Construction of a Scale Assessing Patients' Perceptions Regarding Sanitation and Hygiene in a Clinical Setting

Article *in* Journal of Patient Safety · May 2021

DOI: 10.1097/PTS.0000000000000862

CITATIONS
0

READS
51

4 authors, including:

Nestor Asiamah
University of Essex
64 PUBLICATIONS **461** CITATIONS
SEE PROFILE

Kwame Adu-Gyamfi
Niagara College Canada
4 PUBLICATIONS **7** CITATIONS
SEE PROFILE

Frank Frimpong Opuni
Accra Technical University
24 PUBLICATIONS **104** CITATIONS
SEE PROFILE

Construction of a Scale Assessing Patients' Perceptions Regarding Sanitation and Hygiene in a Clinical Setting

Nestor Asiamah, MSc, Mavis Aggrey, MPH,† Kwame Adu-Gyamfi, MBA,‡ and Frank Frimpong Opuni, MBA§*

Objective: This study attempted to develop a scale, hereby called HYGIENICCARE, that assesses patients' perceptions regarding sanitation and hygiene in a healthcare environment. It also evaluated the relationship between the new measure and a previously validated scale measuring healthcare quality.

Methods: This study was a psychometric test in which we constructed a new survey and administered the survey to patients in wards and the outpatient departments of 5 hospitals in Accra North. A robust procedure, including a review of selected questions by an expert panel, was followed to determine the original bank of items of the instrument. Principal component analysis with varimax rotation was used to select items for the scale, whereas confirmatory factor analysis was used to assess construct validity. Multiple linear regression was used to examine the association between the new scale and an existing measure of healthcare quality.

Results: A bank of 10 items was determined through a systematic review of the literature and the engagement of 7 expert reviewers. Through principal component analysis, the items were reduced to 9. Principal component analysis yielded 2 factors: "environment and equipment" and "personnel and process," which both explained 82% of the total variance and produced Cronbach α coefficients of 0.912 and 0.86, respectively. Confirmatory factor analysis confirmed the 2-factor solution and produced satisfactory discriminant validity and convergent validity indicators. The 2 domains of the new scale were highly correlated with all dimensions of a scale measuring healthcare quality called HEALTHQUAL ($r \geq 0.76$, $P < 0.001$). In multiple linear regression, each of the 2 domains of HYGIENICCARE explained a total variance of 41% or greater in all domains of HEALTHQUAL ($P < 0.001$).

Conclusions: We developed a brief scale measuring hospital hygiene and sanitation that correlated well with an existing measure of healthcare quality. This effort shows that the new tool is a valid measure of patient-perceived hospital hygiene and sanitation.

Key Words: hospital sanitation, hospital hygiene, healthcare quality, continuous quality improvement, psychometric testing

(*J Patient Saf* 2022;18: e534–e541)

The fight against nosocomial infections, also commonly called hospital-related infections, is a major challenge to hospitals, especially in developing countries. These infections are often influenced by poor hospital sanitation and hygiene attributable to resource constraints.[1,2] Even if poor hygiene in the hospital does not contribute to nosocomial infections, it could reduce the quality of care provided. This observation is consistent with studies[3,4] that have ascribed low health service quality in developing countries to factors including poor hospital hygiene and sanitation. Similarly, healthcare ethics and standards, such as hand hygiene, are reportedly compromised in many hospitals in developing countries,[5–7] which undermines the need for healthcare to be harmless.

Delivering healthcare under hygienic conditions is one of the criteria that hospitals must meet to receive accreditation from stakeholders such as Joint Commission International (JCI) and World Health Organization, which suggests that healthcare quality is ultimately delivered in a hygienic environment. It is therefore not surprising that many scales developed for measuring healthcare quality, such as HEALTHQUAL by Lee[8] and SERVQUAL by Parasuraman et al,[9] incorporate some items that evaluate hospital hygiene. We have observed, however, that items included by these and other available scales measure only the looks of hospital staff and equipment and undermine standard practices such as hand hygiene, sewage disposal (including a constant supply of water), and regular emptying and cleaning of waste containers and equipment. Worse yet, no identifiable study has provided potential items for measuring clinical sanitation and hygiene, which we operationally define as cleanliness of physical facilities, hospital environment and staff, and the delivery of care under hygienic conditions. Physical facilities include bed sheets, curtains, waste containers, lawns, and other spaces accessible to patients and their relations. The said hygienic conditions are ultimately standards recommended by regulators, including the WHO.[10–12] A plethora of studies[3,8,13,14] have reported that the beauty and cleanliness of a clinical environment are predictors of healthcare quality. Popular scales developed for measuring healthcare quality[8,9] also recognize hospital sanitation as a determinant of health service quality and patient retention. It could, therefore, be contended that poor sanitation and hygiene in healthcare can discourage the utilization of health services and consequently limit access to these services. That being so, it is necessary for healthcare accreditation institutions, researchers, and healthcare facilities to regularly monitor sanitation and hygiene in healthcare.

