JRIIE Journal of Research Innovation and Implications in Education
Center for Research Implications & Practice

Website:www.jriiejournal.com ISSN 2520-7504 (Online) Vol.9, Iss.4, 2025 (pp. 594 – 607)

Community Stages of Behaviour Change for Sustained Sanitation: A Transtheoretical Model Based Assessment Four Years Post -Open Defecation-Free Certification in Balaka District, Malawi

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Abstract: *Malawi adopted Community-Led Total Sanitation (CLTS) in 2008 with the aim of achieving open defecation-free (ODF) status nationwide by 2015. Balaka District was certified ODF in 2017 but regressed to open defecation in 2019. This study assessed the community's stage of change (SoC) in behaviour, readiness to change (RtC), and committed action to change (CAtC) for four sanitation behaviours: latrine construction, hand washing facility (HWF) construction, latrine use, and hand washing with soap (HWWS) after defecation four years post-certification. A descriptive cross-sectional study was conducted using a structured questionnaire adapted from the University of Rhode Island Change Assessment (URICA). Data were collected from household heads. Principal Component Analysis and reliability testing (Cronbach's α = 0.82) were conducted. Means and standard deviations were calculated for Stages of Change (SoC: 1 = pre-contemplation to 4 = maintenance), RtC (range 1–12), and CAtC (range -1 to +1).Results showed that the community was at the action stage for latrine construction (Mean = 4.308 ± 0.003), latrine use (Mean = 4.335, SD = 0.076), and HWF construction (Mean = 4.349, SD = 0.076), but at pre-contemplation for HWWS (Mean = 3.171, SD = 0.065). Readiness to change was intermediate for latrine (Mean = 9.340) and HWF construction (Mean = 9.665), moderate for latrine use (Mean = 9.549), and low for HWWS (Mean = 6.660). Committed action to change scores were lowest for HWF construction (Mean = 0.017), latrine construction (Mean = 0.027), and latrine use (Mean = 0.113), and negative for HWWS (Mean = –0.055). In conclusion, the community maintains moderate engagement with latrine-related behaviours but shows low readiness and commitment to HWWS. Sustainable sanitation in Balaka requires renewed investment in behaviour change strategies, especially for hand washing with soap, focusing on motivation, habit formation, and social norm reinforcement.*

Keywords*: Certification, Community Led Total Sanitation, Open defecation, Slippage*

How to cite this work (APA):

Kamwana, L., Tembo, M. & Chidya, R. (2025). Community stages of Behaviour Change for Sustained Sanitation: A Transtheoretical Model Based Assessment Four Years Post -Open Defecation-Free Certification in Balaka District, Malawi. *Journal of Research Innovation and Implications in Education, 9*(4), 594 – 607. **https://doi.org/10.59765/fty37s.**

1. Introduction

Community-Led Total Sanitation (CLTS) is a participatory behavior change approach aimed at eliminating open defecation (OD) by empowering communities to recognize and address their sanitation challenges. The method promotes construction and consistent use of household latrines and hand washing facilities, alongside adoption of hygienic practices such as hand washing with soap after defecation (Kar & Chambers, 2008; Vernon & Bongartz, 2016; Mosler et al., 2018; Venkataramanan et al., 2018; Crocker, 2015). Unlike hardware-based interventions, CLTS emphasizes social awakening and community-led behavior change over subsidies, thus encouraging collective responsibility and sustainability.

The effectiveness of CLTS in achieving rapid elimination of open defecation is well-documented, particularly during the initial implementation phase (Kar & Chambers, 2008; Crocker et al., 2016). However, sustaining improved sanitation behaviors long after Open Defecation Free (ODF) certification has proven far more difficult. A growing body of literature has reported post-ODF slippage across a range of contexts often within two to four years of achieving ODF status (Tyndale-Biscoe et al., 2013; Coffey & Spears, 2017). Key factors contributing to slippage include inadequate follow-up systems, declining community motivation, poor-quality or temporary latrine structures, lack of access to water, and weak reinforcement of hygiene norms (Bongartz et al., 2016; Sigler et al., 2015).

Malawi adopted CLTS in 2008 as a strategy to achieve nationwide ODF status by 2015. Significant progress was made, and Balaka District was certified ODF in 2017. Yet, within two years, many communities in Balaka had relapsed into OD, signaling challenges in sustaining sanitation behavior change post-certification (Taulo et al., 2018). This reversal highlights the challenge of sustaining behavior change after external monitoring and support ends. Evidence suggests that while CLTS effectively initiates sanitation uptake, it does not consistently incorporate long-term psychological and behavioral support mechanisms that are crucial for sustained deep-rooted behavioral transformation beyond latrine construction (Cole, 2015; Davis et al., 2019). Central to this transformation is a community's internal motivation and psychological readiness to maintain positive sanitation habits, particularly under changing circumstances.

In similar low-resource settings such as Ethiopia, Nigeria, and Nepal, post-ODF sustainability has been influenced by behavioral, social, and structural factors. Studies in Ethiopia, for example, have documented slippage in latrine use and hand washing due to weak behavioral reinforcement mechanisms (Gebremariam et al., 2018). In Nigeria and Kenya, sustainability has been associated with community ownership, continuous triggering, and behavior monitoring (Venkataramanan et al., 2018; Odagiri et al., 2017). These findings underscore the necessity of embedding behavior change theory in sanitation programming to ensure long-term impact.

