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ADAPTED SERVQUAL: A Health Service Quality Scale Incorporating Indicators of Sanitation and Hygiene

Nestor Asiamah, MSc; Frank Frimpong Opuni, MBA; Mavis Aggrey, MPH; Kwame Adu-Gyamfi, MBA

Background and Objectives: Many scales have been developed to measure health care quality over the years, but no scale available today incorporates all important indicators of sanitation and hygiene in health care. This study therefore assessed the psychometric properties of an adapted scale, hereby called ADAPTED SERVQUAL, in an attempt to provide a scale that includes relevant indicators of hospital hygiene and sanitation. **Methods:** The setting of the study was low- and medium-capacity hospitals in the Greater Accra Region of Ghana. Patients in wards and outpatient departments in the hospitals participated in the study. We used relevant statistical tools to estimate the psychometric properties of ADAPTED SERVQUAL. To understand the relative importance of the new scale, we compared and related it to a recent scale, HEALTHQUAL. **Results:** Principal component analysis yielded 6 factors: "tangibles," "reliability," "responsiveness," "assurance," "empathy," and "sanitation and hygiene," which explained 84% of the total variance. ADAPTED SERVQUAL has a good internal consistency (Cronbach $\alpha = 0.96$). Confirmatory factor analysis confirmed the 6-factor solution and produced satisfactory discriminant validity and convergent validity indicators. The adapted scale was highly correlated with all dimensions of HEALTHQUAL, including continuous quality improvement ($r \geq 0.75$, $P < .001$). In multiple linear regression, the 5 domains of HEALTHQUAL explained 59% of the variance in ADAPTED SERVQUAL ($P < .001$). **Conclusions:** The study concluded that 8 items that make up a single factor (ie, sanitation and hygiene) and contribute most of the total variance satisfactorily fit into the SERVQUAL scale as additional indicators of health care quality.

Key words: health care quality, hygiene, psychometric testing, sanitation, SERVQUAL

The delivery of high quality care is the most fundamental and important goal of hospitals and represents a prerequisite for the maintenance of population health at the national level.[1-3] This fact explains why stakeholders like governments, the World Health Organization (WHO), and individual hospitals consider health care quality assurance as an apex strategy for meeting the health care needs of the population.[2,3] Health care quality is perhaps the most frequently mentioned and assessed health care performance indicator in the literature, but it has been measured and conceptualized in different ways.[1,4,5] Inconsistencies in its measurement are nevertheless unavoidable because researchers tend to adopt unique theoretical, practical, or conceptual perspectives to address their research goals. Many existing scales for patient-perceived health care quality (eg, HEALTHQUAL, SERVQUAL, and SERVPERF) have proven popular for measuring quality across countries, because they have proven adaptable to incorporating previously ignored aspects of health care that may be increasingly important. Each of these scales is unique to a large extent in the sense that it measures health services quality using different indicators and/or employs different reference periods in rating patient experience. The SERVQUAL scale developed by Parasuraman et al,[6] for instance, measures comparison of patients' experience before and after health care delivery. Cronin and Taylor's[7] SERVPERF, on the other hand, only explores the perceptions of patients regarding their experiences in health care. So, while the SERVQUAL scale measures both expectations and perceptions, the SERVPERF assesses only perceptions (including performance) relating to care. Recently, Lee[1] developed an integrative scale that considers criteria applied for hospital accreditation, needs of patients, and capabilities of the health care provider. The focus of this study is to develop a scale that incorporates items on sanitation and hygiene in health care.

For reasons mentioned earlier, there is no one-fits-all scale for measuring patients' perceptions of health care quality, but researchers' relentless effort to develop new scales to fill crucial gaps in the literature continue to give rise to a broad spectrum of scales from which measures that best fit a particular situation can be chosen. What could be inferred of this thinking is that health care quality would be impossible to

