



Contents lists available at ScienceDirect

# International Journal of Hygiene and Environmental Health

journal homepage: [www.elsevier.com/locate/ijheh](http://www.elsevier.com/locate/ijheh)

## Latrine use practices and predictors in Rural Vietnam: Evidence from Giong Trom district, Ben Tre



Duy Anh Le, Nikita Makarchev\*

Centre of Development Studies, University of Cambridge, Cambridge, CB3 9DP, UK

## ARTICLE INFO

## Keywords:

Improved sanitation  
Latrines  
Use gaps  
Behavioural change  
Rural Vietnam

## ABSTRACT

**Purpose:** Rural Vietnam has been subject to continuous hygienic latrine interventions since the mid-1990s. However, most have concentrated on improving coverage rather than use. It is thus important to examine rural hygienic latrine use rates and the predictors impacting them. Accordingly, this can inform subsequent sanitation policy and enrich pertinent, rural health scholarship.

**Methods:** For this study, 792 adult household heads were surveyed in Giong Trom district, Ben Tre, Mekong Delta region, Vietnam. A logistic regression analysis was performed on household heads owning a hygienic and unhygienic latrine simultaneously (N = 140). Included use predictors were individual-contextual and RANAS. This permit assessments of behavioural or normative predictors that, in many instances, are absent from comparable studies. Predictors' statistical significance was set at  $p < 0.03$ .

**Findings:** Unsatisfactory hygienic latrine use in Ben Tre, among hygienic latrine owners, exceeds 20%. Many owners (26.8%) choose to retain their unhygienic latrine when acquiring a hygienic one, resulting in a 46.4% unhygienic latrine use rate within this sub-group. Meanwhile, the only hygienic latrine use predictors with statistical significance are neighbours' behaviour, user preference and health-benefit beliefs.

**Conclusion:** The Ben Tre case underscores that hygienic latrine ownership or access does not ensure comprehensive use. This even applies to latrines that are clean, working and adequate privacy-providing. Sanitation interventions thus ought to consider a targeted, community-coverage approach with expansive health messaging and emphasis on behavioural change. Demographic or socioeconomic-particular targeting, however, is not always necessary: no individual-contextual predictors proved statistically significant.

### 1. Introduction

Poor sanitation remains a pressing developing world concern. Over 4500 children in developing countries perish each day from preventable diarrheal diseases. This total exceeds that of measles, malaria and HIV combined (Langford et al., 2014). The status quo in contemporary Vietnam, meanwhile, is no less troubling. Data from Vietnam's Health Environment Management Agency points to, among other issues, 1 million annual cases of diarrhoea and 1.5 million children suffering from malnutrition or stunting (i.e. 3.7 cm height deficiency and 5–11 point IQ loss) related to poor sanitation (VHEMA, 2015). Moreover, sanitation conditions are highly uneven across the country, with rural communities exhibiting the worst indicators. For example, only 65% of rural households own a hygienic latrine (VHEMA, 2015) and, in three rural regions, this number is notably lower: Northern Mountains (–7.3%), Central Highlands (–4.1%) and Mekong Delta (–5.3%). The same dynamic is apparent on the provincial level: out of 63 provinces,

only 37 (59%) achieve household hygienic latrine coverage above 65%. Unsurprisingly, ten provinces with the worst coverage (i.e. under 50%) predominantly reside in the Northern Mountains and Mekong Delta.

The Vietnamese government has understood the severity of the situation and taken concrete countermeasures. Among the most wide-sweeping is the National Action Plan, launched in 2017 to deliver sustainable development including universal (domestic) sanitation by 2030. Other prominent examples, often targeting rural regions, include or have included the National Program New Rural, Results-based Scaling-Up Rural Sanitation and Water Supply Program and even the National Patriotic Sanitation Movement. The upside to these government-run sanitation interventions centres on adequate financial support, robust timetabling and target setting. Consequently, they have contributed to various sanitation improvements: rural hygienic latrine coverage has, for instance, risen almost 35 percentage points since 1990. However, as detailed earlier, much progress remains to be made. Furthermore, most government interventions perceive coverage as a

\* Corresponding author. Magdalene College, Cambridge, CB3 0AG, UK.

E-mail address: [nm596@cam.ac.uk](mailto:nm596@cam.ac.uk) (N. Makarchev).

<https://doi.org/10.1016/j.ijheh.2020.113554>

Received 31 October 2019; Received in revised form 4 May 2020; Accepted 5 May 2020

1438-4639/© 2020 Elsevier GmbH. All rights reserved.

core, or exclusive, sanitation-improvement indicator. The National Program New Rural thus relegated attention and resources away from behavioural change initiatives. Indeed, even when these initiatives are present, they are usually target-less and limited in scope (e.g. concentrating on non-expansive health awareness or knowledge).

The government's approach, then, is questionable as latrine coverage does not assure latrine use. Pertinent studies, investigating rural adult communities in developing countries, underscore this issue's variability. In particular, some describe latrine use as inconsistent, "not satisfactory" or "low." Gebremariam et al. (2018), researching the status quo in Laelay Maichew District, North Ethiopia, reported a 47.4% use rate. Debesay et al. (2015) observed a not too dissimilar rate (57.3%) in Gulomekada District, Tigray Region, North Ethiopia. Studies examining use across wider age group ranges also prove corroborative at times. For instance, Sinha et al. (2017: 193) determined that, among the sampled Odisha, India residents aged 4+, the average latrine "always/usual" use rate was 51.9% and the "likelihood of reportedly never (compared to always) using the latrine... increases with age." Even so, studies where no sizeable use gaps occur exist: Anteneh and Kumie (2010: 116) noted a 97% "usage of latrine[s] by adults" in Hulet Ejjū Enessie Woreda, East Gojjam Zone, Amhara Region, and Daniels et al. (1990) a 99% use in Mohale's Hoek District, Lesotho. It is, therefore, important that Vietnamese sanitation intervention programs avoid "one-size-fits-all" mind-sets, as strong use variations exist across contexts.

