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VALIDATION OF SAFETY CLIMATE FACTORS: A FIRST LOOK AMONG NURSES IN NIGERIA

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Abstract

Purpose – The primary aim of this paper is to validate safety climate factors (management commitment to safety, safety training, safety rules and procedures, safety communication and workers' involvement in safety) among nurses in select Nigerian healthcare facilities.
Design/methodology/approach – A survey of 149 nurses of primary and secondary healthcare facilities in South-south Nigeria was carried out with the use of self-reported measures to obtain data on safety climate factors. The partial least squares structural equation modeling (PLS-SEM) technique was used in ascertaining the validity of the factors in study.
Findings – In the present study, it was found that the reliability and validity of the factors were significant notwithstanding that this is a first long among the respondents of the study.
Research limitations/implications – Generalizing the findings of this study may be limited to the location from which the respondents are drawn. Also, the present study validated existing safety climate factors, hence did not permit a correlational, causal or longitudinal inferences.
Practical Implications – The study highlights some of the most important safety climate factors needed that could determine attendant safety-related behaviours in the healthcare setting.
Originality/value – Existing literature indicates the absence of safety climate research in the Nigerian healthcare industry and especially among nurses. Also, as nurses are routinely exposed to occupational hazards and attendant accidents and injuries, this study brings to light the most critical safety climate factors that should be worthy of note in possibly ensuring the safety and health of nurses in the Nigerian healthcare system.
Keywords Nigeria, safety climate, nurses, healthcare
Paper type Research paper

1. Introduction

Safety climate is one of the leading socio-psychological organizational factors crucial to improving workplace safety performance indicators. The possible safety performance indicators are, reduction in accidents, injuries and fatalities rates, and improvements in safety-related behaviours (Cavazza and Serpe, 2009; Kath, Magley and Marmet, 2010; Bosak, Coetsee and Cullinane, 2013; Cigularov, Adams, Gittleman, Haile and Chen, 2013; Vogus, 2016; Srinivasan, Ikuma, Shakouri, Nahmens and Harvey, 2016). While safety climate scholars are in agreement with the above theoretical and evidence-based position, they are not in consensus as to the factor structure and/or dimensions that should constitute the safety climate construct (Hahn and Murphy, 2008; Huang, Zohar, Robertson, Garabet, Lee and Murphy, 2013). Also, safety climate scholars are yet to agree on which of the safety climate scales are most critical to eliciting safety and related outcomes across various industries and socio-demographic milieu (Mearns *et al*., 2003; Smith *et al*., 2006; Lin *et al*., 2008).

In separate meta-analytic reviews of safety climate studies across industries, cultures and work settings, concerns have been raised as to the generalizability of some of the commonly recurring and/or often examined safety climate factors (Clarke, 2006; Christian, Bradley, Wallace and Burke, 2009; Beus, Payne, Bergman and Arthur, 2010; Nahrgang, Morgeson and Hofmann, 2011). Unfortunately, very little research has however been done on possibly generalizing safety climate factors across national cultures (Bahari and Clark, 2013; Barbaranelli, Petitta and Probst, 2015). This is in view of the fact that most of the safety climate studies have been done across Western and Eastern cultures that are characterized by advanced technological and safety management systems. A huge paucity of research in this regard has plagued the Nigerian work setting. More so, it is possible that safety climate factors inherently significant in developed work systems such as those of the United States, China, and related countries, may possibly not be applicable in an under-developed system such as that of Nigeria. Human resources practices, cultures, technological systems and related other factors are definitely not the same across countries.

Safety climate as a construct was given prominence by Zohar (1980). Safety climate is referred to as employees' shared perceptions of their organizations' policies, procedures and practices vis-à-vis the true priority accorded safety within the organization (Zohar, 1980, 2003; Neal, Griffin and Hart, 2000), and the basis on which day-to-day tasks are performed (Hahn and Murphy, 2008). Interestingly, debates on whether safety climate should be measured as a single construct factor (Neal *et al*., 2000), or a multi-dimensional latent variable (Cooper and Phillips, 2004; Zohar and Luria, 2005) has been on, yet unresolved. Unfortunately, proponents of the multi-dimensional view of the nature of safety climate are still in disagreement as to the number of factors that it should be constituted of (Cavazza and Serpe, 2009). Researchers are thus allowed the liberty of selecting and examining factors that suit the context and direction of their research (Lin *et al*., 2008). Consequently, we are of the opinion that it is better to measure safety climate as a multi-dimensional construct so that single effects of factors and how they are able to elicit safety-related outcomes can be felt and/or better explained. After all, safety climate is the shared perceptions of employees based on safety-related policies, values and procedures (Griffin and Neal, 2000).