Performance measurement forms a key part of any effort to continuously monitor clinical practice,[10,12] implying that the measurement of sanitation and hygiene in healthcare is a necessary part of any evidence-based monitoring program that would enable stakeholders to improve hygiene in healthcare over time. This study, therefore, attempts to develop a scale measuring patient perceptions of sanitation and hygiene in a clinical setting. The scale is developed based on patient perceptions for a couple of reasons. Firstly, services and resources in a clinical environment are tailored for patient satisfaction and safety. Moreover, as recipients of health services, patients would give the most objective assessment of sanitation and hygiene in healthcare. This is to say healthcare personnel and hospital administrators are likely to be biased in evaluating any aspect of healthcare and/or hospital performance. Therefore, the ideal questionnaire for measuring patients' perceptions on hospital sanitation and hygiene should be completed by patients. The foregoing argument implies that sanitation and hygiene can predict patients' service quality perceptions.

From the *Africa Centre for Epidemiology; †Greater Accra Regional Hospital, Accra, Ghana; ‡Department of Tourism and Hospitality, Niagara College, Welland, Ontario, Canada; and §Department of Marketing, Accra Technical University, Accra, Ghana.
Correspondence: Nestor Asiamah, MSc, Africa Centre for Epidemiology, P.O. Box AN 16284, Accra North, Accra, Ghana (e-mail: nestor.asiamah@ace-gh.org).
The authors disclose no conflict of interest.
Supplemental digital contents are available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site (www.journalpatientsafety.com).

Healthcare facilities can as a result continuously augment healthcare quality by maintaining hygiene and sanitation in healthcare. To assess the practicality of this idea, we examine the overlap between the new scale and different domains of HEALTHQUAL, the only identifiable tool that has a dimension measuring continuous healthcare quality improvement.

METHODS

Design and Participants

This study used a quantitative (cross-sectional) technique to assess the psychometric properties of a potential scale, hereby referred to as HYGIENICCARE, for measuring hospital sanitation and hygiene. In line with previous studies,[15,16] we evaluated concurrent validity by examining the association between the scale and different dimensions of HEALTHQUAL.[2,17] The relative importance of the new scale was also demonstrated by comparing it to HEALTHQUAL. We preferred HEALTHQUAL to other scales because it is recent, mitigates much of the weakness associated with other scales, and includes a domain that measures "quality improvement," an increasingly important component of healthcare quality. Quality improvement in this context refers to the ability of the health facility to enhance the quality of health services in the face of changing patient needs and expectations.[8] The study's participants were patients in wards and outpatient departments (OPD) of low- and medium-capacity community health facilities. Six hundred ten patients who met selection criteria were selected from the research registry of the hospitals. The selection criteria applied were as follows: (*a*) having at least a basic educational qualification, which was an indicator of one's ability to read and write in English, the medium in which questionnaires were administered; (*b*) having ample experience (of at least 24 hours) with hospital facilities and staff; (*c*) availability at the time of data collection; and (*d*) willingness to participate in the study voluntarily. Outpatients who participated had routinely received services from the hospitals and had a medical appointment in their respective hospitals in the period of data collection. All 610 patients were asked to participate in the study to make room for nonresponses and discarded questionnaires, bearing in mind the theory that confirmatory factor analysis (the main statistical tool used for data analysis) works best with sample sizes greater or equal to 500.[18]

Questionnaire Development

Variables captured in the questionnaire include patient characteristics: gender (male versus female); National Health Insurance Scheme (NHIS) status (subscriber versus nonsubscriber); educational qualification (the highest educational qualification of the patient); and age.

We followed 3 steps to determine a bank of items for HYGIENICCARE. First, we reviewed traditional and gray literature to identify standards (including the WHO's 5-moment model) for the maintenance of sanitation and hygiene in healthcare. In this process, we found the standards (regulatory framework) of the WHO and the JCI most suitable because they form the basis of practice and international accreditation of hospitals. Hence, we developed 10 items that agree with these regulations and standards. Our second step involved asking 2 experts in healthcare accreditation institutions and 5 psychometricians to review the items and establish content validity. This panel of experts had relevant expertise as we ensured that each of its members had been licensed as an infections control and hospital sanitation expert, developed a reputable scale on hygiene and sanitation or received specialized training on the WHO's 5-moment healthcare hygiene model. Six of the 7 experts perceived 2 of the items to be vague and, therefore, asked for their rewording. Finally, we spoke with 50 patients from different medical departments of the participating hospitals in a semistructured interview and pilot study to further enhance content validity and identify ambiguous items. The pilot study further unfolded 2 ambiguous items that were rephrased. Thus, 10 items were endorsed final indicators of the new scale (see Appendix A, http://links.lww.com/JPS/A399, for the items). The new items were accompanied with 7 descriptive anchors used for similar tools[9] (i.e., strongly disagree [1], disagree [2], somewhat disagree [3], neutral [4], somewhat agree [5], agree [6], strongly agree [7]).

HEALTHQUAL was measured using items borrowed from its originator.[8] It comprises 5 factors (i.e., empathy [7 items], tangibles [5 items], safety [4 items], efficiency [4 items], and continuous quality improvement [6 items]) based on a 5-point Likert scale with descriptive anchors (i.e., very bad [1], bad [2], somewhat good [3], good [4], very good [5]).

