers to enable sustained toilet use among women, as even well-designed infrastructure may remain underutilised without addressing gender dynamics.

Table 6. Gender-Related Sanitation Barriers and Interventions.

Dimension	Findings
Social Norms and Women's Toilet Usage (Babbar et al., 2023)	Examines how social norms influence women's public toilet usage in urban slum areas of Tamil Nadu and Bihar. This highlights the need for behavioural change interventions to sustain toilet usage.

The gendered division of sanitation labour affects behaviour change efforts. Women are responsible for keeping household toilets clean and attend to the sanitation needs of children but have little say about toilet construction. Research indicates that interventions that reach both genders have better results than interventions that only include women. Programmes addressing toilet use as a matter of family dignity and not women's health have been successful in changing men's attitude to sanitation investments. Gender disparities are visible in the patterns of usage over time, which causes women to reserve using toilets at specific times in order to secure privacy in shared toilets. These behaviours can cause opposite effects of public health benefits thereby emphasising the need for gender sensitive monitoring beyond binary access metrics. Future interventions should be linked with design innovations to meet the needs of women in this area such as better lighting, menstrual hygiene facilities and female-friendly maintenance systems. The integrating gender analysis in the entire sanitation programming is a necessity for making sanitation equitable in Tamil Nadu.

Disaster Resilience and Sanitation Sustainability

An intersection between disaster management and sanitation, the use of toilets in Tamil Nadu, a region vulnerable to cyclones, floods and water scarcity faced challenges. While research has not directly focused on the effect of disasters on sanitation behaviour, there is evidence that disaster resilience should be incorporated into sanitation programming, to avoid backsliding from open defaecation-free status. Flooding damages the pit latrines and contaminates the water sources and communities are forced to go back to open defaecation (Raj et al., 2025). Drought conditions lead to conflicts in fulfilling domestic water needs and toilet maintenance (Pasupuleti 2013), especially for women who are exposed to safety risks while open defequation in disasters.

Table 7. Disaster-Related Sanitation Challenges and Mitigation Strategies.

Disaster Type	Sanitation Impact	Mitigation Strategies
Flooding (Raj et al., 2025)	Latrine damage, groundwater contamination	Raised toilet platforms, disaster-resistant designs
Drought (Pasupuleti, 2013)	Water scarcity limiting toilet use	Water-saving technologies, alternative sanitation systems

The lack of Tamil Nadu specific studies therefore points to an important research gap considering the state's vulnerability to the impacts of climate change. Evidence from other Indian states shows that communities with strong sanitation behaviours maintain greater resilience during disasters (Pandian et al., 2013), suggesting that behaviour change interventions should include disaster preparedness messaging. Future studies should address the role of the socio-cultural background of Tamil Nadu in sanitation resilience in the state. Technological innovations added for disaster-resilient sanitation include raised toilet platforms and waterless sanitation systems - the solutions emerge but their adaptation to local situations is needed (Krishnan, 2019). The mainstreaming of sanitation into disaster risk reduction strategies is not yet developed in many countries. With extreme weather events becoming more frequent, construction of resilient sanitation systems will become the key to sustain ODF status of Tamil Nadu.

DISCUSSION

The synthesis of evidence shows that infrastructure alone cannot ensure long-term sanitation behaviour change in Tamil Nadu. While toilet construction is necessary, its impact depends on strategies addressing sociocultural norms, gender dynamics, and contextual factors

(Mehta, 2018; Martin et al., 2018). There is a need for hardware and software components integration for future interventions. Social norms play a strong role in sanitation behaviours in rural communities as people's collective practices override their personal preferences. Behaviour change is most effective when targeting communities (Shakya et al., 2015; Gauri et al., 2023). Programs that involved local leaders were found to have more sustainability. Gender dynamics significantly influenced the success of the intervention. Women are disproportionately faced with barriers despite driving household sanitation improvement (Babbar et al, 2023). This requires gender transformative approaches that explore practicality and power structures. policy landscape affecting the sustainability of the use of even toilet in Tamil Nadu While the Swachh Bharat Mission increased coverage, its ODF+ phase revealed limitations in maintaining behaviour change (Ghosh, 2016). There is evidence of the potential of women's self-help group to strengthen sanitation behaviours. The limitations of this Review are the focus on a specific geographical location, which limits the generalization of the results, the predominance of qualitative studies, and publication bias. Gaps in the literature that need to be filled with longitudinal studies are identified. The results are making several important recommendations. Behavioural change programs must address structural barriers through community mobilisation and infrastructure development. Gender considerations need to be incorporated into programs. Monitoring systems need to be changed from measuring coverage to measuring the usage patterns. These results are significant from the theoretical perspective. The evidence is in support of complex frameworks that include social, cultural and environmental influences. This review focuses on the adaptive programming based on emergent challenges.