To address these limitations, behavioral science models have increasingly been called upon to better explain and predict sanitation behavior dynamics over time. Among these, the Transtheoretical Model (TTM), also known as the Stages of Change Model has gained attention for its capacity to describe how individuals and communities transition through behavior change stages, from pre-contemplation to maintenance (Prochaska & Velicer, 1997). The model emphasizes that change is a non-linear, progressive process, and interventions should be stage-appropriate to be effective (Gordaliza Iruarrizaga et al., 2021).

In Malawi, limited empirical evidence exists regarding the current placement of communities within the TTM Stages of Change framework following ODF certification. This gap undermines the ability of practitioners to identify which groups require renewed motivational efforts or tailored interventions. This study addresses that gap by applying validated TTM tools to assess the Behavioural Stage of Change (SoC), Readiness to Change (RtC), and Committed Action to Change (CAtC) of households in Balaka District four years after initial ODF certification. The goal is to provide insight into the sustainability of sanitation behaviors and generate context-specific insights that can inform more effective, behaviorally grounded post-ODF support strategies.

2. Literature Review

2.1 Community-Led Total Sanitation and the Challenge of Sustained Sanitation Behavior

Community-Led Total Sanitation has proven highly effective in rapidly eliminating OD during its initial phases of implementation. (Kar & Chambers, 2021).By triggering collective disgust and promoting community-wide action (Crocker et al., 2019).Through community-led "triggering" events that evoke collective disgust and pride, CLTS has been successful in initiating widespread latrine construction and improved hygiene practices in various countries (Garn et al., 2019; Crocker et al., 2016). However, while many communities initially attain Open Defecation-Free (ODF) status, sustaining these gains over time has proven to be a significant challenge. Numerous studies from South Asia and Sub-Saharan Africa, including interventions in India, Ghana, Nigeria, and Tanzania, have shown significant short-term gains following CLTS

implementation (Crocker et al., 2016; Venkataramanan et al., 2018; Harter et al., 2018).

Research from countries such as India, Ghana, Indonesia, and Malawi consistently highlights widespread post-ODF slippage, defined as the reversion to open defecation or abandonment of proper hand washing practices, has been widely reported within two to four years s after certification (Coffey & Spears, 2019; Sigler et al., 2018).This slippage has been attributed to a variety of interlinked factors. Weak monitoring and follow-up systems after triggering events limit the ability to reinforce new behaviors. Declining community motivation and weakening social pressure further erode commitment to hygiene norms. Additionally, poor-quality construction of latrines and hand washing facilities (HWFs), combined with water scarcity and a failure to internalize sanitation behaviors as social norms, contribute to the reversion to open defecation (Bongartz et al., 2018; Mosler, 2019).In Malawi, even with nationwide adoption of CLTS, some communities such as those in Balaka despite previously attaining ODF status have experienced similar structural and behavioral challenges that have undermined sustainability (Taulo, Mkandawire, & Banda, 2021).

2.2 The Transtheoretical Model of Behavior Change

To understand and address the issue of sanitation slippage, behavioral science frameworks have increasingly been employed. These models move beyond infrastructure and environmental factors to explore the psychological and motivational dimensions of behaviour change. The Transtheoretical Model (TTM), developed by Prochaska and DiClemente (1983), is one such model that has gained prominence in sanitation and hygiene studies. The Transtheoretical Model (TTM), developed by Prochaska and DiClemente (1983), has emerged as particularly relevant. TTM offers a nuanced understanding of behavior change by positioning individuals or communities along a continuum of five distinct stages: pre-contemplation, contemplation, preparation, action, and maintenance rather than as a single decision-making event. In the pre-contemplation stage, individuals are not yet considering change and may be unaware of the health risks of their current behavior (Prochaska & Velicer, 1997) During contemplation, they acknowledge the problem and begin to consider making a change, often within a six-month timeframe. The preparation stage reflects the intent to act in the near future, with plans to implement new behaviors within the coming month. The action stage is marked by the actual implementation of new behaviors, such as consistent latrine use or hand washing, typically lasting less than six months. Finally, the maintenance stage involves sustaining the new behavior for six months or more, with a reduced risk of relapse (Prochaska & Velicer, 1997; Mosler, 2019) (Fig 1)