Data Collection

The study was approved by the management of the participating hospitals and received ethical clearance from the ethics committee of the Africa Center for Epidemiology (Number: ACE-SVP2019). Data were collected over 4 working days in the pilot study, whereas the main survey lasted 3 weeks. In both surveys, 3 trained research and field assistants were led by one of the researchers to administer questionnaires through hand delivery after each participant was contacted by the researchers and asked to sign an informed consent form that detailed the purpose and potential risks of the study. To maximize response rate and avoid questionnaire misplacement, patients were asked to respond immediately and return completed questionnaires in stamped envelopes provided by the researchers. In the main survey, 11 patients in the OPD did not honor their appointments within the period of data collection and hence did not respond. Of 599 questionnaires administered, 532 were completed but 12 were discarded because they were incompletely filled. Thus, 520 questionnaires were analyzed.

Statistical Analysis Procedure

We used SPSS 24 (IBM SPSS, Inc, New York) and its in-built Amos software to analyze the data. In the exploratory analysis, descriptive statistics (frequency, percent, mean, and standard deviation [SD]) were used to summarize the data. Estimated kurtosis and skewness met recommended criteria applied elsewhere[16] and, therefore, signified that outliers in the data were not significant. The few missing values in the data were replaced using the linear interpolation method in harmony with previous studies.[8,19] Principal component analysis was used to select relevant items and gain insight into the factor structures of HYGIENICCARE and HEALTHQUAL. Two measurement models were then fitted to estimate the psychometric properties of the scales or confirm that their factor solutions reached in principal component analysis. Multivariate normality of the data, which is a requirement for confirmatory factor analysis, was met in the 2 measurement models based on criteria applied elsewhere.[8,19–22] In agreement with some studies,[15,16,23–25] Pearson correlation test and multiple regression analysis were used to assess concurrent validity. Cohen criterion ($r < 0.3$ = small; $0.3 \leq r < 0.5$ = medium; and $r \geq 0.5$ = large)[23] was applied in the correlation analysis. In multiple regression analysis, the association between factors of HYGIENICCARE and domains of HEALTHQUAL was tested, with relevant patient characteristics controlled for. Other relevant assumptions (independence of errors and multicollinearity) were met through the multiple regression analysis. Statistical significance of estimates was detected at a P value of less than 0.05.

RESULTS

Findings From the Pilot Survey

Of the 50 patients who responded, 62% (n = 31) were male and 38% (n = 19) were female. Moreover, 70% (n = 35) of the respondents had basic and secondary education qualifications, whereas 30% (n = 15) of them had tertiary qualifications. Approximately 10% (n = 5) of all the patients had received healthcare in the hospital for up to 2 years: 20% (n = 10) for between 3 and 5 years, 60% (n = 30) for between 6 and 10 years, and 10% (n = 5) for more than 10 years. Finally, approximately 90% (n = 45) of the participants were NHIS subscribers, whereas 10% (n = 5) were nonsubscribers. The questionnaire produced a Cronbach α coefficient of 0.922 and a 2-factor solution based on factor loadings of 0.5 or greater (0.58–0.97). The 2 factors produced were "process and personnel" (factor 1 comprising, SE1–SE5 in Appendix A, http://links.lww.com/JPS/A399) and "environment and equipment" (factor 2, comprising HH1–HH5 in Appendix B, http://links.lww.com/JPS/A400). The total variance accounted was 89.7% (factor 1 = 64.4%, factor 2 = 25.3%), and the eigenvalues of factors 1 and 2 were 6.95 and 1.51, respectively. In the context of principal component analysis, a factor extracted must have an eigenvalue of at least 1, and larger eigenvalues better contribute to the total variance of the factor.[18] The items reworded in the pilot study are HH3 and SE5.

Findings From the Main Survey

Of the 520 patients who responded, approximately 54% (n = 280) of the patients were male and 46% (n = 240) were female. Patients with tertiary educational qualifications made up 38% (n = 200) of the sample, and those with basic and secondary qualifications made up 35% (n = 180) and 27% (n = 140) of the sample, respectively. Approximately 42% (n = 220) of all patients had received healthcare in the hospital for up to 2 years: 31% (n = 161) for between 3 and 5 years, 23% (n = 119) for between 6 and 10 years, and 4% (n = 20) for more than 10 years. Last but not least, approximately 85% (n = 439) of the participants were NHIS subscribers and 15% (n = 81) were nonsubscribers.

After conducting principal component analysis (with varimax rotation) on the 10 items of HYGIENICCARE, a 2-factor solution emerged (Fig. 1). The total variance accounted was 82.4% (factor 1 = 67.6%, factor 2 = 14.8%; see Appendix A, http://links.lww.com/JPS/A399). The first factor extracted, "process and personnel," comprised 4 items with factor loadings of 0.5 or greater (0.53–0.95), and the second factor, "environment and equipment," embodied 5 items with loadings of 0.5 or greater (0.75–0.90). Thus, a single item (i.e., the hospital environment smells bad [R]) was removed from the initial set of items based on loadings of less than 0.5. Concerning the HEALTHQUAL scale, a 5-factor solution was reached in principal component analysis on 24 items that met the criterion loadings of 0.5 or greater (0.59–0.92; see Appendix B, http://links.lww.com/JPS/A400). In this vein, a total variance of 86.8% (factor 1 = 62.7, factor 2 = 8.5%, factor 3 = 6.4%, factor 4 = 5.3%, and factor 5 = 3.8%) was accounted for by the 5 factors formed by 24 instead of the original 26 items incorporated into the analysis. This is to say that 2 items were removed based on loadings of less than 0.5 from the initial bank of items—1 item each from "empathy" (i.e., the hospital knowing your needs) and "quality improvement" (degree of efforts and willingness by the hospital to prevent you from contracting diseases).