Moreover, the government's commitment to narrow health messaging, on occasions when use initiatives occur, raises comparable concern. For, pertinent studies present a more complicated picture. In particular, though Roma et al. (2010) emphasized the importance of health, others remain more cautious. Thys et al. (2015), examining rural Eastern Zambia, countered that, in certain instances, "latrine promotion messages should not only focus on health benefits." Indeed, various non-health norms, driving latrine non-use, have been proposed: "preference for open defecation" was the primary respondent reason in Debesay et al.'s study (2015) on rural Ethiopia (74.8%) and Sinha et al.'s study (2017) on rural India (80.1%). "Habit" and "comfort" held a similar distinction in studies by Yimam et al. (2014) and PSI (2017). Meanwhile, Thys et al. (2015) positioned "taboos related to sanitation practices" among the top "consensual reasons [for latrine non-use]." Varying prominence has also been given to environmental conditions (e.g. flies, smell and functionality), though these often come secondary (Yimam et al., 2014; Sinha et al., 2017; Gebremedhin et al., 2018). Consequently, the diverse academic landscape problematizes the Vietnamese government's health-particular use strategy.

This study, therefore, casts greater, much-needed insight on Vietnam's sanitation use gap. In so doing, it can assist the Vietnamese government with developing improved sanitation interventions and enrich existing academic scholarship. For, pertinent studies have directed their attention elsewhere - predominantly to African countries or India. Vietnam accordingly remains a "black box:" the little scholarship there is also possesses certain shortcomings. For example, Le et al. (2012) explored children's latrine use in Northern rural Vietnam schools. The authors concluded latrine use was uncommon and remained contingent on various environmental variables. However, the extent to which this informs adult use rates in rural Vietnam households is questionable. Meanwhile, PSI (2017) inspected, more aptly, adult sanitation practices in Tien Giang and Dong Thap households. It reported that 66% of sampled adults were using "hygienic latrine only" and 18% "unhygienic latrine only." Even so, these statistics represent an amalgamation of data from multiple districts across two provinces. Important details are likewise unclear (e.g. unhygienic latrine use regularity when a hygienic latrine is present) and many use predictors are omitted or examined in a non-quantitative manner.

Furthermore, this study adopts a more comprehensive "improved sanitation" notion in its latrine use analysis. This involves necessitating that hygienic latrines (i.e. flush with septic tank) are also clean,

working and adequate privacy-providing. Accordingly, such latrines combine several key environmental variables existing studies consider important to predicting use. For instance, Gebremedhin et al. (2018) determined that model and non-model households, in Tigray, Ethiopia, were 11.91 and 4.1 times more likely to use clean latrines than non-clean ones. Chanie et al. (2016), reviewing Aneded district, Ethiopia, equally found that households with "clean latrine facilities were 4 times more likely to use [them]." These studies, moreover, pinpointed clean latrine use as high as 94.9% and 96.2% respectively. Other environmental variables, including latrine privacy, functionality and type, were seen as significant use predictors in many relevant analyses (Roma et al., 2010; Gebremariam et al., 2018; Gebremedhin et al., 2018). From this standpoint, use gaps among clean, working, privacy-providing hygienic latrines can prove informative to Vietnam government's sanitation policy and environmental-predictor scholarship.

This study also concentrates on hygienic-unhygienic latrine dual owners - a sub-group most prone to not using hygienic latrines despite direct access to them. In so doing, it underscores a prominent, though under-researched, problem area facing use-expansion. Moreover, in selecting use-predictors to assess, it draws on the RANAS model (Mosler, 2012). RANAS (risk, attitudes, norms, ability, and self-regulation) has already seen application in some developing country-focused sanitation studies (Tumwebaze and Mosler, 2015; Seimetz et al., 2017; Gamma et al., 2017). It proposes a wide range of socio-psychological predictors that, according to behavioural theories, possess the "highest intervention potential" (Seimetz et al., 2017). As a result, RANAS enriches this study with valuable predictors that supplement the more standard individual-contextual ones also under review. This is important given that, within similar research, "relatively little is known about local perception and cultural barriers [i.e. socio-psychological associated factors] for using latrines" (Gebremedhin et al., 2018). Even when these considerations are present, they are often non-comprehensive and assessed in qualitative fashion. Accordingly, this study can help drive forward sanitation behaviour scholarship pertinent to rural Vietnam and comparable developing settings.

## 2. Materials and methods

### 2.1. Setting and design

The present study was undertaken in Giong Trom district, Ben Tre, Mekong Delta region, Vietnam between March and April 2017. Giong Trom, one of Ben Tre's eight districts, contains 21 communes and 49,120 households with a combined population close to 170,000. Its sanitation coverage averages 60.7%, though this percentage varies across communes, from 34.4% (Hung Nhuong) to 99.7% (Chau Binh). Indeed, 5 communes stand at under 50%, 12 communes between 50% and 70%, and 4 over 70%. Interviews with local government representatives indicate that, despite systematic attempts, since 1994, to improve the sanitation situation, progress has been sporadic and slow. This has also been the case in Ben Tre: hygienic latrine coverage remains more than 15 percentage points under Vietnam's rural average. Consequently, to examine the status quo in greater detail, this study proceeds to employ a comparative cross-sectional design.

### 2.2. Sampling and sample size

Cluster random sampling was implemented to select the survey sites within Giong Trom. In particular, Giong Trom's 21 communes were ranked vis-à-vis their sanitation coverage rate and divided into three groups: the high (communes with coverage over 70%), the average (communes with coverage between 50% and 70%) and the low (coverage under 50%). In each group, one commune was chosen randomly, resulting in the ensuing sample: My Thanh (83.6%), Thuan Dien (69.6%) and Hung Nhuong (34.5%). At minimum three villages were then picked, in a random manner, within these three communes.