The first dimensional classification of safety climate was done by Zohar (1980) and an eight-factor structure was generated. Similarly, Brown and Holmes (1986) came up with a three-factor structure upon using the same questionnaire as Zohar (1980). A few other studies have also found varying factorial differences in the safety climate structure based on industry and context of the empirical endeavours (Cox and Cox, 1991; Coyle *et al*., 1995; Dedobbeleer and Beland, 1991; Hale, 2000). However, it is important to note that inconsistencies were reported in validating the dimensions of safety climate, possibly due to methodological, sampling and instrumentation disparities (Glendon and Litherland, 2001). Also, there are notable differences in the order of constructs as extracted from the various studies.

Notwithstanding the inconsistencies, nomological and nomenclature differences in the empirical validation and extraction of safety climate factors, some common themes have emerged. For example, management commitment to safety, risk perceptions, workers involvement in safety, safety trainings, safety systems – rules and procedures, etc. (Seo *et al*., 2004; Tharaldsen *et al*., 2008; Choudhry *et al*., 2009). However, a further look into the literature suggest that the differences so noted would have been as a result of cultural and language differences in the population being studied (Brown and Holmes, 1986; Flin *et al*., 2000; Lin *et al*., 2008; Cavazza and Serpe, 2009; Barbaranelli, *et al*., 2015). Also, the differences would have been as a result of differences in the countries' health policies, regulations, educational and employment practices (Spangenbergen *et al*., 2003).

Interestingly, most of the studies conducted to validate safety climate scales were done and/or are being done in cultures of similar socio-demographic milieus (Bahari and Clarke, 2013). For instance, in the healthcare industry setting, in countries like Norway (Olsen, 2010), Switzerland (Pfeiffer and Manser, 2010) and the Netherlands (Smits, Christiaans-Dingelhoff, Wagner, Wal and Groenewegen, 2008). Specific healthcare related studies in this regard also are, Hutchinson *et al*., 2006; Wet *et al*., 2010). In the industrial and related sectors similar studies have also been done (Huang, Ho, Smith, and Chen, 2006; Cigularov *et al*., 2009. Pousette, Larsson and Torner, 2008; Tomas, Cheyne and Oliver, 2011; Braunger, Frank, Korunka, Lueger and Kubicek, 2013; Huang, Zohar, Robertson, Garabet, Murphy and Lee, 2013). Aside from the national culture differences described by Bahari and Clarke (2013), countries where these studies were conducted share similar socio-economic characteristics, superior safety management structures and high technology capabilities. Shockingly, only a few of related studies have been done in the developing countries and work systems (Vinodkumar and Bhasi, 2009; Bahari and Clark, 2013). Unfortunately, we are yet to identify a similar study with unquestionable integrity that was done in the Nigerian work setting and more specifically in the Nigerian healthcare system.

Therefore, the aim of this study is to cross-validate empirically underpinned safety climate scales in the Nigerian work setting. Specifically, we intend to ascertain the reliability and validity of the prevalent safety climate factor scales in the Nigerian healthcare industry with specific focus on nurses. The items representing the various dimensions of safety climate are noted to have varying levels of statistical significance in studies conducted in the healthcare and other industries (DeJoy *et al*., 1995; Gershon *et al*., 1995; Felknor, *et al*., 2000; Neal, Griffin and Hart, 2000; Neal and Griffin, 2006; Hutchinson *et al*., 2006; Ashcroft and Parker, 2009; Singer, Lin, Falwell, Gaba and Baker, 2009; McCaughey, DelliFraine, McGhan and Bruning, 2013; Barabaranelli *et al*., 2015). We examined the Nigerian work setting, and especially the healthcare setting because the state of occupational safety and health therein is poor (Ologe, Akande and Olajide, 2005; Sabitu, Iliyasu and Dauda, 2009; Umeokafor, Umeadi and Jones, 2014). Also, we believe that since nurses are at the forefront of healthcare service delivery, conducting this study amongst them would be most appropriate and would suggest critical safety climate factors that should be able to determine their safety-related behaviours.

