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Household-level sanitation in Ethiopia and its influencing factors: a systematic review

Josef Novotný* and Biruk Getachew Mamo

Abstract

Background: Within the past two decades, Ethiopia has achieved one of the fastest reductions of open defecation worldwide. This change can be attributed to the implementation of a national sanitation strategy that focused on facilitating community demand for latrine adoption and use of basic self-constructed latrines but less on other preconditions of hygienic sanitation. Recognition of sanitation by policymakers also catalyzed primary research in this area. As such, the synthesis of the available evidence is both warranted and possible. In this article, we thus decided to assess available primary evidence on the household-level sanitation in Ethiopia and its influencing factors.

Methods: We searched primary studies that present findings on the role of factors influencing household-level sanitation outcomes in Ethiopia. We typologically classified sanitation outcomes analyzed in identified literature and computed pooled estimates for the most prevalent ones (measures of latrine availability and use). We characterized thematic types (themes and sub-themes) of influential sanitation drivers and used network analysis to examine the relational patterns between sanitation outcomes and their influencing factors.

Findings: We identified 37 studies that met our inclusion criteria—all but one published after 2009. The general latrine coverage pooled across 23 studies was 70% (95% CI: 62–77%), the share of improved latrines pooled across 15 studies was 55% (95% CI: 41–68%), and latrine use pooled across 22 studies was 72% (95% CI: 64–79%). Between-study heterogeneity was high, and no time trends were identified. The identified sanitation outcomes were classified into eight types and factors reported to influence these outcomes were classified into 11 broader themes and 43 more specific sub-themes. Factors around the quality of latrines represented the most frequent sub-theme of consequential drivers. We found that the available research focused predominantly on outcomes concerning the initial adoption and use of basic latrines, emulating the main focus of national sanitation strategy. By contrast, research on drivers of the sustainability of sanitation change and, in particular, on the upgrading of latrines, has been rare despite its urgency. There is a high need to redirect the focus of sanitation research in Ethiopia towards understanding these factors on both the demand and supply side.

Keywords: Environmental health, Ethiopia, Latrine adoption, Sanitation, Systematic review

Introduction

A global sanitation target incorporated into the Sustainable Development Goals (SDGs) aims to achieve access to adequate and equitable sanitation for all and end open

defecation (OD) by 2030 [1]. Despite improvements, it is unlikely that the SDGs sanitation target will be met [2]. There are pronounced inequalities in sanitation conditions across the world with the worst situation being in Sub-Saharan Africa. There, only one fifth of the population had access to safely managed sanitation facilities in 2020 [3].

Along with the inclusion into the SDGs, sanitation has been recognized among development and public

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health priorities in many low- and middle-income countries which have implemented large-scale sanitation programs. Concurrently, sanitation research has also gained momentum. The volume of primary evidence has increased as several systematic reviews were recently published that primarily assessed the effects of sanitation interventions [4–9].

Although informative, it is argued that the focus on interventions' effectiveness may not be enough to fully understand how complex context-sensitive sanitation conditions evolve [10–13]. Thus far, factors that are potentially important for sanitation outcomes have been viewed through conceptual frameworks such as the IBM-WASH [14] or the RANAS model [15]. They provide comprehensive classifications of theoretically and empirically justified factors and/or mechanisms that are important to consider as potentially important WASH drivers. However, they do not systematically quantify the occurrence of specific consequential drivers (or their thematic types) based on available empirical literature.

With an estimated population of more than 115 million, Ethiopia plays a major role concerning both regional and global trends in sanitation indicators. Between 2000 and 2020, the country recorded the most notable reduction of OD worldwide from 79% to 17% [3, 16]. This pronounced change can largely be attributed to efforts coordinated under the national sanitation strategy [17–19] implemented through the country-wide health extension program [20, 21]. The sanitation strategy adapted Community-Led Total Sanitation (CLTS) as a central approach, so Ethiopia was among the first countries to implement it at scale since 2006 [22]. However, this reduction of OD was achieved predominantly by ensuring access to sanitation facilities which often fail to meet basic hygienic standards. Only 7% of them were classified as safely managed in 2020 [3]. This brings into question the presumed public health effects of toilet adoption in Ethiopia. The low quality and durability of latrines is also a major risk for the return of OD [23]. More recent sanitation policies have recognized these challenges [24, 25], yet their results remain to be seen. Household-level sanitation continues to be a priority of Ethiopian public policy, and the present attempt to synthesize available evidence on its drivers is warranted.

The general aim of our study is to assess published research that analyzes the role of drivers of household-level sanitation outcomes under similar geographical and institutional settings. Therefore, the focus of our study is on a single country, Ethiopia. We conducted systematic search of primary literature that reported research findings on how various factors influence sanitation outcomes at the household level in Ethiopia. Our more specific objectives are (1) to characterize this literature,

(2) to examine the evidence concerning the major outcomes analyzed in these studies, (3) to identify factors that influence these outcomes, and (4) to analyze the relationships between the factors and outcomes.

Methods

Focusing on factors influencing sanitation outcomes, this study represents a specific type of systematic review. It is not based on any registered protocol, but a global review with similar objectives as this study [26] served as a template, particularly with respect to data extraction and presentation.

Study eligibility and search

Primary studies that analyzed household-level sanitation and its influencing factors in Ethiopia were considered for this review. Importantly, only those studies which analyzed sanitation measures as main study outcomes and provided information on factors of these sanitation-related outcomes were considered. We thus excluded studies that employed sanitation measures solely to examine other outcomes (such as the environmental measures of exposures to pathogens or epidemiological measures of health conditions) if they made no attempts to explain the observed sanitation conditions. We applied no exclusion criteria regarding the type of considered factors. It means that we considered the contextual, psychosocial as well as technology factors in terms of the IBM-WASH classification of factors [14].

No restrictions were applied with respect to the study type and research design. We also searched for studies that examined household-level sanitation conditions in both rural and urban settings and in both interventional and non-interventional settings. We searched for primary research studies published between 2000 and 2021. As previously mentioned, OD was reduced substantially during this period, and the nationwide health extension program has been implemented since 2003 which has been important for addressing sanitation in Ethiopia. Together with the increased emphasis on sanitation in the global strategic frameworks such as SDGs, research on sanitation in Ethiopia increased significantly after 2000 which was also confirmed by our preliminary literature search.

The initial searches for this review were done between February and March 2020 and addressed both literature in peer-reviewed journals and grey literature written in English or Amharic. Additional searches for more recently published studies were conducted at the beginning of October 2021 but focused only on the Web of Science and Scopus databases (compromise between practical constraints and usefulness of our previous searches). The following databases (or search engines)

were searched in our initial searches: PubMed, Web of Science, Scopus, Google Scholar, Campbell Collaboration Library, Cochrane Collaboration Library, International Initiative for Impact Evaluation evidence portal, and Addis Ababa University digital library. In addition, the following organizations' website resources were searched: Africa Development Bank: Water and Sanitation Program, World Bank: Water and Sanitation Program, World Health Organization, United Nations Children's Fund, International Water and Sanitation Center, Plan International, USAID, UK Department for International Development, One WASH program, and Ethiopian Ministry of Health. The following search string was used where applicable: "(latrine OR toilet OR privy OR child feces OR open defecation OR CLTS OR sanitation) AND Ethiopia." When not applicable, individual keywords or their combinations were searched. In addition, a few potentially relevant papers were also found by screening references in previously identified studies (done for 183 studies that were assessed for eligibility).

The initial searches were conducted by one of the authors (BGM) and monitored by the second reviewer (JN) who was involved in the additional searches for more recent studies. Ambiguities that emerged during the search and selection phase were discussed and sorted out by both scholars. When the initial searches were completed, we eliminated duplicate records and excluded irrelevant studies based on the assessment of titles and abstracts (mostly done by BGM). The full texts of those studies that were found to be potentially relevant were then assessed based on whether they met our inclusion criteria or not (both authors participated in this).

Data extraction and analysis

The following four general types of data were extracted into predefined extraction forms from studies in our sample. First, characteristics of individual studies such as bibliographic information, geographical focus, design, sample size, and method of data collection were recorded. Second, we extracted information on specific sanitation outcomes that were examined in individual studies and the methodology of their measurement. Third, we extracted information on individual factors influencing sanitation outcomes. More specifically, for relationships that were reported as statistically significant in quantitative studies (p -value less than 0.05) or consequential in qualitative studies we recorded factor-outcome relationships and specific details such as their direction, effects size and confidence intervals (if quantitative). We grouped the factors into themes and then broke down into sub-themes. We assessed the representation of these themes and sub-themes by counting the frequency of occurrence of significant/consequential

factors pertinent to these themes and sub-themes. The extraction was firstly conducted by one reviewer (BGM) and then checked in detail by a second reviewer (JN).

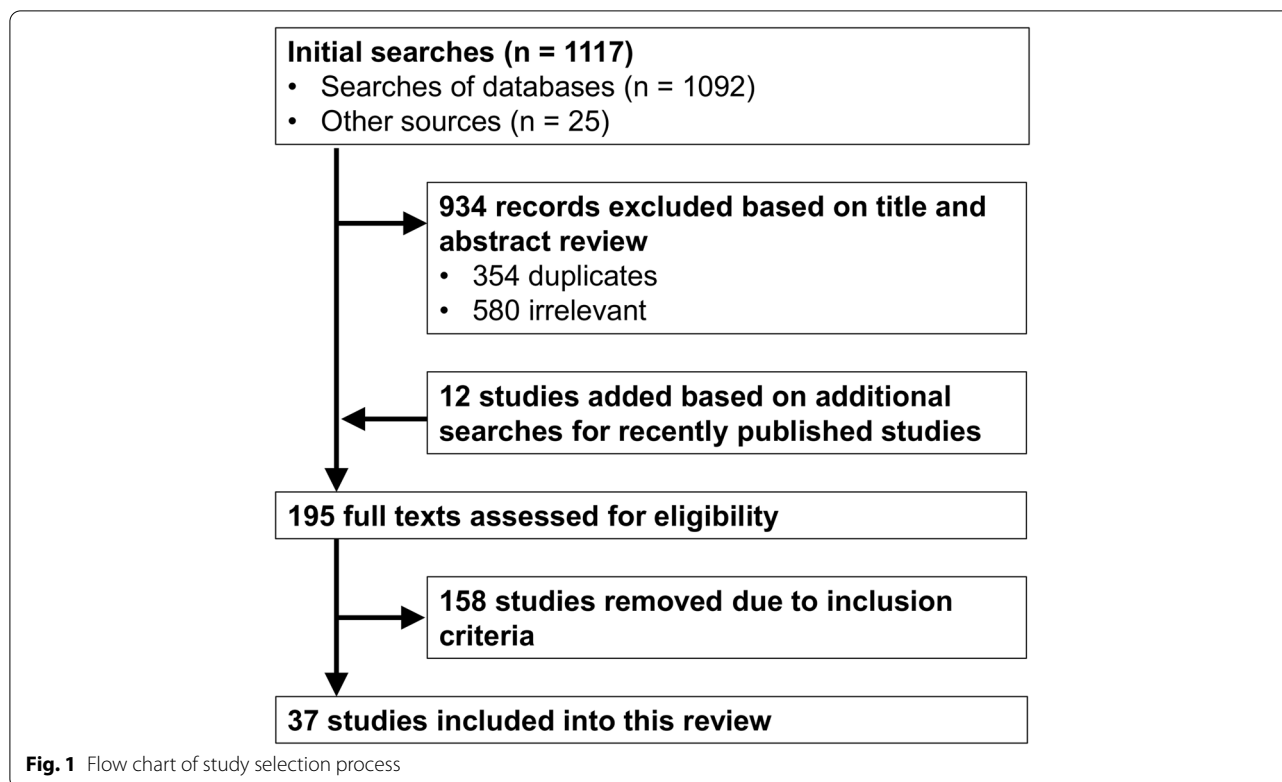
The data analysis consisted of the following steps which also correspond to the presentation of findings in the **Results** section below. First, we considered the feasibility of quantitative summarization of identified outcomes and decided to calculate pooled estimates for three measures of the two most prevalent outcomes in terms of latrine coverage and use. Because of the substantial between-study heterogeneity, we calculated pooled estimates (their confidence intervals) using random-effect models as in [27]. Second, we typologically classified and descriptively characterized identified sanitation outcomes. Third, we thematically classified the identified consequential drivers of these outcomes at two hierarchical levels into themes and sub-themes and assessed their representation. Fourth, we discussed relationships between factors and outcomes with the emphasis on their underlying mechanisms. For example, we inspected whether individual factor-outcome relationships classified into the same themes and sub-themes have identical and expected directions. If not, we looked into the respective studies and confronted their explanations of mechanisms operating beyond these relationships. In this fourth step, we also examined the pattern of these relationships by constructing a network visualization that depicts how particular sub-themes of influential factors interlink different types of sanitation outcomes. The network was constructed using the Cytoscape software [28] based on the edge-weighted spring embedded algorithm with the size of sub-themes considered as weights.

All data generated or analyzed during this study are included in this published article [and its supplementary information files].

Results

Final sample of studies

After removing duplicate and irrelevant records obtained through our searches, we examined the full texts of 195 studies—37 of which met our inclusion criteria (Fig. 1). Several studies which collected data on household-level sanitation in Ethiopia were excluded due to the eligibility criteria. They mostly analyzed sanitation measures as explanatory variables for examining other outcomes but did not report on factors influencing these sanitation measures. Some examples are [29–31]. Studies that were included in our sample are listed in Supplementary Table S1 with their descriptive characteristics. Although we searched for literature published since 2000, the earliest study that we identified was [32] based on data collected in 2004. The majority of studies in our sample were published in recent years (70% after 2015).



Four studies provided comparisons of samples collected in more than one regional state, while the remaining 33 studies used data from a single region. Most of the studies were conducted in the following four regions: Amhara (16 studies), Southern Nations Nationalities and Peoples' Region (SNNPR) (11), Tigray (10), and Oromia (9). Only three studies contained data collected in additional regions [33–35]. This can be partially explained by differences in the size of regional states, but also by their centrality (both locational and political) and their history with sanitation interventions (the first campaign for universal sanitation implemented in SNNPR since 2003 [36]). Only four studies focused on urban or semi-urban areas [35, 37–39]. Although there are different challenges posed by urban and rural sanitation, we decided to keep these four studies in the sample because they were comparable to other research regarding technology and observed sanitation patterns (decentralized sanitation, simple pit latrines, either with or without slab platforms). We searched for research works written in English and Amharic as mentioned in the [Methods](#) section. However, we did not identify any study in Amharic that would qualify for the full-texts assessment of eligibility criteria (as in Fig. 1) and only papers written in English qualified for the sample. Except for one organizational report [34], all studies were journal articles. Regarding the design, studies based on cross-sectional data analyzed

quantitatively clearly dominate the sample (33 studies). A few of them (5) collected qualitative data simultaneously, while two other studies solely utilized qualitative data [40, 41]. Only three studies collected data that allowed to directly examine changes in sanitation outcomes over time [42–44] and, exceptionally, the drivers influencing these changes in sanitation outcomes ([44] represents a sole example of such findings).

The majority of studies in our sample (24 of 37) did not focus on any specific intervention, though the implementation of a national sanitation policy was commonly acknowledged as an important motivation and implicit contextual feature. The remaining research included in our sample was more or less explicitly designed to analyze specific types of sanitation interventions such as the WASH components of the trachoma control program implemented in the 2000s [32, 42, 45] or a specific locally implemented promotion of composting “arborloo” latrines [46] or various types of Ethiopian adaptations of CLTS (examined in nine studies).

Quantitative characterization of most frequent sanitation outcomes

Although multiple different types of sanitation outcomes were identified, measures of latrine use and availability were the most frequently represented (see next section). We decided to attempt the quantitative

summarization of results on three measures related to these most frequent outcomes across studies (Table 1). More specifically, we were able to extract information on latrine availability (coverage) from 23 studies, on the improved latrine availability from 15 studies, and on latrine use from 22 studies (Supplementary Table S2). As shown in Table 1, on average around 70% of households had access to a latrine, 72% of latrine-owning households used them, and 55% of latrines were improved latrines, meaning that they contained at least basic solid slabs assumed to separate excreta from human contact. Figures extracted from individual studies were determined based on data collected between 2004 and 2019 in different parts of Ethiopia. Nevertheless, we did not identify any notable time trends or geographic variations regarding the pooled measures of latrine use and prevalence of improved latrines. For latrine availability, 10 studies based on surveys conducted between 2013 and 2015 reported generally higher levels of latrine availability compared to both earlier and more recent surveys, but we found that this was attributable to geographical variations. Studies conducted in South-Western Ethiopia (Oromia and particularly SNNPR) revealed higher latrine availability rates (with an average of 77%, based on 13 studies) compared to those from the North-West (Tigray and Amhara; 12 studies with an average of 58%).

However, the pooled averages should be interpreted with caution because of considerable between-study heterogeneity. The latter is obvious from the wide ranges of values extracted from individual studies, wide confidence intervals (CI), and high I^2 statistics (above 90% for all three outcomes). The heterogeneity stems from variations in study designs and, perhaps even more notably, from contextual differences between studies, including pronounced geographical variations in sanitation conditions across Ethiopia. Moreover, in addition to the between-study heterogeneity, some of the studies also documented considerable within-study heterogeneity in terms of differences in the levels of analyzed outcomes between different sites or regions within their samples [43, 47].

Classification of sanitation outcomes

We classified specific outcomes that were examined in 37 studies in our sample into the eight types (Table 2). The frequencies of occurrence of these types were assessed based on the number of studies that analyzed them (second column of Table 2) and also based on the number of significant/consequential relationships between identified factors and these outcomes (third column)—as in Supplementary Table S3. Although directly related, the identified outcome types refer to typologically distinct aspects of sanitation conditions or changes in these conditions. The most frequent type of outcome was latrine use analyzed in 24 studies, followed by latrine availability (11 studies), OD (10), and latrine adoption (10). Latrine adoption predetermines latrine availability and, intuitively, both these outcomes are inversely related to OD. However, we realized that the set of studies that examined latrine availability largely differed from the set of studies that analyzed latrine adoption and open defecation. Overall, only three studies reported on drivers of all these four interrelated types of outcomes simultaneously [33, 36, 40].

Studies that reported on factors influencing latrine availability and adoption were always concerned with access to private latrines but differed in the definition of sanitation facilities (e.g., whether the focus was on the presence of any, solely functional, or improved latrines). Latrine availability represents a necessary but not sufficient condition for latrine use. Nevertheless, several studies in our sample reported on the drivers of latrine use but not on those influencing latrine availability, including nine articles that purposely analyzed latrine use among solely latrine-owning households.

Other types of outcomes shown in Table 2 capture specific aspects around household-level sanitation such as the sustainability of latrine adoption, satisfaction with latrine use, or quality improvement of sanitation facilities. In addition, one study focused on the composite score of sanitation safety based on multiple characteristics of household-level sanitation situations [48]. Most of the identified types of sanitation outcomes can be classified by considering their position

Table 1 Pooled estimates of basic indicators of latrine coverage and use

	Latrine availability (any latrine)	Improved latrines ^a of all latrines	Latrine use among latrine-owning households
Number of studies	23	15	22
Households covered altogether	19810	11793 (latrine-owning households)	13742 (latrine-owning households)
Range	0.36–0.98	0.16–0.93	0.47–0.97
Pooled average (unweighted)	0.70	0.55	0.72
95% CI for pooled average	0.62–0.77	0.41–0.68	0.64–0.79

^a Improved latrines are defined as latrines with solid slab platforms

Table 2 Identified types of sanitation outcomes

Broader types of outcomes	Nm. of studies	Nm. of observations ^a	Specification of outcomes as examined in individual studies
Latrine use	25	126	Latrine use; consistent latrine use by family members; latrine utilization
Latrine availability	11	43	Latrine availability, latrine ownership, availability of improved latrine
Open defecation (OD)	10	41	OD; reasons for not constructing latrine; reasons for not using latrine; perceived disadvantages of OD
Latrine adoption	10	55	Latrine adoption (generally); latrine construction; reasons for constructing latrine; adoption of arborloo latrine
Sustainability of latrine adoption	8	42	Sustainability of latrine use and latrine quality (longitudinal focus); reasons for abandoning latrine use; re-construction of latrines and reasons thereof; sustained use of arborloo latrines
Satisfaction with latrine use	5	18	Perceived advantages/benefits of latrine and its use; satisfaction with latrine use; reasons for dissatisfaction with latrine
Latrine quality improvement	3	6	Improvement of latrine; Intention to improve latrine; reasons for (not) improving latrine
Sanitation safety	1	5	Composite score based on 11 characteristics of availability, quality, and use of latrines

^a Number of observations (or links) refers to the number of identified significant/consequential relationships between specific factors and sanitation outcomes as examined in the “[Relationships between factors and outcomes](#)” section

in the sanitation ladder in terms of the processual chain towards a safer sanitation environment with the following sequence: OD → latrine adoption → latrine availability → latrine use → satisfaction with latrine use → latrine quality improvement → sustainability of latrine adoption. From this perspective, Table 2 documents that available research on household-level sanitation in Ethiopia has disproportionately focused on the initial parts of the process, while studies focusing on the drivers of sustainability of latrine use and quality improvements are comparatively less represented.