**Table 1**  
Principal characteristics of surveyed household heads.

	My Thanh	Thuan Dien	Hung Nhuong	All
<b>Average age</b>	52.05	51.25	52.19	51.69
<b>Female/Male</b>	158/99	169/106	184/76	511/281
<b>Family size</b>	3.89	3.87	3.83	3.83
<b>Main occupation/income source</b>	Agriculture = 36.6% Worker = 5.5% Civil servant = 2.3% Trader = 15.6% Domestic = 5.9% Seasonal/unstable Job = 34% Other = 0.4%	Agriculture = 71.3% Worker = 1.5% Civil servant = 1.8% Trader = 18.7% Domestic = 1.5% Seasonal/unstable Job = 14.9% Other = 0.4%	Agriculture = 61.5% Worker = 0.8% Civil servant = 1.5% Trader = 12.7% Domestic = 2.3% Seasonal/unstable Job = 18.5% Other = 2.7%	Agriculture = 56.8% Worker = 2.5% Civil servant = 1.9% Trader = 12.3% Domestic = 3.2% Seasonal/unstable Job = 22.3% Other = 1.1%
<b>Poverty certificate</b>	10.1%	13.8%	14.2%	12.8%
<b>Education attainment</b>	Illiterate = 5.4% Only read and write = 5.8% Primary = 32.7% Lower secondary = 37.7% Upper secondary = 14.4% University/college or higher = 3.9%	Illiterate = 4.4% Only read and write = 9.1% Primary = 37.5% Lower secondary = 34.9% Upper secondary = 9.8% University/college or higher = 4.4%	Illiterate = 3.8% Only read and write = 3.8% Primary = 36.9% Lower secondary = 40% Upper secondary = 13.8% University/college or higher = 1.5%	Illiterate = 4.5% Only read and write = 6.3% Primary = 35.7% Lower secondary = 37.5% Upper secondary = 12.6% University/college or higher = 3.3%
<b>Ethnicity</b>	100% Kinh	99.6% Kinh 0.4% other	99.6% Kinh 0.4% other	99.7% Kinh 0.3% is other

Meanwhile, household selection was made via random walk-based sampling: survey teams embarked on random routes from disparate starting villages, interviewing household heads in every third household they encountered. Any excluded households contained heads that voluntarily declined participation or were not: (a) over 18 years old at the interview date (b) living in the household for at least 12 months prior to the interview (c) cognizant of their latrine practices.

The minimum sample size was set at 750 household heads, with 250 being drawn from each commune. 792 household heads were, ultimately, surveyed on their latrine practice: 257 from My Thanh, 275 from Thuan Dien and 260 from Hung Nhuong. This ensured sample size similarity with comparable studies (Harter et al., 2018). Likewise, the sample represented, on average, over 10% of My Thanh, Thuan Dien and Hung Nhuong household heads. For the regression analysis, a subset of the sample (i.e. 140 household heads owning a hygienic and unhygienic latrine) was used. The principal demographic and socioeconomic characteristics of all surveyed heads are shown in Table 1.

### 2.3. Operational definitions

Exley et al. (2015: 1086) note that, among sanitation practitioners or commentators, there is no uniform clarity over “what actually constitutes a hygienic latrine.” Consequently, this study draws on Vietnam’s National Technical Regulations criteria to assess latrine status: a hygienic latrine “ensures the total isolation of human faeces, preventing animals or insects’ contact with untreated human faeces... [And is] capable of eliminating the pathogens inside the faeces, not creating foul smells or contaminating the environment” (Hoa Binh Provincial CPM, 2014: 4). In practice then, only flush latrines with septic tanks match, consistently and completely, the aforementioned prerequisites.

However, this study necessitates that hygienic latrines are also clean (i.e. no faeces or urine surrounding the stool; no unpleasant odours or insects), working (i.e. not requiring maintenance) and adequate privacy-providing (i.e. possessing a superstructure with no major opening). To ensure these criteria are met, survey teams directly inspected every latrine in the sampled Ben Tre households. As a result, this allows greater accuracy in measuring latrine use vis-à-vis a more comprehensive conceptualization of “improved sanitation” - an important point given most comparable research remains silent on “anything regarding the... overall quality of the facility” (Exley et al., 2015: 1086). Indeed, this has made “some commentators... suggest... current figures of... access to adequate sanitation are significantly

overestimated” (Exley et al., 2015: 1086).

### 2.4. Use and predictor measurement

For descriptive statistics purposes, hygienic latrine use was measured on a 5-point monopolar Likert scale, ranging from 1 (always) to 5 (almost never). To enhance precision, (scale) frequencies were set to: always = at least once per day, surpassing any unhygienic latrine use; often = at least once every 3 days; sometimes = at least once per week; rarely = no more than once per month; almost never = no more than once every few months. This thus provides a more thorough indication of (longitudinal) use patterns and consistencies. For regression analysis purposes, on the contrary, use was a binary yes/no dependent variable: participants either regularly used hygienic latrines or not. Regularity, in this case, indicated a once per day use, at minimum, that surpassed any unhygienic latrine use.

Many independent predictors, meanwhile, were also measured on a 5-point Likert scale, including some related to risk (i.e. perceived severity and vulnerability), attitude (i.e. user preference, disgust, benefits beliefs), norms (i.e. neighbours’ behaviour, appreciation of neighbours’ behaviour, social status, personal norms) and ability (i.e. self-efficacy). Alternative scales were used for predictors conducive to narrower or wider numeric ranges (e.g. perceived cost, education level, overall factual knowledge). Other predictors, by contrast, were measured in binary (e.g. discrete factual knowledge, technical know-how, poverty certificate possession) or categorical (e.g. main income source) terms.

### 2.5. Predictors

Two groups of predictors, associated with latrine use, are considered in this study: individual-contextual and RANAS. Among the included individual and contextual predictors are: commune, age, gender, main income source, poverty certificate possession, education level, household size, number of generations in household, number of women in household, number of children under 5 in household and number of children household heads have. This individual-contextual predictor set, as a whole, is derived from similar sets compiled by major hygienic latrine ownership/use systematic reviews (e.g. Hulland et al., 2015). Meanwhile, standard RANAS predictors (Mosler, 2012), which co-exist across 5 blocks (risk, attitude, norm, ability and self) and possess a more socio-psychological orientation, are also examined for statistical significance. A complete summary and explanation of these (RANAS)

predictors, as adopted to the hygienic latrine use case, is presented in Table S1, Appendix A.