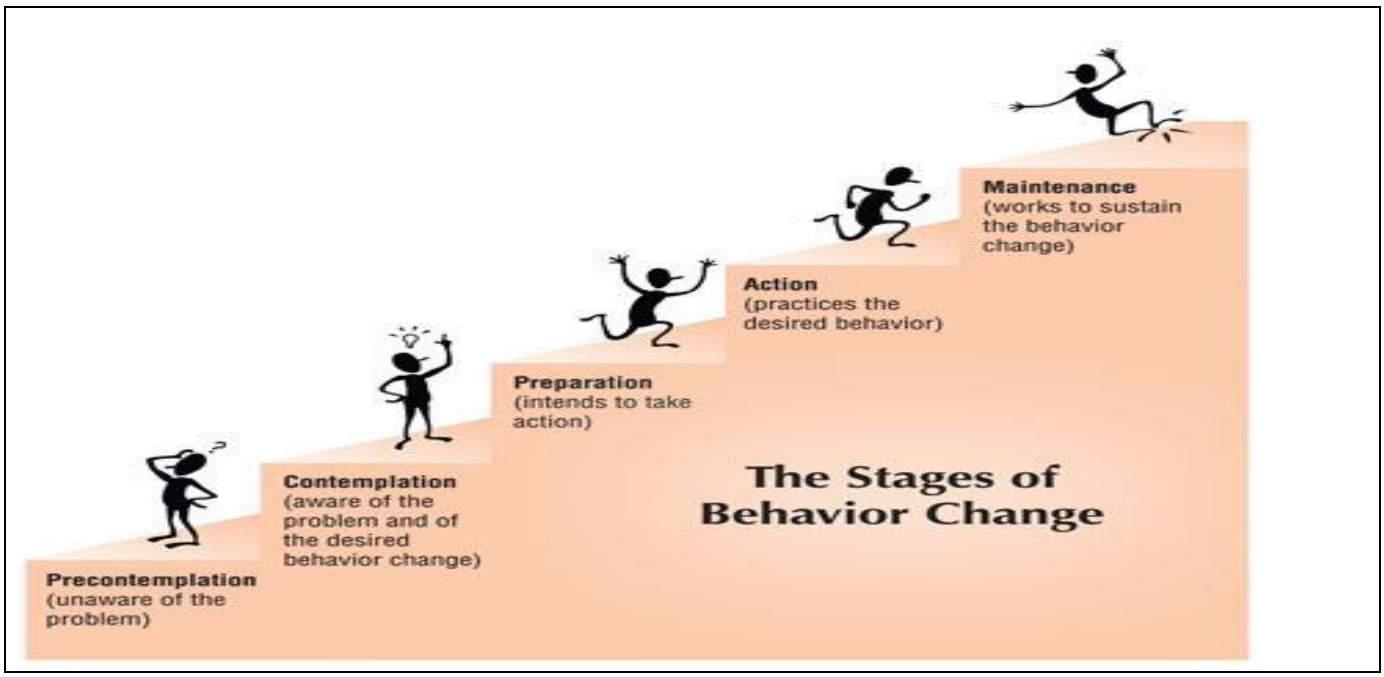

Figure 1. Transtheoretical Model – Stages of Change .

Source: Adapted from Prochaska & Velicer, 1997.

In the sanitation context, TTM allows researchers and practitioners to identify whether individuals or communities are unaware of the need to change, considering change, preparing to change, actively

changing, or working to sustain new habits. Each stage requires a different type of support or intervention, making the model particularly useful for tailoring sanitation programming (Siddharthan et al., 2021).

TTM emphasizes that behavioral change is cyclical rather than linear. Individuals may relapse and re-enter earlier stages before eventually achieving sustained behavior. In addition to the stages, the model incorporates two key constructs Readiness to Change (RtC) and Committed Action to Change (CAtC have recently been validated as predictors of long-term sanitation behavior. Readiness to Change (RtC), reflects an individual's psychological preparedness for change and adopt improved practices. Committed Action to Change (CAtC) reflects the strength of their intention, determination, planning and decisiveness for a sustained action to new behaviour (Guess, Petroff, & Young, 2020; Jenkins & Acharya, 2021).

2.3 Applying Trans-Theoretical Model to Community Led Total Sanitation and Open defecation Free Status Sustainability

There is a strong conceptual alignment between the stages of behavior change in TTM and the phases of CLTS implementation. The pre-triggering phase of CLTS typically corresponds to the pre-contemplation and contemplation stages of TTM of change, where communities are either unaware or only beginning to acknowledge sanitation problems of sanitation issues such as consequences of OD to consider change. Triggering events in CLTS are analogous to the preparation and action stages in TTM, where behavior change is initiated through emotional and social motivation. Individuals and communities move into the preparation or action stages, as they construct latrines and HWF and start using them. The post-triggering phase of CLTS aligns with the maintenance stage, where consistent behaviour and reinforcement are critical to preventing relapse. (Garn et al., 2019; Davis et al., 2019). Figure 2 illustrates this alignment, showing how the TTM's stages of individual behaviour change can be mapped onto the CLTS process at the community level. This conceptual bridge allows for more integrated programming that considers both structural and psychological determinants of sustained sanitation.