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measure in some contexts if suitable scales are not developed. A deep look into the literature, for example, indicates that no identifiable scale incorporates items of hospital hygiene and sanitation into the measurement of health services quality. The SERVQUAL scale and many others focused on interposal dynamics and failed to consider underlying resource problems that occur with sanitation and hygiene in clinical settings. That is, the SERVQUAL and other available scales undervalue items relating to hospital hygiene and sanitation (eg, waste disposal provisions) and hygiene (eg, hand hygiene, wearing of gloves if necessary, and regular change of bed sheets). A close look at existing scales further indicated that existing scales for measuring health care quality are context-specific, which means that each scale was developed to assess care quality in a particular context.[6,7] Health care quality assessment scales should, however, not be context-specific for a couple of reasons. First, disaster, terrorism, and war are pressing issues affecting the ability of both developed and developing countries to finance health care and maintain clinical standards.[8,9] For instance, flooding in the United States over the years has been reported to have caused environmental sanitation concerns[8] while terrorism and war have been an impediment to sewage disposal and sanitation management in Yemen and Syria.[9] Second, economic instability and uncertainties around the world connote that even developed countries, which are able to effectively finance health care, may be unable to maintain hygiene and sanitation in health care in future.[10-12] Finally, the assumption that health facilities in developed countries are always able to ensure sanitation in health care can discourage routine monitoring of clinical sanitation, making it less possible for the patient's experience to be enhanced.

The fact that available scales fail to incorporate a factor or factors that assess hospital hygiene and sanitation is a backdrop that does not only undermine international standards (eg, ISO 9001, WHO's regulation on hospital hygiene and sanitation) but also questions the completeness of current measures of patient-perceived health care quality. On a global scale, the burden of nosocomial infections continues to grow and thwart health care delivery efforts; yet this issue is more alarming in African countries where hospitals account for most of the world's hospital-related infections.[7,10,13,14] So, although an assessment of hygiene and sanitation in health care should not be context-specific and is therefore necessary in every setting, it is mandatory for health facilities in developing countries to regularly evaluate clinical hygiene and sanitation as a component of health care quality. For this reason, the adapted scale validated in this study is especially well suited for health care quality assessment in developing country contexts. To add, a systematic review conducted by Bouzid and colleagues[10] revealed that hygiene in health care has a positive influence on health care quality. Shi et al[15] also reported that hygiene in the hospital is a determinant of health care quality. With many other studies[11,16] identifying nosocomial infections as outcomes of poor hospital hygiene and sanitation, there is no doubt waste management is an important facet of health care quality assurance, especially in Africa. Further to this, a major concern of stakeholders in developing countries such as Ghana is poor environmental sanitation that has rendered many hospitals places where epidemics can easily break out.[10,12] Resource constraints often compel health care professionals to compromise standards regarding handwashing and related practices. More so, many hospitals are not well resourced to manage waste efficiently, and sewage disposal leaves much to be desired. Reported in some studies[11,12] are abysmal sanitation situations in hospitals in Ghana and its neighboring countries that can mar high quality delivery and improvement. It is therefore possible that high quality health care in Ghana and other developing countries is farfetched—a hospital is unlikely to deliver high quality health care when it grapples with sanitation issues. This being the case, it is necessary for sanitation and hygiene to be monitored closely and therefore measured as an indicator of health care quality, at least in developing countries, thereby making it possible for stakeholders to recognize hospital hygiene and sanitation as a crucial determinant of health care quality and patient satisfaction. This study therefore attempted to assess the psychometric properties of a relevant patient-perceived health care quality measurement scale that incorporates items of hospital hygiene and sanitation.

METHODS AND MATERIALS

Design and approach

This study was a cross-sectional study that adapted the SERVQUAL scale developed by Parasuraman et al[6] to measure health care quality by incorporating items aimed at measuring hospital hygiene and sanitation. Thus, multivariate statistical methods, including confirmatory factor analysis (CFA), were used to investigate how well the adapted scale (ADAPTED SERVQUAL) measures perceptions of a specified population of patients in Accra. To assess concurrent validity and the relative importance of the adapted scale, we related and compared it to a recently updated measure, HEALTHQUAL, based on the Akaike information criterion (AIC).[17] 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 "continuous quality improvement," an increasingly important component of health care quality. In line with previous studies,[18] we also evaluated concurrent validity by examining the association between the scale and previous measures of health care quality as well as relevant patient characteristics.

Participants and recruitment

The study's participants were patients in wards and the outpatient departments (OPD) of low- and medium-capacity health facilities in Accra North, Ghana. Six hundred ten patients who met selection criteria were selected from the research registry of 5 hospitals—2

private and 3 public (government-owned) facilities. The 5 hospitals constituted 60% (5/8) of low- and medium-capacity health facilities in Accra North, and a recent analysis conducted by Kpessa-Whyte[19] suggests that the population of Accra North is similar to the overall population of Ghana and is therefore representative of the general population. The selection criteria applied are: (*a*) having at least a basic educational qualification, which was an indicator of one's ability to read and write in English, the language 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.