### 2.6. Data analysis

Survey data was imported into Excel and examined with SPSS version 24. Logistic regression analysis was performed on predictors associated with hygienic latrine use among household heads owning hygienic and unhygienic latrines. Two logistic regression models were then developed: one with individual-contextual predictors, the other with RANAS predictors. Statistical significance (of each predictor) was set at  $p < 0.03$  due to the sample size ( $N = 140$ ).

### 2.7. Ethics

This study received ethical approval from University of Cambridge's Politics and International Studies Ethics Committee. Further permission, to conduct surveys in Ben Tre, was obtained from Vietnamese government's Provincial People Committee and the Department of Health. Three fieldwork assistants also attained one-day training, from Ben Tre Preventive Medicine Centre's principal researcher, on interviewee interaction and written consent procedures. All participants in this study, meanwhile, were voluntary and had to provide informed, written consent.

## 3. Results

### 3.1. Latrine use

Within the sampled population, 47.1% always used a hygienic latrine and 33.2% almost never (Table 2). More than half (i.e. 50.3%) used it less than once every 3 days (i.e. sometimes, rarely and almost never). Of course, these statistics stem from a respondent sample where 66% own hygienic latrines. Even so, among hygienic latrine sole owners, only 89.6% always used a hygiene latrine, while 7.3% used it either sometimes, rarely or almost never (Table 3). Among hygienic-unhygienic latrine dual owners, meanwhile, 46.4% did not regularly use a hygiene latrine. This is pertinent as dual owners are a sizeable sub-group, comprising 26.8% of the hygienic latrine-owning population. It is worth noting, too, that among those owning a hygienic latrine, whether on its own or alongside an unhygienic one, 20.1% used it unsatisfactorily (i.e. less than once per day or irregularly).

Reported reasons for irregular hygienic latrine use, among hygienic-unhygienic latrine dual owners, included: habit (75.6%), convenience or preference towards the unhygienic latrine type (56.4%), long hygienic latrine queues (6.4%). This ownership group also reported retaining unhygienic latrines due to: ongoing use (47.1%), back-up use (22.9%), burdensome removal costs (13.6%).

### 3.2. Factors associated with latrine use

According to the logistic regression analysis, no individual-contextual predictors were statistically significant (Table 4). However, two RANAS attitude predictors and one RANAS norm predictor displayed a

**Table 2**  
Frequencies of hygienic latrine use among surveyed household heads.

	Frequency	Percent	Cumulative Percent
Almost Never	263	33.2	33.2
Rarely	52	6.6	39.8
Sometimes	83	10.5	50.3
Often	21	2.7	52.9
Always	373	47.1	100
Total	792	100	N/A

**Table 3**  
Frequencies of hygienic latrine use among surveyed hygienic latrine sole owners.

	Frequency	Percent	Cumulative Percent
Almost Never	5	1.3	1.3
Rarely	3	0.8	2.1
Sometimes	20	5.2	7.3
Often	12	3.1	10.4
Always	343	89.6	100
Total	383	100	N/A

**Table 4**  
Individual and contextual predictors' effect on hygienic latrine use among hygienic-unhygienic latrine dual owners.

I/C Predictors	B	S.E.	Wald	df	Sig.	Exp(B)
Commune			1.335	2	.513	
Commune (1)	-.590	.580	1.035	1	.309	.554
Commune (2)	-.406	.440	.852	1	.356	.666
Under 5	.702	.413	2.885	1	.089	2.018
Women	.428	.284	2.277	1	.131	1.535
Gender(1)	.871	.416	4.396	1	.036	2.390
Income			.360	5	.996	
Income(1)	-.355	.608	.341	1	.559	.701
Income(2)	-.273	1.268	.046	1	.830	.761
Income(3)	-.232	1.596	.021	1	.884	.793
Income(4)	-.344	.825	.174	1	.677	.709
Income(5)	-.163	1.715	.009	1	.924	.849
Poverty(1)	.036	.745	.002	1	.961	1.037
Education	.250	.245	1.043	1	.307	1.284
Children	-.160	.135	1.408	1	.235	.852
Famsize	-.305	.246	1.541	1	.214	.737
Generation	.165	.409	.163	1	.686	1.179
Age	.037	.020	3.401	1	.065	1.037
Constant	-2.296	1.750	1.720	1	.190	.101

$N = 140$ , participant with regular hygienic latrine use is coded "1." \* $P < 0.03$ ; \*\* $P < 0.003$ ; \*\*\* $P < 0.0003$ .

**Table 5**  
RANAS predictors' effect on hygienic latrine use among hygienic-unhygienic latrine dual owners.

RANAS predictors	B	S.E.	Wald	df	Sig.	Exp(B)
Factual knowledge	-.020	.146	.018	1	.892	.980
Vulnerability	.422	.257	2.701	1	.100	1.525
Severity	-.025	.258	.009	1	.923	.975
HL Instrumental beliefs	2.532	1.139	4.943*	1	.026	12.575
HL Disgust	-.173	.425	.166	1	.684	.841
HL Preference	1.030	.388	7.043*	1	.008	2.800
HL Descriptive norms(1)	1.574	.540	8.493*	1	.004	4.828
HL Injunctive norms	.354	.471	.566	1	.452	1.425
HL Social norms	.185	.536	.119	1	.731	1.203
HL Personal norms	.566	.328	2.982	1	.084	1.761
HL Self-efficacy	.219	.331	.438	1	.508	1.245
HL Perceived costs			.710	2	.701	
HL Perceived costs(1)	.433	.632	.469	1	.493	1.541
HL Perceived costs(2)	.441	.703	.393	1	.530	1.555
HL technical ability and knowledge(1)	-.793	.597	1.763	1	.184	.453
Constant	-18.841	5.107	13.610	1	.000	.000

$N = 140$ , participant with regular hygienic latrine use is coded "1." \* $P < 0.03$ ; \*\* $P < 0.003$ ; \*\*\* $P < 0.0003$ .