We evaluated psychometric properties based on the factor solutions reached in principal component analysis. Internal consistency of the scale was assessed with Cronbach α coefficient values and factor loadings estimated in confirmatory factor analysis. The rule of thumb is $\alpha \geq 0.7$ for each dimension or factor and the overall scale.[8,20] Each item should also produce a factor loading of 0.5 or greater.[8,16] Both criteria were met (Tables 1, 2). Convergent validity was assessed with average variance extracted (AVE), which in theory should meet the criterion AVE of 0.5 or greater.[8,14,26,27] Discriminant validity was evaluated with maximum shared variance (MSV) and average shared variance (ASV) based on the criteria MSV < AVE and ASV < MSV.[8,21] The estimates in Tables 1 and 2 show that these criteria are met for both scales. To summarize, the factor solutions reached in the principal component analysis were confirmed in confirmatory factor analysis. As seen in Table 3, the measurement models were of a good fit as the absolute, relative, parsimonious, and centrality fit indicators satisfied recommended criteria.[8,14]

Table 4 shows descriptive statistics and the correlation between relevant variables. Positive correlation coefficients suggest that a dependent variable increases as the predictor increases at *P* values of less than 0.001 or less than 0.05. "Environment and Equipment," for instance, is positively correlated to each domain of service quality at a *P* value of less than 0.001, which suggests that healthcare in terms of all dimensions of HEALTHQUAL improves as perceived sanitation in the hospital environment improves. Similarly, "process and personnel" is positively correlated to all dimensions of

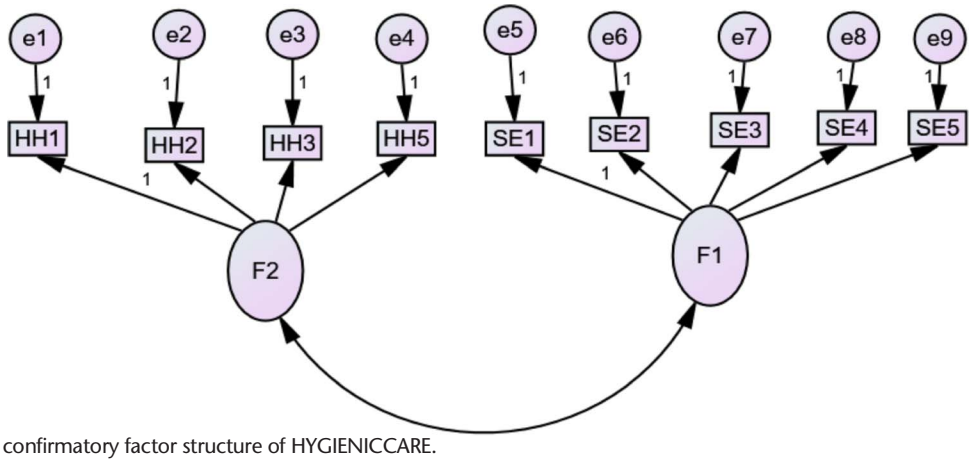

FIGURE 1. The confirmatory factor structure of HYGIENICCARE.

TABLE 1. Psychometric Indicators and Descriptive Statistics on HYGIENICCARE

Factor	Item	Mean	SD	FL	CR	CA	AVE	MSV	ASV
Environment and equipment (F2)	HH1	5.08	1.80	0.783	—	0.912	0.805	0.111	0.065
	HH2	5.35	1.96	0.851	22.385				
	HH4	5.31	1.73	0.821	21.507				
	HH5	5.19	1.86	0.864	22.818				
	SE1	5.54	1.76	0.704	16.994				
Process and personnel (F1)	SE2	5.31	1.86	0.955	—	0.860	0.767	0.111	0.061
	SE3	5.42	1.82	0.909	39.53				
	SE4	5.81	1.50	0.706	21.348				
	SE5	6.04	1.37	0.499	9.719				
All scale	—	5.45	1.74	—	—	0.936	—	—	—

Mean scores are based on descriptive anchors ranging from strongly disagree (1) to strongly agree (7).
—, value not applicable; CA, Cronbach α; CR, critical ratio; FL, factor loading.

healthcare quality at a P value of less than 0.001, which signifies that healthcare improves as hygiene in personnel and healthcare activities increases. In Table 5, "environment and equipment" is positively associated with 2 domains of healthcare quality: "empathy" ($\beta = 0.32$, $t = 4.64$, $P < 0.001$) and "quality improvement" ($\beta = 0.29$, $t = 4.09$, $P < 0.001$). "Process and personnel" is also positively associated with all domains of service quality ($P < 0.001$). Apparently, "process and personnel" is a