Questionnaire development

Variables captured in the questionnaire include patient characteristics: department (wards vs OPD); gender (male vs female); NHIS (National Health Insurance Scheme) status (subscriber vs nonsubscriber); educational qualification (the highest educational qualification acquired by the patient); and age. HEALTHQUAL was measured using items borrowed from its originator.[1] It comprises 5 factors (ie, empathy [7 items], tangibles [5 items], safety [4 items], efficiency [4 items], and continuous improvement [6 items]] based on 5 descriptive anchors ranging from *very bad* (1) to *very good* (5). ADAPTED SERVQUAL was measured using the original items of SERVQUAL and 10 new items selected to measure hospital hygiene and sanitation. Like items of SERVQUAL, indicators selected for measuring sanitation and hygiene are associated with a 7-point Likert scale with descriptive anchors ranging from *strongly disagree* (1) to *strongly agree* (7). SERVQUAL is a 22-item scale comprising 5 domains: tangibles (4 items), reliability (5 items), responsiveness (4 items), assurance (4 items), and empathy (5 items). *Tangibles* represent the neatness and attractiveness of the physical environment and staff of the health facility whereas *reliability* is the ability of the health facility to deliver services accurately and consistently. *Responsiveness* is the willingness of personnel to attend to the needs of customers in a timely manner. *Assurance* measures the ability of personnel to instill confidence and trust in patients. *Empathy* measures personalized attention given to individual patients and the ability of caregivers to cope with the unique needs of individual patients.

We followed 3 steps to determine a bank of items for hospital hygiene and sanitation, which is operationally defined as the maintenance of a clean health care environment and the observance of hygiene in clinical practice.[20] First, we reviewed traditional and gray literature to identify standards for the maintenance of sanitation and hygiene in health care. In this process, we found the standards (regulatory framework) of the WHO (eg, 5-moment model)[20] and Joint Commission International most suitable because they form the basis of practice and international accreditation of hospitals. Hence, we developed 12 items that agree with these regulations and standards. Our second step involved asking 2 experts in health care accreditation at Ghana Health Services and 10 physicians in public hospitals to review the items and establish content validity. Ten out of the 12 reviewers suggested the removal of 2 items that were duplicates of some other items. 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. In the pilot study, participants were asked to complete a questionnaire and indicate questions or items that they did not understand. Comments from participants were audio-taped and later transcribed. Transcribed responses indicated that 2 of the items were vague and needed rephrasing. So, 10 items were endorsed final indicators of the new scale. Six of the items measured sanitation regarding the environment, facilities, and equipment whereas the remaining 4 measured hygiene among workers and in health care. The new items were accompanied with descriptive anchors associated with the host scale, SERVQUAL.

Data collection

The study was approved by management of the participating hospitals in Accra and received ethical clearance from the relevant ethics committee with Institutional Review Board number ACE-SVP2019. Data were gathered at the premises of the hospitals in the first quarter of 2019. Trained research and field assistants administered questionnaires (which were anonymous) through hand delivery after each participant was contacted by the researchers and signed 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. Data were collected over 3 weeks using self-administered questionnaires. Eleven patients in the OPD did not honor their appointments within the period of data collection and hence did not respond. Out of 599 questionnaires administered, 532 were completed but 12 were discarded because items of at least 1 scale in them were not responded to. 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. SPSS was used to conduct exploratory analysis, principal component analysis, Pearson's correlation test, and multiple linear regression analysis whereas Amos was used for CFA. In the exploratory analysis, descriptive statistics (frequency, percent, mean, and standard deviation) were used to summarize the data. Estimated kurtosis and skewness met recommended criteria applied elsewhere[18] and therefore signified the absence of outliers in our data. Nine missing values in the data were replaced using the linear interpolation method in

harmony with previous studies.[21,22] Four (0.77%) of the missing values were produced by education, 2 (0.38%) by "degree of cleanliness of employee uniforms" of HEALTHQUAL, and 3 (0.58%) by "the hospital gives you individual attention" of SERVQUAL.