We further inspected how latrine use as the most represented outcome was measured in the analyzed papers. The majority of studies measured latrine use based on self-reported information about sanitation behavior obtained from respondents in interviews (19 of 25 studies focused on this outcome). We assume that at least some of them validated information about self-reported behavior by direct observation of respondents’ sanitation facilities, but only one of them [43] explicitly mentioned this in the methodology description. Four studies solely considered observations of the signs of latrine use without relying on self-reported information about sanitation behavior [32, 39, 47, 49] and two studies combined information from interviews with the observations of latrines [50, 51]. In general, however, the measurement of latrine use was poorly described, and in a few cases, the definitions of latrine use provided in the methodology descriptions

diverged from what was actually reported in the results [37, 52].

Typology of influencing factors

The analysis of 37 studies included in this review yielded 336 links between factors influencing outcomes described above (Supplementary Table S3). These are factors that were reported to be the statistically significant correlates of household-level sanitation outcomes in the analyzed quantitative studies or consequential drivers in the examined qualitative studies. We classified these factors at two levels. First, we followed the typology proposed by [26] and classified the identified factors into 11 broader themes. Second, factors within each theme were further divided into more specific sub-themes (43 in total). Both levels of classification are presented in Table 3. Socioeconomic factors were identified in the highest number of studies (in 26 of 37), while factors related to sanitation infrastructure were most frequently reported (16% of 336 identified links). In addition to these two themes, demographic characteristics were also reported in more than half of the analyzed studies as correlates of sanitation outcomes and factors relating to privacy, safety, and/or convenience of sanitation practices accounted for more than 10% of identified links.

Of the more specific sub-themes, factors related to the quality of latrines and institutional support were, by far, the most frequently represented, accounting for 10% and 8% of the identified links, respectively. We acknowledged considerable heterogeneity of measures

Table 3 Typology of identified consequential factors (ordered by the number of studies that reported presented themes and sub-themes of factors)

Broader thematic types of factors (<i>S</i> = number of studies; <i>N</i> = number of occurrences)	More specific sub-themes of factors (number of occurrences)
Socioeconomic factors (<i>S</i> = 26; <i>N</i> = 44)	Income or wealth (15); general education (11); cost of toilet or its perception (9); agricultural occupation (6); govt employee (3)
Sanitation infrastructure, maintenance, supply, access to materials or manpower (<i>S</i> = 24; <i>N</i> = 54)	Acceptable quality of latrine (32); availability of material (7); lack of (skilled) manpower (7); need of latrine maintenance (4); unavailability or poor quality of public latrines (4)
Demographic characteristics (<i>S</i> = 21; <i>N</i> = 36)	Household size (12); children in family (11); female head of household (7); age (4); presence of women (2)
Health and/or cleanliness (<i>S</i> = 18; <i>N</i> = 36)	Health-related expectations (14); latrine cleanliness (11); cleanliness of environment (7); attract flies (3); experienced health problems (1)
Spatial and environmental factors (<i>S</i> = 17; <i>N</i> = 31)	Location (centrality, accessibility etc.) (6); lack of space for latrine construction (6); soil, bedrock, terrain suitable for latrine (5); distance of latrine from house (4); climate constraints (floods, rains etc.) (4); access and utilization of water (3); Enough space for OD (3)
Privacy, safety, convenience (<i>S</i> = 14; <i>N</i> = 38)	Safety (12); privacy (11); convenience (8); smell from latrine (2); smell from OD (4)
Institutional support and/or pressure (<i>S</i> = 11; <i>N</i> = 29)	Institutional support (26); institutional pressure, command, sanctions (3)
Social pressure, networks, and learning (<i>S</i> = 11; <i>N</i> = 30)	Social networks, social learning (14); social pressure (11); prestige, status (5)
Hygiene and sanitation knowledge, experience, habits (<i>S</i> = 8; <i>N</i> = 31)	Recognition of hygiene and sanitation advantages (14); experience with latrine (7); knowledge of CLTSH and its acceptance (6); feces as fertilizer (4)
Satisfied, other priorities (<i>S</i> = 4; <i>N</i> = 4)	Satisfied with current practice (4)
Cultural factors (bylaws, taboos etc.) (<i>S</i> = 2; <i>N</i> = 5)	Distinct gender-related cultural norms (3) and other cultural norms (2)
<i>S</i> _{TOTAL} = 37; <i>N</i> _{TOTAL} = 336	

used to characterize these most represented sub-themes of factors. For example, the following, directly observable parameters were used to measure latrine quality: availability, quality, and material of slab platforms; presence and condition of latrine superstructure; availability of handwash facilities and soaps; whether latrine looks maintained; the presence of doors; whether latrine was worn out; whether (ir)regular shape and structure of latrine; whether squat-hole covered; and easiness of latrine construction.

Similarly, several measures were used for capturing institutional support such as: whether sanitation-related information was received by respondents or their households from health workers and/or volunteers, frequency of supervision by health workers, whether representatives of households participated in organized mobilization activities, whether and how CLTS/CLTSH was implemented in the community, and whether health office/post is available. Unlike the measures of institutional support, the role of commands, pressures, or sanctions commonly used to induce sanitation change in Ethiopia has been considerably less studied.

We tried to compare the distribution of factors uncovered in this article for Ethiopia with those reported in the global review by [26]. We found that factors related to hygiene and sanitation knowledge, demographic characteristics, institutional support, and quality of sanitation

infrastructure were comparatively more represented in the present sample of studies focused on household-level sanitation in Ethiopia. The relative occurrences of the two most represented sub-themes of factors (acceptable quality of latrines and institutional support) were also considerably higher for our Ethiopian sample. By contrast, factors capturing privacy, safety, and/or convenience of sanitation practices was a relatively less represented type in our Ethiopian sample compared to the global set of studies analyzed in [26].

In addition to the main classification presented above, we also categorized factors into three general types proposed by the IBM-WASH model [14]. We found that according to the IBM-WASH model definitions 34% of factors identified in our review can be considered as contextual factors, 36% as psychosocial factors, and 30% as technology factors (last column in Supplementary Table S3). The share of the latter category was two times higher than in the global review by [26] in which technology drivers accounted for only 15% of all identified factors.

Relationships between factors and outcomes

As already indicated, we identified 336 links between specific factors and sanitation outcomes. Hereafter, these links are referred to as observations and they are listed in Supplementary Table S3 with their specifications. More than half of them (193) can be denoted as descriptive

findings established as either binary statistical associations or based on qualitative data. The remaining 143 (43%) observations were quantitatively determined using multivariate analytical techniques. They were extracted from 29 studies (of total 37), and in all cases, they were estimates obtained through multivariate regressions, mostly binary logistic regression models, with the effects measured mostly by the adjusted odds ratios. We abandoned an initial plan to quantify pooled effects for the most frequently represented types of observations as we realized that measures used in individual studies for capturing both factors and outcomes are very

heterogeneous, and the same holds for the specifications of the underlying regression models.

We thus adopted the approach used in [26] and examined the patterns of observations using network analysis (Fig. 2). In addition, Table 4 shows the frequency of identified observations between individual types of sanitation outcomes and themes of factors and Supplementary Tables S4, S5, and S6 provides additional tabular depictions of the distributions of identified relationships. The tables may be easier to read and useful for inspecting the role of specific themes and sub-themes of factors for specific types of sanitation outcomes. However, the network

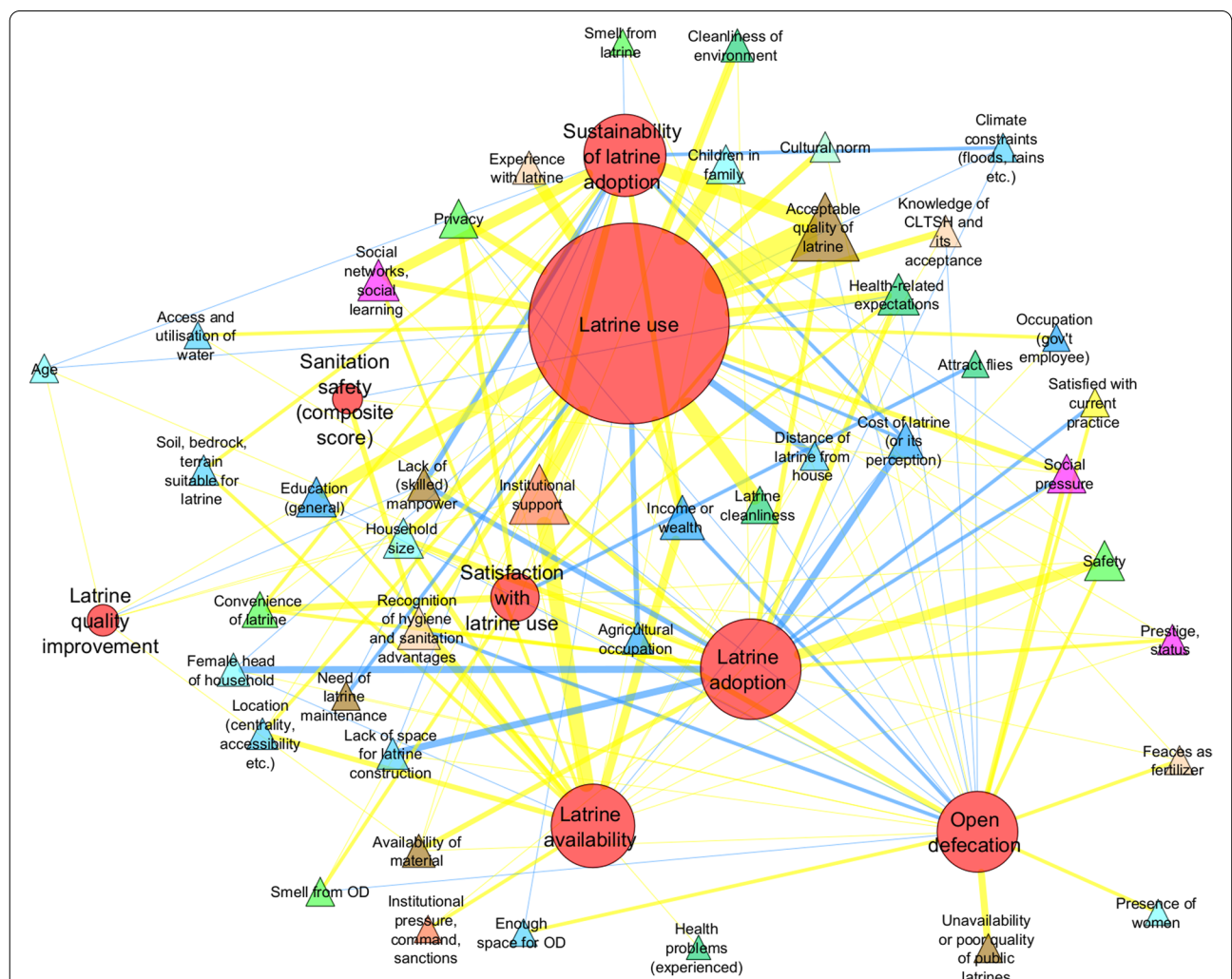


Fig. 2 Factors influencing sanitation outcomes in Ethiopia: a network visualization. The circular nodes depict 8 types of sanitation outcomes identified in this review. The triangle nodes show the 43 sub-themes of factors as in the right column of Table 3 and their colors distinguish their 11 broader themes as in the left column of Table 3. Edges represent identified relationships between factors and outcomes (i.e., observations). Positions of circular nodes and their mutual distances in the network indicate the extent to which their respective influencing factors overlap. Edge width and node size indicate differences in the frequency of observations. Yellow edges represent the prevalence of positive relationships and blue edges the prevalence of negative relationships. Network visualization was obtained based on the edge-weighted spring embedded algorithm. Positions of a few triangle nodes were slightly adjusted to prevent overlaps between the labels with no effect on the interpretation

Table 4 Number of identified relationships between factors aggregated by themes and sanitation outcomes aggregated by types

	Latrine adoption	Latrine availability	Latrine quality improvement	Latrine use	Open defecation	Sanitation safety (composite score)	Satisfaction with latrine use	Sustainability of latrine adoption	Total
Socioeconomic factors	4	9	1	18	6	0	0	6	44
Sanitation infrastructure, maintenance, supply, access to materials or manpower	9	0	2	21	7	0	2	13	54
Demographic characteristics	8	5	2	15	5	0	0	1	36
Health and/or cleanliness	4	2	0	19	3	1	5	0	34
Spatial and environmental factors	7	5	0	10	3	0	0	6	31
Privacy, safety, convenience	9	2	0	8	5	0	10	4	38
Institutional support and/or pressure	4	11	1	8	1	0	0	4	29
Social pressure, networks, and learning	5	4	0	9	3	1	1	7	30
Hygiene and sanitation knowledge, experience, habits	3	5	0	14	5	3	0	1	31
Satisfied, other priorities	2	0	0	0	2	0	0	0	4
Cultural factors (bylaws, taboos, etc.)	0	0	0	4	1	0	0	0	5
Total	55	43	6	126	41	5	18	42	336

plot in Fig. 2 provides an additional information about the aggregated patterns of identified relationships.

The pattern visualized in Fig. 2 is intuitively interpretable and, once again, can be related to the anticipated positions of particular outcomes in the sanitation ladder. The three types of outcomes capturing the initial part of sanitation change—i.e., OD, latrine adoption, and latrine availability—are located in the bottom part near one another. Latrine use, as the most represented type of outcome, occupies the upper part together with the sustainability of latrine adoption. It suggests that these two types of outcomes are influenced by a similar set of drivers. Improvement of latrine quality, as a less studied outcome type, is located away from other outcomes in the peripheral part of the network.

Positions of triangle nodes that denote factor sub-themes can be interpreted analogously. For example, the most represented sub-theme is the acceptable

quality of latrine (32 observations) located in the upper part of Fig. 2. It implies that parameters around the quality of latrines are relatively more consequential for latrine use and sustainability compared to open defecation and latrine availability (which are outcomes at the initial part of the sanitation ladder). This is less true for institutional support which is the second most frequent sub-theme of identified sanitation drivers (26 observations). This node occupies a more central position in the network (based on both visual inspection and measures of network centrality). It implies that institutional support is important for outcomes at various parts of the sanitation ladder.

Different colors of edges in Fig. 2 symbolize the prevalence of positive (yellow edges) or negative (blue edges) relationships concerning how factors from a sub-theme influence an outcome. The directions of relationships were homogeneous and expectable for the

majority of factor sub-themes. In some cases, however, factors within the same sub-theme affected sanitation outcomes contrarily. For example, age was negatively related to latrine use in [53] and to the sustainability of latrine adoption according to [40]. Both these studies pointed out differences between elderly households and the rest of the respondents. By contrast, [46] identified a positive relationship between age and latrine adoption, but this finding applies specifically to the age of female heads of households and the adoption of arbor-loo latrines. Another study [54] also reported a positive relationship between age and latrine quality improvement, while attributing it to differences between very young (less than 25 years) and elderly (over 70) households. The differential effects of age variables may be thus explained by distinct definitions of outcomes, age measures, but possibly also distinct mechanisms operating behind age variables. For example, [40] referred to the lack of capacity of elderly people for adopting toilets, while [54] mentioned higher motivation of elderly people to choose improved latrines because of their physical concerns. Similarly, differential effects were identified for the presence and age of children in households. Studies that considered the presence of children under five years of age reported negative effects of this variable on latrine use [51, 55] and its positive effect on OD [56]. This can be compared to results from a few studies which focused on the presence of school-aged children or children of any age and reported positive relationships with latrine availability and use [39, 47, 50–52, 57–59].

Several of the relationships identified in our sample of studies were related to women, while we distinguish three types of these findings. First, in several studies, female-headed households, which are prevalent across rural Ethiopia, revealed comparatively worse sanitation outcomes [36, 41, 45, 47]. These findings were mainly explained by referring to a generally disadvantageous situation of female-headed households and their lack of capacity to adopt toilets. Second, women were found to practice OD comparatively more than males, reportedly due to the perceived inconvenience and fear of latrine use [41, 47] and women's responsibility for small children [56]. Third, the literature revealed contradictory findings concerning the gendered socio-cultural norms around sanitation in Ethiopia. It was argued that being seen practicing OD is extremely shameful for women in rural Ethiopia so they are strongly influenced to use latrines consistently [40]. By contrast, [41] mentioned that the unacceptability to share the same latrine with in-laws dissuades married women from latrine use.

Socio-cultural norms partly overlap with other factors classified in Fig. 2 such as social pressure and social

networks and learning. In this respect, the identified evidence showed that peer pressures and learning can positively affect latrine adoption, availability, and use, but they can also have opposite effects and inhibit latrine use, adoption, and its sustainability [33, 47, 54, 60].

Convenience, comfort, and safety were reported among motivations for toilet adoption and use. At the same time, safety and inconveniences related to smell, uncleanliness, and the presence of flies were identified as factors discouraging people from consistent latrine use and bolstering OD. Once again, the generally low quality of latrines in rural Ethiopia plays a role in this.

Several studies revealed that expectations that the adoption and use of toilets will prevent diseases and reduce medical expenses are consequential drivers of the examined sanitation outcomes [33, 36, 40, 42, 61]. Actually experienced health conditions were nevertheless rarely reported as significant factors influencing sanitation outcomes. This may be because sanitation measures are mostly examined as determinants of human health without accounting for the reverse relationship. Another explanation may nevertheless be that the actual health impacts of toilet adoption in Ethiopia remain uncertain [62, 63].

Discussion

We identified 37 studies published between 2010 and 2021 that reported findings on how specific sanitation drivers influence various household-level sanitation outcomes in Ethiopia. Although it does not seem to be a particularly large sample for a priority topic in a country with a population of more than 110 million, it means a notable increase in the research focus on this topic. The majority of studies in our sample were published in recent years, mostly after 2015. This indicates an association between the research focus and political recognition and implementation of sanitation policy in Ethiopia.

Let us repeat that we excluded several studies that also collected data on household-level sanitation in Ethiopia but examined sanitation measures as correlates of other outcomes (such as health outcomes) without attempting to explain observed sanitation conditions. These excluded studies mostly address the more upstream parts of the anticipated chain between environmental sanitation and human well-being. Similarly, we observed that the majority of literature in our sample did not explicitly analyze any specific sanitation intervention, while some studies that focused on impacts of sanitation intervention did not meet eligibility criteria and were excluded. These excluded studies are typically designed to isolate causal impacts of sanitation measures and/or interventions (arguably it is the most common focus of sanitation research published in high ranked journals) without

paying much attention to factors influencing examined sanitation measures.

The literature considered for this review is different. Although mostly based on cross-sectional data and thus weaker in the power of establishing cause-and-effect relationships, it is no less important as it facilitates understanding of drivers and conditions that explain intermediate (sanitation) outcomes and operates alongside or independently of interventions (i.e., role of “other” factors). As argued elsewhere, engagement with the type of evidence analyzed in this review challenges a common assumption inherent to the logic of counterfactual (quasi) experimental studies that the other factors represent something that should primarily be controlled for.

Despite the high between-study heterogeneity, we tried to quantitatively summarize results on the three most represented measures of latrine use and availability. The pooled average across 23 studies indicated the general latrine coverage of 70% with the 95% CI of 62–77%. The estimated share of households having improved latrines (of all households with latrines) pooled across 15 studies was 55% with the 95% CI of 41–68%. If combined, these results would imply that only around 39% of Ethiopian households had access to latrines with solid slab platforms, which is considered to be a basic attribute of a hygienic sanitation facility. Our point estimates are not far from the national-level sanitation figures provided for Ethiopia by the WHO/UNICEF Joint Monitoring Programme, which reported the 2017 toilet coverage of 79% with the share improved latrines of 54% [16]. The year of data collection for studies considered for the calculation of the pooled averages spanned the period 2004–2018 and 2007–2019 for latrine coverage and share of improved latrines, respectively (the mean year was 2015 in both cases). We did not identify any notable time trends in the levels of the analyzed indicators. It may imply that there has been little change in the analyzed indicators in Ethiopia since around the year 2015, but the between-study contextual and methodological heterogeneity makes this observation only indicative at most.

In addition, the average of latrine use pooled across 22 studies was 72% with the 95% CI of 64–79%, implying that around 28% of latrine-owning households in Ethiopia do not properly use their sanitation facilities. This rate subsumes both unused and inconsistently used latrines so it may well be compatible with the 16% rate of behavioral slippage from toilet use to OD provided by a recent study by [23]. The measurement of latrine use is nevertheless known to be challenging [64, 65] and our inspection of approaches used for the measurement of this central aspect of sanitation behavior in Ethiopia suggested that the comparability and reliability of findings on this outcome may be problematic.