TABLE 2. Psychometric Estimates and Descriptive Statistics on HEALTHQUAL

Factor	Item	Mean	SD	FL	CA	AVE	MSV	ASV
Empathy*	EMP1	3.92	1.52	0.593	0.847	0.658	0.103	0.053
	EMP2	4.12	1.28	0.501				
	EMP3	3.96	1.16	0.713				
	EMP4	3.88	1.19	0.631				
	EMP5	3.77	1.28	0.780				
	EMP7	3.58	1.18	0.727				
Tangibles†	TAN1	3.19	1.39	0.780	0.872	0.693	0.106	0.054
	TAN2	3.54	1.50	0.764				
	TAN3	3.35	1.49	0.628				
	TAN4	3.77	1.37	0.665				
	TAN5	3.81	1.27	0.627				
Safety‡	SF1	3.58	1.42	0.828	0.872	0.672	0.106	0.054
	SF2	3.42	1.42	0.768				
	SF3	3.58	1.39	0.503				
	SF4	3.58	1.39	0.587				
Efficiency§	EF1	3.62	1.33	0.751	0.856	0.637	0.104	0.053
	EF2	3.65	1.36	0.708				
	EF3	3.42	1.39	0.500				
	EF4	3.81	1.27	0.590				
Quality improvement‖	IMP1	3.69	1.41	0.851	0.936	0.749	0.114	0.053
	IMP2	3.73	1.43	0.713				
	IMP3	3.73	1.46	0.814				
	IMP4	3.73	1.29	0.541				
	IMP6	3.54	1.37	0.826				
	All scale	3.66	1.06	—	0.897	—	—	—

Mean scores are based on descriptive anchors ranging from very bad (1) to very good (5).
*Factor 1.
†Factor 5.
‡Factor 2.
§Factor 4.
‖Factor 3.
CA, Cronbach α; FL, factor loading.

TABLE 3. Model Fit Statistics

	Absolute Indices				Relative Indices		Parsimonious Indices		Centrality
Model	χ^2	***P***	**GFI**	**RMR**	**TLI**	**NFI**	**PGFI**	**PNFI**	**RMSEA**
1	1.150	0.241	0.962	0.021	0.988	0.969	0.981	0.965	0.010
2	1.221	0.231	0.966	0.032	0.976	0.961	0.972	0.959	0.011
Recommended	≤3.00	≥0.05	≥0.95	≤0.08	≥0.9	≥0.95	≥0.95	≥0.95	≤0.08

Model 1, HYGIENICCARE measurement model; Model 2, HEALTHQUAL measurement model.

GFI, Goodness-of-Fit Index; NFI, Bentler-Bonett Normed Fit Index; PGFI, Parsimonious Goodness-of-Fit Index; PNFI, Parsimonious Bentler-Bonett Normed Fit Index; RMR, root mean square residual; RMSEA, root mean square error of approximation; TLI, Tucker-Lewis Index.

stronger correlate of healthcare quality when compared to "environment and equipment."

DISCUSSION

HYGIENICCARE is the first questionnaire developed to measure hospital sanitation and hygiene from the viewpoint of patients. It has satisfactory internal consistency with a Cronbach α coefficient of greater than 0.9 for the first subscale "process and personnel" and greater than 0.8 for the second subscale "environment and equipment." Similar highly cited studies[24,25,28–30] have confirmed the internal consistency of their scales based on Cronbach α coefficients greater or equal to the recommended minimum value of 0.7. Moreover, the internal consistency of the new scale is complemented by the accuracy of item selection that is signified by the significant association between each subscale and different measures of healthcare quality, including the hospital's ability to improve quality continuously. Our questionnaire's concurrent validity is therefore adequately demonstrated in line with previous studies.[16,30]

We used confirmatory factor analysis to further confirm our 2-factor solution realized in principal component analysis. Interestingly, the results of the confirmatory analysis reflect ample discriminant and convergent validity of the questionnaire based on recommended baselines.[8,14,16,20] Some previous studies have produced reliable scales based on less robust statistical procedures,[9,16] but not limited to the use of principal component analysis. Noteworthy is the fact that although these previous studies did not confirm their results using confirmatory factor analysis, their scales have been either reproduced in subsequent studies or used to reach satisfactory estimates and outcomes. The new scale can be said to be of significant psychometric significance and thus promises to be a potential measure of patient-perceived hospital sanitation and hygiene, at least in developing countries. This is premised on the fact that it has been developed on more resilient statistical procedures, including evaluation of concurrent validity using the best of 2 methods applied in the literature.[16,23]

The removal of some items from HEALTHQUAL is not an isolated and unexpected development—no identifiable study has retained all items of an existing scale in a population different

TABLE 4. The Correlation Between Domains of HYGIENICCARE, HEALTHQUAL, and Demographic Variables

Variables	No.	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
Environment and equipment	1	5.23	1.64	1	0.851*	0.381*	0.430*	0.403*	0.383*	0.434*	−0.018	0.011	−0.280*	−0.028	0.125*	−0.115*
Process and personnel	2	5.64	1.38		1	0.305*	0.407*	0.424*	0.374*	0.383*	−0.006	−0.041	−0.284*	−0.174*	0.025	−0.223*
Empathy	3	3.81	1.09			1	0.894*	0.748*	0.774*	0.785*	−0.006	0.108†	0.166*	0.169*	−0.017	0.254*
Tangibles	4	3.53	1.14				1	0.881*	0.823*	0.776*	−0.001	0.299*	0.074	0.151*	0.179*	0.234*
Safety	5	3.54	1.20					1	0.922*	0.769*	0.005	0.342*	0.265*	0.067	0.148*	0.104†
Efficiency	6	3.64	1.12						1	0.870*	0.008	0.203*	0.173*	0.240*	−0.014	0.210*
Quality improvement	7	3.71	1.19							1	0.005	0.03	0.003	0.107†	0.106†	0.313*
Department (wards)‡	8	0.53	0.05								1	−0.004	−0.012	−0.01	0.002	0.015
Sex (male)§	9	0.46	0.50									1	0.052	−0.140*	0.395*	0.048
Education	10	2.04	0.87										1	0.056	−0.231*	−0.277*
Service experience	11	4.66	1.89											1	−0.294*	0.434*
NHIS status (nonsubscriber)‖	12	0.85	0.36												1	0.074
Age	13	26.11	5.11													1

*$P < 0.001$.