In tune with some studies,[17,21] missing values were assigned the distinctive code 444 and represented with this code in the data, making their identification easier. Principal component analysis (with varimax rotation) was used to select relevant items and gain insight into the factor structures of the 2 scales. Two CFA measurement models were then fitted to estimate the psychometric properties of ADAPTED SERVQUAL and HEALTHQUAL or confirm the factor solutions reached in principal component analysis. Multivariate normality of the data, which is a requirement for CFA, was met in the 2 measurement models with the criterion $P2 > .05$,[17,21] where $P2$ is the significance level from the Mahalanobis distance test. In agreement with some studies,[18,23-26] Pearson's correlation test and multiple regression analysis were used to assess concurrent validity. Cohen's criterion ($r < 0.3$ = small; $0.3 \leq r < 0.5$ = medium; and $r \geq 0.5$ = large)[26] was applied in the correlation analysis. Other relevant assumptions (independence of errors and multicollinearity) were met through the multiple regression analysis. Statistical significance of estimates was detected at $P < .05$.

RESULTS

Patient characteristics

Of the 520 patients who responded, about 47% (n = 246) of them were in the OPD whereas 53% (n = 274) were in wards. Moreover, 54% (n = 280) of the patients were male while 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. About 42% (n = 220) of all patients had received health care 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, about 85% (n = 439) of the sample were NHIS subscribers while 15% (n = 81) were nonsubscribers.

Selection of items

After conducting principal component analysis (with varimax rotation) on the 32 items of the ADAPTED SERVQUAL, a 6-factor solution emerged. The total variance accounted was 83.8% (sanitation and hygiene = 46.5%; responsiveness = 11.9%; assurance = 8.6%; empathy = 6.7%; reliability = 5.11%; and tangibles = 5.09%) (see Supplemental Digital Content Appendix A, available at: http://links.lww.com/QMH/A41). The first factor extracted, "sanitation and hygiene," comprised 8 items with factor loadings ≥0.5 (0.51-0.87). Thus, 2 items (ie, "the hospital environment smells badly (R)" and "this hospital uses clean equipment in health care") were removed from the initial set of items based on loadings <0.5. One item was removed from the original SERVQUAL scale, particularly from "responsiveness" (ie, the behavior of employees in the hospital instills confidence in you). Other items of SERVQUAL were retained with their original dimensions. Thus, 29 items out of the initial 32 were selected in the principal component analysis. With respect to the HEALTHQUAL scale, a 5-factor solution was reached in principal component analysis on 24 items that met the criterion loadings ≥0.5 (0.51-0.92) (see Supplemental Digital Content Appendix B, available at: http://links.lww.com/QMH/A42). In this vein, a total variance of 86.8% (empathy = 62.7; safety = 8.5%; continuous improvement = 6.4%; efficiency = 5.3%; and tangibles = 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 <0.5 from the initial bank of items—1 item each from "empathy" (ie, the hospital knowing your needs) and "continuous improvement" (ie, the degree of efforts and willingness by the hospital to prevent you from contracting diseases).

Psychometric properties of the final scales

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 CFA. The general rule of thumb is $\alpha \geq 0.7$ for each dimension or factor and the overall scale.[1,17] Each item should also produce a factor loading ≥0.5.[1,18] Both criteria were met (see Tables 1 and 2). Convergent validity was assessed with average variance extracted (AVE), which in theory should meet the criterion AVE ≥0.5.[1,27-29] Discriminant validity was evaluated with maximum shared variance (MSV) and average shared variance (ASV) based on the criteria MSV < AVE and ASV < MSV.[1,30] The estimates in Tables 1 and 2 show that these criteria are met for both scales. The relative fit of the scales was assessed with AIC. In theory, the scale with a smaller AIC has a better fit.[17] With reference to Table 3, HEALTHQUAL produced a smaller AIC and therefore better measured attitudes of the study population. In a nutshell, the factor solutions reached in the principal component analysis were confirmed in CFA. As seen in Table 3, the measurement models were of a good fit at $P > .05$; $\chi^2 \leq 3$; root mean square error of approximation ≤0.08; Tucker-Lewis Index ≥0.9 and goodness-of-fit index/adjusted goodness-of-fit index ≥0.8.[1,30]