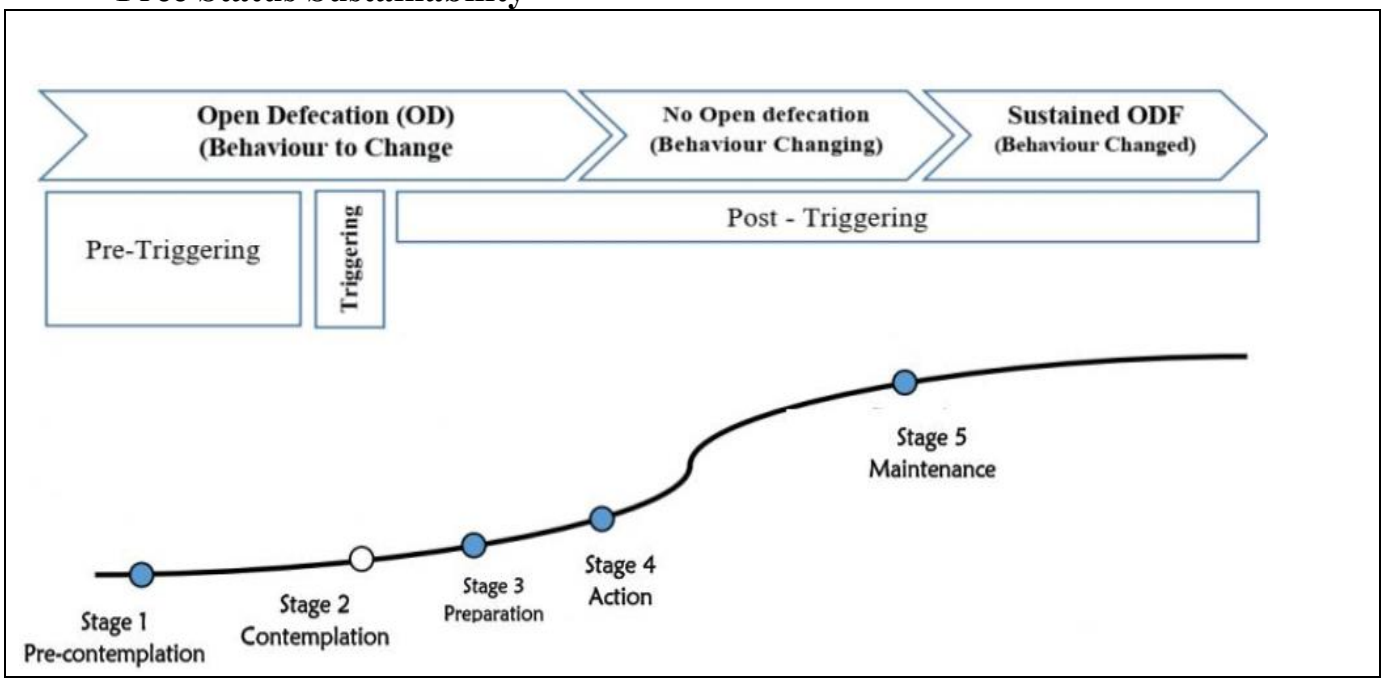

Figure 2. Community Led Total Sanitation and the Transtheoretical Model – Integrated Stages of Change
Source: Adapted from Jenkins & Scott, 2017.

Understanding where individuals or communities fall within this behavioral continuum provides a valuable framework for diagnosing community behavior after ODF certification. Such alignment enables WASH practitioners to segment populations by behavioral readiness and provide differentiated follow-up interventions based on psychological stage. It enables WASH practitioners to assess not only whether latrines and HWF are present, but also whether households are in a psychological and behavioral state that supports sustained use. This allows for more precise tailoring of interventions, including targeted

re-triggering and motivational reinforcement. (Mosler, 2019; Gordali et al., 2021).

2.4 Transtheoretical Model in Global Sanitation Research and the Malawian Context

Several studies have applied the TTM to sanitation and hygiene behaviors in low- and middle-income countries. In Ethiopia, India, Kenya, India, Nepal and Cambodia, researchers have used the model to investigate how individuals progress or fail to progress through the stages of change in relation to latrine adoption, open defecation, and hand hygiene practices. Guess et al. (2020) found that many households with latrines remained in the contemplation or preparation stages, indicating weak internal motivation. Jenkins and Acharya (2021) demonstrated that CAtC scores predicted latrine use more strongly than infrastructure presence alone. Similarly, White et al. (2020) observed in Bangladesh that hygiene practices post-ODF certification often relapsed due to lack of behavioral reinforcement and monitoring. This shows indicates that infrastructure availability alone was insufficient to sustain behavioral change. Communities, households remained stuck in the contemplation or preparation stages despite having access to latrines, highlighting that psychological readiness and motivation are stronger predictors of behavior than physical infrastructure.

Despite the potential of the TTM to support sustained sanitation programming, TTM remains underutilized in post-ODF sanitation monitoring in sub-Saharan Africa. Few studies in Malawi have explicitly applied the model to analyses post-ODF dynamics. Most evaluations remain focused on latrine coverage and the presence of hand washing facilities without assessing the psychological and motivational dimensions commitment to maintenance of sanitation behaviours. This represents a critical gap in the evidence base. In Balaka District, where this study is set, anecdotal evidence suggests that many communities have slipped back into open defecation or sporadic hygiene practices within a few years of ODF certification. This calls for a more nuanced understanding of where individuals and communities stand along the behaviour change continuum.

The present study seeks to fill this gap by applying validated TTM-based tools in Balaka District. Specifically, it uses assessments of Stage of Change (SoC), Readiness to Change (RtC), and Committed Action to Change (CAtC) to determine where households stand along the behavioral continuum after achieving ODF status. These tools allow for empirical assessment of not only whether households engage in sanitation behaviours, but also why and how consistently they do so. These insights are expected to inform more adaptive, targeted, and sustainable sanitation interventions that align with the real behavioral needs of communities.

3. Methodology

3.1 Study design and setting

This study employed a cross-sectional quantitative design to assess the behavioral stages of sanitation and hygiene practices in the post-ODF context. The study was conducted in Balaka District, Malawi, a model ODF certified District. The setting provided a relevant context for investigating sustainability of sanitation behavior, particularly latrine use and hand washing with soap in the post-ODF context.

3.2 Sample Size and Sampling

A total of 438 heads of households were selected through systematic random sampling from village registers. Eligible participants were adult (≥18 years), permanent residents who had lived in the area before and after ODF certification.