We identified multiple sanitation outcomes that were examined in the reviewed literature for their influencing factors and classified them into eight broader types. Latrine use was the most frequently analyzed type followed by latrine availability and OD. By contrast, outcomes describing more advanced steps in the processes of change towards a safe and equitable sanitation environment were considerably less often studied. It applies to outcomes such as the sustainability of latrine adoption and the quality/upgrading of latrines that have been rarely examined regarding their underlying drivers even though these issues currently represent the most pressing challenges of sanitation in Ethiopia. These findings mean that the focus of sanitation research in Ethiopia mirrors the nature of Ethiopian sanitation policies (biased towards the focus on the creation of demand for basic latrines) rather than anticipating their gaps and addressing future challenges.

We classified factors that were reported as consequential in the analyzed studies into 11 broader themes and, additionally, into 43 more specific sub-themes. Socio-economic factors were found in the highest number of studies. The majority of them referred to characteristics such as household income or wealth, education, or occupation. Their frequent associations with household-level sanitation inequalities in Ethiopia is not surprising but underscores the importance of structural change for sanitation in Ethiopia. It reminds us that hygienic and equitable sanitation can hardly be achieved through specific sanitation interventions alone, without general socioeconomic development as a key prerequisite.

The general socioeconomic factors have been interwoven with demographic and cultural sanitation drivers. Perhaps a prime example represents the repeatedly documented adverse sanitation conditions of female-headed households, which signifies how sanitation represents yet another dimension of gendered inequality in Ethiopia. Importantly, a few distinct interpretations of the effects of this factor on sanitation outcomes demonstrate that this aspect of sanitation inequality arises due to an interplay between socioeconomic factors (generally weaker socioeconomic situation of female-headed households, and a lack of capacity or skills to adopt latrines) and cultural factors (prevalence of polygamy, cultural norms around sanitation) and also traditional gender roles (including traditional responsibility of women for water-related issues).

In terms of the frequency of individual observations (relationships between specific factors and outcomes), the most widely reported consequential factors were those around the availability and quality of sanitation infrastructure including access to materials or manpower required for toilet construction

and maintenance. Its major sub-theme covers drivers directly related to the acceptable quality of latrines, which itself accounted for nearly 10% of all identified observations. By means of comparison with findings from a global review by [26], we also found that the factors associated with quality of sanitation infrastructure are particularly prominent in Ethiopia. We also took note of the focus on sanitation infrastructure concerned with the presence or cleanliness of the basic pit latrine's components (slab platform, particular parts of superstructure) or general user assessments (perceived acceptance and convenience). Other consequential aspects such as the supply of adequate infrastructure (including awareness of it at the household level) or alternative technology options and management and reuse of fecal waste (their acceptance at household level) have been rarely studied in Ethiopia.

The second most represented sub-theme of factors were drivers referred to as institutional support. They commonly assessed the presence and delivery of activities of health workers (or other agents involved in sanitation-related mobilization and supervision) such as the frequency of their visits to households or households' participation in trainings and awareness creation and behavior change campaigns. In studies that were focused on the examination of a specific intervention, these measures often captured the intervention's delivery. However, they were reported in several other non-interventional studies too. It indicates that differences between interventional and non-interventional studies are blurred due to the implementation of the national sanitation campaign. The latter also constrains the applicability of contra-factual evaluations that may be used for comparing the performance of distinct intervention modalities [43] rather than attributing the net effects of intervention. This remark once again challenges the conventional understanding of what is referred to as the hierarchy of evidence that still uncritically prioritizes experimental studies without adequately considering their limitations and usefulness for practice.

The importance of institutional support for the reduction of OD and initiation of latrine adoption in Ethiopia is clear. Still, we think that the analyzed literature too often conceived and portrayed the measured institutional support as a black box. There were rare exceptions, but generally little can be learned from the analyzed literature regarding the content and nature of institutional pressures. The examined cases of institutional support were mostly presented as positive and unproblematic. The focus on the presence and role of negative pressures and sanctions were considerably scarcer, though it is known that they have been used in Ethiopia. We believe that the prevalent mechanistic approach is unfortunate,

particularly considering that implementation fidelity is increasingly recognized as a key problem of the large-scale sanitation interventions in Ethiopia [63].

It may be beyond the scope of our review, but we believe that these comments have wider relevance for the available research on sanitation in Ethiopia. According to our reading of this literature, it tends to be heavily shaped towards the emphasis on routine data collection and descriptive characterization of empirical results. Attempts for a critical interpretation and discussion of findings that may explain sanitation conditions and discuss documented failures seem to be rare. One aspect of this is that the research is often presented as apolitical without an attempt to challenge authorities or touch upon the local politics and power relations involved in the implementation of interventions at the micro-level.

Another notable finding of this review is the confirmation of health-related expectations as consequential motivation for latrine adoption and use in Ethiopia. It was reported more often than non-health motivations such as convenience, privacy, and safety. The prevalent belief that latrine use is good for human health can be contrasted with the uncertain actual health benefits of sanitation change in Ethiopia [62, 63, 66, 67]. It means that there is a relatively good public awareness about the biological plausibility of toilet adoption. Likely, the national sanitation campaign and the community-level persuasion techniques that were used played a role in creating this awareness. However, it simultaneously focused on the adoption of basic sanitation so the conviction about health benefits of latrines coexists with the acceptance of their generally low hygienic standards. It implies that there may be an inadequate perception of what a hygienic toilet is. Indeed, a study from Amhara analyzed user preferences and uncovered that concrete slab platforms, which are considered as key components of hygienic pit latrines, were not preferred over dirt floors [68]. Unless the prevalent conception of hygienic toilets changes, health-related expectations will probably be not as effective for catalyzing the demand for upgrading sanitation facilities in Ethiopia as they have been for the initial adoption of basic latrines. Although other non-health motivations may be more influential, there has been very little research on the demand for latrine upgrading and its influencers in Ethiopia thus far.

Limitations

The inclusion criteria were designed by considering our primary objective to review evidence on factors influencing household-level sanitation outcomes. Pooled averages of latrine coverage and use presented above thus did not cover findings from excluded studies. We covered research evidence solely from studies that analyzed

sanitation outcomes at the household level. Studies that addressed sanitation in Ethiopia at other levels were not considered, though they may report findings on sanitation drivers which also impact household-level sanitation (e.g., ecological studies, policy analyses, implementation studies). The representation of outcomes, factors, and their relationships were assessed by counting their occurrences. Although we extracted information on the effect sizes (from quantitative studies), we did not use them for our synthesis due to the high between-study heterogeneity. In addition, we only extracted information on factors that were found significant but not on insignificant relationships. Almost all studies in our sample were observational studies that measured statistical associations and not cause-and-effect relationships. We tried to reflect specific qualitative explanations provided for the relationships in the analyzed studies. However, these interpretations of underlying mechanisms were sometimes ambiguous (as discussed above), speculative, and not always available.

Conclusion

This review assessed available research on the drivers of household-level sanitation outcomes in Ethiopia. The findings may help practitioners to understand what the key types of sanitation drivers are in the Ethiopian context and how they are related to distinct sanitation outcomes at the micro-level. They may also inform researchers and policymakers about the nature of available evidence, gaps in it, and priority directions. Despite the reduction of OD in Ethiopia, hygienic sanitation is rather the exception than the rule across the country. We argued that the focus of research mainly emulated the focus of the approach chosen for national sanitation strategy (CLTS) on initial latrine adoption and use. Key areas such as a demand for upgrading sanitation facilities and a variety of issues on the supply side have been almost ignored in both policy and research. We also call for a more critical approach to sanitation research in Ethiopia.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12889-022-13822-5>.

Additional file 1: Table S1. List of considered studies and their descriptive characteristics. **Table S2.** Extraction of measures of latrine coverage and use. **Table S3.** Links between types of outcomes and factors. **Table S4.** Number of identified relationships between factors (aggregated by THEMES) and sanitation outcomes (aggregated by TYPES). **Table S5.** Number of identified relationships between factors (aggregated by SUB-THEMES) and sanitation outcomes (aggregated by TYPES). **Table S6.** Sums of identified DIRECTIONAL relationships between factors (aggregated by SUB-THEMES) and sanitation outcomes (aggregated by TYPES).

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Authors' contributions

JN designed the study, participated in literature searches, participated in data extraction and analysis, and wrote the manuscript. BGM conducted literature searches, participated in the data extraction and analysis, and contributed to the manuscript preparation (writing). The author(s) read and approved the final manuscript.

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Availability of data and materials

Data are available as supplementary materials submitted together with the manuscript.

Declarations

Ethics approval and consent to participate

Not applicable (manuscript does not report primary data).

Consent for publication

Not applicable (no personal data are presented).

Competing interests

The authors declare no competing interests.

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Barriers for upgrading of latrines in rural Ethiopia: disentangling a sanitation socio-technical lock-in

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ABSTRACT

Ethiopia achieved the fastest reduction in open defaecation worldwide over the two past decades. However, it was through the use of predominantly non-durable, unhygienic latrines. It questions the presumed effects of latrine adoption on public health and heightens a risk of return to open defaecation. Resources invested into sanitation in Ethiopia may be wasted if upgrading to latrines is not facilitated. This paper aims to understand factors hindering the improvement of latrines in Southern Ethiopia based on the structured interviews and direct observations among 504 rural households supplemented by qualitative interviews with local representatives. We examine the quality and past improvements of latrines, revealed plans and attitudes regarding the improvements, willingness to pay for hygienic latrine components, costs perceptions and infrastructural barriers. We identified a socio-technical lock-in characterised by the sustained use of unhygienic latrines without recognisable shifts up the sanitation ladder. It has been cemented by the demand-oriented sanitation strategy, poverty and infrastructural constraints. People are generally satisfied with unhygienic latrines, being convinced that their use is good for health. The satisfaction curbs the demand for latrine upgrading. The demand for latrine upgrading is further reduced by poverty and material constraints, preventing local supply of hygienic sanitation components to develop. Our findings show that market approaches alone will not solve the problem. Provision of subsidised sanitation products is required together with a campaign that would disintegrate the widespread belief that the use of any latrine is good for human health.

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1. Introduction

Unhygienic sanitation results in a high health and socioeconomic burden, which is highly concentrated in low- and middle-income countries (Murray et al. 2020). A sanitation target to achieve access to adequate and equitable sanitation for all and to end open defaecation (OD) by 2030 has been included into SDGs (UN 2015) and large-scale sanitation interventions have been implemented in many countries. However, despite some progress, access to hygienic sanitation remains low and the SDG target is unlikely to be met (WHO 2020). Sanitation interventions have often focused primarily on the elimination of OD and initiation of toilet adoption without

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paying sufficient attention to adequate hygienic standards of sanitation facilities, and user needs and expectations. Available systematic reviews found only modest impacts of these interventions on toilet coverage and use (Garn et al. 2017), their low effects on reduction of faecal exposures along disease transmission pathways (Sclar et al. 2016), and uncertain benefits for human health (Freeman et al. 2017).

The problem of low-quality sanitation facilities has been particularly pronounced in Ethiopia. Ethiopia achieved the worldwide fastest reduction of OD from 79% to 22% between 2000 and 2017 (UNICEF/WHO 2019), largely due to the implementation of the National Sanitation Strategy (MoH 2005; 2011; 2013; 2015). However, at the end of this period, 82% of the latrines in Ethiopia were unimproved, failing to prevent direct contact with faeces, and only minor share of latrines (7% for rural Ethiopia) were safely managed sanitation facilities (UNICEF/WHO 2019). This pattern has not changed in more recent years (UNICEF/WHO 2021). It questions presumed effects of the attained sanitation change on public health (Aragie et al. 2022) and pose a major risk of return to OD practice (Abebe and Tucho 2020; Crocker, Saywell, and Bartram 2017; Freeman et al. 2017; Novotný, Hasman, and Lepič 2018; UNICEF 2016; Novotný and Mamo 2022).

A central approach chosen for the Ethiopian National Sanitation Strategy introduced in 2011 was the Community-Led Total Sanitation and Hygiene – CLTSH (MoH 2011), an Ethiopian adaptation of the Community-Led Total Sanitation approach. This approach has been widely used across the world, but its applications have been increasingly contested as it primarily focuses on the rapid elimination of OD using behavioural change techniques and less on the quality of toilets (Ficek and Novotný 2019; Venkataramanan et al. 2018). The Ethiopian CLTSH promoted the construction of simple low-cost dry pit latrines from local materials (Crocker, Fuente, and Bartram 2021; Crocker, Saywell, and Bartram 2017) making the approach reflective to the budgetary and infrastructural constraints. Supply of affordable hygienic sanitation infrastructure has been side-lined (Alemu et al. 2017; UNICEF 2016). Newer strategic documents announced changes to address these weaknesses (FDRE 2019a, 2019b), but their results remain to be seen. Recent political and security upheavals in Ethiopia are likely to further aggravate the public health system in the country by prioritising more acute problems over the long-run efforts to improve environmental health (e.g. Gesesew et al. 2021).

To this end, understanding the barriers for the improvement of sanitation facilities represents a critical issue in Ethiopia. There has been surprisingly little research in this direction because previous research focused predominantly on the initial adoption of latrines (Novotný and Mamo 2022). A rare study on the sustainability of sanitation facilities in selected Ethiopian regions by Crocker, Saywell, and Bartram (2017) reported a significant 45% rate of collapsed but rebuilt latrines over the period of two years. However, the authors found no significant changes in generally low technical standards of these rebuilt latrines compared to the original ones. In a recent study from Oromia, Chambers, Carrico, and Cook (2021) reported that only 57% of households reconstructed their latrines that were previously damaged by floods, while only 30% of these reconstructed facilities were improved latrines. An assumption that households would gradually move up the sanitation ladder after the adoption of rudimentary latrines (e.g. Giné-Garriga et al. 2017) doesn't seem to hold in Ethiopia. Research conducted in Southern Ethiopia identified a widespread satisfaction with low-quality latrines attributable to social and political pressures and constructed perception that use of any latrine is good for health (Novotný, Kolomazníková, and Humňalová 2017; Novotný, Humňalová, and Kolomazníková 2018). This can be related to the findings of low user preferences for the adoption of concrete slab platforms compared to other latrines' components, suggesting that the prevalent conception of what a hygienic latrine is may be inadequate (Goddard et al. 2018).

Motivated by the challenges and the research gap outlined above, the *general aim of this study* is to examine factors inhibiting the upgrading of latrines in rural Ethiopia. We draw on a cross-sectional survey among 504 rural households conducted in Wolaita, Southern Ethiopia, in 2020 supplemented by qualitative interviews with local representatives and officials. We approached this study with an intention to comprehend the topic in its context and by considering the interplay of institutional,

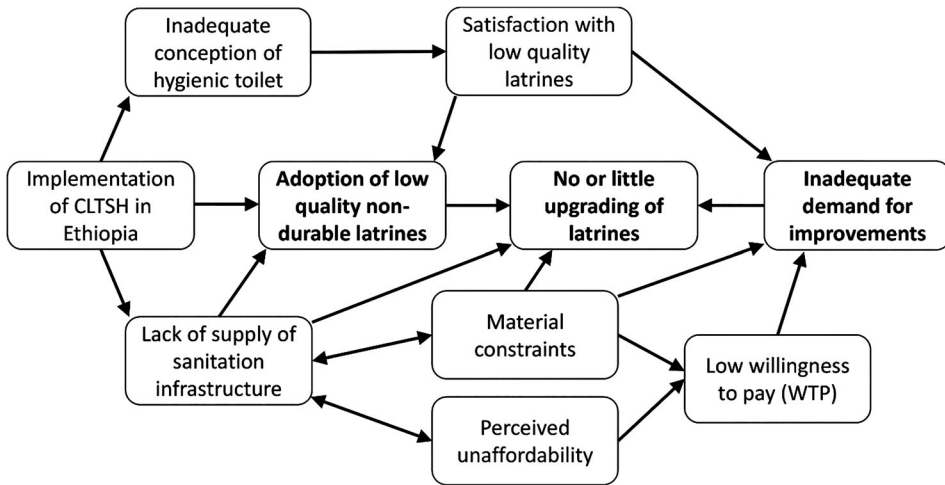


Figure 1. Conceptual diagram indicating reasoning behind this study and its objectives.

Source: The authors.

infrastructural and psychosocial factors. We argue that the household-level sanitation situation in Ethiopia can be conceived as a specific example of socio-technical lock-in that emerged due to the design of implemented national sanitation strategy and structural constraints. To disentangle this lock-in situation, we developed a path diagram (see [Figure 1](#)) that outlines our pre-understanding of the problem based on which we determined a few more specific research objectives as follows:

Our *first objective* is to examine whether sanitation pattern indicated in previous literature from Ethiopia also applies to our study area. More specifically, this assumed pattern would be characterised by the prevalence of low-quality, non-durable latrines that are accepted by communities and consistently used, and also by the unavailability of sanitation-related infrastructure and services (left part of [Figure 1](#)). This first objective is addressed in Section 3. 1.

We assume that the acceptance of low-quality latrines is caused by a general satisfaction with these facilities. Alternatively, local people may be dissatisfied with them but not capable to upgrade them. To disentangle these two options, we analyse the (dis)satisfaction with current sanitation situation and its associated reasons as the *second objective* in Section 3. 2.

The *third objective* addressed in Section 3. 3. examines the demand for latrine improvements and its drivers. Firstly, we characterise the demand descriptively, including the specification of reported plans to improve latrines and their motivations revealed by respondents. Secondly, we use a binary logistic regression to analyse predictors of the plans to improve latrines. We test the relationships between reported plans to improve and multiple different variables collected in our survey. We are particularly interested in whether and how are the plans to improve related to the satisfaction of respondents with their current sanitation situation and to their willingness to pay (WTP) for pre-fabricated slab platforms.

As the *fourth objective*, we consider the WTP for prefabricated slabs as an outcome variable and use an ordinal regression to identify its predictors (Section 3.4). Following the reasoning indicated in the bottom part of [Figure 1](#), we are interested specifically in the role of material constraints and perceived costs on WTP.

The perception of costs with respect to a referral model latrine is then elaborated as our *fifth specific objective* in Section 3. 5. We look at how the estimates of costs reported by respondents compare to the actual costs to test a hypothesis about the possible presence of perceived unaffordability that may in turn influence WTP and/or plans to improve latrines.

2. Data and methods

2.1. Data

The main source of data for this study is a household survey conducted in November and December of 2020 in Duguna Fango and Kindo Koysha woredas (districts) in Wolaita Zone, South Ethiopia (Figure 2). The survey consisted of structured interviews and direct observations of latrines in 504 households of 15 kebeles (smallest administrative units that usually comprise a few villages). The woredas were selected purposively based on the authors' previous work and research experience in this area. The surveyed kebeles within these woredas were chosen randomly from the strata of kebeles with distinct travel accessibility and agro-ecological conditions (reflecting vertical diversity of the area that comprises the low-, mid- and high-land kebeles).

A random walk technique was used to sample households within the villages (31–43 households per kebele) in an effort to reflect their spatial structure. Heads of households were interviewed, and if not available, another adult member (preferably spouse) was interviewed. Five trained enumerators conducted the interviews in the Wolaita language spoken in the surveyed area. The structured interview comprised 89 questions, while 17 parameters related to sanitation facilities and conditions were recorded by enumerators in the direct observations of sanitation facilities and their surroundings.