Table 4 shows descriptive statistics and the correlation between relevant variables. Positive correlation coefficients suggest that a dependent variable increases as the predictor increases. For example, ADAPTED SERVQUAL (the overall scale) is positively correlated to all dimensions of HEALTHQUAL at $P < .001$. This result suggests that the adapted scale increases with each domain of HEALTHQUAL. Similarly, SERVQUAL and hygiene and sanitation each positively correlates with every dimension of HEALTHQUAL at $P < .001$. In Table 5, all dimensions of HEALTHQUAL are significantly

Table 1. Psychometric Estimates and Descriptive Statistics on ADAPTED SERVQUAL[a]

Factor	Item	Mean (SD)	FL	CA	AVE	MSV	ASV
Tangibles[b]	TAN1	3.65 (2.11)	0.607	0.847	0.605	0.103	0.04
	TAN2	3.81 (2.06)	0.597				
	TAN3	4.35 (2.15)	0.609				
	TAN4	3.92 (2.06)	0.607				
Reliability[c]	REL1	5.08 (1.64)	0.847	0.950	0.864	0.079	0.04
	REL2	5.04 (1.68)	0.87				
	REL3	4.85 (1.79)	0.865				
	REL4	4.62 (1.96)	0.875				
	REL5	5.35 (1.71)	0.755				
Responsiveness[d]	RES1	5.19 (1.88)	0.816	0.86	0.783	0.08	0.04
	RES2	5.27 (1.89)	0.777				
	RES3	4.77 (2.12)	0.656				
Assurance[e]	ASS1	5.58 (1.47)	0.729	0.813	0.664	0.099	0.05
	ASS2	5.42 (1.99)	0.756				
	ASS3	5.23 (1.95)	0.516				
	ASS4	5.27 (1.85)	0.689				
Empathy[f]	EMP1	5.35 (1.71)	0.843	0.896	0.697	0.109	0.05
	EMP2	5.35 (1.66)	0.819				
	EMP3	5.50 (1.69)	0.525				
	EMP4	5.54 (1.72)	0.771				
	EMP5	5.58 (1.55)	0.534				
Sanitation and hygiene[g]	SH1	5.08 (1.80)	0.818	0.936	0.81	0.114	0.05
	SH2	5.35 (1.96)	0.77				
	SH3	5.31 (1.73)	0.861				
	SH5	5.19 (1.86)	0.751				
	SH7	5.31 (1.86)	0.834				
	SH8	5.42 (1.82)	0.852				
	SH9	5.81 (1.50)	0.734				
	SH10	6.04 (1.37)	0.857				
All scale	...	*5.09 (1.16)*	...	*0.958*	...	...	...

Abbreviations: ASV, average shared variance; AVE, average variance extracted; CA, Cronbach α; FL, factor loading; MSV, maximum shared variance.
[a]Mean scores are based on descriptive anchors ranging from *strongly disagree* (1) to *strongly agree* (7).
[b]Factor 6; [c]factor 5; [d]factor 2; [e]factor 3; [f]factor 4; [g]factor 1.

associated with the overall scale (ie, ADAPTED SERVQUAL) and sanitation and hygiene at $P < .001$. Moreover, 3 out of the 5 domains of HEALTHQUAL are positively associated with SERVQUAL. Four out of the 6 patient characteristics or covariates are also significantly associated with the overall scale. The standardized (β) coefficients between 3 dimensions of HEALTHQUAL and each of SERVQUAL and the overall scale are particularly large (0.55-0.94). The relationship between all dimensions of HEALTHQUAL and "sanitation and hygiene" is also strong at $\beta \geq 0.5$ (0.50-0.75). These strong associations indicate that the adapted scale significantly overlapped with the dimensions of HEALTHQUAL, an outcome that confirms concurrent validity.[18]

DISCUSSION

The questionnaire has satisfactory internal consistency or reliability with a Cronbach α coefficient >0.9 for the overall scale and α >0.8 for the subscales. The comparative scale, HEALTHQUAL, also produced satisfactory internal consistency at α >0.9 for the overall scale and α >0.8 for the domains. Previous studies[23,24,31] have used Cronbach α and principal component analysis to evaluate internal consistency, and the criteria applied

Table 2. Psychometric Estimates and Descriptive Statistics on HEALTHQUAL[a]

Factor	Item	Mean (SD)	FL	CA	AVE	MSV	ASV
Empathy[b]	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[c]	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[d]	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[e]	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				
Continuous improvement[f]	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*	. . .	. . .	. . .