†$P < 0.05$.

‡Reference = OPD.

§Reference = female.

‖Reference = NHIS subscriber.

TABLE 5. The Association Between Factors of Sanitation and Hygiene and Healthcare Quality

	Model 1 (Empathy)				Model 2 (Tangibles)				Model 3 (Safety)				Model 4 (Efficiency)				Model 5 (Quality Improvement)			
Variable	***B***	**SE**	**β (*t*)**	**95% CI**	***B***	**SE**	**β (*t*)**	**95% CI**	***B***	**SE**	**β (*t*)**	**95% CI**	***B***	**SE**	**β (*t*)**	**95% CI**	***B***	**SE**	**β (*t*)**	**95% CI**
Main estimates																				
Constant	−1.52	0.36	(−4.20)*	±1.42	−3.22	0.35	(−9.31)*	±1.36	−3.24	0.34	(−9.58)*	±1.33	−1.44	0.36	(−4.05)*	±1.40	−1.8	0.40	(−4.50)*	±1.57
Environment and equipment	0.22	0.05	0.32(4.64)*	±0.18	0.02	0.05	0.03(0.48)	±0.18	0.01	0.04	0.01(0.21)	±0.17	0.09	0.05	0.13(1.87)	±0.18	0.21	0.05	0.29(4.09)*	±0.20
Personnel and process	0.26	0.06	0.32(4.43)*	±0.23	0.56	0.06	0.65(9.92)*	±0.22	0.57	0.06	0.65(10.35)*	±0.22	0.37	0.06	0.46(6.35)*	±0.23	0.30	0.07	0.34(4.58)*	±0.25
Covariate estimates																				
Department (wards)[†]	0.01	0.08	0.01(0.19)	±0.30	0.03	0.07	0.01(0.35)	±0.28	0.03	0.07	0.01(0.38)	±0.28	0.02	0.07	0.01(0.32)	±0.29	0.02	0.08	0.01(0.22)	±0.33
Sex (male)[‡]	0.08	0.08	0.04(0.95)	±0.33	0.45	0.08	0.19(5.59)*	±0.31	0.68	0.08	0.28(8.71)*	±0.31	0.54	0.08	0.25(6.57)*	±0.32	−0.13	0.09	−0.06(−1.45)	±0.36
Education	0.61	0.05	0.48(12.07)*	±0.20	0.54	0.05	0.41(11.16)*	±0.19	0.78	0.05	0.56 (16.31)*	±0.19	0.52	0.05	0.41(10.29)*	±0.20	0.50	0.06	0.36(8.88)*	±0.22
Service experience	0.04	0.05	0.03(0.66)	±0.21	0.24	0.05	0.18(4.71)*	±0.20	0.11	0.05	0.08(2.18)[§]	±0.20	0.20	0.05	0.16(3.76)*	±0.21	−0.07	0.06	−0.05(−1.21)	±0.23
NHIS status (subscriber)[‖]	−0.05	0.13	−0.02(−0.40)	±0.49	0.57	0.12	0.18(4.78)*	±0.47	0.48	0.12	0.15(4.12)*	±0.46	−0.04	0.12	−0.01(−0.33)	±0.48	0.36	0.14	0.11(2.60)[§]	±0.54
Age	0.51	0.04	0.51(11.96)*	±0.17	0.44	0.04	0.42(10.85)*	±0.16	0.37	0.04	0.34(9.38)*	±0.16	0.34	0.04	0.35(8.22)*	±0.16	0.59	0.05	0.54(12.56)*	±0.18
Model fit	M1				M2				M3				M4				M5			
R^2	0.443				0.536				0.580				0.434				0.412			
Adjusted R^2	0.434				0.529				0.574				0.425				0.403			
Change in R^2	0.009				0.007				0.006				0.009				0.009			
Durbin-Watson	2.411				2.221				2.044				2.431				2.211			
F	48.909				70.917				84.901				47.099				43.023			
P	0.000				0.000				0.000				0.000				0.000			

Tolerance ≥0.1 for all predictors (minimum = 0.21, maximum = 0.91); variance inflation factor ≤5 for all predictors (minimum = 1.21, maximum = 4.91).

*$P < 0.001$.

[†]reference = OPD.

[‡]reference = female.

[§]$P < 0.05$.

[‖]Reference = non-NHIS subscriber.