In addition to a set of demographical, socioeconomic, sociocultural and socioecological variables (Appendix 1), the survey instrument included a variety of questions that inquired about past experiences, current situation and plans regarding latrine adoption, use, maintenance and upgrading as well as associated reasons, motivations and barriers. This section also included items on the management of faecal waste, availability of sanitation-related services, exposure of households to past sanitation interventions, and items on water accessibility and use. The survey elicited information on subjective preferences (including WTP), satisfaction with current sanitation situation, and perceptions of advantages and disadvantages related to OD and latrine use. We also incorporated questions

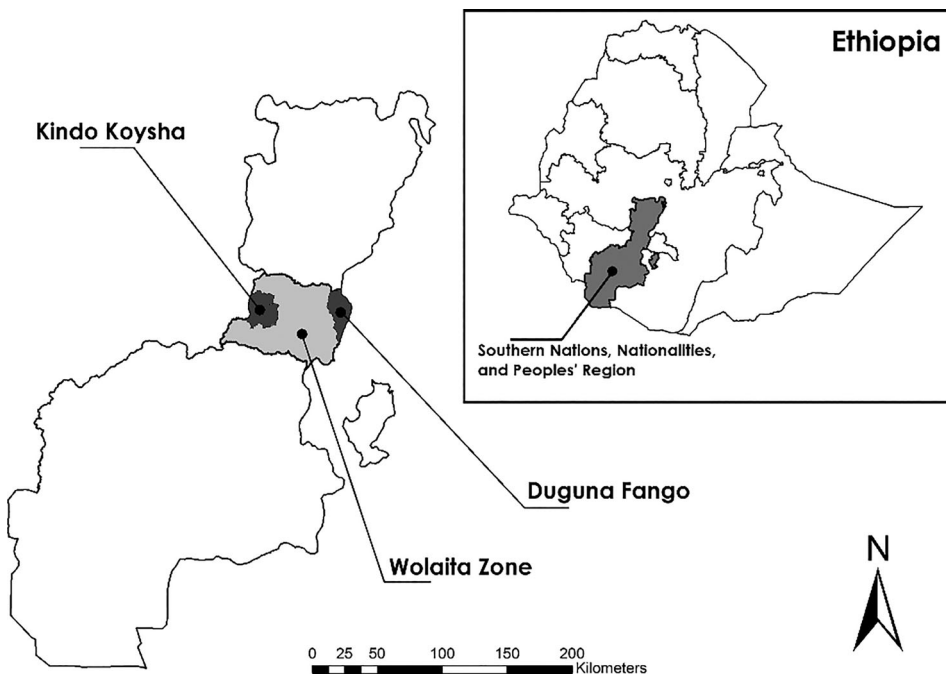


Figure 2. Location of our study area.

Source: The authors.

on various other psychosocial variables related to sanitation – see [Appendix 2](#). They were designed based on the RANAS model (Mosler 2012) and its applications (e.g. Mosler, Mosch, and Harter 2018; Harter, Mosch, and Mosler 2018), but we adjusted some of these items based on local context and our previous experience from the study area. In addition to questions on attitudes and self-regulation factors already addressed in questions mentioned above, these psychosocial variables focused on the risk perceptions, sanitation and hygiene-related awareness, descriptive and injunctive social norms around latrine use, and on social context (social identification, social trust, social cooperation).

The household survey was supplemented by 17 semi-structured interviews conducted with health extension workers, local leaders, heads of the local health centres, and with the district WASH focal person. All these interviews were carried out by the first author. Although opinions on problems and challenges related to sanitation and latrine upgrading were also discussed, these interviews mainly collected descriptive information on the local situation regarding sanitation-related services, past and current interventions, and measures applied to encourage or coerce people to use latrines.

2.2. Ethics

All participants and informants participated in our field research voluntarily, based on their oral consents that were sought and provided at the beginning of the interviews, after an introductory description of the survey and its purpose. The participants were assured of the anonymity and confidentiality of the collected material. Consents for audio recording were also sought and provided at the beginning of the qualitative interviews with local representatives. Prior to the surveys, our research received formal approvals from Ethiopian authorities at the zonal office, woreda office and in the surveyed kebeles. The research project was also approved by the ethical committee of Charles University (approval number 2019/16).

2.3. Main measures and data analysis

A composite score measuring latrine quality was constructed as follows: We firstly examined consistency between the following eight basic parameters assessed through the observation of sanitation facilities: presence of walls ensuring privacy, doors ensuring privacy, roof protecting from rain and sun, availability of a solid slab, general condition (kept well and clean), availability of a pit hole cover, presence of flies and lastly presence of foul odour. The two latter parameters were inconsistent with others and were excluded. Internal consistency between other six measures was good as suggested by the Cronbach's alpha of 0.82. The composite index was then created from these six measures using the Principal Component Analysis. The first component which explained 53% of the variance was used as a latrine quality composite score. The loadings for particular input parameters ranged between 0.57–0.80.

In addition to the composite index, we also considered a common dichotomous variable measuring the presence of solid slabs at some points of our analyses. We considered all platforms that can separate excreta from human contact as solid slabs, irrespective of the materials they were made of.

A dichotomous measure of the intentions to improve latrine was measured based on the question: “Do you plan to improve your latrine in the near future?” Following this question, respondents were asked to specify their planned improvements and their motivations for these improvements. Those who reported no plan to improve their latrines were asked for reasons why.

To measure the WTP for a prefabricated slab, a contingent valuation approach was used. Respondents were presented a picture of the cemented slabs ([Figure 3](#)) with a brief description of the product and its application. They were then asked whether they would pay 470 Birr for such slab (around 14 USD), which corresponded to a local market price at the time of our survey. Those who answered that they wouldn't pay were asked whether they would pay half of this price. If



Figure 3. Prefabricated cemented slab platforms available nearby to the study area. Sources: The authors.

the response was again no, they were asked how much they would pay. Based on this procedure, we constructed an ordinal variable of WTP with three categories that were used in the analyses.

To assess the perception of latrine costs we referred to a model latrine promoted earlier in the surveyed area by an NGO as a reference. Respondents were first shown a picture of a model latrine (Figure 4) with a brief explanation of its indoor and outdoor features (e.g. concrete slab, or gravel surrounding to lower the risk of pit's collapse). After this introduction, they were asked to estimate its costs, including labour costs.

In the results section, we consecutively present findings on the research objectives as they were outlined in introduction following the reasoning indicated in Figure 1. The presentation of results combines descriptive findings with results obtained from the regression analyses. The survey instrument contained closed questions, but also open and semi-open questions. Responses to the semi-open and open questions were typologically classified to allow their presentation in the paper.

Regression analysis was used to assess the predictors of reported plans to improve latrines and WTP for prefabricated solid slabs. The plan to improve was measured as a dichotomous variable and binary logistic regressions were used to model this outcome. Ordinal regression models were used to examine the predictors of the ordinal measure of WTP after checking that the proportional odds assumption is not violated. The regression analyses were conducted using the SPSS complex samples module through which we accounted for the data clustering.

The specification of regression models was not straightforward. We worked with a moderate sample size and collected information on a larger number of potentially relevant predictors of which some were mutually correlated. Based on the exploration of binary relationships between the outcomes and basic demographic and socioeconomic characteristics of respondents and their households, we first determined a baseline model specification that consisted of the following variables: sex of respondent, sex of household head, education of respondent and household income. In addition, the composite score of toilet quality was also considered in this baseline model specification. For each of the outcomes, we initially analysed the baseline model and then consecutively examined other potential predictors by adding them separately (i.e. one by one) to the baseline model.



Figure 4. Model toilet constructed in a surveyed village.
Source: The authors.

The semi-structured interviews that supplemented household surveys were audio-recorded and their selective transcriptions and translations to English were carried out by the first author. Considering the thematic focus of this study, a simple descriptive coding was conducted to summarise the content of relevant parts of the interviews. We use some of the summarised information to support findings from the household survey. Given the secondary importance of this component for our study, we decided not to present the qualitative data using illustrative quotes or by discussing specific arguments provided by individual participants.

3. Results

3.1. Sanitation conditions and services in the study area

The survey confirmed relatively high latrine coverage in the study area. Of the 504 households, 89% owned latrines and another 5% stated that they had functional latrines in the past. Only 2% of respondents from latrine-owning households admitted inconsistent use of their sanitation facilities for defaecation. In 89% and 81% of these families, other adult members and children aged between 5

and 15, respectively, were reported to always use latrines for defaecation. In addition, 93% of these toilet-owning households reported that they dispose faeces of their children under five years of age in the latrine.

All sanitation facilities observed in our survey were dry pit latrines (Figure 5). Their relatively high availability and reported use can be contrasted with their low quality. In terms of the JMP sanitation ladder (<https://washdata.org/monitoring/sanitation>), the majority of toilet-owning households were using unimproved sanitation facilities as only a minor share of the latrines (37%) had solid slabs. Walls ensuring privacy were also observed only in a minority of cases (34%) and solely 45% of the latrines contained functional roofs. One-third of the surveyed sanitation facilities didn't meet any of the six parameters considered for the calculation of the quality of latrines composite score, thus making its frequency distribution right-skewed.



Figure 5. Examples of sanitation facilities. A – a pit latrine with a tin roof, a solid slab and water for handwashing. B – a pit latrine with a grass roof and a solid slab. C and D – Collapsed tin and grass roof latrines with solid slabs but without solid superstructures. Both still in use.

Source: The authors.

Latrine ownership has been sustained in the study area for a relatively long time. Only 23% of toilet-owning households adopted their first latrine less than five years ago, while in 34% of the cases it was between five and ten years ago and in 43% it was more than ten years ago. Only one percent of toilet-owning households had their first latrine at the time of our survey. On average, they owned 3.2 latrines before their current one (SD = 1.2). The reported latrine durability was 3.7 years on average, with the median of four years (SD = 1.6). A need to reconstruct the latrines was most often attributed to collapses of latrine's superstructure, (mentioned by 82% of latrine-owning households), followed by unstable soil conditions (70%), and erosion or flooding (67%). Only 25% of the respondents from latrine-owning households mentioned large family size, associated with limited capacity of the pit, among the reasons. These findings indicate that latrines often collapse before the pit capacity is utilised. It is not common to empty the pits when it is full in the study area. Commonly, the pits are covered with soil and a new latrine is built elsewhere. More than half (57%) of respondents who previously owned a latrine stated that their current latrine is better than the previous one(s); 25% mentioned it is the same; and 16% stated that the current latrine is worse.

The survey was conducted in the Southern Nations, Nationalities and Peoples Region, where an earlier sanitation programme had been implemented since 2003 (e.g. Peal, Evans, and van der Voorden 2010). The semi-structured interviews with kebele representatives, health extension workers, and zonal and districts health officers confirmed, that in all communities CLTSH campaigns were implemented in various years between 2012 and 2015 and that toilet ownership had been reportedly monitored by the health extension workers until the time of our survey. Although we are unable to establish the extent of causal relationships between the observed sanitation pattern and past interventions, the interviews and our own experience from previous work in the study area, indicate that these interventions played a key role in attaining the high rates of both latrine ownership and use.

Majority of respondents (64%) reacted positively to the question: "Are there craftsmen, masons or other labourers providing services related to latrine construction, maintenance, improvement, or pit emptying, available if needed?". In addition, 40% of them reported that they used these services. Most frequently, it was for digging the pit or (re)constructing the superstructure. These services were nevertheless only rarely mentioned as a means of acquiring better latrine components, except a few households who reported the use of such services for obtaining latrines with tin roofs.

3.2. Satisfaction with current sanitation

The satisfaction with own's sanitation practice (survey question asked specifically about the practice of defecation) was relatively high, with 78% of respondents being satisfied. The satisfaction in the subgroup of latrine-owning households was 82% showing the role of latrine ownership. However, relationship between satisfaction and latrine quality score was not particularly strong, although statistically significant. Majority of households revealed satisfaction despite using facilities that lacked basic latrine attributes such as solid walls, roofs, doors, or slabs. Shares of satisfied respondents for the respective subgroups ranged between 73% and 78%.

An open question on reasons for the satisfaction was answered by 81% of those who reported satisfaction. Most frequently, they referred to privacy and health-related reasons, with 41% of them stated explicitly that it is because latrine use is good for health of their families. Unlike for privacy, the prevalent belief in health benefits of available latrines can hardly stem from the own realisation of these benefits but was socially constructed. This is also obvious from responses to a question on reasons for the initial latrine adoption – reduction of health risks was clearly the most frequent reason in this respect mentioned by 75% of latrine-owning families.

Privacy and health benefits were also two prominent types of perceived latrine advantages. [Table 1](#) disaggregates the occurrence of these perceptions by subgroups of respondents based on their satisfaction with the current sanitation situation. It shows that some of the non-health benefits

Table 1. Relationships between satisfaction with current sanitation practice and perception of latrine advantages.

Types of latrine advantages (share of those who reported particular types)	Shares of those who reported particular types of latrine advantages		<i>p</i> -value of t-test for difference between shares of satisfied and dissatisfied*
	Satisfied with own's sanitation practice (N = 391)	Dissatisfied with own's sanitation practice (N = 113)	
Privacy (0.78)	0.82	0.65	0.049
Good for health/avoid diseases (0.76)	0.72	0.90	0.002
Avoid contaminating environment (0.51)	0.47	0.67	0.004
Avoid sharing with other (0.50)	0.50	0.50	0.628
Easy to keep clean (0.44)	0.47	0.32	0.001
Prestige / status (0.34)	0.38	0.22	0.041
Reduce medical expenses (0.27)	0.24	0.37	0.005
Convenience (0.26)	0.26	0.29	0.057
Every household must have latrine (0.16)	0.16	0.30	0.007

Notes: *Accounted for clustering and controlled for sex, sex of household head, income, latrine ownership and latrine quality score.

such as privacy, prestige, or easiness of maintenance (easy to keep clean) were more typically reported by those who were satisfied with their current sanitation situation. By contrast, advantages related to impacts of latrine on health, environmental contamination, or convenience for users were acknowledged significantly more often by those dissatisfied. We think that it is because these latter types of anticipated benefits have often remained unrealised and thus become the actual reasons for dissatisfaction.

3.3. Demand for latrine upgrading

All households without private latrine at the time of our survey – except three – stated that they plan to adopt latrines in the near future. 64% of respondents from latrine-owning households plan to improve their latrine in the near future as well. The majority of them described their motivations for the intended improvement. The most frequent reported motivation was dissatisfaction with the current latrine reported by 66% of latrine owning households. Intentions to increase privacy, safety, or comfort were mentioned by around 50% of respondents. Interestingly, only 21% plan the upgrade in order to reduce health risks. Even though, as mentioned above, 75% of toilet-owning households stated that health-related expectations led them to adopt their first latrine.

In 22% of the cases, reported plans involved the construction of new latrines, including digging of new pits. Out of specific improvements, (re)construction of roofs was the most frequently mentioned – by 47% of those willing to improve their toilets, followed by plans to strengthen walls (45%) and doors (33%). Plans for upgrading slabs were comparatively less frequent (15%). In addition, [Table 2](#) shows differences in the plans to improve latrines disaggregated by specific latrine components. These disaggregated figures once again show notably lower intention to upgrade slab platforms

Table 2. Reported plans to improve latrine disaggregated by specific latrine parts.

Latrines with:	N (Of total 450)	Plan to repair specifically:		Plan to reconstruct entire latrine
No solid walls	280	Walls	41%	20%
No water-/sun-protecting roof	222	Roof	48%	23%
No doors	336	Doors	22%	18%
No solid slab platform	263	Slab	10%	20%

Notes: Subgroups of those planning to reconstruct entire latrines and those who expressed plans of specific improvements do not overlap.

– only 10% of respondents from households having unimproved toilets (i.e. without solid slabs) expressed plans to improve their missing or broken slabs. Interestingly, unlike for other latrine components, those who revealed plans to improve slab platforms did not have significantly worse sanitation facilities than the rest of latrine-owning households, whether measured by the latrine quality composite score or in terms of availability of solid slabs. It implies that the construction of solid slab platforms is conditional upon having acceptable latrine superstructure (roof and walls in particular). We did not record any plans to introduce typologically distinct toilets than dry pit latrines that were already prevalent in the study area, and we did not notice any intentions to use distinct management practices of faecal waste such as pit emptying, composting, or reuse.

On the other hand, 36% of respondents from toilet-owning families revealed unwillingness to improve their latrines. In the majority of these cases (68%) the reported reason was satisfactory condition of their current sanitation facilities. It is true that latrines in this subgroup had comparatively higher latrine quality composite scores. The remaining group of respondents with no intention to improve referred to high costs (39%), lack of external support (20%), or unavailability of material (14%).

Results from the analysis of correlates of revealed plans for latrine improvement obtained using a binary logistic regression are presented in Table 3. A significant negative effect was confirmed for latrine quality score, supporting the above-mentioned observation that unsatisfactory latrine condition was the most commonly reported motivation for plans to improve. Analogous explanation holds for a negative relationship between the improvement plans and satisfaction with current sanitation practice. Diarrhoea prevention awareness was positively related to plans to improve latrine, suggesting the role of relevant knowledge. In addition, households' intentions to improve their toilets were positively related to income indicating the importance of material constraints. Similar relationships were not found for other socioeconomic variables like land- and livestock-ownership, education, or reported food-shortages. Unlike these other socioeconomic variables, income better

Table 3. Predictors of revealed plans to improve latrine (binary logistic regression).

Baseline model variables	Beta coefficient	Standard errors	P-value	Nagelkerke R^2	Cox & Snell R^2
If female respondent (vs. male)	-0.518	0.265	0.071	0.195	0.143
If female household head (vs. male headed households)	-0.405	0.287	0.180		
No formal education of respondent (vs. at least some primary education)	-0.156	0.170	0.375		
Household income (in logarithms)	0.691	0.305	0.040		
Composite score of latrine quality	-0.774	0.118	0.000		
Other variables with statistically significant relationships when individually added to baseline model*					
If family economic situation in past 2 years improved (vs. worsened or stayed same)	-0.591	0.230	0.022	0.209	0.153
If good awareness about diarrhoea prevention (vs. low awareness)	0.775	0.192	0.001	0.212	0.155
If satisfied with current defaecation practice	-1.084	0.278	0.002	0.224	0.164
WTP for prefabricated slab:					
Pay less than 235	-0.700	0.310	0.040	0.216	0.158
Pay 235–470	-0.017	0.249	0.947		
Pay 470 and more	Reference category				
Recognised disadvantages of OD (sum of reported disadvantages)	-0.154	0.071	0.048	0.204	0.149

Notes: $N = 450$ (subsample of households with private latrines). Standard errors account for clustering at kebele level. *Results for "other variables" refer to regression estimates obtained when these other variables were separately added to the baseline model specification. The following variables were also analysed but their effects were statistically insignificant at the 0.05 level: Respondent age; Family size; Presence of children under 5; Religion; Ownership of land; Ownership of livestock; Reported shortages of food; Reported shortages of water; Whether household appointed as "model" family; Availability of sanitation services (whether reported; whether used); Time required for drinking water collection; Nondurability of previous latrine(s); Time from adoption of first latrine; Number of recognised advantages of latrine use; Knowledge of sanitation and hygiene messages; If specific latrine advantages reported (prestige/status, comfort/convenience, health benefits); Risk perception (susceptibility and severity of diarrhoea); Perception of costs of model latrine; Social norms around latrine use (descriptive and injunctive); Social trust; Social identification, Social cooperation.

captures the current purchasing power of households that may be more consequential for intention to invest in their sanitation facilities. This reasoning is supported by the confirmation of a positive relationship between plans to improve and WTP. A seemingly unexpected negative effect was revealed for the improvement in economic situation of household over the past two years. A closer inspection of this result uncovered that households who reported improvements in their economic situation already owned better latrines and this relationship was confounded by income (became weaker and insignificant when income was excluded).

A number of variables that might be assumed as potentially relevant predictors of plans to improve latrines were not corroborated. In addition to several socioeconomic variables already mentioned above, it holds for the measures of hygiene and sanitation awareness, social norms around sanitation, risk perception and other examined psychosocial variables, or to an institutional variable distinguishing designated model families from the rest of households.

3.4. Willingness to pay (WTP) for prefabricated slab

In the next step, we assessed WTP for the cemented slab platform, which is considered as a key component of hygienic latrines. Responses were quite equally distributed across the three categories of the WTP ordinal measure with 37% of respondents willing to pay the full price (470 Birr which equalled around 14 USD), 26% of them opted for the half price and the remaining 38% would only pay less than that. Individual responses within this last category were distributed around the mean of 97 Birr (SD = 51).

We already saw in Table 3 that WTP was positively correlated with the plan to improve toilet, indicating that WTP captures a relevant aspect of the demand for toilet upgrading. Therefore, we also

Table 4. Predictors of WTP for prefabricated slab (ordinal regression).