2. Materials and Methods

2.1 Instrument

Safety climate factors and related scales are numerous in the safety climate literature. Based on industry needs and contextual settings, researchers identify and examine safety climate measures accordingly (Choudhry *et al*., 2009). In view of the nomenclature differences of the safety climate measures, certain factors have been predominant. However, we will be purposefully exploring a five factor structure of safety climate comprising (31 items). The constructs are, management commitment to safety, safety training, safety communication, safety rules and procedures, and workers involvement in safety. The content and substance of most of these items were taken from previous questionnaires of DeJoy *et al*. (1995), Cheyne *et al*. (1998), Flin *et al*. (2000), Flin *et al*. (2006), Singer *et al*. (2009), McCaughey *et al*. (2013) and related studies. However, minor alterations were done to the questions so as to suit the Nigerian healthcare work setting and context.

Upon completing the drafting of the survey instrument, we discussed its content with 4 safety and health professionals in the academia and in the health care setting. The above process was done to ensure face validity of the study instrument. This process led to further rephrasing of some of the items. Two items found not to be relevant to the context of the study were dropped. Subsequently, a pilot test was conducted on a sample of 33 healthcare workers so as to ascertain the internal reliability/consistency of the scales. The results are as follows: management commitment to safety, $\alpha = (0.841)$, safety training, $\alpha = (0.671)$, safety rules and procedures, $\alpha = (0.789)$, workers involvement in safety, $\alpha = (0.631)$ and safety communication, $\alpha = (0.597)$. The cronbach alpha value from the pilot study results are all within acceptable threshold limits and so all items for each of the constructs were retained. Although a low cronbach alpha value so noted could have been as a result of few questions, poor items inter-relatedness, or that the heterogeneity of the constructs (Tavakol and Dennick, 2011).

The final questionnaire comprised of 28 items. Hence, management commitment to safety (7 items), safety training (6 items), safety rules and procedures (5 items), workers involvement in safety (5 items) and safety communication (5 items). The five-point Likert-type interval scale (1 = strongly disagree – 5 = strongly agree) was used to evaluate the responses from the respondents.

2.2 Participants

We administered 250 questionnaires to healthcare workers (nurses) drawn from primary and secondary healthcare facilities in Rivers State, Nigeria. The data collection period lasted for nine weeks, though reminder text messages were sent to head nurses of various facilities when we noted slight delays in retrieving the questionnaires. While 159 of the questionnaires were returned (63.6% response rate), only 149 were usable and eventually keyed in for analysis. Of the 149 respondents, a majority of them are females (129) representing 86.6%, while 27 were males, representing 13.4%. This is a typical characteristics of the Nigerian nursing personnel. On work experience, 58 of the respondents (38.9%) had work experience of 0-5 years, 66 of the respondents had (44.3%) had work experience of 6-10years, 21 of the respondents (14.1%) had 11-15years work experience, while 4 respondents (2.7%) had 16-20years work experience. Other demographic characteristics can be referred to in Table 1.

Table 1. Participant Demographic Variables

Description	Frequencies	N	%
Gender	Male	20	13.4
	Female	129	86.6
Marital Status	Single	20	13.4
	Married	111	74.5
	Divorced	10	6.7
	Widowed	8	5.4
Age	Less than 20	2	1.3
	21-24	22	14.8
	26-30	70	47.0
	31-35	29	19.5
	36-40	12	8.1
	41-45	9	6.0
	46 and above	5	3.4
Facility Type	Primary	78	52.7
	Secondary	71	47.3
Level of Education	Nursing/RN Certificate	117	78.5
	Bachelors	21	14.1
	Masters and above	11	7.4
Work Experience	0-5	58	38.9
	6-10	66	44.3
	11-15	21	14.1
	16-20	4	2.7
Designation	Nursing Officer II	47	31.5
	Nursing Officer I	56	37.6
	Senior Nursing Officer	37	24.8
	Principal Nursing Officer	9	6.0
Safety Trainings	Never	2	1.3
	Rarely	16	10.7
	Sometimes	71	47.7
	Often	52	34.9
	Always	8	5.4
In-House Safety Training	Bi-Weekly	57	38.3
	Monthly	82	55.0
	Quarterly	10	6.7