3.3 Data Collection Methods and Tools

Data were collected through structured face-to-face interviews using an adapted University of Rhode Island Change Assessment (URICA) questionnaire. The URICA tool is grounded in the TTM and assesses measures psychological readiness for behavior change across four stages: Pre-contemplation, Contemplation, Action, and Maintenance. The instrument was modified to reflect four target sanitation behaviors: (1) latrine construction, (2) hand washing facility construction, (3) latrine use, and (4) hand washing with soap after defecation. Responses were rated on a 4-point Likert scale, and subscale scores were computed as means of each stage to generate individual profiles of behavioural readiness.

3.4 Validity and Reliability

Construct validity of the adapted URICA instrument, Principal Component Analysis (PCA) with Varimax rotation was conducted. The analysis extracted four components aligning with the theoretical TTM stages: Pre-

contemplation, Contemplation, Action, and Maintenance. Internal consistency was evaluated using Cronbach's alpha for each subscale to confirm acceptable reliability across subscales. Factor loadings for each item were used to confirm alignment with intended stage

Varimax with Kaiser Normalization Eigenvalues were also used to determine the influence of the factors especially those with weaker influence of less than 0.6. These are latrine construction at pre-contemplation stage (I guess I have faults, but there's nothing that I really need to change and construct a latrine. (-0.015) and maintenance stage (At times my failure to construct a latrine is a difficult problem but I'm working on it (-0.022), HWF at Maintenance Stage (After all I had done to try and construct a HWF every now and then the problem of not having a HWF comes back to haunt me (0.019) and latrine use at pre-contemplation stage (I guess I have faults, but there's nothing that I really need to change and start using a latrine (0.047). These variables were not ignored as they did not influence both latrine and HWF at the same time

3.5 Data Analysis

Quantitative data were entered and analyzed using SPSS version 25.0. Descriptive statistics such as means, frequencies, and percentages were used to summarize participant characteristics and key sanitation behaviors. For determining behavioral stage and motivation: Stage of Change (SoC) was determined by identifying the highest subscale mean score among the four URICA stages to determine the dominant stage for each behavior (latrine construction and use, HWF construction, HWWS)..Alternatively, the readiness score was matched to the closest stage subscale mean to infer a more nuanced SoC categorization (Heather & Honekopp, 2008). Community's Readiness to Change (RtC) was calculated using the formula: RtC = (Contemplation Mean + Action Mean + Maintenance Mean) – Pre-contemplation Mean. Thresholds for classifying readiness levels were based on prior research: For general population, appropriate cut-off scores were used classified as follows: 8 or lower classified as People in Pre-contemplation (least ready), 8-11 classified as people in Contemplation (Middle) and 11-14 classified as people in Preparation or Action Stage (most ready) (Heather. & Rollnik, 2008). Committed Action to Change (CAtC) was determined by subtracting the Contemplation score from the Action score (Action – Contemplation), following Pantalon et al. (2002) and Field et al. (2007). Committed Action to Change scores measured the strength and direction of commitment to behavior change, ranging from negative (−1) to positive (+1) intention levels. (Table 3)

4. Results and Discussion

4.1 Latrine and Hand Washing Facility Construction, Latrine Use and Hand Washing With Soap after Defecation

The study revealed that 94% of households reported owning latrines, though direct observation confirmed only 89% (Fig 1). Of the households without latrines (5.9%), 84.5% cited latrine collapse as the main reason, while 7.7% had never owned one. These findings reflect a persistent issue of post-ODF slippage, particularly in rural Malawi where structural durability and seasonal challenges undermine sanitation infrastructure. Similar challenges were reported by Chunga et al. (2016) and Roma et al. (2013), who noted that in districts such as Kasungu and Nsanje, latrine collapse following ODF declaration was common, particularly in areas with high water tables or poor soils. This reflects a critical issue of sustainability in latrine infrastructure post-ODF certification, where physical deterioration is a common challenge (Bongartz et al., 2016; Tyndale-Biscoe, 2013).

Latrine use was reported to be high, with 95.7% of respondents using latrines consistently (Fig 1), and 70% viewing it as part of daily life. However, among those without latrines, 70.6% used neighbors' latrines while 29.5% still practiced open defecation four years after Balaka achieved ODF status. This suggests that while social norms supporting latrine use may be relatively strong, infrastructural deficits lead some individuals to revert to open defecation. This finding is consistent with data from the UNICEF-WHO Joint Monitoring Program (2021), which highlights that even in certified ODF communities, open defecation continues among marginalized households or those experiencing structural breakdowns.

On hand hygiene, only 36.5% of households had a functional HWF, and only 24.7% reported washing hands with soap after defecation (Fig 1). The main barriers included lack of water (57.9%) and lack of soap (24.8%). This indicates that while the behavioral transition toward latrine use may have occurred, hygiene behavior lags significantly behind. Similar findings were noted in studies by Hanchett et al. (2011) in Bangladesh and by Mlenga et al. (2020) in Malawi's Mangochi District, where HWWS rates remained low despite high latrine use. These findings suggest significant behavioral slippage, which aligns with previous studies showing rapid decline in hygiene practices following ODF certification (Crocker et al., 2017; Cumming et al., 2022).

Fig1 Coverage of Latrine and Hand Washing Facility Construction and Usage

The findings underscore the need for post-ODF interventions that address not only infrastructure sustainability but also continuous behavior reinforcement. This is particularly crucial given that hardware provision alone does not ensure behavior change, as emphasized by Curtis et al. (2009) and Coombes and Devine (2010) in their Focus, Opportunity, Action and Maintenace (FOAM) framework.