Baseline model variables	Beta coefficient	Standard errors	P-value	Nagelkerke R^2	Cox & Snell R^2
If female respondent (vs. male)	-0.237	0.193	0.240	0.272	0.241
If female household head (vs. male headed households)	-1.009	0.211	0.000		
No formal education of respondent (vs. at least some primary education)	-0.390	0.216	0.093		
Household income (in logarithms)	1.801	0.287	0.000		
Composite score of latrine quality	0.347	0.103	0.005		
<i>Other variables with statistically significant relationships when individually added to baseline model*</i>					
Family size	0.143	0.027	0.000	0.287	0.254
Size of landholdings (in logarithms)	0.530	0.240	0.044	0.280	0.248
Ownership of livestock (in tropical livestock units)	0.322	0.061	0.000	0.316	0.280
If shortage of food reported among two most serious problems	-0.595	0.202	0.011	0.289	0.256
Whether "model family"	0.906	0.258	0.003	0.289	0.256
Nondurability of previous latrine(s)	-0.748	0.290	0.022	0.287	0.254
Adoption of first latrine:					
Up to five years ago	0.158	0.292	0.596	0.276	0.245
Five to ten years ago	0.320	0.141	0.039		
More than ten years ago	Reference category				
Knowledge of sanitation and hygiene messages (sum of messages recalled)	0.134	0.055	0.029	0.288	0.255

Notes: $N = 504$. Standard errors account for clustering at kebele level. *Results for "other variables" refer to regression estimates obtained when these other variables were separately added to the baseline model specification. The following variables were also analysed but their effects were statistically insignificant at the 0.05 level: Respondent age; Presence of children under 5; Religion; Reported shortages of water; Change in economic situation over past two years; Availability of sanitation services (whether reported; whether used); Time required for drinking water collection; Satisfaction with current defaecation practice; Awareness about diarrhoea prevention; Number of recognised advantages of latrine use; If specific latrine advantages reported (prestige/status, comfort/convenience, health benefits); Risk perception (susceptibility and severity of diarrhoea); Perception of costs of model latrine; Social norms around latrine use (descriptive and injunctive); Social trust; Social identification, Social cooperation.

examined WTP as an outcome to understand its drivers. Results obtained based on the ordinal regression models are presented in [Table 4](#). We can see that household income was a strong predictor of WTP and other variables capturing households' material situation (land and livestock ownership, reported food shortages) were also significant. These findings clearly confirm the key role of objective material constraints and affordability for investing in hygienic sanitation in rural Ethiopia. Of all considered psychosocial variables, only a measure of hygiene and sanitation awareness was related to WTP, but its positive effect was smaller compared to the socioeconomic predictors.

Unlike the intention to improve latrine that was examined above, latrine quality score had a positive statistical association with WTP. In an additional analysis, we confirmed that this relationship remained similar even if we included a measure of the availability of solid slabs as a control variable. It implies that it is the experience with the use of generally better latrines (including but not only those equipped with solid slabs) that enhances the willingness to invest in hygienic slabs. This is further supported by the negative relationship between the WTP and nondurability of previous latrines. It means that those who reported collapses of previous latrines as the main reason for repeated construction of toilets revealed, *ceteris paribus*, a lower WTP than those who attributed this need to external factors (erosion, soil texture, high water table or floods) or utilisation of pit capacity by users. Previous experience with non-durable latrine structures thus seems to discourage households from investing in solid slabs.

3.5. Perception of costs of latrine

As indicated in [Figure 1](#), our hypothesis examined as the fourth specific objective of this study was that there may be a tendency to overestimate the actual costs of hygienic sanitation. We further assumed that this may be associated with the perceived unaffordability of hygienic latrines, adversely impacting WTP and/or willingness to improve latrines. However, responses to a survey question on the estimated costs of a model latrine (demonstrated to respondents in the picture with appropriate specifications) showed that there is a tendency to underestimate rather than overestimate the actual costs. Based on the own expertise of one of the authors and the discussions of costs with local health officers, the actual cost of the model latrine referred to in our survey was about 4000 Ethiopian Birr (refer to the range between 3000 and 5000 would be more accurate), which equaled to around 110 USD. A smaller part of this amount is attributed to labour costs and a major part to materials. Estimates obtained in the survey ranged between 300 and 6000 Birr, with the mean value of 2281 Birr (SD = 1126). The actual and estimated figures can be compared to the reported monthly household income of less than 800 Birr on average. It reveals that actual rather than perceived unaffordability prevents local people from investing in hygienic sanitation. The same conclusion was indicated by the results of regression analyses above as we saw that the cost perception was neither among the statistically significant predictors of the plans to improve latrine ([Table 3](#)) nor among the predictors of WTP ([Table 4](#)).

4. Discussion

Efforts to improve sanitation conditions have gained global momentum in recent decades. Ethiopia recorded the highest reduction of OD worldwide in the 2010s, but it was largely towards the use of basic latrines that do not meet basic hygienic standards. Impacts of their utilisation on public and environmental health remain uncertain. There is a risk that resources invested into sanitation in Ethiopia so far may get wasted if latrine upgrading is not adequately addressed. This major challenge received little attention in previous research on sanitation in Ethiopia that largely emulated the predominant focus of interventions on the initial latrine adoption.

We sought to address this gap using data from a household survey conducted in 2020 in Wolaita, South Ethiopia. The goal of this paper was to understand the demand for latrine upgrading by considering the interplay between institutional, infrastructural and psychosocial factors operating in the

context of our study. For these purposes, a conceptual scheme was developed (Figure 1) that helped us to articulate a few more specific objectives. Accordingly, we examined the quality and past improvements of latrines, revealed plans and attitudes regarding their improvements, WTP, costs perceptions and infrastructural barriers.

Our survey confirmed the expected sanitation pattern in the study area in terms of the relatively high latrine coverage (90% of households) with the generally poor quality of latrines (e.g. only 37% of facilities had solid slabs), but their arguably consistent use. The repeated construction of non-durable latrines was a norm in the study area, with the average length of use of the same facility corresponding to less than four years. Based on retrospective recalls, we recorded only marginal improvements in toilet quality over time. Although we identified a notable demand for latrine improvement (64% of households revealed such intention), the reported plans concerned mostly with the “status-quo” repairs or reconstructions with only a few cases of the latrine’s components upgrading, mostly by a tin roof. We found no indication of the process upgrading, whether regarding latrine construction, use, or the management and possible reuse of faecal waste.

We examined two general types of explanations for this sanitation pattern. The first one attributes it to the objective infrastructural and material constraints, while the second one refers to various subjective psychosocial drivers. While the former type of barriers was obvious, some psychosocial impediments of possible upgrading of sanitation facilities in the study area were uncovered too.

Despite the low technical standards of latrines, people accepted them, and the majority reported satisfaction with them. Although satisfaction was positively related to latrine quality, majority of latrine users were satisfied even if their facilities lacked some of the basic components. We also showed that the satisfaction curbs the demand for latrine improvement. Therefore, it is important to understand the underlying sources of this satisfaction. In this respect, privacy and health-related reasons were the two most frequently reported explanations. While the feeling of privacy associated with latrine use represents a directly experienced and intuitively understandable benefit, this is less true for the impacts of latrine use on health. It was demonstrated earlier that the constructed conviction about health benefits of any type of latrine has been a powerful driver of the initial latrine adoption in Ethiopia (Novotný, Humňalová, and Kolomazníková 2018). Although our results confirmed this finding, we simultaneously uncovered that this conviction, as a source of satisfaction with current sanitation practice, impacts negatively on the demand for latrine upgrading. As the flip side of the same coin, for a smaller group of those dissatisfied with their sanitation situation, the dissatisfaction may be explained by their recognition that the expected impacts of latrines on human and environmental health have not materialised.

The finding of the widespread perception that the use of any latrine reduces health risks corresponds to observations that both the prevalence and preference of hygienic slabs were low. Understanding of what are the basic requirements of hygienic sanitation facilities seem to be inadequate. Previous persuasive tactics used for the elimination of OD in our study area and elsewhere in Ethiopia did not address this understanding properly and amplified expectations that may easily be false in the given context.

Previous interventions also did not focus on a supply of improved sanitation components. The supply of sanitation products and services has been underdeveloped in the study area, cementing the “status quo” situation regarding the quality of latrines. We are aware of some earlier attempts to promote sanitation products in this area through sanitation marketing (Vrana et al. 2017). However, our survey indicated that these attempts failed. Lack of demand prevents more local supply chains to develop.

To assess the demand, we analysed WTP for prefabricated slabs. The results showed that slightly more than one-third (37%) of respondents would pay the slab market price. If the price falls to half of the market price, 63% of households would purchase the slab according to our findings. Even if the WTP exercise perfectly captured the actual decisions to purchase (and there were both smooth supply and no additional transaction costs), market alone would not lead to any notable improvement in the improved latrine coverage rate in the study area. In addition, multiple variables reflecting

the socioeconomic situation of households were clearly the strongest predictors of WTP, while the effects of other types of potential drivers including various types of psychosocial factors were comparatively negligible. As such, material constraints and limited purchasing power represent a major explanation for the low prevalence of prefabricated sanitation products as well as their undeveloped supply chains. Although 37% of households in our sample had latrines that were classified as improved facilities because they contained solid slabs, these platforms were mostly made of stones and logs covered by mud rather than of concrete and/or being prefabricated.

Latrine quality score was the statistically significant predictor of the plans to improve latrines but not of the WTP for prefabricated slabs. Similarly, WTP was also not related to satisfaction with current sanitation practice, despite the latter being confirmed as a strong predictor of plans to improve. These differences may be explained by the observed low preference for solid slabs apparent from the descriptions of specific plans for latrine improvements. Purchasing of prefabricated platforms was rarely considered to be a practically feasible (affordable) option in the study area.

The analysis of WTP not only indicated preferences of consumers, but WTP measure was also positively correlated with the reported plans of latrine improvement. We additionally examined whether the respondents' perception of latrine costs shapes the WTP. More specifically, we assumed that perceived unaffordability associated with the tendency to overestimate actual costs may negatively affect the WTP and/or demand for latrine upgrading. However, these hypotheses were ruled out by our results. We found that people in the study area tend to underestimate rather than overestimate the true costs of a model latrine and the cost perception was neither related to WTP nor to plans to improve latrines. Moreover, the comparison between the actual costs of the latrine and household income demonstrated that objective material constraints rather than perceived unaffordability represent a key barrier.

Our results on WTP resemble the pattern documented by Gross and Günther (2014) in Benin, Peletz et al. (2017) in Tanzania, or Peletz et al. (2019, 2021) in Kenya. These studies conducted across Sub-Saharan Africa demonstrated insufficient WTP for improved sanitation products due to the lack of households' economic resources. Low affordability of these products at their commercial prices further aggravates the market penetration in these countries. By contrast, Novotný et al. (2018) identified a socially constructed perception of financial unaffordability of toilets in India that was not straightforwardly related to household poverty or wealth. It may reflect generally higher levels of socioeconomic development of India compared to countries in Sub-Saharan Africa or regional differences in sociocultural and environmental sanitation drivers. The nature of previous sanitation policies can be another reasonable explanation for the differences. Indian sanitation schemes have traditionally relied on the provision of subsidised toilets, while many countries in Sub-Saharan Africa relied primarily (some of them solely) on less expansive demand-oriented sanitation approaches such as CLTS.

Practical implications of our findings are relatively straightforward, though uneasy to achieve. There is a need to communicate soundly that unhygienic sanitation facilities may be similarly or more dangerous than OD in order to disintegrate the widespread belief that the use of any latrine is good for human health. Emphasis on the understanding of the key role of solid slabs represents an immediate priority but other features of hygienic dry pit latrines (water-demanding toilets are not an option in the study area) such as pit ventilation or alternative technologies and practices such as double vault systems, urine diversion systems, or ecological sanitation techniques may also be considered. To improve sanitation conditions, it will no longer be possible to ignore the supply-side. At the same time, our results indicated that relying only on the market-based approaches will not solve the situation. The promotion of subsidised sanitation infrastructure is required. The SDGs target of hygienic sanitation for all could not be achieved in Ethiopia without increasing government expenditures on sanitation substantially. Another option would be to wait and hope for general socioeconomic development as an ultimate solution. Unfortunately, known budgetary constraints, need to focus on more acute priorities than sanitation, and current political and economic turmoil in Ethiopia doesn't allow much optimism.

Some limitations of this study should be mentioned. It is based on cross-sectional data. Identified relationships should therefore be interpreted as statistical associations rather than causal relationships. Time trends were assessed based on retrospective recalls and prospective plans that may not actually materialise in future. Our measure of WTP refers to the stated preferences elicited using a contingent valuation technique. It may not capture the actual WTP for sanitation products perfectly (e.g. Tidwell 2020; Peletz et al. 2021). The social desirability bias may be an issue for questions on sanitation in the context of our study, particularly if considering that past sanitation campaigns utilised social and institutional pressures for achieving high latrine coverage.

5. Conclusion

Expected benefits from the adoption of latrines in Ethiopia have been seriously undermined by low standards and nondurability of the sanitation facilities. Poverty and infrastructural constraints and the nature of implemented sanitation policies have created a socio-technical lock-in situation. People are satisfied with the use of largely unhygienic latrines and considerable barriers on both the demand- and supply-side have cemented this sanitation pattern. Policy interventions targeted at the challenge of latrine upgrading in Ethiopia should disintegrate the widespread conviction that the use of any latrine is good for human health. This should be accompanied by the provision of subsidised sanitation products because market-approaches alone will not solve the problem. Given the scarcity of public resources in Ethiopia and the presence of other burning issues associated with the current deterioration of the political and economic situation, it is unlikely that adequate sanitation change will be achieved in the near future.

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Appendices

Appendix 1 – Descriptive statistics for considered demographic, socioeconomic, sociocultural and socioecological variables.

Age of respondent – mean age (SD)	39.86 (10.91)
Share of female respondents	0.67
Share of female household heads	0.18
Household size – mean size (SD)	5.78 (1.91)
Share of households with children (under 5)	0.51
Religion (relative shares):	
Protestant Christian	0.84
Orthodox Christian	0.16
Attained education of respondent; of household head (relative shares):	
No formal education	0.54; 0.52
Up to lower secondary	0.41; 0.39
Secondary complete and higher	0.05; 0.09
Monthly average income in ETH Birr – median; mean (SD)	400; 737 (998)
Ownership of land in hectares – median; mean (SD)	0.50; 0.76 (0.97)
Livestock ownership in tropical livestock units – median; mean (SD)	2.50; 2.73; 1.67

Change in economic situation over past two years (relative shares):	
Improved	0.27
Not changed	0.48
Worsened	0.25
Whether Model family, as per Health Extension Programme, (relative share)	0.18
Time required for drinking water collection, in minutes, including waiting time – mean (SD) (Rainy season; Dry season)	44.6 (50.87); 78.88 (75.03)
Food shortages – share of respondents who reported food shortages among two most important problems	0.37
Water stress – share of respondents who reported water shortages among two most important problems	0.52

Appendix 2 – Construction of considered psychosocial variables and their basic descriptive statistics

Knowledge of hygiene and sanitation messages – the sum of relevant messages reported by respondents to an open-ended question about knowledge of hygiene and sanitation messages. Min.; Max.; Average (SD):	0; 9; 4.71 (2.17)
Awareness about diarrhoea prevention – a binary variable based on question to list the three most effective ways of preventing diarrhoea. The measure distinguishes those who reported at least one relevant way from those with no awareness:	0.84
Satisfaction with current sanitation practice (practice of defaecation) – share of those who reported that they are satisfied:	0.78
Recognition of benefits of latrine – the sum of recognised types of latrine benefits ascertained through an open-ended question and typological classification of responses. Min; Max; Average (SD)	0; 10; 4.66 (1.69)
Recognition of disadvantages of OD – the sum of recognised types of latrine benefits ascertained through an open-ended question and typological classification of responses. Min; Max; Average (SD)	2; 8; 4.57 (1.29)
Risk perception with respect to diarrhoea – perceived susceptibility – based on a question: How likely is it that you or your family members would get diarrheal disease in the next 3 months? Measured on a 5-point Likert scale. The distribution of responses from impossible to very likely:	0.47; 0.26; 0.22; 0.03; 0.02
Risk perception with respect to diarrhoea – perceived severity – based on a question: If you got diarrhoea, how serious would be impact on your daily life? Measured on a 4-point Likert scale. The distribution of responses from not serious at all to very serious:	0.00; 0.00; 0.19; 0.81
Perceived descriptive norms around latrine use – measured using a question: Do other people in your village mostly use a latrine? The distribution of responses along the scale: all of them; majority of them; minority of them; none of them; don't know:	0.62; 0.34; 0.03; 0.00; 0.01
Perceived injunctive norms around latrine use – measured using a question: Do you think that other people in your village should defaecate in a latrine? The distribution of responses along the scale: definitely yes; probably yes; definitely no; probably no; don't know:	0.72; 0.28; 0.00; 0.00; 0.00
Perception of cost of model latrine – estimated costs (including labour costs) for model latrine (described in the methods section). Min; Max; Average (SD):	300; 6000; 2281 (1125)
Willingness to pay for prefabricated cement slab (WTP) – an ordinal variable constructed using a contingent valuation procedure as described in the methods section. Relative shares of those who would pay: At least 470 Birr; 235–469 Birr; not more than 234 Birr:	0.37; 0.26; 0.37
Plan to improve latrine – based on question ascertaining whether a household plan to improve their latrine in near future. Share of those who reported plans to improve:	0.64
Social trust – elicited through a statement: Most people who live in this village can be trusted – measured on a 5-point scale – strongly agree; agree; disagree, strongly disagree, don't know. Distribution of responses:	0.27; 0.59; 0.11; 0.01; 0.02
Social identification – elicited through a statement: I have a lot in common with other community members – measured on a 5-point scale – strongly agree; agree; disagree, strongly disagree, don't know. Distribution of responses:	0.41; 0.45; 0.13; 0.01; 0.00
Social cooperation – elicited through a statement: People in my village are working together towards the common goal of making our village clean – measured on a 5-point scale – strongly agree; agree; disagree, strongly disagree, don't know. Distribution of responses:	0.22; 0.36; 0.17; 0.18; 0.07

Notes: The interviews were conducted in Wolaita language and questions mentioned above refer to the English translations by the authors. Descriptive information on the measures of the perceptions of specific types of latrine advantages were already presented in Table 1 so these variables are not included here.

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Research Paper

Quality of latrines and willingness to improve them in rural Ethiopia

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ABSTRACT

Ethiopia recorded the world's fastest increase in latrine coverage over the past two decades, but it was largely achieved by the adoption of latrines that do not meet basic hygienic standards. Therefore, this study aims to examine the quality of latrines and their upgrading at household level through a case study from the Loka Abaya district, South Ethiopia. Of the initially sampled 549 households, 422 (77%) had private latrines, and a survey was administered among them. The data were characterized descriptively, and correlates of the latrine quality and willingness to improve were analysed. The average latrine quality score in the sample was only 2.8 of the maximum six quality dimensions. Despite the low quality of latrines, 63% of respondents were satisfied with their sanitation situation. Both past improvements and plans to improve latrines were frequently reported. However, these reported changes mostly involved regular maintenance or reconstructions of collapsed latrines. No substantial upgrading of the functionality was identified. We identified inadequate awareness about the means of hygienic sanitation, implying the importance of community education. Demand for as well as supply of hygienic sanitation products are further constrained by the low purchasing power of households implying a need for sanitation subsidies.

Key words: Ethiopia, latrine quality, latrine upgrading, preferences, sanitation, willingness to improve

HIGHLIGHTS

- Significant increase of toilet coverage in Ethiopia was achieved through adoption of low-quality latrines.
- This article thus examines the quality of latrines and willingness to improve them in Loka Abaya district, South Ethiopia.
- The survey confirmed the generally poor quality of latrines and found little latrine upgrading over time.
- This sanitation pattern was explained by inaccessibility and unaffordability of better toilets and inadequate conception of hygienic sanitation.
- Toilet subsidies and education about means of hygienic sanitation are required.

ABBREVIATIONS

IBM-WASH integrated behavioural model for water, sanitation, and hygiene
 OD open defecation
 RANAS risks, attitudes, norms, abilities, and self-regulation
 SD standard deviation

INTRODUCTION

With the most significant decrease in the estimated national open defecation (OD) rate worldwide from 79 to 22% between 2000 and 2017, Ethiopia has been praised for its remarkable progress in improving sanitation conditions (UNICEF/WHO 2019). Less attention has nevertheless been given to the unsettling fact that the sanitation change has largely comprised a shift towards the utilization of unhygienic latrines. According to the 2017 national estimates, 82% of sanitation facilities were unimproved (did not safely prevent excreta from human contact) and only 7% of latrines in rural Ethiopia were

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considered as safely managed latrines (UNICEF/WHO 2019). The generally low quality of latrines in Ethiopia was also documented by several field level cases studies (Awoke & Muche 2013; Irish *et al.* 2013; Crocker *et al.* 2017; Novotný *et al.* 2017, 2018a; Zeleke *et al.* 2019). A similar pattern is prevalent across some other countries of Sub-Saharan Africa and represents a major reason why implemented sanitation interventions often fail to prevent the transmission of pathogens (Irish *et al.* 2013; Exley *et al.* 2015; Sclar *et al.* 2016).

The increased latrine coverage in Ethiopia can be attributed to a national hygiene and sanitation strategy (MoH 2013) implemented through the country-wide health extension programme (MoH 2015; Assefa *et al.* 2019). A key component was the community-led total sanitation approach which is known to be effective for rapidly eliminating OD but problematic regarding the quality and durability of adopted sanitation facilities (Venkataramanan *et al.* 2018; Ficek & Novotný 2019). Facilitation of access to sanitation hardware had been originally included in the national Ethiopian strategy, but it was side-lined in practice (Novotný *et al.* 2018a). Low quality and undurability of latrines not only challenge their presumed positive impacts on human health but also contribute to the slippage back to OD (Crocker *et al.* 2017; Abebe & Tucho 2020; Aragie *et al.* 2022; Freeman *et al.* 2022).