M1, model 1 (with empathy as outcome); M2, model 2 (with tangibles as outcome); M3, model 3 (with safety as outcome); M4, model 4 (with efficiency as outcome); M5, model 5 (with "continuous improvement" as outcome); SE, standard error (of *B*).

from the original population on which the scale was constructed. Our result, therefore, corroborates the idea of scale "volatility," which is a concept that Asiamah et al[20] used to explain the instability of scales across populations. Needless to say, every scale is likely to change in structure and content if validated in a population different from the population on which it was developed. In agreement with some researchers,[9,20,31,32] therefore, the reliability and validity of any scale, for that matter the current one, need to be always verified and/or retested in future research. In this regard, it is permissible for future researchers and psychometricians to introduce items that are unique to their populations and contexts. Finally, a change in the factor structure of HYGIENICCARE can be expected in other settings and studies.

Noteworthy is the positive association confirmed between each of the 2 dimensions of hospital sanitation and hygiene and different domains of healthcare quality. This result implies that the maintenance of hospital sanitation and hygiene can benefit service quality delivery efforts in the hospital. As reported in some studies,[1,6,13,33,34] patients may attach importance to not only the beauty of the hospital environment but also the level of hygiene ensured in healthcare. It can thus be inferred that healthcare is more satisfactory to patients when it is delivered in a clean and hygienic environment. No doubt that the WHO and accreditation institutions such as the JCI uphold hospital standards and practices relating to hygiene and sanitation. Moreover, as our result suggests, adherence to the foregoing standards can be positively correlated with patients' quality perceptions.

Our psychometric estimates are not exhaustive; time validity (i.e., test-retest validity) has not been captured in the present study, which means that other researchers are obliged to consider this test in future assessments. The current study's sample is relatively large, but considering the limited number of hospitals in the study setting that made up its population, our result may not be representative of all populations. Issues relating to hospital sanitation and hygiene may be less alarming in developed countries and could, as a result, be associated with different patient opinions and ratings. For this reason, a complete replication of our study in developed countries is imperative. In harmony with previous studies,[1,8,16,33,34] future tests should include patients' rating of the importance of hospital sanitation and hygiene.

CONCLUSIONS

Nine of 10 items are potential measures of patients' perceptions regarding sanitation and hygiene in healthcare and make up 2 components, namely, "environment and equipment" and "personnel and process." "Quality improvement" increases as the 2 dimensions of hospital sanitation and hygiene increase. Efforts to improve hospital hygiene and sanitation, if noticed by patients, can be positively correlated with perceptions of quality. Moreover, all domains of healthcare quality increase as "personnel and process" increases, but only "empathy" and "quality improvement" are positively correlated with "environment and equipment." The study concludes that the effort of hospitals to improve healthcare quality over time is more likely to be rated highly by patients if sanitation and hygiene are ensured and maintained in healthcare.

REFERENCES

1. Huttinger A, Dreibelbis R, Kayigamba F, et al. Water, sanitation and hygiene infrastructure and quality in rural healthcare facilities in Rwanda. *BMC Health Serv Res*. 2017;17:517. doi:10.1136/bmjopen-2013-003416.
2. Hasan MM, Rahman MH. Assessment of healthcare waste management paradigms and its suitable treatment alternative: a case study. *J Environ Public Health*. 2018;2018:6879751.
3. Quilab MT, Johnson S, Schadt C, et al. The effect of education on improving hand hygiene compliance among healthcare workers. *Hosp Palliat Med Int J*. 2019;3:66–71. doi:10.15406/hpmij.2019.03.00153.
4. Samuel R, Almedom AM, Hagos G, et al. Promotion of handwashing as a measure of quality of care and prevention of hospital-acquired infections in Eritrea: the Keren study. *Afr Health Sci*. 2005;5:4–13.
5. Babanyara YY, Ibrahim DB, Garba T, et al. Poor medical waste management (MWM) practices and its risks to human health and the environment: a literature review. *World Acad Sci Eng Technol*. 2014;7:780–787.
6. Bouzid M, Cumming O, Hunter PR. What is the impact of water sanitation and hygiene in healthcare facilities on care seeking behaviour and patient satisfaction? A systematic review of the evidence from low-income and middle-income countries. *BMJ Glob Health*. 2018;3:e000648. doi:10.1136/bmjgh-2017-000648.
7. Ezirim I, Agbo F. Role of national policy in improving health care waste management in Nigeria. *J Health Pollut*. 2018;8:180913. doi:10.5696/2156-9614-8.19.180913.
8. Lee D. HEALTHQUAL: a multi-item scale for assessing healthcare service quality. *Serv Bus*. 2017;11:491–516. doi:10.1007/s11628-016-0317-2.
9. Parasuraman A, Zeithaml VA, Berry LL. SERVQUAL: a multiple item scale for measuring consumer perceptions of service quality. *J Retail*. 1988;64:12–40.
10. Mitchell A, Boisvert E, Wilson T, et al. Hand hygiene: a quality improvement project. *Biomed J Sci Tech Res*. 2017;1:1–4. doi:10.26717/BJSTR.2017.01.000601.
11. Mara D, Lane J, Scott B, et al. Sanitation and health. *PLoS Med*. 2010;7:e1000363. doi:10.1371/journal.pmed.1000363.
12. World Health Organization. Water, sanitation, and hygiene in health care facilities: practical steps to achieve universal access to quality care. 1–31. Available at: https://apps.who.int/iris/bitstream/handle/10665/311618/9789241515511-eng.pdf. Accessed July 06, 2016.
13. Sapkota B, Gupta GK, Mainali D. Impact of intervention on healthcare waste management practices in a tertiary care governmental hospital of Nepal. *BMC Public Health*. 2014;14:1005. doi:10.1186/1471-2458-14-1005.
14. Asiamah N, Mends-Brew E, Boison BKT. A spotlight on cross-sectional research: addressing the issues of confounding and adjustment. *Int J Healthc Manag*. 2019;4:1–14. doi:10.1080/20479700.2019.1621022.
15. Sackett PR, Lievens F, Berry CM, et al. A cautionary note on the effects of range restriction on predictor intercorrelations. *J Appl Psychol*. 2007;92:538–544. doi:10.1037/0021-9010.92.2.538.
16. Salomon L, Gasquet I, Mesbah M, et al. Construction of a scale measuring inpatients' opinion on quality of care. *Int J Qual Health Care*. 1999;11:507–516. doi:10.1093/intqhc/11.6.507.
17. Hesselink G, Kuis E, Pijnenburg M, et al. Measuring a caring culture in hospitals: a systematic review of instruments. *BMJ Open*. 2013;3:e003416. doi:10.1136/bmjopen-2013-003416.
18. Kelava A. A review of confirmatory factor analysis for applied research (second edition). *J Educ Behav Stat*. 2016;20:1–5.
19. Abaasi MI. Psychometric evaluation of job satisfaction scale in Uganda's teacher population sample. *Global J Hum Soc Sci*. 2016;16:42–50.
20. Asiamah N, Mensah HK, Danquah E. An assessment of the emotional intelligence of health workers: a scale validation approach. *J Global Responsibility*. 2018;9:141–159. doi:10.1108/JGR-03-2017-0014.
21. Asiamah N, Opuni FF, Mensah HK. The nexus between internal marketing in hospitals and organizational commitment: Incorporating the mediation roles of key job characteristics. *Int J Healthc Manag*. 2018;11:1–16. doi:10.1080/20479700.2018.1551951.
22. Körner M, Wirtz MA. Development and psychometric properties of a scale for measuring internal participation from a patient and health care professional perspective. *BMC Health Serv Res*. 2013;13:374. doi:10.1186/1472-6963-13-374.