$p$ -value  $< 0.03$  (Table 5). Among the two attitude predictors were preference ( $p$ -value 0.008) and instrumental beliefs ( $p$ -value 0.026). Preference represents the extent respondents enjoy using a hygienic latrine. A higher preference, therefore, associates positively with regular hygienic latrine use among hygienic and non-hygienic latrine dual owners. Meanwhile, instrumental beliefs represent the extent respondents consider hygienic latrines as beneficial to their health.

Higher instrumental beliefs, thus, associate positively with regular hygienic latrine use among dual owners. Moreover, based on a B coefficient comparison, the effect size for instrumental beliefs (2.532) is greater than that for preference (1.030).

Neighbours' behaviour ( $p$ -value 0.004), meanwhile, was the only statistically significant norm predictor. It represents the frequency of respondents' neighbours not owning a hygienic latrine, as perceived by the respondent. A higher hygienic latrine non-ownership among respondents' neighbours, therefore, associates positively with non-regular hygienic latrine use among dual owners. Furthermore, according to a B coefficient comparison, neighbours' behaviour possesses an effect size (1.574) larger than preference (1.030) but smaller than instrumental beliefs (2.532).

#### 4. Discussion

This study provides important insights on the sanitation situation in Ben Tre - an under-researched Vietnamese province. First, as Giong Trom, Ben Tre sampled data shows, hygienic latrine coverage is inadequate (66%). Second, coverage alone is not ensuring widespread sanitary practice: 20.1% of respondents owning a hygienic latrine (whether on its own or alongside an unhygienic one) unsatisfactorily use it. This is surprising as, within this study's "improved sanitation" conceptualization, hygienic latrines are clean, working and adequate privacy-providing. Accordingly, they mitigate the negative impact of certain environmental variables that research associates with use. Even so, some hygienic latrine owners remain un-swayed, explaining their irregular use largely in terms of habit (75.6%) or preference and convenience vis-à-vis unhygienic latrines (56.4%). Third, at 26.8%, unhygienic latrine retention rate, among hygienic latrine owners, is excessive. For, retention increases the prospect of contact with, or even use of, unhygienic latrines. Respondents' reasons also underscore this point's seriousness: 22.9% of hygienic latrine owners, who did not indicate using an unhygienic latrine, nonetheless retained unhygienic latrines for "back-up" purposes.

Moreover, this study's sanitation statistics contribute to pertinent research on Vietnam, more broadly, and other developing regions. In particular, they produce some important and, at times, surprising points of contrast. For example, the observed hygienic latrine use rate in Ben Tre (47.1%) is sharply lower than the 68% in PSI's study (2017) of Tien Giang and Dong Thap, Mekong Delta, Vietnam. However, it is higher than the average use rate across the entire Mekong Delta, where "roughly 55% of households use unhygienic latrines" (WSP, 2016: 3). As a result, this suggests that considerable use variance is present across, even neighbouring, Mekong Delta provinces. Meanwhile, Ben Tre's 8.2% unhygienic latrine (regular) use rate, among dual owners vis-à-vis the entire sample, appears unexpectedly lower than the rate (i.e. 13.3%) in PSI (2017: 13): "among 1,200 individuals interviewed, 160 reported having installed a hygienic latrine but continued to use unhygienic latrines." Even so, this cannot be attested with certainty as it is unclear what unhygienic latrine use frequencies (e.g. always, sometimes or regularly) PSI (2017) is implying here.

Concerning other developing regions, the 47.1% hygienic latrine use rate in Ben Tre compares unevenly. On the one hand, it is lower than rural Bangladesh's, which Akter et al. (2014) pinpointed at 57.4%. Indeed, Parvez et al. (2018) observed a 94–97% use rate among adults in Bangladesh's Gazipur, Kishorjonj, Mymensingh and Tangail districts. Likewise, in Kuthambakkam village, Tamil Nadu, India, the 62.5% use rate (Anuradha et al., 2017) surpasses Ben Tre's. In rural Madagascar, however, the use rate is lower: Tearfund (2007) reported a 31.5% average across seven Madagascan villages. These patterns persist in comparisons of unhygienic sanitary practices among hygienic latrine owners. For instance, Ben Tre's 20.1% hygienic latrine unsatisfactory-use rate appears higher than rural Bangladesh's, where Ahmed et al. (2015: 6) observed "92% of the households that have a hygienic latrine regularly use it." Yet, vis-à-vis another similar study, it is lower: "73.3%

[of sanitary latrine-using rural Bangladesh households] continued with this practice, while the rest switched to other unsanitary practices" (Akter et al., 2014). Meanwhile, compared to Tamil Nadu, India, Ben Tre's rate is again higher as Kuthambakkam households with a sanitary latrine had "all their family members... using it" (Anuradha et al., 2017).

These variances can stem from numerous local environment-specific conditions (Waithaka, 2015) and measurement choices (e.g. definitions of 'regular' use and 'hygienic' latrine). Even so, some appear more apt than others. In PSI's (2017) case, the researched area (i.e. Tien Giang and Dong Thap) had a higher hygienic latrine coverage rate, which may explain, in part, its higher use rate. However, the seemingly higher percentage of unhygienic latrine users (13.3%), among dual owners vis-à-vis PSI's sample, likely derives from overly-coverage focused sanitation interventions in Tien Giang and Dong Thap. By contrast, those recently targeting Ben Tre employed community-oriented approaches (Huyen, 2018) that, according to some studies (Gebremariam and Tsehaye, 2019), are more conducive to increasing use. Concerning variances with other developing regions, rural Madagascar's lower hygienic latrine use rates arise from, predominantly, inadequate sanitation interventions and "cultural factors" (Tearfund, 2007). Rural Bangladesh, on the contrary, had experienced a major WASH intervention (2006–2011) and a positive norms change (WSP, 2011), which put its use rates above Ben Tre. However, poverty, "severe natural disasters" and "lack of local leadership" (WSP, 2011: 3) exacerbate problematic unhygienic sanitary practice rates - which according to Akter et al. (2014) surpass Ben Tre's - among its hygienic latrine owners.