CA = Cronbach's alpha; FL = factor loading; AVE = average variance extracted; MSV = maximum shared variance; ASV = average shared variance.
[a]Mean scores are based on descriptive anchors ranging from *very bad (1)* to *very good (5).*
[b]Factor 1; [c]factor 5; [d]factor 2; [e]factor 4; [f]factor 3.

to all acceptable scales, including highly reputable ones used today,[1,6,17,32,33] are factor loadings $\geq$0.5 and $\alpha > 0.7$.[6,18,31] The adapted scale therefore promises to serve as an internally consistent measure of health care quality, at least in Ghana and other developing countries where sanitation and hygiene are of concern in health services quality assessment. The internal consistency of the scales is complemented by the accuracy of our item selection signified by concurrent validity confirmed in the analysis. Thus, there was a strong relationship between thematic splits (dimensions) of ADAPTED SERVQUAL and HEALTHQUAL as well as various patients' characteristics that have been previously confirmed to overlap with health care quality, patient satisfaction, and related measures.[18,34] Similar methods have been used to adapt the SERVQUAL

Table 3. Model Fit Statistics

Model[a]	χ^2	*P*	RMSEA	TLI	GFI	AGFI	AIC
1	2.102	.178	0.031	0.966	0.951	0.970	42.09
2	1.221	.231	0.011	0.976	0.966	0.988	40.33
Recommended	$\leq$3.00	$\geq$.05	$\leq$0.08	$\geq$0.9	$\geq$0.8	$\geq$0.8	. . .

Abbreviations: AGFI, adjusted goodness-of-fit index; AIC, Akaike information criterion; GFI, goodness-of-fit index; RMSEA, root mean square error of approximation; TLI, Tucker-Lewis Index.
[a]Model 1 = ADAPTED SERVQUAL measurement model; model 2 = HEALTHQUAL measurement model.

Table 4. Bivariate Correlations of Relevant Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. ADAPTED SERVQUAL	1	0.972[a]	0.849[a]	0.380[a]	0.486[a]	0.469[a]	0.506[a]	0.602[a]	−0.01	−0.072	−0.291[a]	0.011	0.127[a]	0.005
2. SERVQUAL		1	0.701[a]	0.351[a]	0.460[a]	0.442[a]	0.508[a]	0.621[a]	−0.008	−0.091[b]	−0.261[a]	0.045	0.134[a]	0.084
3. Sanitation and hygiene			1	0.360[a]	0.436[a]	0.429[a]	0.394[a]	0.427[a]	−0.013	−0.013	−0.293[a]	−0.098[b]	0.082	−0.171[a]
4. Empathy				1	0.894[a]	0.748[a]	0.774[a]	0.785[a]	−0.006	0.108[b]	0.166[a]	0.169[a]	−0.017	0.254[a]
5. Tangibles					1	0.881[a]	0.823[a]	0.776[a]	−0.001	0.299[a]	0.074	0.151[a]	0.179[a]	0.234[a]
6. Safety						1	0.922[a]	0.769[a]	0.005	0.342[a]	0.265[a]	0.067	0.148[a]	0.104[b]
7. Efficiency							1	0.870[a]	0.008	0.203[a]	0.173[a]	0.240[a]	−0.014	0.210[a]
8. Continuous improvement								1	0.005	0.03	0.003	0.107[b]	0.106[b]	0.313[a]
9. Department (wards)[c]									1	−0.004	−0.012	−0.01	0.002	0.015
10. Gender (male)[d]										1	0.052	−0.140[a]	0.395[a]	0.048
11. Education											1	0.056	−0.231[a]	−0.277[a]
12. Service experience												1	−0.294[a]	0.434[a]
13. NHIS status (nonsubscriber)[e]													1	0.074
14. Age														1

Abbreviations: NHIS, National Health Insurance Scheme; SD, standard deviation.
[a] $P < .001$.
[b] $P < .05$.
[c] Reference = OPD.
[d] Reference = female.
[e] Reference = NHIS subscriber.

scale and other questionnaires for measuring health care quality. Babakus and Mangold,[35] for example, used methods similar to ours to construct one of the most widely used adapted versions of the SERVQUAL. However, their procedure, compared to the one used in this study, was less robust, as it did not compare the adapted scale to a related service quality scale. Recently, Oren et al[36] in Turkey also used similar methods to adapt a scale measuring health care quality. Results from these and similar adaptations have produced satisfactory psychometric indicators similar to ours,[35,36] with key examples being internal consistency and validity (ie, discriminant validity, convergent validity, and concurrent validity).