Only a very few studies examined issues around latrine upgrading in Ethiopia (Novotný & Mamo 2022) and they report no or little shifts upwards through the sanitation ladder (Crocker *et al.* 2017; Chambers *et al.* 2021; Mamo *et al.* 2023). Resources invested in sanitation interventions may be wasted if basic hygienic standards of latrines are not ensured. Understanding the behaviours, preferences, and priorities of households with respect to latrine quality and its improvements is thus an important task. This task is addressed in this study based on data from the Loka Abaya district, Sidama region, through direct observations of latrines and structured interviews among 422 latrine-owning households. The aim is to examine latrine quality and latrine upgrading and the respective plans and preferences.

METHODS

The data collection took place in December 2019 in 12 kebeles of Loka Abaya district in the Sidama region (Figure 1). The district was purposively selected based on the practical feasibility considerations linked to the involvement of the first author in the

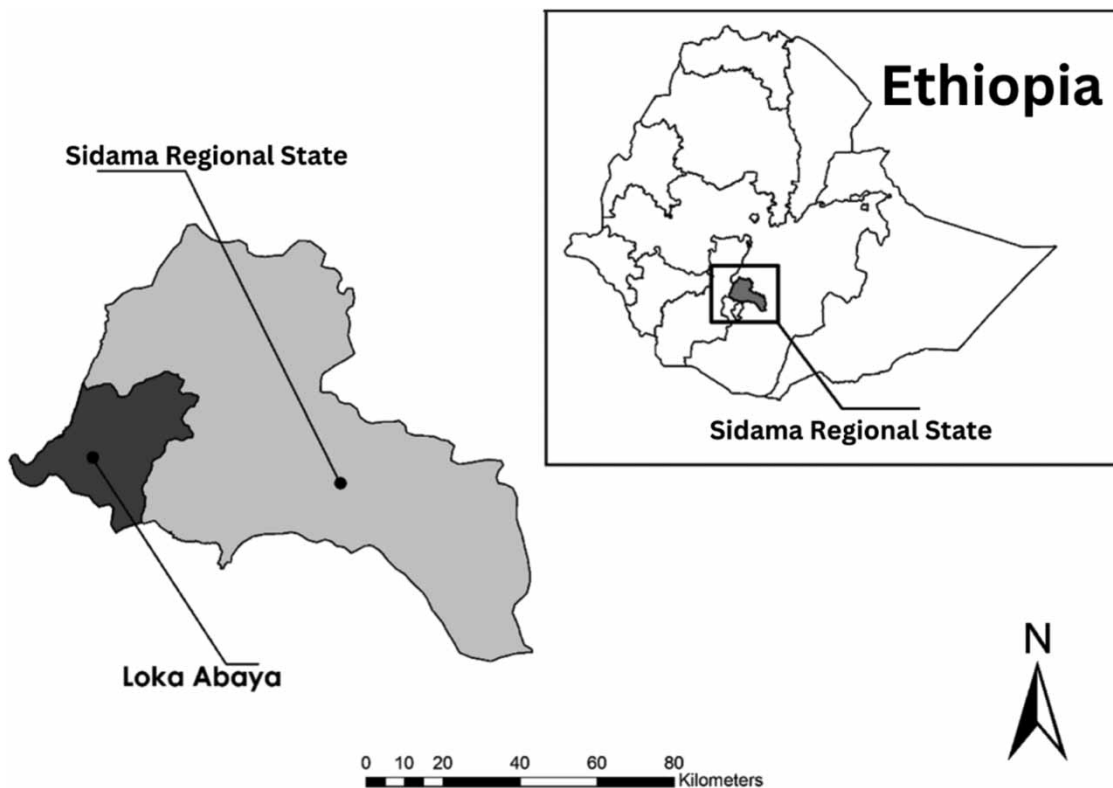


Figure 1 | Location of the study area.

implementation of sanitation interventions in this region. The kebeles were selected randomly from three subgroups of kebeles defined by travel accessibility, OD-free status, and protected drinking water availability, reflecting local variations in these three parameters. A random walk technique was used to sample households within the selected kebeles. We sampled 549 households and conducted structured interviews and direct observations of sanitation facilities in 422 of them in which latrines were identified. Five trained enumerators administered the data collection in the local language (Sidaamu Afoo) under the supervision of the first author. Heads of households were interviewed. If not available, a spouse or another adult member was interviewed.

The interview schedule consisted of 57 questions covering demographic and socioeconomic characteristics; questions on latrine adoption, use, maintenance, past improvements, and plans to improve in the near future; sanitation-related preferences, availability of sanitation-related services; and psychosocial measures related to sanitation. Direct observations of sanitation facilities and their surroundings assessed 19 parameters.

All participants and informants participated voluntarily in the survey based on their oral consent sought after an introductory description of the survey and its purpose. Participants were assured of their anonymity and the confidentiality of the gathered information. Ethical clearances were obtained from the Ethical Committee of the Wolaita Sodo University and the Ethical Committee of Charles University. Approval was also obtained from the district authorities.

The descriptive findings represent an important part of this study. In addition, we analysed the correlates of latrine quality and willingness to improve latrines using linear regression and binary logistic regression, respectively. The analysis was conducted using a Complex Samples module in SPSS, while accounting for the sampling frame (clustering of data). Latrine quality was measured by the aggregate latrine quality score constructed based on 11 distinct parameters of latrine quality measured through the direct observations of latrines and their surroundings. We explored the dimensionality of the set of these parameters and identified six underlying dimensions that were eventually used for the construction of the composite score (see Supplementary materials S1). Although the latrine quality score is a bounded outcome that can attain values between zero and six, we still used linear regression for modelling this outcome after checking that the distribution of the regression residuals is approximately normal and that the fitted values are not extrapolated outside of its range (see Supplementary materials S2).

The willingness to improve was elicited by a question, 'Do you plan to improve your latrine in the near future?' measured on a five-point Likert scale. We could not use ordinal regression to examine its predictors as the proportional odds assumption was not met. We thus used the binary logistic regression by considering a dichotomous outcome that distinguished between those who reported intention to improve their latrines against those who didn't.

We conceptually distinguish the following three subgroups of explanatory variables: (1) general objective characteristics of respondents and their households (demographic, socioeconomic, sociocultural, and ecological), (2) sanitation-related objective characteristics (latrine quality variables, characteristics of the process of adoption, maintenance, and improvement of latrines based on retrospective recalls), and (3) sanitation-related psychosocial variables (knowledge, perceived health risks, satisfaction, attitudes and preferences, descriptive and injunctive social norms, social identity, social cohesion). The IBM-WASH model categorises contextual, technology, and psychosocial factors (Dreibelbis *et al.* 2013). In addition, the RANAS model (Mosler 2012) provided a vital inspiration for the specification of psychosocial variables considered in this study. The description of the considered variables appears in Supplementary materials S3, together with their descriptive statistics. The directions of their expected relationships with the analysed sanitation outcomes are mostly intuitive. The exceptions are some demographic variables for which documented effects can lead in both directions due to multiple possible underlying mechanisms (Novotný *et al.* 2018b, p. 129).

Specification of regression models was not a straightforward task as we worked with a moderate sample size and a larger number of potentially relevant predictors of which some were correlated. We could not include them altogether in a single model. We proceeded in the following steps. In the first step, we considered demographic and socioeconomic variables only. In the second step, we excluded some of the variables that were insignificant in the first step and included the three sanitation-related objective variables. In the third step, we excluded some other more insignificant variables and additionally included psychosocial variables (those for which multicollinearity was acceptable).

RESULTS

Sanitation conditions

Of 549 households that were originally sampled, 422 owned latrines, which means 77% latrine coverage. The 62% of respondents from latrine-owning households reported that they always use their latrine for defecation when at home or nearby, and

another 22% stated that they mostly use their latrine. The remaining 16% admitted that they use latrines only sometimes or rarely in at least one of the time spells that we asked for (dry and rainy seasons and day-time and night-time). The latrine quality score for this subgroup was significantly lower than for the rest of the respondents. The findings above imply that around 38% of households in the study area used OD as their main defecation practice. This is not far from the respondents' estimates of the OD rates in their villages – on average, they estimated an OD rate of 30%. In addition, latrine use was considerably lower for children (aged 5–15), particularly in the rain-season and night-time. More than half of latrine-owning households with children admitted that their kids rarely use latrines.

The supply of hygienic latrine components (slabs in particular) and sanitation services was almost non-existent in the study area. Only a minor share of 14% of households reported that they have ever used some sanitation services. These predominantly involved general tasks such as the digging of pits or crafting or fixing latrine superstructures.

Quality of latrines

Except for one latrine with a ventilated pit, all sanitation facilities identified in our survey were simple dry unventilated single-pit latrines. [Figure 2](#) provides some illustrative examples. On average, they were located 18 m from the living house. They were made almost exclusively of locally available and often non-durable materials. The observed maximum value of the latrine quality score was five of the total six considered dimensions with an average of 2.87 and SD 0.88. Only 55% of latrines had solid walls ensuring privacy, only 37% of them had functional doors, and even fewer (27%) had functional roofs. Although the majority of surveyed latrines (82%) had some slab platform, their functionality regarding the separation of faeces from human contact was often disputable. The slabs were mostly made of logs, stones, and mud and only 32% of



Figure 2 | Examples of latrines in the study area. *Notes:* Pictures A and C show an improved pit latrine with a roof, solid walls, and a solid plastered slab platform, respectively. Pictures B and D are the examples of low-quality nondurable latrines typical for the study area.

them were assessed as easily cleanable. No functional handwashing facilities were found at the inspected latrines. However, 88% of respondents reported that they always or mostly wash their hands after defecation at home, mainly due to water scarcity.

Table 1 presents results from the analysis of correlates of latrine quality score. Two demographic variables in terms of family size and the presence of children under 5 years of age were identified as the statistically significant predictors with positive relationships to latrine quality in the first and second (for family size) models. However, their regression coefficients were relatively weak and became statistically insignificant when we additionally included psychosocial variables in the third regression model. Of the socioeconomic variables, only those that distinguished households that primarily depend on casual

Table 1 | Predictors of latrine quality score (linear regressions)

	(1)		(2)		(3)	
	Beta coefficient	Standard errors	Beta coefficient	Standard errors	Beta coefficient	Standard errors
Intercept	2.959	0.882**	3.813	0.756**	2.621	0.291**
If female respondent (binary variable)	0.093	0.103	0.106	0.081	0.055	0.073
If female household head (binary variable)	-0.333	0.215	-0.267	0.231		
No formal education of respondent (binary variable)	0.105	0.193				
Age of respondent (continuous variable measured in years)	0.008	0.006				
Presence of children under 5 years in household (binary variable)	0.212	0.090*	0.123	0.090	0.092	0.064
Family size (continuous variable measured in number of persons)	0.064	0.020**	0.058	0.022*	0.042	0.021
Casual labour as primary source of livelihood (binary variable)	-0.444	0.142*	-0.487	0.127**	-0.566	0.123**
If socioeconomic situation improved over past 2 years (binary variable)	0.156	0.101	0.141	0.085		
Household income (continuous variable measured in Ethiopian Birr; in logarithms)	-0.358	0.257	-0.450	0.240		
<i>Sanitation-related objective variables:</i>						
Reported use of sanitation services (binary variable)			0.089	0.091		
Reported improvement of latrine in past 2 years (binary variable)			0.340	0.112*	0.297	0.084**
Reported that current latrine is better than first one (binary variable)			0.455	0.138**	0.263	0.117*
<i>Sanitation-related psychosocial variables:</i>						
Perceived vulnerability to diarrhoea (binary variable distinguishing respondents who reported that it is likely that someone from their households would get diarrhoea in the next 3 months)					-0.359	0.100**
Perceived severity of impacts of diarrhoea (share of those who reported that getting diarrhoea would have quite or very serious impacts on their daily life)					0.273	0.108*
Agreed that other people in village think that respondent's family use latrine (binary variable)					0.750	0.270*
Reported satisfaction with current defecation practice (binary variable)					0.429	0.083**
R^2 (adjusted R^2)	0.130 (0.111)		0.222 (0.203)		0.302 (0.285)	

Notes: **Statistically significant at p -level < 0.01, * p -level < 0.05. Accounted for data clustering at kebele level. Some other variables were also examined but not included in the models presented here because they were not statistically significant or because of the multicollinearity. Construction of all variables and their descriptive statistics are provided in Supplementary materials S3.

labour (agricultural wage labourers) from the rest of households (mostly farmers) revealed a negative relationship with latrine quality. The effect was comparatively strong and statistically significant across all three model specifications. Expectably, two variables that recorded whether there had been any improvements in latrines in the past 2 years were positively correlated with the latrine quality score. This was not the case for the reported use of sanitation services, which may be explained by the nature of these services (digging the pits and/or basic construction works).

The sanitation-related psychosocial variables were comparatively more important predictors of latrine quality (model 3 in Table 1). Interestingly, the measure of perceived vulnerability to diarrheal disease showed a negative relationship with latrine quality, while that for perceived severity was positive. The variables of injunctive but not descriptive social norms were statistically significant in terms of norm perception. Satisfaction with the current sanitation practices was positively related to latrine quality. On the other hand, some intuitively relevant psychosocial variables, such as measures of hygiene and sanitation knowledge, recognition of the benefits of latrines (their various types), or social context variables (social trust, identification, cohesion), were not statistically significant predictors of latrine quality.

Perceived problems and preferences

Despite the generally poor quality of latrines, 63% of respondents reported satisfaction with their current sanitation practice, and nearly a quarter of respondents didn't recognize (reported) any disadvantages or weaknesses of their latrines. The most frequent problems and disadvantages were the nondurability of latrine (32% of respondents), flooding (26%), bad smell, concentration of flies, and maintenance costs (each mentioned by 25–30% of respondents). By contrast, concerns about possible safety risks, health risks, or adverse effects of latrines on the environment were considerably less frequent (mentioned by less than 5% of respondents). These observations can be directly related to the fact that the majority of respondents (61%) explicitly stated that they believe that the use of their latrine helps them to avoid diseases.

In addition, we asked respondents to compare the importance of particular components of pit latrines prevalent in the study area (Table 2). Pit size was clearly perceived as the most important latrine attribute, followed by solid walls, a solid slab platform, and functional doors.

Past improvements of latrines

Only 10% of households in the sample adopted latrines recently, while for 43% it was more than 1 year ago, and for 40% it was more than 5 years before our survey. For nearly all households in our sample (94%) the present latrine was not their first latrine. The usual durability of sanitation facilities in the surveyed area was between 2 and 5 years. When a pit gets full, it is covered by soil and a new pit is dug elsewhere.

Nearly two-thirds of households (70%) stated that their current latrines are better than their initial sanitation facilities. Although this might indicate possible gradual upgrading, qualitative descriptions of recent improvements suggested that these are mostly limited to regular maintenance tasks. Table 3 classifies households according to the types of reported improvements. We can see that only less than a third of households didn't undertake any improvements and that this subgroup of households had significantly lower quality of their latrines. Nearly a third of households undertook the significant reconstruction of their latrines, which mostly comprised new latrine constructions either due to exhausting pit capacity or due to their collapses. The rest of the households (38%) reported various minor improvements. These were mostly repairs of walls, roofs, doors, or floors and less often also pits enlargements or solidifications. Interestingly, the average

Table 2 | Importance of latrine components

Latrine component	Times reported among three most important components of latrine (of 412 responses)
Large pit (depth)	377 (92%)
Solid walls	241 (58%)
Solid floor (slab)	182 (44%)
Functional doors	180 (44%)
Solid roof	121 (29%)
Functional light	72 (17%)
Wash facility	58 (14%)

Table 3 | Latrine quality score disaggregated by responses on question 'Within the past 2 years did you make any improvements to your latrine?'

	<i>N</i>	%	Average of latrine quality score
Yes, significant reconstruction	134	32	2.96
Yes, minor improvements	163	38	3.07
No, our latrine is more or less the same	118	28	2.57
No, condition of our latrine deteriorated	7	2	1.88
Total	422	100	2.87

quality score for this subgroup was higher than for those who substantially reconstructed their facilities, though the difference was not statistically significant. It suggests that newly rebuilt latrines tend not to be of better quality than previous ones.

Willingness to improve latrine

Nearly two-thirds of respondents (61%) reported an intention to improve their latrines in the near future (Table 4). Of 232 respondents who answered an open-ended question on the nature of planned improvements, 47% wanted to construct an entirely new latrine, 40% planned to improve the roof, 28% doors, 17% slabs, and 16% walls. Other specific plans were rarely reported.

Ensuring more privacy was the most frequent motivation for latrine improvement (expressed by 42% of those with an intention to improve latrine) followed by safety (36%), comfort (21%), and reduction of health risk (17%). On the other hand, the most frequent reason for the lack of willingness to improve was that the current latrine is satisfactory (reported by 41% of those with no intention to improve), followed by high costs (21%), and a lack of materials (12%). The relatively rare occurrence of health-related motivations for latrine improvement (17%) can be compared to the considerably more frequently reported health-related motivations for the initial latrine adoption (79%) and for the current latrine use (61%).

Table 4 shows that the predictive power of variables examined in this survey with respect to the willingness to improve latrines was generally low. None of the demographic and socioeconomic variables was statistically significant. There was a positive relationship between the willingness to improve and latrine quality identified in model 2, though it became statistically insignificant when we additionally included psychosocial variables in model 3. This is a counterintuitive finding which contradicts an expectation that people who have comparatively worse sanitation facilities would be more interested in their improvement. The perception of vulnerability to diarrhoeal disease was positively related to the willingness to improve the latrine. By contrast, knowledge of sanitation and hygiene messages was negatively associated with this outcome. Rather surprisingly, none of the other variables that were also examined as potentially consequential predictors of the willingness to improve latrines were found to be statistically significant.

DISCUSSION

The latrine coverage in our study area was 77%, which is close to 79% estimated for Ethiopia by the UNICEF/WHO Joint Monitoring Programme (UNICEF/WHO 2019). In our survey, 12% of latrine-owning households admitted OD as their main defecation practice. This can be compared to the 16% rate of OD-free slippage identified in a systematic review by Abebe & Tucho (2020). It means that basic sanitation indices revealed for our study area are similar to the national estimates and that the findings of this paper may have a wider relevance beyond the context of this study.

Previous research on household-level sanitation in Ethiopia predominantly examined the initial adoption and availability of latrines. In spite of the fact that the majority of sanitation facilities across rural Ethiopia are considered to be unsafe (UNICEF/WHO 2019), issues around the sustainability and upgrading of latrines have been much less studied (Novotný & Mamo 2022). Our survey also documented the generally low quality of inspected latrines. Nearly all sanitation facilities in the study area were unventilated pit latrines constructed from local and mostly nondurable materials. On average, they met only 2.8 of the total six latrine quality dimensions determined based on multiple latrine parameters observed in the survey.

Almost all households in our sample had already rebuilt their latrines at least once prior to our survey. More than two-thirds of them (70%) reported some improvements in their latrines in the past 2 years. For one-third of households, these

Table 4 | Predictors of willingness to upgrade latrine (binary logistic regression)

	(1)		(2)		(3)	
	Beta coefficient	Standard errors	Beta coefficient	Standard errors	Beta coefficient	Standard errors
Intercept	3.365	2.486	2.019	2.267	0.528	2.531
If female respondent (binary variable)	0.136	0.185	-0.029	0.196	-0.074	0.199
If female household head (binary variable)	-0.582	0.446	-0.458	0.454	-0.591	0.503
No formal education of respondent (binary variable)	0.206	0.265	0.316	0.249	0.136	0.328
Age of respondent (continuous variable measured in years)	0.024	0.012			0.021	0.013
If children under 5 years in family (binary variable)	0.356	0.263	0.194	0.268	0.041	0.272
Family size (continuous variable measured in number of family members)	0.044	0.070	0.041	0.070		
Casual labour as primary source of livelihood (binary variable)	0.186	0.231				
If socioeconomic situation improved over past 2 years (binary variable)	0.375	0.272				
Household income (continuous variable measured in Ethiopian Birr; in logarithms)	-1.306	0.852	-0.786	0.812	-0.749	0.756
<i>Sanitation-related objective variables:</i>						
Composite score of latrine quality (continuous variable)			0.238	0.091*	0.227	0.106
Reported use of sanitation services (binary variable)			0.220	0.243		
Reported improvement of latrine in past 2 years (binary variable)			0.195	0.223		
Reported that current latrine is better than first one (binary variable)			0.156	0.367		
<i>Sanitation-related psychosocial variables:</i>						
Perceived vulnerability to diarrhoea (binary variable distinguishing respondents who reported that it is likely that someone from their households would get diarrhoea in the next 3 months)					1.094	0.245**
Knowledge of sanitation and hygiene messages (continuous variable measured as quantity of relevant messages recalled)					-0.131	0.039**
Nagelkerke R^2 (Cox & Snell R^2)	0.051 (0.038)		0.053 (0.039)		0.137 (0.101)	

Notes: **Statistically significant at p -level < 0.01, * p -level < 0.05. Accounted for data clustering at kebele level. Some other variables were also examined but not included into the models presented here because they were not statistically significant or because of the multicollinearity. Construction of all variables and their descriptive statistics are provided in Supplementary materials S3.

changes mostly involved basic repairs of latrines' superstructure, while another third rebuilt their latrines completely due to either collapses or full pits. The mean quality scores for both these subgroups were comparatively higher than for the rest of the households, but still quite low. Our results thus did not show any substantial shifts up through the sanitation ladder. Similar findings were documented by Crocker *et al.* (2017) or Mamo *et al.* (2023).