Concerning use-predictors, meanwhile, this study underscores those significant to hygienic-unhygienic latrine dual owners. Among them is neighbours' behaviour, which suggests neighbours' latrine ownership associates with individual latrine use. This can emanate from normative group pressures, expectations and aspirations (Diallo et al., 2007; O'Reilly and Louis, 2014; Odagiri et al., 2017). Moreover, intervention-wise, this predictor points to the importance of targeted, community-wide coverage expansions. Another significant predictor, in the Ben Tre case, is user preference of hygienic latrine. Preference, of course, relates to habit or socio-cultural norms. It can also engrain unhygienic practice: most respondents noted the "habit" of using unhygienic latrines during day and hygienic latrines, at best, only at night. Any sanitation interventions must, therefore, mitigate this behaviour. The remaining significant predictor is belief in hygienic latrine health benefits, which appears to support interventions with health messaging. However, there are limits to this: perceived severity and vulnerability vis-à-vis sanitation-related diseases is not a significant use predictor. Health messaging can thus adopt a wider scope, stressing "reduced risk of accidents and/or sexual harassment, to enhanced psycho-social well-being" (Scott, 2006).

The aforementioned predictors (i.e. neighbours' behaviour, user preference and health-benefit beliefs) were also found pertinent in some previous research - despite it not examining dual owners as a unique user-group. For instance, Diallo et al. (2007) argued that participants from communities with higher hygienic latrine ownership are more inclined to use their hygienic latrine due to mutual aspirations or knock-on effects. O'Reilly and Louis (2014: 44), observing rural India, made a similar point: habitual latrine use was dependent, in part, on "proximate social pressure, i.e., person-to-person contact between rural inhabitants with their neighbors, and with toilets." This can equally apply to slippage occurrence (i.e. reverting to open defecation): Odagiri et al. (2017) concluded "respondents' perceptions around latrine ownership coverage in their [rural Indonesian] community... [were] significantly associated with slippage occurrence." For Barnard et al. (2013), meanwhile, preference of unhygienic sanitary practice was the most common respondent reason driving latrine non-use. Roma et al. (2010: 593) also drew attention to health-benefit beliefs' importance, noting "a decrease of 24% [in latrine use] is reported in the perceptions of health benefits."

Even so, there is no clear-cut academic consensus over some above-noted predictors' strength. For instance, Bicchieri et al. (2017: 5), examining sanitation in Bihar and Tamil Nadu, stressed "[latrine use] is most associated with the behavior of close relatives and friends... [than] with neighbors." Likewise, Lopez et al. (2019: 733), using rural Ecuador as a case study, stated that "knowledge of the health benefits of sanitation may not be as important [latrine use predictor]." Thys et al. (2015), too, cast attention on health messaging not translating, without issue, into latrine use increases. Kiyu and Hardin (1993), meanwhile, suggested excluding health emphases in messaging entirely. However, the inconsistencies these studies present are, in many cases, not comprehensive. Bicchieri et al.'s analysis (2017), in particular, concerns rural, urban and intermediary regions. This can therefore introduce new socio-economic and cultural characteristics that impact its results. Lopez et al. (2019) and Thys et al. (2015), by contrast, do not wholly dismiss health-benefit beliefs, noting that other predictors simply appear even stronger. Such studies are also prone to conceptualizing health-benefit beliefs narrowly (i.e. in relation to particular sanitation diseases), which potentially moderates, from the outset, this predictor's significance.

Moreover, some predictors, which were important in previous studies, did not show statistical significance in the Ben Tre case. Of the individual-contextual ones, in particular, none met  $p < 0.03$  in the regression analysis. This thus emphasizes the local characteristics of Ben Tre: contrary to some developing regions, demographic-specific or socio-economic status-specific variables were not impacting latrine use. Certain wider, Vietnam-related research supports this observation: Jones et al. (2012: V) noted "the country has made remarkable progress in reducing gender disparities in education, employment and health." Moreover, the Vietnam Women's Union has participated in numerous sanitation initiatives (Sijbesma et al., 2010; Huyen, 2018). Socio-economic status-wise, Sijbesma et al. (2010: 19) observed "there was no class factor in access to information on sanitary toilets." Active mass organization involvement in sanitation matters also appears to mitigate the issue. Accordingly, Ben Tre's sanitation policy need not adopt separate strategies vis-à-vis particular demographic and socio-economic groups. The statistically significant RANAS predictors further point to the importance of targeted, community-coverage approaches with expansive health messaging and behavioural change emphasis.

#### 4.1. Limitations

This study possesses certain limitations. First, owing to its cross-sectional nature, no causal relationships between the dependent variable (i.e. hygienic latrine use) and the independent explanatory predictors could be drawn. Second, the collected data was self-reported, which can produce over or under-estimation. Moreover, reporting bias, among female participants, may have been exacerbated due to this study's use of a male research team. Respondents also had to, at times, recall their latrine use behaviour over several months. This thus increases the prospect of memory-related errors. Third, Ben Tre may possess certain characteristics not present, or commonplace, in rural Vietnam, as a whole, or other developing regions. How variances in these characteristics relate to latrine use rates and predictors has not been thoroughly examined in this study.

#### 5. Conclusion

As this study has shown, hygienic latrine ownership does not ensure comprehensive use. Indeed, this even applies to hygienic latrines that are clean, working and adequate privacy-providing. This is somewhat surprising, given such latrines incorporate many environmental predictors in a manner that ought to, based on previous research, increase use. Nonetheless, 20.1% of their owners, in Ben Tre, continue to unsatisfactorily use them. Among those also retaining an unhygienic latrine, the rates are even more alarming: 46.4% do not regularly use

their hygienic latrine. It is thus imperative that sanitation interventions understand this problem and adopt ameliorative measures. Accordingly, this study's analysis of individual-contextual and RANAS use-predictors, pertinent to hygienic-unhygienic latrine dual owners, underscored the importance of neighbours' behaviour, user preference and health-benefit beliefs. For intervention purposes, then, this suggests a targeted, community-coverage approach with expansive health messaging and emphasis on behavioural change. No particular demographic or socio-economic targeting is required in this case, as individual-contextual predictors were not statistically significant.

#### Funding sources

This study was supported by the Suzy Paine Fund and the University of Cambridge Politics and International Studies Department Research Fund.