3. Data Analysis

We first assessed the descriptive statistics of the SC factors with the use of the SPSS 20. Thereafter, the SMART PLS-SEM tool was used to assess the reliability and validity of the constructs. Specifically, the convergent and discriminant validity of the scales were assessed and results are presented accordingly.

3.1 Results

Table 2. Descriptive Statistics for the Safety Climate Scales

Safety Climate Scales	Mean	Standard Deviation
Management Commitment to Safety (7 items)		
MCS1	4.05	1.035
MCS2	4.11	.909
MCS3	3.89	1.060
MCS4	3.99	1.030
MCS5	4.08	.912
MCS6	3.70	1.057
MCS7	4.15	.898
Safety Training (6 items)		
SFT1	3.96	1.013
SFT2	3.97	.940
SFT3	3.86	1.121
SFT4	3.90	1.076
SFT5	3.79	1.030
SFT6	3.82	1.145
Safety Systems (Rules and Procedures) – 7 items		
SSRP1	3.90	1.089
SSRP2	3.90	1.038
SSRP3	3.92	1.030
SSRP4	3.97	.822
SSRP5	4.00	.908
SSRP6	4.04	.743
SSRP7	3.88	1.071
Workers' Involvement in Safety (6 items)		
WKI1	4.38	.653
WKI2	4.06	.910
WKI3	3.71	1.141
WKI4	3.80	1.084
WKI5	3.70	.998
WKI6	3.54	1.136
Safety Communication (6 items)		
Scom1	3.87	.827
Scom2	3.74	.815
Scom3	3.75	1.120
Scom4	4.03	.744
Scom5	3.74	.871
Scom6	3.84	.952

Table 3. Descriptive Statistics of the main constructs

Construct	Minimum	Maximum	Mean	Standard Deviation
Management commitment to safety	1.29	5.00	3.9962	0.72842
Safety training	2.17	5.00	3.9944	0.60476
Safety rules and procedures	1.71	5.00	3.9444	0.61506
Safety communication	2.17	5.00	3.9720	0.59161
Workers involvement in safety	2.50	4.83	4.0369	0.49881

3.2 Measurement Model

Table 4 illustrates the results of the assessment of the reliability of the constructs and also the convergent validity. The composite reliability values of 0.917 (MCS), 0.882 (SFT), 0.879 (SRP), 0.886 (SCOM) and 0.896 (WKI) is an indication that the safety climate factors above has high level of internal consistency. On a similar note, all the variables examined in this study show satisfactory convergent validity having achieved the minimum threshold value of 0.5 for average variance extracted (AVE). This is an indication that the retained items explain more than 50 percent of the construct's variances (Hair *et al*., 2014).

3.2.1 Convergent Validity

Convergent validity is used to assess if indicators correlate positively with other measures of the same construct (Hair *et al*., 2014). This assessment can only be done on the relationship between items and constructs that is reflective in nature. In this instance it is expected that each of the items of the safety climate factors should load on their respective factors. Specifically, the average variance extracted and the factor loadings were used to assess the convergent validity (Hair *et al*., 2014). They advocated that an AVE value of 0.5 and above is an indication that a construct explains at least half or more of the variance of its indicators. The results in Table 4 confirms the achievement of convergent validity of the constructs of this study.

On a similar note, and on the use of factors loadings to access convergent validity, Hair *et al*. (2014) suggested a threshold of 0.708. Upon conducting the assessment of the loadings, some factors were dropped as they did not meet the threshold value as suggested by Hair *et al*. (2014). The reported loadings are those that meet the threshold and were eventually retained.