Despite the generally low quality of latrines in our sample, the majority of their users (63%) expressed satisfaction with their sanitation situation. Unlike in Novotný *et al.* (2017), satisfaction was positively related to latrine quality, indicating that users do acknowledge the benefits associated with comparatively better facilities. However, this recognition does not translate into their plans to improve latrines as suggested by the absence of a relationship between the willingness to improve and satisfaction with the current sanitation situation. In other words, an intuitive assumption that dissatisfaction with one's own sanitation situation would catalyse the interest in improving this situation seems to not hold in the context of our study. This inference might appear incompatible with the observation that the majority of households in our sample (61%) reported plans to improve their latrines in the near future. However, the willingness to improve was positively related to latrine quality,

which indicates that the poor latrine quality is itself not a major motivation for its improvement. The reported plans to improve mostly referred to the reconstructions and maintenance tasks rather than to upgrade the functionality.

Accordingly, a large pit was clearly seen as the most important latrine attribute. As in [Goddard *et al.* \(2018\)](#), we found that the solid slab, which is commonly regarded as a key aspect of a hygienic pit latrine, was perceived as comparatively less important. Similarly, issues around the limited lifespan and durability, together with privacy for users, prevailed in the discussions of motivations for latrine improvement, while motivations to reduce health risks or enhance user safety were rarely mentioned. Interestingly, however, our respondents were generally convinced about the health benefits of their latrines. All these findings suggest that there is an inadequate understanding of how a hygienic latrine works for preventing the transmission of pathogens. Such a conclusion is further supported by the fact that the measures of hygiene and sanitation knowledge were not related to latrine quality in our survey and, moreover, their relationship with the willingness to improve was negative. There is an apparent need to enhance the understanding about what are the key attributes of hygienic latrines. This was underplayed in the previous sanitation campaigns in Ethiopia. It seems that they created a widespread but superficial normative perception of the inevitably positive health benefits of latrines, irrespective of their technical standards.

Research literature from other countries than Ethiopia show that the socioeconomic situation of households represents a major factor for the investments of households into hygienic sanitation ([Gross & Günther 2014](#); [Simiyu 2017](#); [Turrén-Cruz *et al.* 2020](#); [Tiwari *et al.* 2022](#)). In our study, however, we did not identify any relationship between the latrine quality and household income, wealth or attained education. We think that it is related to the type of latrines used in the study area. Their construction requires some manpower, suitable space, and basic local materials. They were predominantly self-constructed and only very rarely contained commercially purchased components. For adopting these facilities, the socioeconomic situation of households does not appear to be a crucial barrier. A sole socioeconomic variable that was the statistically significant predictor of latrine quality in our regression analysis was the dependence of households on casual agricultural labour. Although reporting comparatively higher income, this subgroup of families revealed significantly lower quality of latrines. This may just be due to their worse access to land and local materials.

That socioeconomic factors did not predict the quality of latrines in our sample obviously does not mean that they are unimportant in the present context. The contrary is true with respect to the prospective upgrading of local sanitation conditions. The documented socioeconomic situation in the study area predetermines the generally very low purchasing power of the local population. It undermines the development of a local supply of hygienic sanitation products and services on a commercial basis. Such services were non-existent in the surveyed area at the time of our survey. Identifying and supporting local-level sanitation actors is obviously another key challenge. However, it is unlikely that this will be possible without bolstering the purchasing power of local people. While the no-subsidy approach was used to initiate latrine adoption in Ethiopia, financial and/or material incentives would be instrumental and very probably required for facilitating latrine upgrading ([Gebremariam & Tsehaye 2019](#); [Tamene & Afework 2021](#); [Afework *et al.* 2022](#); [Mamo *et al.* 2023](#)).

Finally, let us mention some limitations of this study. First, we used cross-sectional data and the relationships identified in our regression analyses represent statistical associations only. Reverse causality may be particularly an issue when interpreting results on the role of psychosocial predictors. Second, the quality of latrines was measured through direct observations of latrine attributes. Although practically feasible, the latrine quality score considered here is obviously only a very crude proxy measure of the effectiveness of latrines regarding the reduction of pathogens as well as concerning the comfort and safety of users. Third, previous community-based sanitation campaigns implemented in the study area utilized social and institutional surveillance. It established a strong perception of the injunctive social norms around latrine use. As such, what the respondents reported on their sanitation-related behaviours and preferences may thus involve a social desirability bias.

CONCLUSION

This study examined the quality of latrines and their improvements at the household level in the Loka Abaya district, South Ethiopia. The former was analysed based on direct observations and the latter by retrospective recalls and questions on preferences and future plans concerning latrine upgrading. The quality of latrines in our sample was low, questioning their positive effects on human health. In spite of this fact, the majority of respondents reported satisfaction with their sanitation situation. The prevalence of past latrine improvements and the willingness to improve latrines in the near future were high. However, they rarely addressed substantial functional upgrading and mostly involved regular maintenance and reconstruction due to the low durability of sanitation infrastructure. Our findings showed that there is an inadequate understanding

about what are the key attributes of hygienic latrines. Together with the low purchasing power of local people, it impairs demand for hygienic sanitation and prevents the development of the respective supply chains. It implies a need for sanitation subsidies or material support, community education about the means of hygienic sanitation, and promotion of hygienic sanitation infrastructure. Both sanitation interventions and research should concentrate more on the sustainability and quality of sanitation facilities and not solely on increasing latrine coverage.

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AUTHOR CONTRIBUTIONS

B.G.M. designed the study, organized and supervised data collection, processed and analysed the data, and participated in the manuscript preparation. J.N. designed the study, analysed the data, and participated in the manuscript preparation. A.A. designed the study and participated in the manuscript preparation. All authors read and approved the final manuscript.

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ETHICS APPROVAL AND CONSENT TO PARTICIPATE

All participants and informants participated voluntarily in the survey based on their oral consent sought after an introductory description of the survey and its purpose. Participants were assured of their anonymity and the confidentiality of the information gathered. Ethical clearances were obtained from the Ethical Committee of the Wolaita Sodo University and the Ethical Committee of the Charles University. A written approval was also obtained from the district authorities.

DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

CONFLICT OF INTEREST

The authors declare there is no conflict. Although the first author was involved in sanitation projects implemented in some of the surveyed kebeles, the authors feel and declare that it does not impact the interpretation of findings in this article.

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Article

Promotion of market-based sanitation in Ethiopia: a case study from Wolaita zone

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Abstract

Ethiopia increased the availability of latrines notably, but the sanitation facilities rarely meet hygienic standards. Therefore, the market-based sanitation (MBS) programme has been implemented across the country for nearly a decade to expand the market and boost the demand for hygienic sanitation products and services. While it does not seem that the MBS would bring any notable change in sanitation conditions so far, its implementation challenges are not adequately understood. To address this gap, this article delves into the grassroots-level implementation of MBS in the Wolaita zone. The study relies on qualitative data gathered through interviews with various stakeholders, examining both demand- and supply-side challenges. Some issues identified were external to MBS implementation, such as high inflation and an unstable political and security situation in Ethiopia. Additionally, the study reveals that more general deficiencies of the Ethiopian health extension program, including the stress and discouragement of local change agents (health extension workers, health development army members) due to workloads and low remuneration, have adversely impacted MBS delivery. The implementation of MBS has also not effectively addressed the affordability of hygienic sanitation products. On the supply side, economic constraints and organizational inefficiencies have hindered the development of the sanitation market, preventing it from reaching a critical mass. Our research suggests that MBS alone will not suffice to improve sanitation in Ethiopia.

Keywords: Ethiopia, market-based sanitation, supply of sanitation products, demand for sanitation products, latrine quality

INTRODUCTION

Promoting hygienic, safe, and sustainable sanitation is a collective aim for governments, policymakers, and stakeholders, crucial for human health and overall well-being (UN, 2015). While numerous countries, especially in the global south, strive to meet the Sustainable Development Goal's sanitation target through localized efforts, success levels vary (WHO, 2022). Ethiopia, with a sizable population and initially low sanitation rates, significantly influences global indicators due to its population size and baseline sanitation rates.

Over the past two decades, Ethiopia has made substantial progress in increasing toilet coverage. This achievement is primarily attributed to the national sanitation strategy (FMOH, 2011; Humňalová and Ficek,

2023), which was implemented through the Health Extension Program—HEP (Assefa *et al.*, 2019). A prominent approach within this strategy was the Ethiopian adaptation of Community-Led Total Sanitation and Hygiene, building upon the Community-Led Total Sanitation (CLTS) approach (Crocker *et al.*, 2017; Novotný *et al.*, 2018a). However, the increased latrine coverage often compromised quality, using low-cost, locally available materials, resulting in sustainability issues, collapses, and a resurgence of open defecation (Abebe and Tucho, 2020; UNICEF, 2020; Novotný and Mamo, 2022; Kouassi *et al.*, 2023). Research indicates that relying solely on the CLTS approach may not be sufficient for achieving hygienic sanitation (Cavill *et al.*, 2015; Crocker *et al.*, 2017; Novotný *et al.*, 2018b; Ficek and Novotný, 2019). Consequently, in

Contribution to Health Promotion

- The MBS program has been implemented in Ethiopia to address the prevalence of unhygienic sanitation facilities, but its challenges are not adequately understood. This article aims to address this gap through a qualitative case study from Southern Ethiopia.
- Unaffordability remains a major barrier, coupled with the distress and demotivation of local change agents. On the supply side, limited access to capital and organizational instability of local enterprises are some notable issues. Conflict and inflation exacerbated these problems.
- Achieving hygienic sanitation in Ethiopia is unlikely through the MBS approach alone; additional investments in the development of the sanitation sector are necessary.

2013, sanitation marketing was introduced in Ethiopia to complement CLTS and enhance access to hygienic sanitation, although both its scale and outcomes fell short of expectations (FMOH, 2013).

Recognizing the challenges, in 2019, the ‘Total Sanitation to End Open Defecation and Urination’ campaign was launched with the goal of making Ethiopia open defecation free by 2024 (FMOH, 2019). As a part of the effort, the Ethiopian government revised the national sanitation marketing guidelines and renewed the approach as the market-based sanitation (MBS) programme (FMOH, 2020). It was initiated in 2020 with the aim of expanding the market for sanitation products and services, improving their supply and boosting demand through subsidies and behavioural measures (FMOH, 2022; Phillips *et al.*, 2022; USAID, 2023). The MBS supports the establishment of local business enterprises and provides them with training in the production, installation, and promotion of improved sanitation products to rural households (Schau-Jones, 2011; Sparkman, 2013; O’Keefe *et al.*, 2015). The government handles the establishment and legalization of these enterprises, while development partners provide training and financial and material support. MBS has also been integrated with the HEP to ensure the promotion of sanitation products to households through door-to-door visits, community mobilization activities, and monitoring by the health extension workers (HEWs), members of the women’s community organizations known as the health development army (HDAs), and kebele (village) administration (FMOH, 2020; see also Medhanyie *et al.*, 2012; Maes *et al.*, 2015).

The implementation of MBS has challenges (e.g., Schaub-Jones, 2011; Barrington *et al.*, 2017; Agarwal *et al.*, 2020). While promotional activities can improve demand and facilitate a suitable environment at the initial stage, dissemination of the products, business financing, and the creation of viable local markets in later stages are critical steps that are not easy to accomplish. A recent study from Southern Ethiopia reported that households tend to underestimate the market price of sanitation products such as prefabricated hygienic slabs, sometimes expect to receive them for free, and that these products are often unaffordable for them (Mamo *et al.*, 2023a, 2023b). Recent inflation adds to this concern notably, as it is expected to soar the price of factory and locally constructed items, presenting a major challenge for both suppliers and consumers (Sisay *et al.*, 2022; Tolasa *et al.*, 2022). The government has designed a policy to subsidize sanitation products under certain conditions, but it is not yet in effect (FMOH, 2022). While the MBS has thus remained a major sanitation promotion programme in Ethiopia, little research studied its grassroots implementation.

Prior research, conducted partly in the same area as this paper, confirmed the relatively high latrine coverage associated with poor-quality latrines and minimal upgrades over time. Households often construct latrines independently, lacking basic construction skills, leading to structural collapses. The CLTS program, in place for over a decade, didn’t address these challenges (Novotný *et al.*, 2018a, 2018b; Mamo *et al.*, 2023a, 2023b).

In this context, this article aims to fill the gap with the objective of examining the MBS implementation in a case study from the Wolaita zone, where the 5-year MBS projects were implemented in the six selected districts. The study draws on the qualitative data collected through semi-structured interviews and focus group discussions (FGDs) with various actors (key informants) involved or knowledgeable about both the demand- and supply-side issues around the MBS implementation and, more generally, the sanitation situation in the study area.

DATA AND METHODS

Data collection

The study is based on field research conducted in four districts of Wolaita zone: Humbo, Damot Gale, Damot Pullassa and Damot Sore. These districts were chosen for the MBS project due to favourable conditions for initial large-scale proof-of-concept development and testing. In each district, we purposely sampled two kebeles based on consultation with the zonal, woreda, and NGO representatives and considering their performance to cover one kebele with high performance and

the other with low performance regarding promotion, sales, and community engagement on the improved sanitation products implementation.

Data were collected between August 2022 and September 2022 through key informant interviews and FGDs. Prior to the interviews, we communicated the research purpose to project implementers. Participants were selected based on their involvement at various levels, and findings are presented anonymously using positions or responsibilities. Drawing from our prior research in the study area, relevant literature and practical experience in the water, sanitation and hygiene (WASH) sector in Ethiopia, we developed an interview guide covering topics such as the local sanitation situation, challenges in hygienic sanitation, micro-level WASH enterprises in MBS and institutional support. The guide, in English, was translated into local languages (Wolaytta Doonaa and Amharic). Wolaytta Doonaa was used for kebele-level interviews, and Amharic for zonal, district and NGO interviews, based on interviewee preferences. The first author, fluent in Wolaytta Doonaa and Amharic, conducted interviews and recorded, transcribed and translated them into English for analysis. Transcriptions were verified for accuracy by a linguist from Wolaita Sodo University, not involved in the study. The study complies with the Consolidate Criteria for Reporting Qualitative Research (Supplementary Material A; Tong *et al.*, 2007).

Data analysis

For this research, we employed a deductive–inductive approach to theme identification (Braun and Clarke, 2006; Bradley *et al.*, 2007). Initially, we developed a thematic framework based on pre-existing knowledge that was used for an interview guide. In the data analysis, we found that the predefined main themes effectively captured the data, with minor revisions. We covered five main themes, as follows: (i) conception of the hygienic toilet and its core components; (ii) availability and quality of latrines in the study area and the changes through time; (iii) demand-side issues; (iv) supply-side issues; (v) institutional and political support. Within each main theme, we identified more specific codes through inductive analysis of the data corresponding to more specific aspects of the knowledge of hygienic toilets and their quality parameters, sanitation behaviours, institutional and political barriers, strategies for promoting improved sanitation products, or financial constraints on both the demand and supply sides, among other specific topics. We observed that these themes were interconnected. For example, specific financial constraints were identified as constraints on both the supply and demand sides. This insight provided additional context for reporting the

main themes. When presenting our findings, we categorized these subthemes under their respective main themes.

The first author coded the data. The second author examined the organization of the data to analyse thematic results and present findings. Due to a language barrier, the second author could only participate in the data analysis after the material was translated into English. Data were analysed using NVivo software.

FINDINGS

After providing a brief description of the study participants, the findings are presented according to the main themes as follows: comments on the sanitation situation in the study area, description of the MBS implementation, supply of sanitation products, demand for sanitation products and institutional and political support.

Characterization of the study participants

In total, 30 key informant interviews and 8 FGDs were conducted with different stakeholders at zonal, district and kebele levels. The kebele-level interviewees included HEWs (8 interviews), HDAs (8 FGDs), kebele leaders (4 interviews) and sales agents (4 interviews). In addition, we interviewed representatives of local enterprises established with the support from the WASH projects (8 interviews). The district-level interviews were conducted with the WASH focal persons from each selected district health office (4 interviews). The zonal-level interviewees were the WASH focal persons from the zonal health department and the WASH program officers from the NGOs (2 interviews). In total, there were 86 participants in the study, of which 68 were women and 18 were men. More than half of the study participants were in the age group 25–34 (60%). The average age of the key informant interview participants was 31 and most of them attended college or university (87%). All the FGD attendants were female, with 56 participants.

Sanitation situation in the study area

Interviews confirmed that open defecation has become less prevalent over the past decade or so but was not eliminated. However, both the share of improved latrines and the quality of sanitation facilities remain low. Wooden log slabs, occasionally plastered with mud or cement, are commonly used. Local sanitation services, including those from the private sector, are underutilized. In the past, the promotion of latrine construction encouraged any type of latrine. However, a new procedure implemented by the zonal health department now requires households to have an iron-sheet (tin roof) latrine in practice. The promotion also

includes other parts such as the pit, slab and door. According to several interviewees, the number of households with tin-roofed latrines and plastered walls is steadily increasing due to these changes. Illustrative quotes are as follows:

We are exclusively promoting improved latrines transitioning (maintaining or upgrading the latrine) from grass-roofed to tin-roofed latrines, which have a washable solid slab, wall, roof, door, and so on. (WASH Officer, Zonal Health Department)

We encourage households to construct tin-roofed latrines. In our kebele, around 30% of HHS changed their latrines to tin-roofed latrines. (HEW, Koyisha Wangala)

However, the participants also mentioned that the situation is not homogenous and the speed of transition to improved sanitation facilities varies between kebeles. While most households have been receptive to these changes, some have resisted due to financial costs (as will be discussed below). The shared opinion was that community members are expected to comply, with enforcement overseen by HDAs, HEWs and kebele administrators.

MBS in the study area

To tackle latrine quality, improved sanitation products such as prefabricated slabs have been promoted through the MBS. As of our survey, these initiatives were ongoing, hindering a conclusive assessment of their impact on sanitation conditions. Interview insights, however, indicate that the scale of MBS projects is limited, and they encounter numerous challenges. Efforts to use sanitation marketing in the study area date well back before the implementation of the MBS promotion discussed in this study but they were rather scattered and not wide enough:

Sanitation marketing was started a long time ago, but it was in the last five years it has been implemented in an organized way. It is being implemented in six districts in our zone (Wolaita) by two big projects called TRANSFORM-WASH AND GESHIYARO. (WASH Officer, Zonal Health Department)

Both projects mentioned were launched between 2018 and 2019. The Geshiyaro project, by World Vision Ethiopia in collaboration with zonal and district offices, aimed at preventing soil-transmitted infections, including a WASH component with MBS as one part (Mekete *et al.*, 2019). The Transform WASH project sought to test market-based models to increase demand and supply of quality WASH products. It also

aimed to develop scalable business models to support the OneWASH national program in marketing and promoting improved WASH products and services (USAID, 2023). In the Wolaita zone, MBS activities were implemented in five districts under the Geshiyaro project (Damot Pullassa, Damot Gale, Damot Sore, Bollosso Sore and Bollosso Bonbe), while the Transform WASH was implemented in one district (Humbo).

Although the projects include other WASH implementation activities, for the purpose of our study, we only focus on the MBS part. The supply-side MBS activities (slab production and sales) have involved the establishment of local enterprises by employing mostly college graduate youths, both males and females, selected from different kebeles and different backgrounds and functioning at the cluster level (one cluster consists of not less than 10 kebeles).

The establishment of enterprises mainly aimed at unemployed youth to enable them to generate income while improving sanitation in their community. (WASH Officer; NGO)

Micro and small-scale enterprises in Ethiopia, such as those established under the WASH projects, follow specific policies within a 5-year timeframe. The objective is to generate employment, ensure fair income distribution and foster enterprise growth. The enterprises aim for financial stability within this period, with performance evaluations determining potential replacement after 5 years.

“After five years of enabling themselves with income, they will be graduated and replaced by another similar enterprise.” (WASH Officer; Zonal Health Department)

Prior to starting slab production, the enterprises received 15 days of training provided by the implementing NGOs in partnership with the zonal- and district-level health offices in practical and theoretical aspects of MBS, including financial management. The training was given by skilled trainers from the technical and vocational schools. The training covered 70% of practice and it also included financial management, bookkeeping, business projections and planning.