#### Declaration of competing interest

None.

#### Acknowledgements

The authors thank Prof. Peter Nolan (Centre of Development Studies, University of Cambridge) for comments on this study and advice during study design. Additional thanks is expressed to Ben Tre's local organizations for data collection support: Ben Tre People's Committee; Ben Tre Department of Health; Giong Trom district Health Centre; Giong Trom People's Committee; My Thanh, Thuan Dien and Hung Nhuong Health Centres.

#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijheh.2020.113554>.

#### References

- Ahmed, M., Jacimovic, R., Bostoen, K., Ahammed Gazi, A.F., 2015. WASH III Report on QIS data analysis: findings from the first round 2014. 25.9.19. [https://www.ircwash.org/sites/default/files/brac\\_irc\\_wash\\_iii\\_final.pdf](https://www.ircwash.org/sites/default/files/brac_irc_wash_iii_final.pdf).
- Akter, T., Ali, A.R., Dey, N.C., 2014. Transition overtime in household latrine use in rural Bangladesh: a longitudinal cohort study. *BMC Publ. Health* 14, 721.
- Anteneh, A., Kumie, A., 2010. Assessment of the impact of latrine utilization on diarrhoeal diseases in the rural community of hulet Ejjū Enessie Woreda, East Gojjam Zone, Amhara region. *Ethiop. J. Health Dev.* 24, 110–118.
- Anuradha, R., Dutta, R., Raja, J.D., Lawrence, D., Timisi, J., Sivaprakasam, P., 2017. Role of community in Swachh Bharat Mission. Their knowledge, attitude and practices of sanitary latrine usage in rural areas, Tamil Nadu. *Indian J. Community Med.* 42, 107–110.
- Barnard, S., Routray, P., Majorin, F., Peletz, R., Boisson, S., Sinha, A., Clasen, T., 2013. Impact of Indian Total Sanitation Campaign on latrine coverage and use: a cross-sectional study in Orissa three years following programme implementation. *PLoS One* 8, e71438.
- Bicchieri, C., Ashraf, S., Das, U., Kohler, H.-P., Kuang, J., McNally, P., Shpenev, A., Thulin, E., 2017. Phase 1 project report: social networks and norms: sanitation in Bihar and Tamil Nadu, India. 15.9.19. <https://repository.upenn.edu/pennsong/16/>.
- Chanie, T., Gedefaw, M., Ketema, K., 2016. Latrine utilization and associated factors in rural community of Aneded district, North west Ethiopia, 2014. *J. Community Med. Health Educ.* 6, 478.
- Daniels, D.L., Cousens, S.N., Makoae, L.N., Feachem, R.G., 1990. A case-control study of the impact of improved sanitation on diarrhoea morbidity in Lesotho. *Bull. World Health Organ.* 68, 455–463.
- Debesay, N., Ingale, L., Gebresilassie, A., Assefa, H., Yemane, D., 2015. Latrine utilization and associated factors in the rural communities of Gulomekada district, Tigray region, North Ethiopia, 2013: a community based cross-sectional study. *J. Community Med. Health Educ.* 5, 338.
- Diallo, M.O., Hopkins, D.R., Kane, M.S., Niandou, S., Amadou, A., Kadri, B., Amza, A., Emerson, P.M., Zingesser, J.A., 2007. Household latrine use, maintenance and acceptability in rural Zinder, Niger. *Int. J. Environ. Health Res.* 17, 443–452.
- Exley, J.L., Liseka, B., Cumming, O., Ensink, J.H., 2015. The sanitation ladder, what constitutes an improved form of sanitation? *Environ. Sci. Technol.* 49, 1086.
- Gamma, A.E., Slekiene, J., Medeaazza, G., 2017. Contextual and psychosocial factors predicting Ebola prevention behaviours using the RANAS approach to behaviour