Table 4. *Assessment of convergent validity*

Construct	Item	Loading	CR	AVE	Convergent Validity
Management Commitment to Safety	MCS1	0.798	0.917	0.650	Yes
	MCS2	0.783			
	MCS3	0.859			
	MCS4	0.807			
	MCS5	0.878			
	MCS7	0.699			
Safety Training	SFT3	0.754	0.882	0.652	Yes
	SFT4	0.829			
	SFT5	0.866			
	SFT6	0.776			
Safety Rules and Procedures	SSRP1	0.791	0.879	0.646	Yes
	SSRP2	0.857			
	SSRP3	0.847			
	SSRP4	0.713			
Safety Communication	Scom1	0.863	0.886	0.724	Yes
	Scom2	0.932			
	Scom3	0.748			
Workers' Involvement in Safety	WKI2	0.877	0.896	0.744	Yes
	WKI3	**0.930**			
	WKI4	**0.772**			

On assessment of discriminant validity, Table 5, 6 and 7 illustrates the assessment based on the criteria by Fornell and Larcker (1981) and Henseler *et al*. (2015). The essence of this assessment is to ensure that all factors are conspicuously different from each other. The first assessment we did was the use of the loadings and cross-loadings, then Fornell and Larcker (1981) and Henseler *et al*. (2015) criteria. A look at the loadings and cross loadings on Table 5 indicates that all items loaded on their respective constructs, confirming and indication of discriminant validity.

Table 5. Loadings and cross loadings of the constructs to assess discriminant validity

	Management Commitment to Safety	Safety Training	Safety Rules and Procedures	Safety Communication	Workers Involvement in Safety
MCS1	**0.798**	0.144	0.243	-0.008	0.001
MCS2	**0.783**	0.167	0.296	-0.014	0.088
MCS3	**0.859**	0.213	0.293	0.140	0.129
MCS4	**0.807**	0.194	0.198	-0.053	-0.092
MCS5	**0.878**	0.279	0.316	0.109	0.101
MCS7	**0.699**	0.386	0.345	0.219	0.204
SFT3	0.035	**0.754**	0.307	-0.073	-0.147
SFT4	0.214	**0.829**	0.408	0.021	-0.003
SFT5	0.371	**0.866**	0.426	0.050	-0.027
SFT6	0.230	**0.776**	0.371	0.062	0.089
SSRP1	0.492	0.419	**0.791**	0.197	0.134
SSRP2	0.247	0.466	**0.857**	0.245	0.205
SSRP3	0.138	0.298	**0.847**	0.249	0.304
SSRP4	0.209	0.322	**0.713**	0.206	0.221
Scom1	0.102	-0.026	0.261	**0.863**	0.646
Scom2	0.096	0.067	0.288	**0.932**	0.634
Scom3	0.021	0.044	0.131	**0.748**	0.447
WKI2	0.088	-0.012	0.224	0.646	**0.877**
WKI3	0.083	-0.005	0.261	0.637	**0.930**
WKI4	0.087	-0.012	0.185	0.482	**0.772**

As depicted in Table 6, the square root of the AVE of each of the construct is larger than the correlation estimates of the constructs. This is a sign that all the constructs are conspicuously different from one another, suggesting that each construct is unique and captures occurrence not denoted by other constructs in the model of this study (Hair *et al*., 2014). The Fornell and Larcker (1981) criteria was achieved, so also is Henseler *et al*.'s (2014) $HTMT_{0.85}$ criterion. Specifically, Henseler *et al*. (2014) proposed that $HTMT_{inference}$ score ranging between -1 – 1 ($-1 < HTMT < 1$) indicates that two constructs are different. Hence, Table 7 indicates that discriminant validity was further achieved.

Table 6. Fornell and Larcker (1981) Criterion

	MCS	SCOM	SRP	SFT	WKI
Management Commitment to Safety	**0.806**				
Safety Communication	0.093	**0.851**			
Safety Rules and Procedures	0.356	0.278	**0.804**		
Safety Training	0.294	0.032	0.476	**0.807**	
Workers Involvement in Safety	0.100	0.687	0.261	-0.011	**0.862**

Table 7. HTMT Criterion

	MCS	SCOM	SRP	SFT	WKI
Management Commitment to Safety					
Safety Communication	0.154				
Safety Rules and Procedures	0.390	0.329			
Safety Training	0.307	0.091	0.560		
Workers Involvement in Safety	0.154	0.824	0.325	0.109	

In addition to the above criteria, we also tried to establish the absence of collinearity issues. The VIF score of the safety climate factors in Table 8, are all lower than the offending value of 3.3 as suggested by (Diamantopoulos and Sigouw, 2006) suggesting that there were no collinearity issues.