4.2 Factor Structure and Principal Component Analysis

Principal Component Analysis (PCA) was conducted on URICA scale items for each key sanitation behavior: latrine construction, HWF construction, latrine use, and hand washing with soap. For each behavior, four main components were extracted: Pre-contemplation, Contemplation, Action, and Maintenance, consistent with the stages of the Transtheoretical Model. These four components together explained between 62% and 69% of total variance for each behavior, confirming the robustness of the factor structure.

The largest percentage of explained variance for latrine construction (32.12%) and HWF construction (37.86%) was associated with the Pre-contemplation stage. This suggests that a significant portion of respondents are in early stages of readiness and may not fully acknowledge the need for behavior change in these areas. On the other hand, the largest variance for latrine use (36.95%) and hand washing with soap (33.06%) was associated with the Action stage, indicating that for these behaviors, more respondents had begun implementing behavior change, albeit inconsistently. (Table 1)

This factor distribution supports the applicability of the TTM in evaluating sustained behavior change in sanitation. Recent studies (Guess et al., 2016; Manchaiah et al., 2015) have supported the robustness of TTM in health behavior research, though its application in WASH is still emerging. In Malawi, similar findings were reported by Banda et al. (2021) in Machinga, where they found that sanitation behavior change often follows non-linear progress, with many individuals regressing to earlier stages during hardship. The URICA tool, initially developed for addiction and counseling contexts (Prochaska & DiClemente, 1983), thus proves useful in mapping sanitation behavior trajectories when adapted carefully to local contexts.

Internationally, a study by Aluko et al. (2017) in Nigeria applied a similar multistage behavioral framework and found that while many households reached the Action stage following CLTS interventions, Maintenance was rarely achieved without sustained external support. This aligns with the pattern seen in Balaka, where sustainability of hygiene practices appears vulnerable due to limited reinforcement and infrastructural challenges.

Table 1 Principal Component Analysis for community sanitation stage of change after open defecation free status certification

Construction of Latrine and Hand Washing Facility Questionnaire			
#	Stage of Change	Factor Loading	
		Latrine Construction	HWF Construction
	Pre-contemplation (% of TV: LC = 32.12% HWFC 37.86%)		
1	It doesn't make much sense for me to consider constructing a Latrine/ HWF.	0.564	0.875
5	Trying to change and construct a latrine / HWF is pretty much a waste of time for me because the problem of not having a Latrine /HWF doesn't have to do with me	0.803	0.639

6	I guess I have faults, but there's nothing that I really need to change and construct a latrine / HWF.	-0.015	0.904
	Contemplation (% of TV: LC = 27.31% HWFC= 27.54%)		
2	I've been thinking that I might want to change something about Latrine / HWF Construction	0.693	0.675
8	I may have a problem with Latrine / HWF construction and I think I should work on it.	0.605	0.560
10	I hope that someone will have some good advice for me about Latrine / HWF construction.	0.958	0.885
	Action (% of TV: LC = 20.72% HWFC = 18.58%)		
3	At times my failure to construct a Latrine / HWF is a difficult problem but I'm working on it.	0.625	0.746
9	I am really working hard to change and construct a Latrine / HWF	0.803	0.853
11	Anyone can talk about changing and have a Latrine / HWF.I'm actuallygoing to do something about it.	0.693	0.885
	Maintenance (% of TV: LC = 19.85% HWFC = 16.02%)		
4	At times my failure to construct a Latrine / HWF is a difficult problem but I'm working on it.	-0.022	0.666
7	I guess I have faults, but there's nothing that I really need to change and construct a latrine / HWF.	0.578	0.904
12	After all I had done to try and construct a Latrine / HWF every now and then the problem of not having a Latrine / HWF comes back to haunt me.	0.860	0.019

Latrine Use and Washing Hands with Soap after Latrine use Practice Questionnaire			
	Pre-contemplation (% of TV: LU = 36.95% HWWS =33.06%)		
1	It doesn't make much sense for me to consider using a Latrine / Washing Hands after using a Latrine	0.933	0.584
5	Trying to change and start using a latrine / Washing Hands after using a Latrine is pretty much a waste of time for me	0.704	0.644
6	I guess I have faults, but there's nothing that I really need to change and start using a latrine / Washing Hands after using a Latrine.	0.047	0.865
	Contemplation (% of TV: LU = 20.81% HWWS =31.36%)		
2	I've been thinking that I might want to change and start using a Latrine / Wash Hands after using a Latrine.	0.856	0.680
8	I may have a problem with starting using a latrine / Washing Hands after using a Latrine and I think I should work on it.	0.551	0.874
10	I hope that someone will have some good advice for me about start using a latrine/Washing hand after using a Latrine.	0.925	0.673
	Action (% of TV: LU = 18.95% HWWS =18.51%)		
3	At times my failure to use a Latrine / Washing Hands after using a Latrine is a difficult problem but I'm working on it.	0.806	0.691
9	I am really working hard to change and start using a latrine / Washing Hands after using a Latrine.	0.567	0.567
11	Anyone can talk about changing and start using a latrine / Washing Hands after using a Latrine; I'm actually going to do something about it.	0.925	0.647
	Maintenance (% of TV: LU = 13.29% HWWS = 17.07%)		
7	I thought once I had resolved my problem of not start using a latrine / Washing Hands after using a Latrine I would be free, but sometimes I still find myself struggling with it.	0.522	0.622
9	I am really working hard to change and start using a latrine / Washing Hands after using a Latrine.	0.567	0.644
12	After all I had done to try and start using a latrine / Washing Hands after using a Latrine every now and then the problem of not using a Latrine / Washing Hands after using a Latrine comes back to haunt me.	0.859	0.822