After training, they were provided with financial, construction materials (i.e. sand, gravel and reinforcement bars) and production tools support from the NGOs. The provision of production tools and equipment was because the tools were expensive and the enterprises couldn't afford them. However, the support differs as per the project. An enterprise from the Humbo district which was under the Transform WASH project reported that, except the theoretical and

skill training, financial and material support were not provided.

It has been four years since I started this job. An NGO gave me my first round of training (theory and practical) on how to produce and sell sanitation products. But they didn't provide any initial capital. So, I asked my brother for help to give me some money. (Member of enterprise; Humbo)

Legalization of the enterprise establishment and provision of the production sites, which serve as hubs for the production, demonstration and sale of sanitation products, were facilitated by the respective district governments. The shades construction was financially supported by the NGO in the case of the Geshiyaro project.

Initially, locating a suitable production site was challenging. However, after convincing the concerned government offices, the site was given on lease to the producers (each site is around 250 square meters) at a cluster level. In each of our implementation districts, two to three production centers were constructed. (WASH Officer; NGO)

But in the Transform WASH project district (i.e. Humbo), it is the enterprise that built the production shade by themselves on the site provided by the district government.

The government gave me only the working space, but not the budget nor the NGO so we were struggling. We constructed the shade by ourselves. (Member of enterprise; Humbo)

The projects endorsed sanitation slabs through door-to-door campaigns led by HEWs, HDAs and local enterprises. Administrative backing came from NGOs, zonal and district health offices and kebele leaders. Influential figures, model households and designated promoters, including business owners, church and community leaders, teachers and educated individuals, strategically facilitated private business engagement and community-wide access. Agricultural officers and kebele administrators also joined the promotion due to their expertise in selling agricultural inputs and managing household loans.

To ensure inclusivity, the promotion targeted even the poorest households in a kebele, acknowledging the risk that they are more likely to still practice open defecation. Recognizing their right to access improved sanitation facilities, kebele administrators, HEWs and HDAs facilitate financial or material contributions through methods like mobilizing households within the same village or utilizing government financial schemes like the Productive Safety Net Program (Gilligan *et al.*, 2009; Cochrane and Tamiru, 2016). Each kebele has at least one sales representative overseeing savings and promoting slab use among households, collecting payments from households willing to purchase slabs and linking them to the slab producers.

Supply of sanitation products

In all four districts studied, there have been one to two enterprise groups that produce sanitation products at a cluster level. Nevertheless, the status of promotion, types of sanitation products and approach to sales differ slightly from one cluster to another. The most common products are concrete slabs (Figure 1). In



Fig. 1: (a) Circular concrete slab and (b) rectangular concrete slab with plastic pan.

the Humbo cluster, plastic slabs were also available imported from abroad and transported from distributors more than 150 km away.

We produce concrete slabs in two forms (circular and rectangular) and we also sell plastic slab such as SATO Pan and SEAL Africa in different sizes. Initially, it was the NGO that used to deliver the plastic slabs to us. After a while, they stopped delivery so that they could link us with the distributors located in the regional town. So, we ourselves start bringing the products from the distributors. (Member of enterprise, Humbo)

Enterprise members reported several challenges. The limited supply arises from small-scale production, causing slabs to be intermittently unavailable even when households are prepared to purchase. Slab producers attribute this to low or inconsistent demand. Additionally, enterprises cited the manual nature of the production process as a constraint on productivity, stating financial constraints prevent investments for improvement. The physically demanding nature of the work discourages slab producers, leading to a high turnover among members, as reported by enterprise leaders.

Initially, there were ten members in the enterprise, but due to the labor-intensive nature of the job, several members decided to leave and seek alternative employment opportunities. For a short period of time, only five members continued. However, eventually, even these five members left the association due to administrative issues so that the establishment of enterprises was done recently for the second time. (Member of enterprise; Ade Aro)

Identified challenges in the effective supply of sanitation products in the study area were mainly the issues related to transportation and delivery, installation and conflicts among enterprise members. Proximity to the production site offers advantages, while delivery and installation issues arise in distant kebeles, leaving households responsible for these tasks. Lack of guidance on technical skills results in some households storing slabs without installing them. Some of the difficulties in installation stem from a mismatch between slab and latrine pit sizes stemming from inadequate prior consultation with the slab producers/distributors. Additionally, despite the presence of skilled masons in the study area, hiring them for sanitation services is uncommon. Many households construct their latrines independently, even without the necessary skills, leading to reduced facility lifespan.

... the challenge with a concrete slab is that sometimes the existing latrine's pit diameter and slab diameter don't match, so households need to dig another pit. (HDAs; FGD, Zamine Wulisho)

Although the cost of transport (~50–100 ETB (0.95–1.9 USD)) is insignificant compared to the price of the slab (mentioned below), it adds stress on households due to the inconvenient transportation system in the area. In some cases, the NGO provides delivery access, but it is not consistent. On the other hand, the history of slab distribution for free by another NGO in the past has instilled a perception among households that slabs should be acquired at no cost.

When households buy a slab, they transport it by donkey cart. It is the household that covers the transportation costs. It is approximately 30–50 ETB, depending on the household's distance from the slab storage site. (HDAs; FGD, Gola Shanto)

Both projects were providing slabs to rural households through direct sales. However, specifically, the Geshiyaro project started partial subsidies for the targeted households in the final year of the project. For the subsidized option, a household pays only 20% of the slab's market price, while the project covers the rest, aiming not to leave behind the households who cannot afford the full price of the slab.

At the final year of the project (fifth year), we started implementing the subsidy for the targeted two types of households. The first group of households are those who are unable to contribute their share (households who are in the transitory food program), and the second group of households are those who can contribute at least 20% of the slab market price. (WASH Officer; NGO)

Income disparities among association members, stemming from varied earnings and the reliance of some of them on slab sales, create conflicts among them. Limited demand results in stored slabs, leading to unpredictable and sporadic sales that pose financial difficulties, particularly for members supporting families. Additionally, a lack of business understanding and unrealistic profit expectations contribute to frustration and discouragement among members.

Despite our efforts, the slab sale did not generate significant profits. Eventually, all nine group members, except for myself, left due to dissatisfaction with the job. The primary issues were the labor-intensive nature of the work and the lack of necessary skills among the workers. Many individuals

joined the association out of unemployment, possibly as a means for political appeasement. Most of the members made the decision to continue with this work until they secure alternative employment, preferably a stable government job. (Member of enterprise; Wandara Bollosso)

Demand for sanitation products

During house-to-house slab promotion, HDAs often encounter resistance from residents questioning the prioritization of a latrine over basic needs like food due to economic constraints. Both FGD participants and key informants emphasize financial limitations as the primary barrier. The community's diverse financial circumstances lead some to afford slabs independently, while others require subsidies. Notably, community leaders and facilitators, including kebele administrative bodies, HDAs, HEWs, church leaders and teachers, and institutions at the kebele level tend to own slabs. Their willingness to pay is driven not only by affordability but also by the need to set an example and pressure from higher political officials.

Households with financial resources, engaged in business activities, and recognized as model households are more likely to afford the slab prices. Likewise, institutions such as schools, churches, and health centers can afford to install slabs due to their financial capabilities. (HEW; Humbo)

Promoting slab acquisition informed households about prices and recognized the need for financial resources, exploring various saving approaches. Payment options include full-upfront payment or half-upfront payment with the remaining amount settled later. Despite the availability of local microfinance institutions, households in the study area prefer using their own funds. Common savings methods include contributing fixed amounts with neighbouring households or saving individually until reaching the slab price, often using HDAs, sales agents or village associations. While a few households save specifically for slabs, the prevailing trend is saving for purposes other than slabs.

Over the last 5 years, slab prices have consistently increased due to escalating construction material costs, including factory products like cement and iron bars, as well as locally sourced materials such as gravel and sand. Initially priced from 450 ETB (8.55 USD) for medium sizes to 650 ETB (11.4 USD) for large sizes, current prices have surged to 650 ETB (12.35 USD) for medium slabs and 950 ETB (18.05 USD) for large slabs (at the time of the survey).

The escalating prices now exceed the financial resources of households, posing a challenge for them to afford the full amount upfront. Affordability issues

stem primarily from a shortage of cash among households, hindering their ability to make purchases even when there is demand. Additionally, the high market prices directly impact the promotional efforts of change agents (HDAs and HEWs). Consequently, these agents advocate for government intervention to regulate the market.

We wonder why the government does not control the market. For example, when we promote slabs and proper handwashing, households respond that we don't even get soap to wash our children. If the government doesn't know the market price which is above our capacity, who sent you for the promotion? (HDAs; FGD, Zamine Wulisho)

However, based on the assessment of the household's financial capacity, the project implementers (NGOs) believe that affordability does not emerge as a significant issue.

Despite the market price increment, households demonstrate the ability to purchase and acquire expensive items, investing in home improvements with materials that surpass the cost of slabs. (WASH Officer; NGO)

By contrast, it was reported by the HDAs during an FGD that financial constraints are a problem for the entire community, primarily driven by the impact of inflation.

Life is difficult for people. People appear to be in good shape because they dress well. They are empty inside and struggling because of a lack of savings and income shortage. This is not only the problem of farmers but also government employees because of inflation, which has affected their financial stability. (HDAs; FGD, Zamine Wulusho)

While most households in the community share a similar economic status, certain households, led by disabled, elderly, female heads, or those in a food transitory program, seek special support. Kebele authorities and HEWs identify households requiring such support. Support is also provided by volunteer village members, typically in groups of four or five households, offering labour and sometimes materials, without monetary contributions. It was reported that the voluntary efforts aim to assist disadvantaged groups in constructing latrines, driven by the understanding that a lack of latrines among neighbours increases the risk of community contamination due to poor sanitation practices.

In cases where we identify a household's inability to afford latrine construction, we offer material or labor support, enabling them to proceed with the construction. (HDAs; FGD, Kindo Wangalla)

Interviews also revealed challenges related to soil texture. Households in swampy areas, where the water table is high, express less interest in purchasing slabs due to latrine collapse issues. In these areas, latrine lifespans are short, leading to frequent reconstruction, causing residents to view slab purchases as wasteful. Additionally, it was stated that the lack of awareness about the health and non-health benefits of concrete slab-equipped latrines affects households' willingness to pay. Over time, however, neighbouring households share knowledge about slab advantages, leading to increased recognition that constructing a latrine with a slab can prevent frequent reconstruction, ensuring longevity and promoting health.

There were households that resisted the idea of purchasing slab. However, as they witnessed the advantages and positive impact of having latrines with concrete slab from other households that were using latrine with slab, they not only showed interest in purchase the slab but also apologized for their previous resistance. (HDAs; FGD, Ade Aro)

Institutional and political support

It was revealed in the interviews that enterprises confront a crucial hurdle when applying for loans from microfinance institutions. Despite thorough evaluation of business plans, they face challenges in obtaining loans due to the requirement for a mortgage, often linked to their production site. Curiously, NGOs exhibit reluctance to provide loans, fearing the potential misuse of production facilities as collateral. Initially, enterprises struggled with inadequate working capital, as they received only limited starting capital from NGOs and lacked sustained support over time.

The sanitation products market was slow at the beginning. Later, the district gave me the working space, though they didn't provide financial support. I was struggling at the beginning. I went to a local microfinance institution and took a 15-thousand-birr loan by myself to construct the shade. (Member of enterprise; Humbo)

Enterprises in the study area thus rarely utilize loans to run sanitation businesses, being mostly dependent on the initial small capital offered by NGOs. However, the financial constraints and the soaring costs of inputs impede their ability to scale up their production. While microfinance institutions also have some established

systems for providing limited household loans, obtaining loans for purchasing sanitation products is less likely for households.

Most of the time, households do not prefer to take loans to buy slabs. Unless the government or an NGO puts in place a system to link households with microfinance institutions or banks, they prefer to take loans to buy cows or other domestic animals, start businesses, or build houses. (Member of enterprise; Humbo)

Institutional support is vital for implementing MBS in the study area. To ensure sustainability, higher officials should provide ongoing support through regular monitoring, follow-up, capacity-building training, and financial assistance for lower-level implementing bodies. However, current practices indicate that sanitation activities are perceived as seasonal, with higher officials visiting kebeles more frequently during specific periods, such as open defecation-free milestones, and less frequently afterwards.

The higher officials (i.e., from the health and political sectors) see sanitation activities as seasonal activities. For example, during the open defecation-free program, they would visit us daily, but once the program period concluded, their visits became infrequent or ceased altogether. (HEW; Humbo)

Moreover, key informants noted a decline in institutional support over time, attributed to political challenges such as the civil war in Northern Ethiopia, local political instability and the impact of the COVID-19 pandemic. Political support for health work, including sanitation and other HEP activities, is commonly in practice with other developmental activities at the kebele level. However, the sanitation agenda often receives less priority during assignments.

Assigned politicians from the district level are meant to support us; however, they prioritize other activities such as collecting money contribution for certain agendas from farmers, repaying fertilizer loans, and engaging in various political endeavors. Sanitation issues consistently take a back seat on their agenda, lacking the necessary priority. (HEW; Damot Gale)

Households occasionally encounter conflicts in activities as they navigate political demands for monetary contributions. This presents a challenge, particularly due to financial constraints. In such situations, households often prioritize meeting

government requests for other contributions over purchasing sanitation slabs, fearing penalties such as imprisonment or restricted access to social programs for non-compliance.

On the other side, when we promote slab, the government is pressuring households to contribute a fixed amount of money for war (supporting the military during a civil war on northern Ethiopia). ... though households struggling to secure daily food consumption are compelled to contribute to the war effort. (HEWs; Damot Pullassa)

HEWs and HDAs play a crucial role in promoting sanitation awareness, but their effectiveness is hindered by administrative weaknesses and heavy workloads. HEWs express career advancement aspirations, yet limited opportunities exist within or outside HEP. Despite completing 2 years of upgrade training on HEP, they often return to previous roles, causing discouragement. Both HEWs and HDAs note reduced benefits and challenges in motivation due to diminished promotions and regular training. The demanding nature of HEP activities requires full dedication and residing in the assigned kebele, but many HEWs opt to live in district towns for a better lifestyle. Balancing family life and social commitments further challenges their focus on HEP activities.

When I initially joined the HEP, I was unmarried, and my commitment to the job was more straightforward. However, now that I am married, have children, and actively participate in social activities, I face challenges in fully engaging with my work. (HEW; Damot Pullassa)

HEP relies heavily on the presence and work of HEWs, and their long absences due to various reasons, such as career upgrading training, maternity leave, relocation, illness, or leaving the job, can significantly impact the implementation of HEP activities, including sanitation and hygiene promotion.

Upon my return [from upgrade training for two years], I found that things were not properly organized. As a result, I intend to reestablish and resume the HEW activities from where it were when I left. (HEW; Damot Gale)

Both HEWs and HDAs are expected to perform a wide range of health and non-health-related activities, including engaging in local politics and NGO project activities. This situation has led to a sense of disappointment and dissatisfaction with their working conditions.

It feels disheartening that government officials, politicians and other stakeholders are expecting you to multi-task within a limited amount of time. Moreover, individuals with limited knowledge of the HEP are controlling over your work. (HEWs; Humbo)

CONCLUDING DISCUSSION

Our study aimed to explore the ground-level implementation of MBS in a case study from the Wolaita zone. While this study did not quantitatively examine the household-level sanitation conditions, interviews, as well as both zonal health offices and implementing NGO reports, suggested that the MBS activities have initiated a positive shift in latrine coverage and upgrading, though not radical. We identified various challenges manifested at different levels, ranging from problems that are external to the MBS projects implementation, issues related to institutional and administrative support, notable supply-side constraints at the level of producers and distributors of sanitation products, or household-level demand-side limitations.

Inflation in Ethiopia has surged notably in the examined period. It has had multiple direct and indirect adverse effects on households, producers, and distributors, but also on the government and its individual change agents at the grassroots level (HEWs, HDAs, etc.). Violent conflict, ongoing political turbulences, the COVID-19 pandemic and prolonged dry seasons over the past 2 years have constituted other significant negative external factors impacting local livelihoods, the economy and the state as well as the non-governmental sector in Ethiopia. These risks could hardly have been expected in their actual scale.

Nevertheless, we also noted certain drawbacks internal to the MBS implementation. The initiatives began by establishing enterprises based on the primary criterion of involving college graduate youths, irrespective of their prior experiences and skills, aiming to address unemployment and gain political support in communities. However, labour-intensive tasks such as slab production—demand-specific skills and experience. The 2-week training on basic production skills and marketing proved insufficient. Incorporating more experienced artisans alongside newcomers could have been a more effective approach.

Each enterprise operates with a 10-member association, but the large number of members impacts the enterprise in two crucial ways. First, it complicates management as leaders grapple with diverse member interests. Second, it leads to high turnover. Despite modest sales, members expect profits, but actual shares are disproportionately small, causing discouragement and turnover. This, coupled with

inadequate marketing skills, necessitates enterprise re-establishment. Additionally, replacing existing micro and small-scale enterprises every 5 years, as proposed, may adversely impact the MBS approach's overall effectiveness. Given the modest revenue of sanitation businesses, this policy seems impractical. Enterprises slated for replacement should have a stable financial and practical base for a successful upgrade.

Production sites are strategically located at the cluster level, covering up to 10 kebeles to enhance the sale and delivery of improved sanitation products. However, the extensive network poses challenges for enterprises, managing both production and promotion activities due to significant distances. A potential solution involves reducing kebeles, aligning with existing health center clusters. Enterprises face difficulties in delivering slabs due to poor road access, with households taking on the responsibility. To address this, an effective approach could offer a comprehensive service package, stimulating community demand (see also UNICEF, 2020).

The current enterprise services are limited to slab sales, excluding superstructure features and mason works, which households handle. While financially viable for households, this approach may impact latrine quality (Mamo *et al.*, 2023a, 2023b). Installation challenges arose due to insufficient consultation on slab-latrines compatibility. Consulting households before sales could aid in choosing suitable slabs. The affordability and awareness barriers are probably not independent of the design issues. Exploring various sizes and types of slabs could possibly result in identifying the right balance between customer costs, preference and ease of installation. In addition, implementing a targeted sales approach could enhance the promotion and adoption of improved sanitation products in households (Jenkins and Scott, 2007).

Our study indicated that the examined initiatives have initiated some positive changes, indicating the potential to enhance sanitation conditions over time. Nevertheless, the projects were designed with a short-term perspective. The government should continue and could also intensify a messaging campaign to support market development as a relatively low-cost option.

The Ethiopian sanitation strategy has largely relied on the existing HEP and its change agents such as HEWs, HDAs and local health officials and politicians, as well as material and financial support from development partners. However, a notable limitation seems to be its limited engagement with the private sector, though, in the context of rural Ethiopia, it may require substantial government support and oversight, at least initially (see also Carrard *et al.*, 2009; Hueso, 2016; Savelli *et al.*, 2019). Currently,

low market returns discourage the private sector (Sy *et al.*, 2014; OECD, 2019) in relation to insufficient household demand that stems from the factual economic constraints but also from the inadequate conception of hygienic sanitation facilities (Goddard *et al.*, 2018; Mamo *et al.*, 2023a). Subsidizing interested private sector companies or start-ups either directly, through (micro)finance institutions, or through targeted household-level subsidies could stimulate their engagement. Identifying the financing options and market-compatible social subsidy approaches could help to reach the poorest (Guiteras *et al.*, 2015). Ideally, examining these options as well as determining the adequate level of financial support required in the given context represents a useful direction for future research.

Given the budgetary constraints, it is not surprising that the Ethiopian government has prioritized low-cost approaches like CLTS or MBS as key components of the national sanitation strategy. However, it is increasingly clear that achieving the tipping point in the transition to sustainable sanitation requires more resources. However, this argument can be extended beyond the sanitation sector to broader health policy and beyond financial to human resources. In particular, the reported stress, dissatisfaction and discouragement of local change agents, indicated serious drawbacks and gendered inequalities in the HEP performance at the grassroots-level as reported by some previous literature (e.g. Maes *et al.*, 2015; Closser *et al.*, 2020).

SUPPLEMENTARY MATERIAL

Supplementary material is available at *Health Promotion International* online.

AUTHOR CONTRIBUTIONS

B.G.M. designed the study, organized and conducted the interview, transcribed and analysed the data and participated in the manuscript preparation. J.N. designed the study, examined the organization of the data, analysed the data and participated in the manuscript preparation.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

All participants and informants participated voluntarily in the interview based on their oral consent sought after an introductory description of the interview and its purpose. Participants were assured of their anonymity and the confidentiality of the information gathered. Ethical clearances were obtained from the ethical committee of Charles University (approval number 2019/16). Written approval was also obtained from the zonal and district authorities of the study area.

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