23. Syrjala KL, Stover AC, Yi JC, et al. Measuring social activities and social function in long-term cancer survivors who received hematopoietic stem cell transplantation. *Psychooncology*. 2010;19:462–471. doi:10.1002/pon.1572.

24. Beattie M, Shepherd A, Lauder W, et al. Development and preliminary psychometric properties of the Care Experience Feedback Improvement Tool (CEFIT). *BMJ Open*. 2016;6:e010101. doi:10.1136/bmjopen-2015-010101.

25. Beattie M, Lauder W, Atherton I, et al. Instruments to measure patient experience of health care quality in hospitals: a systematic review protocol. *Syst Rev*. 2014;3:4. doi:10.1186/2046-4053-3-4.

26. Asiamah N. Enhancing nurses' emotional intelligence: are tenure prolongation, education and in-service training applicable methods even when not specialized? *Cogent Bus Manag*. 2017a;4:1–16. doi:10.1080/23311975.2017.1280896.

27. Asiamah N. The nexus between health workers' emotional intelligence and job performance controlling for gender, education, tenure and in-service training. *J Global Responsibility*. 2017b;8:1–16. doi:10.1108/JGR-08-2016-0024.

28. Frost MH, Reeve BB, Liepa AM, et alMayo/FDA Patient-Reported Outcomes Consensus Meeting Group. What is sufficient evidence for the reliability and validity of patient-reported outcome measures? *Value Health*. 2007;10(suppl 2):S94–S104. doi:10.1111/j.1524-4733.2007.00272.x.

29. Willoughby MT, Cadigan RJ, Burchinal M, et al. An evaluation of the psychometric properties and criterion validity of the religious social support scale. *J Sci Study Relig*. 2008;47:147–159. doi:10.1111/j.1468-5906.2008.00398.x.

30. Jha P, Larsson M, Christensson K, et al. Evaluation of the psychometric properties of Hindi-translated Scale for Measuring Maternal Satisfaction among postnatal women in Chhattisgarh, India. *PLoS One*. 2019;14:e0211364. doi:10.1371/journal.pone.0211364.

31. Schutte SN, Malouff JM, Hall LE, et al. Development and validation of a measure of emotional intelligence. *Personal Individ Differ*. 1998;25:167–177. doi:10.1016/S0191-8869(98)00001-4.

32. Souza AC, Alexandre NMC, Guirardello EB. Psychometric properties in instruments evaluation of reliability and validity. *Epidemiol Serv Saude*. 2017;26:649–659. doi:10.5123/s1679-49742017000300022.

33. Bungau S, Suciu R, Bumbu A, et al. Study on hospital waste management in medical rehabilitation clinical hospital, Baile Felix. *J Environ Prot Ecol*. 2015;16:980–987.

34. Sendall MC, McCosker LK, Halton K. Cleaning staff"s attitudes about hand hygiene in a metropolitan hospital in Australia: a qualitative study. *Int J Environ Res Public Health*. 2019;16:1067. doi:10.3390/ijerph16061067.