We further performed CFA to confirm the factor solutions reached, enabling us to estimate indicators of validity. Interestingly, the validity of both the new and comparative scales is satisfactory. In the literature, internal consistency, convergent validity, and discriminant validity are the 3 main parameters used to assess the psychometric significance of an instrument. This disclosure is backed by studies[17,31,33,37,38] that have reported that multidimensional scales are ideally valid and reliable when they produce satisfactory validity and reliability scores that meet recommended criteria. As the analysis indicates, our estimates meet these criteria and suggest that ADAPTED SERVQUAL and HEALTHQUAL can both generate dependable findings when used to measure health services quality, especially in Ghana and other developing countries where hospitals share environmental characteristics with health care facilities in Ghana. More so, the applicability of our scale 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.[18,26]

Scales for measuring the quality of health care continue to grow in number, which is not a problem but rather an opportunity for researchers to enrich the variety of scales available and have different unique options. Because every scale, like the ADAPTED SERVQUAL, is developed to measure health care quality in a particular context, the proliferation of scales is expected to lead to a complete portfolio of health care quality assessment questionnaires that is exhaustive of all scenarios and contexts in which quality in health care should be measured. This notion makes it necessary for our new scale to be used only when care quality evaluation is expected to provide information on the level of sanitation and hygiene ensured in health care in harmony with WHO's regulation as well as local and internal accreditation criteria. Although we think that every scale measuring quality has to include indicators for assessing hospital hygiene and sanitation, it might be extremely difficult for researchers to develop a one-fits-all scale that is easy-to-use from a statistical point of view, bearing in mind that all statistical software and tools currently available can be difficult to use on multidimensional scales with a large number of items.[6,39] With this in mind, the ADAPTED SERVQUAL does not compete with available scales but rather complements them.

Table 5. Association Between Dimensions of HEALTHQUAL and ADAPTED SERVQUAL[a]

	SERVQUAL					Sanitation and Hygiene					ADAPTED SERVQUAL				
Variable	***B***	**SE**	***β***	**95% CI**	**Tolerance**	***B***	**SE**	***β***	**95% CI**	**Tolerance**	***B***	**SE**	***β***	**95% CI**	**Tolerance**
Main coefficients															
Constant	4.46	0.26	(17.25)[b]	±1.02		7.13	0.28	(25.55)[b]	±1.10		5.19	0.24	(21.40)[b]	±0.95	
Empathy	−0.74	0.11	−0.67 (−6.80)[b]	±0.43	0.29	0.64	0.12	0.49 (5.48)[b]	±0.46	0.19	−0.35	0.10	−0.33 (−3.47)[b]	±0.40	0.29
Tangibles	0.78	0.15	0.74 (5.15)[b]	±0.59	0.14	−0.61	0.16	−0.49 (−3.74)[b]	±0.64	0.24	0.39	0.14	0.38 (2.76)[c]	±0.56	0.24
Safety	−0.06	0.17	−0.06 (−0.33)	±0.67	0.23	2.08	0.18	0.72 (11.36)[b]	±0.72	0.23	0.54	0.16	0.54 (3.36)[b]	±0.63	0.23
Efficiency	−0.32	0.19	−0.28 (−1.69)	±0.74	0.43	−2.27	0.20	−0.71 (−11.18)[b]	±0.80	0.33	−0.86	0.18	−0.78 (−4.86)[b]	±0.69	0.13
Continuous improvement	0.95	0.10	0.93 (9.77)[b]	±0.38	0.10	0.91	0.11	0.75 (8.63)[b]	±0.41	0.10	0.94	0.09	0.94 (10.30)[b]	±0.36	0.10
Covariate coefficients															
Department (wards)[d]	−0.04	0.07	−0.02 (−0.59)	±0.29	0.99	−0.04	0.08	−0.01 (−0.51)	±0.32	0.99	−0.04	0.07	−0.02 (−0.61)	±0.27	0.99
Gender (male)[e]	−0.24	0.11	−0.10 (−2.19)[c]	±0.42	0.49	0.24	0.12	0.08 (2.10)[c]	±0.46	0.49	−0.10	0.1	−0.04 (−1.02)	±0.40	0.49
Education	−0.32	0.06	−0.23 (−5.01)[b]	±0.25	0.45	−1.23	0.07	−0.74 (−17.99)[b]	±0.27	0.45	−0.57	0.06	−0.41 (−9.58)[b]	±0.23	0.45
Service experience	0.11	0.07	0.08 (1.61)	±0.26	0.40	0.48	0.07	0.29 (6.74)[b]	±0.28	0.4	0.21	0.06	0.16 (3.40)[b]	±0.24	0.40
NHIS status (nonsubscriber)[f]	−0.20	0.14	−0.06 (−1.36)	±0.56	0.50	−0.90	0.15	−0.23 (−5.85)[b]	±0.61	0.50	−0.39	0.13	−0.12 (−2.88)[b]	±0.53	0.50
Age	−0.28	0.05	−0.25 (−6.09)[b]	±0.18	0.54	−0.76	0.05	−0.58 (−15.60)[b]	±0.19	0.54	−0.41	0.04	−0.38 (−9.68)[b]	±0.17	0.54
Model fit	*M. 1*					*M. 2*					*M. 3*				
R^2	0.555					0.629					0.590				
Adjusted R^2	0.545					0.621					0.581				
Change in R^2	0.010					0.008					0.009				
Durbin-Watson	2.217					2.332					2.182				
F	55.290					75.307					63.848				
P	.000					.000					.000				