Table 8. Collinearity assessment

Constructs	Safety Climate
Management Commitment to Safety	1.173
Safety Communication	1.934
Safety Rules and Procedures	1.534
Safety Training	1.360
Workers Involvement in Safety	1.939

4. Discussion, Limitations, Future Studies and Conclusion

This study, to the best of our knowledge is the first known effort to measure perceptions of safety climate in the Nigerian healthcare setting, specifically among nurses, and with measurement items adapted from the healthcare and related work settings. Based on the mean and standard deviation scores, the findings revealed generally affirmative perceptions of the present state of safety climate amongst the respondents of the study. Additionally, the reliability and validity of the safety climate factors assessed in this study is in accordance with previous studies across various industries (e.g. Neal and Griffin, 2006; Vinodkumar and Bhasi, 2009; Huang *et al.*, 2013; Hon *et al.*, 2014) and specifically in the healthcare industry (Hutchinson *et al.*, 2006; Singer *et al.*, 2009; Wet *et al.*, 2010; McCaughey *et al.*, 2013). It is therefore confirmed that management commitment to safety, safety training, safety communication, safety rules and procedures, and workers involvement in safety are important components of safety climate.

Specifically, the nurses perceived that management is committed to their safety in their various health facilities which confirms the importance of a strong senior management support for safety and in shaping climate perceptions (Gershon *et al*., 2000). Also, safety training was perceived to be high for possible reasons that the nurses are trained regularly on healthcare and related safety management processes. Safety communication as a component of safety climate would have been positively perceived based on the existence and availability of various safety communication strategies in their facilities, such as, safety reporting procedures, safety manuals, handbooks, leaflets, flyers, etc. Safety rules and procedures are standard expectations in the healthcare system and it is expected that nurses work in line with standard clinical operating procedures and practices. There are rules in the healthcare setting that must be followed to the letter, a deviation from which can lead to serious consequences. We believe that the presence and adherence to standard clinical rules and procedures would have additionally accounted for the positive perception reported for safety rules and procedures as a safety climate factor. Finally, workers involvement safety was also reported to be positive, in that the nurses are presumably actively involved in the safety management process of their healthcare facilities.

On limitations of this study, we share similar positions of researchers who relied on self-report questionnaire data. Hence, the reliability and validity of the factor structures of this study can be challenged. Besides, the design and nature of this study impeded the determination of chronological relations linking the factors of safety climate and safety outcomes. This is because the strength of safety climate and its factors rests on its predictive ability of safety performance (Braunger *et al*., 2013). On a similar note, we were limited to assessing the reliability and validity of safety climate factors among nurses, and in the healthcare system. Consequently, future empirical endeavours can sought to examine and possible explain the relationship between the validated safety climate factors and safety outcomes in the form of safety compliance, safety participation and risky behaviours in the healthcare setting, and among other personnel in the sector. Additional studies can also be done in work settings other than the healthcare setting.

Earlier, we noted that this is plausibly the first of its kind, hence limited to the setting for which it was conducted. A similar research is suggested to explore the nature of safety climate among other personnel in the health care setting. Based on the results obtained from various assessments conducted, we posit that the safety climate factors validated in this study is well placed for further empirical endeavours in the Nigerian healthcare system and other work sectors. It is critical to re-validate these scales accordingly in diverse work settings (Bahari and Clarke, 2013), taking into cognizance differences in work contexts, personnel and administrative procedures vis-à-vis the ability of these factors to shape workers perceptions of existing organizational outcomes.

The benefits of measuring safety climate are innumerable (Colla, Bracken, Kinney and Weeks, 2005). The most critical being the individual level of abstraction of which is in its ability to increase the level of awareness and attendant outcomes among workers (Wet *et al*., 2010). The present study has been able to show some of the most critical safety climate factors that should be further investigated to explain safety-related organizational outcomes in the healthcare setting and across industrial settings in Nigeria.

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