HWF= Hand washing facility; HWWS = Hand washing With Soap; LC = Latrine Construction; LU = Latrine Use; TV=Total variance

4.3 Internal Consistency of the University of Rhode Island Change Assessment Subscales

The internal consistency of the University of Rhode Island Change Assessment (URICA) scale for this study population was high, with an overall Cronbach's alpha of 0.81. Subscale reliability scores were 0.81 for Pre-contemplation, 0.76 for Contemplation, 0.86 for Action, and 0.79 for Maintenance. These results indicate acceptable to high levels of inter-item consistency across all constructs. (Table 2)

Such reliability values are consistent with those reported by previous researchers using URICA. For instance, Mander et al. (2014) reported a Cronbach's alpha of 0.82 when assessing health-related behaviors, while Dozois et al. (2004) found alphas ranging from 0.70 to 0.89 across URICA subscales in clinical populations. While URICA is less commonly applied in WASH-related studies, its strong psychometric performance in this study suggests that it may be a viable tool for assessing readiness and stages of change in sanitation and hygiene behavior, especially when adapted to include locally relevant behaviors such as HWWS.

Table 2 Change assessment sub scales for community sanitation stage of change after open defecation free status certification

URICA Scale	A	Dependent Variable							
		Latrine Construction		HWF Construction		Latrine Usage		HWWS after Latrine Usage	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Pre-contemplation	0.81	2.762	0.409	2.591	0.772	2.421	0.399	2.308	0.484
Contemplation	0.76	4.281	0.009	4.332	0.029	4.222	0.054	3.171	0.065
Action	0.86	4.308	0.003	4.349	0.076	4.335	0.156	3.116	0.088
Maintenance	0.79	3.513	0.870	3.564	0.939	3.413	0.865	2.681	0.583

A = Alpha, SD = Standard Deviation

4.4 Stage of Change in Behaviour

The findings as shown in Table 3 presented distinct variations in the Stage of Change across sanitation and hygiene behaviors. For latrine construction, the mean SoC score was 4.308 (SD = 0.003), indicating that most community members were in the Action stage, with many having already constructed and used latrines following ODF certification. Similarly, latrine use had a mean score of 4.335 (SD = 0.156), suggesting that the behavior was well-established, with a significant proportion of households either in the Action or Maintenance stage, continuing regular latrine use. These results align with Mlenga et al. (2020) study in Machinga, Malawi, which observed sustained latrine use four years post-ODF. The behaviors appear to have transitioned beyond the initial stages, aligning with the Maintenance stage for some households.

However, for HWF construction, the mean SOC was lower at 4.349 (SD = 0.076), indicating that while some households had moved to the action stage, others remained in the Preparation or Contemplation stages, suggesting incomplete or inconsistent adoption. This is consistent with studies by Chipeta et al. (2021), which noted that HWFs are often constructed symbolically during ODF verification but later fall into disuse due to lack of follow-up and materials like soap or water.

The most concerning finding was related to hand washing with soap after defecation, which had the lowest mean SOC score at 3.171 (SD = 0.065) (Table 3). This suggests that many community members remain in the Contemplation stage they recognize the importance of hand washing with soap (HWWS) but have not yet adopted the behavior consistently. This finding aligns with a study by Chipeta et al. (2019) in Dedza, Malawi, which observed that HWWS promotion was often deprioritized during post-ODF follow-up activities, resulting in limited behavior change despite high awareness. Similarly, Kumwenda et al. (2020) reported that in Balaka and Phalombe, HWWS remained poorly practiced even among individuals with sufficient knowledge. Contributing barriers included the unavailability of soap, forgetfulness, and a lack of strong social norms or enforcement mechanisms. These factors hinder progression from contemplation to action, leading to only partial or inconsistent adoption of the behavior. This stage mismatch highlights a persistent gap between knowledge and sustained practice, echoing similar trends documented in other post-ODF communities across Sub-Saharan Africa (Crocker et al., 2017).

4.5 Readiness to Change Behaviour

The community demonstrated moderate levels of readiness to change across all behaviors, based on the composite score derived from Contemplation, Action, and Maintenance minus Pre-contemplation. Readiness to change was highest for HWF construction (M = 9.665) and latrine construction (M = 9.340), suggesting that infrastructural behaviors remained more prioritized and better internalized. Latrine use followed closely (9.549), while HWWS scored significantly lower (M = 6.660), reflecting a weaker state of motivational preparedness (Table 3). These results indicate that for latrine construction, use, and HWF construction, communities had transitioned to higher levels of readiness, though not fully into maintenance Communities were willing and able to continue or resume physical construction of sanitation facilities. However, the readiness score for HWWS remained low and close to the pre-contemplation threshold, signaling weak behavioral adoption. This reflects both external barriers (lack of materials) and internal factors (weaker perceived benefits or reinforcement).