Abbreviations: CI, confidence interval; NHIS, National Health Insurance Scheme; SE, standard error (of B).

[a]Variance inflation factor ≤5 for all predictors (minimum = 1.21; maximum = 4.91). M. 1 = model 1, with SERVQUAL as outcome; M. 2 = model 2, with sanitation and hygiene as outcome; M. 3 = model 3, with ADAPTED SERVQUAL as outcome.

[b]$P < .001$.

[c]$P < .05$.

[d]Reference = OPD.

[e]Reference = female.

[f]Reference = non-NHIS subscriber.

The removal of some items from HEALTHQUAL is not an isolated and unexpected development, as a change in the factor structures as well as contents of the SERVQUAL scale[35] and related questionnaires[17,36] was realized in many previous validations. In the study of Oren and colleagues,[36] for instance, several original items produced factor loadings < 0.5 and were, as a result, not a part of the adapted scale. Our result therefore corroborates the idea of scale "volatility," which is a concept Asiamah and colleagues[17] 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 validated. In agreement with some researchers[6,17,38] therefore, the internal consistency and validity of any scale, for that matter our adapted scale, 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. Our psychometric estimates are not exhaustive; time reliability (ie, test-retest reliability) has not been captured in the present study, which means that other researchers are obliged to consider this test in future assessments. Issues relating to hospital hygiene and sanitation 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 line with previous studies,[6,22,39,40] future tests should include patients' rating of the importance of hospital hygiene and sanitation.

CONCLUSIONS

Twenty-nine out of 32 items came out as indicators of the ADAPTED SERVQUAL scale, which includes hospital hygiene and sanitation. A single item was removed from the original SERVQUAL scale and 2 items from the new sanitation and hygiene factor, leading to a 6-factor solution, with the incorporated factor accounting for a greater part of the total variance. Thus, hospital hygiene and sanitation as a factor fits into the SERVQUAL scale, serves as an indicator of health care quality, and could be an important domain of patient-perceived health services quality. HEALTHQUAL better measures perceptions of our population of patients and may as a result serve as a more suitable measure of health care quality in Ghana, especially in a continuous quality improvement context. Yet, the ADAPTED SERVQUAL is a better option if the assessment assumes that hospital hygiene and sanitation may be of concern to decision-makers. Since the SERVQUAL scale inappropriately ignored sanitation and hygiene that are of concern to health services accreditation organizations, the adapted scale is expected to serve as a useful tool. Developed and developing countries may not face the same issues relating to sanitation and hygiene in health care, but a scale such as the ADAPTED SERVQUAL that incorporates quite standard items on sanitation and hygiene can serve as an audit tool for any country. The effort of hospitals to improve health care quality over time is more likely to be rated highly by patients if sanitation and hygiene are ensured and maintained in health care.

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