- change in Guinea-Bissau. *BMC Publ. Health* 17, 446.
- Gebremariam, B., Hagos, G., Abay, M., 2018. Assessment of community led total sanitation and hygiene approach on improvement of latrine utilization in Laelay Maichew District, North Ethiopia. A comparative cross-sectional study. *PLoS One* 13, e0203458.
- Gebremariam, B., Tsehaye, K., 2019. Effect of community led total sanitation and hygiene (CLTSH) implementation program on latrine utilization among adult villagers of North Ethiopia: a cross-sectional study. *BMC Res. Notes* 12, 478.
- Gebremedhin, G., Tetemke, D., Gebremedhin, M., Kahsay, G., Zelalem, H., Syum, H., Gerense, H., 2018. Factors associated with latrine utilization among model and non-model families in Laelai Maichew Woreda, Aksum, Tigray, Ethiopia: comparative community based study. *BMC Res. Notes* 11, 586.
- Harter, M., Mosch, S., Mosler, H.-J., 2018. How does Community-Led Total Sanitation (CLTS) affect latrine ownership? A quantitative case study from Mozambique. *BMC Publ. Health* 18, 387.
- Hoa Binh Provincial Center for Preventative Medicine, 2014. Technical Instructions for Hygienic Latrine Construction.
- Hulland, K., Martin, N., Dreibelis, R., DeBruicker Valliant, J., Winch, P., 2015. What Factors Affect Sustained Adoption of Safe Water, Hygiene and Sanitation Technologies? A Systematic Review of Literature. 27.4.20. <https://eppi.ioe.ac.uk/cms/Portals/0/PDF%20reviews%20and%20summaries/WASH%20technologies%202015%20Hulland%20report.pdf?ver=2015-06-10-141853-910>.
- Huyen, T., 2018. Summary of the project "Improving sanitation and clean water based on women outputs - CHOBA" [Tổng kết dự án "Cải thiện vệ sinh và nước sạch dựa trên kết quả đầu ra do phụ nữ làm chủ - CHOBA"]. 2018. <http://www.bentre.gov.vn/Lists/TinTucSuKien/-DispForm.aspx?ID=23416&ContentTypeId=0x01006B434E144EA34B09B66CBCE45AAE3E9100C1F820CD5EF17A4CA019FDF092BFE002> 24.9.19.
- Jones, N., Anh, T.T.V., Malachowska, A., 2012. The politics of gender and social protection in Viet Nam: opportunities and challenges for a transformative approach. 5.10.19. <https://www.odi.org/resources/docs/7761.pdf>.
- Kiyu, A., Hardin, S., 1993. Latrine use in rural Sarawak, Malaysia. *Southeast Asian J. Trop. Med. Publ. Health* 24, 40–42.
- Langford, M., Bartram, J., Roaf, V., 2014. Revisiting dignity: the human right to sanitation. The human right to water: theory, practice, and prospects. 9, 1–34.
- Le, T.T., Luu, N.H., Rheinländer, T., Dalsgaard, A., Konradsen, F., 2012. Sanitation behavior among schoolchildren in a multi-ethnic area of Northern rural Vietnam. *BMC Publ. Health* 12, 140.
- Lopez, V.K., Berrocal, V.J., Corozo Angulo, B., Ram, P.K., Trostle, J., Eisenberg, J.N.S., 2019. Determinants of latrine use behavior: the psychosocial proxies of individual-level defecation practices in rural coastal Ecuador. *Am. J. Trop. Med. Hyg.* 100, 733–741.
- Mosler, H.-J., 2012. A systematic approach to behavior change interventions for the water and sanitation sector in developing countries: a conceptual model, a review, and a guideline. *Int. J. Environ. Health Res.* 22, 431–449.
- O'Reilly, K., Louis, L., 2014. The toilet tripod: understanding successful sanitation in rural India. *Health Place* 21, 43–51.
- Odagiri, M., Muhammad, Z., Cronin, A.A., 2017. Enabling factors for sustaining open defecation-free communities in rural Indonesia: a cross-sectional study. *Int. J. Environ. Res. Publ. Health* 14, 1572.
- Parvez, S.M., Azad, R., Rahman, M., Unicomb, L., Ram, P.K., Naser, A.M., Stewart, C.P., Jannat, K., Rahman, M.J., Leontsini, E., Winch, P.J., Luby, S.P., 2018. Achieving optimal technology and behavioral uptake of single and combined interventions of water, sanitation hygiene and nutrition, in an efficacy trial (WASH benefits) in rural Bangladesh. *Trials* 19, 358.
- PSI, 2017. Rural sanitation and hygiene behavioral study Vietnam. 10.9.19. <https://www.psi.org/-publication/2016-rural-sanitation-and-hygiene-behavioral-study-vietnam/>.
- Roma, E., Buckley, C., Jefferson, B., Jeffrey, P., 2010. Assessing users' experience of shared sanitation facilities: a case study of community ablution blocks in Durban, South Africa. *WaterSA* 36, 589–594.
- Scott, B., 2006. Health impacts of improved household sanitation. 15.9.19. <https://www.lboro.ac.uk/-orgs/well/resources/fact-sheets/fact-sheets-htm/Household%20Sanitation.htm>.
- Seimetz, E., Slekiene, J., Friedrich, M.N.D., Mosler, H.-J., 2017. Identifying behavioural determinants for interventions to increase handwashing practices among primary school children in rural Burundi and urban Zimbabwe. *BMC Res. Notes* 10, 280.
- Sijbesma, C., Truong, T.X., Devine, J., 2010. Case study on sustainability of rural sanitation marketing in Vietnam. 6.10.19. [https://www.wsp.org/wsp/sites/wsp/files/WSP\\_Sustainability-CaseStudy\\_TSSM\\_optimized\\_lowest.pdf](https://www.wsp.org/wsp/sites/wsp/files/WSP_Sustainability-CaseStudy_TSSM_optimized_lowest.pdf).
- Sinha, A., Nagel, C.L., Schmidt, W.P., Torondel, B., Boisson, S., Routray, P., Clasen, T.F., 2017. Assessing patterns and determinants of latrine use in rural settings: a longitudinal study in Odisha, India. *Int. J. Hyg Environ. Health* 220, 906–915.
- Tearfund, 2007. Sanitation and hygiene in developing countries: identifying and responding to barriers: a case study from Madagascar. 20.9.19. <https://waterfund.org/ke/watersource/Downloads/-001.%20Sanitation%20and%20Hygiene%20Case%20Study%20Madagascar.pdf>.
- Thys, S., Mwape, K.E., Lefevre, P., Dorny, P., Marcotty, T., Phiri, A.M., Phiri, I.K., Gabriel, S., 2015. Why latrines are not used: communities' perceptions and practices regarding latrines in a Taenia solium endemic rural area in Eastern Zambia. *PLoS Neglected Trop. Dis.* 9, e0003570.
- Tumwebaze, I.K., Mosler, H.-J., 2015. Effectiveness of group discussions and commitment in improving cleaning behaviour of shared sanitation users in Kampala, Uganda slums. *Soc. Sci. Med.* 147, 72–79.
- Vietnam Health Environment Management Agency, 2015. National Target Program Report.
- Waithaka, R.W., 2015. Latrine use and associated factors among rural community members in Samburu East sub-county, Samburu County, Kenya. 22.09.19. <https://pdfs.semanticscholar.org/-13fa/ba311257c4615e9b30922e99bda02636f30b.pdf>.
- Water and Sanitation Program, 2011. Long term sustainability of improved sanitation in rural Bangladesh. 12.9.19. <https://www.wsp.org/sites/wsp/files/publications/-WSP-Sustainability-Sanitation-Bangladesh-Brief.pdf>.
- Water and Sanitation Program, 2016. Understanding determinants of access to hygienic latrines for rural households in Vietnam: from research findings to campaign development. 10.9.19. [https://www.wsp.org/sites/wsp/files/publications/Viet%20LNDeterminants-%20of%20Access\\_0815.pdf](https://www.wsp.org/sites/wsp/files/publications/Viet%20LNDeterminants-%20of%20Access_0815.pdf).
- Yimam, Y.T., Gelaye, K.A., Chercos, D.H., 2014. Latrine utilization and associated factors among people living in rural areas of Denbia district, Northwest Ethiopia, 2013, a cross-sectional study. *Pan Afr. Med. J.* 18, 334.