Globally, studies in Nepal (Cavill et al., 2015) and Ethiopia (Crocker et al., 2017) have shown that hygiene behaviors such as hand washing often show less sustainability compared to latrine use, due in part to lower emotional investment and weaker social norms. In Malawi, Tilley et al. (2014) reported similar results in peri-urban Lilongwe, where hand washing behavior deteriorated rapidly once external support was withdrawn. These findings support the view that sustained behavior change in hygiene requires more than triggering it necessitates continuous reinforcement through community, institutional, and infrastructural support. These studies shown that high readiness scores are essential for progressing to action and maintenance stages (Rosenstock et al., 1988; White et al., 2020). Therefore, the lower readiness for hygiene behaviors points to a need for re-triggering or reinforcement interventions focusing specifically on the perceived importance and practicality of hand washing.

4.4 Committed Action to Change Behaviour

The Commitment to (Fcores showed a concerning pattern. While the community was mostly in the Action stage for both latrine construction (M = 4.308, SD = 0.003) and HWF construction (M = 4.349, SD = 0.076), the corresponding Committed to Action mean scores were very low: 0.027 for latrine construction and 0.017 for HWF construction. For latrine use, a slightly positive commitment score was found (0.113), whereas HWWS had a negative score (-0.055), suggesting a loss of motivation and intention to act has not yet formed or is regressing (Table 3)

The small margins between Action and Contemplation across all behaviors suggest weak commitment, meaning that although awareness may be present, actual internal motivation to change and sustain behavior is insufficient. This finding reflects the concept of "behavioral inertia" discussed by Rogers et al. (2018), where individuals acknowledge the value of a behavior but lack sufficient cues or support to act. Simwanza et al. (2021) similarly found low commitment levels in Phalombe District, in Malawi especially in hygiene behaviors, despite high awareness due to CLTS interventions. The authors concluded that motivational reinforcement and continuous follow-up are necessary to convert contemplation into sustained action. Study's findings by Sheeran & Webb of 2016 emphasize the need to bridge the "intention-action gap," a concept well-established in health psychology literature particularly through strategies that build intrinsic motivation and provide enabling environments for behavior change.

This decoupling of action and commitment is particularly troubling for HWWS, where regression is visible. It supports literature indicating that hygiene behavior is more likely to slip without sustained motivation, reminders, or enabling environments (Hulland et al., 2015). Even among those who construct facilities, continued use and behavior reinforcement are not guaranteed unless intrinsic commitment is fostered.

Table 3: University of Rhode Island Change Assessment Change Scores

	Stage	Mean Scores			
		Latrine Construction	HWF Construction	Latrine Usage	HWWS after Latrine Usage
1	Stage of Change (SoC)Scores				
	Pre-contemplation (PC)	2.762	2.591	2.421	2.308
	Contemplation (C)	4.281	4.332	4.222	3.171
	Action (A)	4.308	4.349	4.335	3.116
	Maintenance (M)	3.513	3.564	3.413	2.681
	Mean Score	3.716	3.709	3.598	2.819
	SoC = Highest Mean Score	4.308 (A)	4.349 (A)	4.335 (A)	3.171(C)
2	Readiness to Change Score (C + A + M – PC = Readiness) ≤ 8 = P (Least Ready) 8 -11 = C (Middle) 11-14 = M (Most ready)	9.340	9.665	9.549	6.660
3	Committed Action (CA) Score (A-C = CA)	0.027	0.017	0.113	-0.055

A = Action, C = Contemplation, M = Maintenance, PC = Pre-Contemplation

5. Conclusion and Recommendations

5.1 Conclusion

The findings reveal a gradient of behavioral adoption and sustainability in the studied communities in Balaka. Latrine construction and use demonstrated high levels of action, readiness, and commitment, showing that these behaviors are entrenched and likely to be sustained. In contrast, HWF construction, while moderately adopted, suffers from incomplete integration into daily routines. The weakest link is hand washing with soap after defecation, which remains at the contemplation stage for most community members, with low readiness and commitment. These findings suggest that while sanitation coverage may remain high, hygiene behavior sustainability remains fragile, posing a risk of disease resurgence and ODF status backsliding if not addressed systematically. The TTM framework, enhanced by URICA, provides a useful structure to gauge not only whether behaviors have changed, but whether the change is likely to persist .These findings highlight a gap between intention and action and underscore the importance of continued support and tailored interventions following ODF certification.

5.2 Recommendations

The study makes the following recommendations:

1. **Bridge the Intention–Action Gap and Readiness and Commitment Gaps**
   Behavior change interventions should be designed to help the community move from mere intention to actual practice, move beyond intention and toward committed action particularly in relation to hand washing with soap after using a latrine and consistent latrine use. Simple practical tools, reminders, and community-based accountability mechanisms can support this transition.

2. **Focus on Behavior, Not Just Infrastructure**
   Programs should shift their focus from simply ensuring the availability of latrines and hand washing facilities to promoting their consistent use. Hygiene promotion efforts must include behavior change messaging and reinforcement, rather than ending at the provision of infrastructure.

3. **Integrate CLTS Improvements**
   The existing Community-Led Total Sanitation approach should be refined based on these findings to include sustained community engagement, post-ODF monitoring, and continuous reinforcement of sanitation and hygiene behaviors long after certification is achieved.

5.3 Recommendations for further research

1. **Explore Barriers to Commitment** Future research should investigate why community members in Balaka, despite expressing awareness and intention, remain uncommitted to sustained sanitation practices. This includes exploring socio-cultural beliefs, financial constraints, and environmental challenges.
2. **Longitudinal Behavior Tracking** Long-term research should be conducted to track how the community's stage of change and commitment evolve over time. This will provide insights into when and how interventions should be adjusted to sustain progress and address backsliding.

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