There are often many nuances of behavioural change that traditional monitoring indicators miss, such as toilet construction. Better measures to determine behavioural consistency and social norms, as well as gender equity outcomes are required. Participatory monitoring can go a long way in offering insights as well as generate local ownership of sanitation results. Such frameworks would allow for a better evaluation of the assessment of what works when it comes to sustaining toilet use. While studies are on social interventions, digital tools provide the potential for strengthening the practices with reminders. However, these innovations need to complement interpersonal approaches, which are low in digital literacy. In the future, it is recommended that studies focus on effective combinations of the use of digital and interpersonal strategies in order to improve mental health. There is evidence of the importance of local adaptation in interventions. Programmes often don't consider disparity in

availability of water, caste and settlement. Behavioural change programs should have contextual analysis and adaptation mechanisms built in and require flexible funding structures. As India moves from the construction phase to the behavioural change phase there are lessons to be learnt from Tamil Nadu about sustaining the use of toilets. The advanced state of coverage in the state offers a chance to experiment with approaches for policy at the national level, which demand investments in research and sharing of knowledge.

The intersection of sanitation behaviour change with other development priorities presents opportunities for synergistic impacts. Cross-sectoral approaches can permit integrating sanitation and nutrition and women empowerment programs to deal with health benefits and gender barriers. The temporal dimension of behaviour change emerged as critical in the reviewed studies, with many interventions showing initial success but struggling to maintain gains. This suggests that behaviour change requires ongoing reinforcement through institutionalised mechanisms. The results obtained with relation to subsidy-based approaches have implications concerning financing for sustainable sanitation. While there are broad advantages to using financial incentives to speed up toilet construction, there are also potential drawbacks given the problem of extrinsic versus intrinsic motivation. Alternative financing models that put the focus on household investment is a promising area that can help foster ownership. Future research should investigate mechanisms for maximising access to low-income households. The evidence base needs to be supplemented with rigour of experiments in which to isolate the effect of particular strategies. The role of the private sector in maintaining the use of toilets is still a subject with very few proofs of the effectiveness of market-based approaches. Public-private partnerships for sustaining sanitation behaviour on a large scale show great promise. The synthesis showed critical interrelationships across the areas of themes. Gender norms and disaster resilience impact on toilet use in crisis, school and household sanitation are suggestive of multiplier effects. These insights suggest the imperative to create holistic programming which tackles multiple determinants. Limitations in this review in representing the views of practitioners and Indigenous people in the context of inclusion as a research problem. Participatory methods should be taken as a priority in future studies. Sustainability of open defaecation-free status needs addressing human dimensions in addition to solely technical solutions with investment in social science research. The review has suggested that not the ability to sustain toilet use in Tamil Nadu but building on successes while innovating to address challenges. With

integrated approaches, gains experienced by the state can be consolidated which requires continuous commitment to evidence-based programming.

CONCLUSION

This systematic review complements the literature review by synthesising evidence on behaviour change strategies in order to sustain toilet use in Tamil Nadu, which revealed some key insights on the interplay between infrastructure, social and contextual factors. The findings show that the construction of toilets is not enough to guarantee long-lasting adoption as behavioural resistance and sociocultural barriers often remain despite increased access to the facilities. Successful interventions integrate the provision of hardware with community engagement, normative change and gender-sensitive approaches, although they are highly dependent on their specific adaptation in communities, particularly their effectiveness. This review identifies the critical role of women's agency in bringing about household sanitation improvements while being at the same time structurally constrained, providing the case for transformative programming for gender justice.

The practical implications of these findings are important for policy makers and practitioners who are striving towards realizing Sustainable Development Goal 6. Multilevel approaches that target behaviours of individuals, norms in the community and policy settings hold the greatest potential for sustainability. Future research should prioritise longitudinal studies to assess the durability of behaviour change, particularly in disaster-prone areas where climate resilience intersects with sanitation access. The gaps identified in this review, in particular, with respect to disaster-resilient sanitation and scalable gender transformative approaches provide opportunities for innovation in the research field and practice. By prioritising focus on solutions specific to context and systemic hindrances, the state of Tamil Nadu can merge its achievements in sanitation while providing transferable lessons to other similar contexts in the world.

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