Psychometric properties of the Safety Climate Survey (SCS) in Austrian acute care: factor structure, reliability and usability

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Abstract

Rationale, Aims and Objectives Hospitals are complex organizations with a high potential for medical errors that can be influenced by safety culture, a central aspect in research and practice to increase patient safety. Safety climate as a measurable element of safety culture, illustrates the perception of safety-relevant aspects of health care staff at a certain time. The Safety Climate Survey (SCS) is applied internationally to measure safety climate. However, psychometrics for the German SCS have yet not been evaluated. Aim of this study is to explore the factor structure, reliability, and potential usefulness of the German SCS in Austrian acute care. Methods Cross-sectional online-surveys of physicians, therapists and nurses/midwives from eight hospitals from one hospital operator were implemented. An exploratory factor analysis (EFA) was carried out, both, for the total sample and also split by two select professions (physicians, nurses/midwives). After deriving a factor structure for both professions, internal consistency and scale means were calculated for the subscales. Finally, mean subscale differences between physicians and nurses/midwives were tested. Results In summary, 933 respondents out of 5,160 eligible staff participated, reaching a response rate of 18.1%. A six-factor solution explaining 59.1% of total variance was identified in the total sample. Comparison by profession illustrated that the factor structures and item loading patterns differ between physicians (n=124) and nurses/midwives (n=713). To achieve an overarching solution, five items were excluded from consecutive subscale measures due to cross-loadings and contradictory factor loadings. Subscales demonstrated good to low internal consistency (α=0.794 to 0.535). Significant mean differences between subscales of professions were found relating to three factors. Conclusions The German SCS measures safety climate multi- rather than unidimensional, demonstrated limitations in factor structures and item loadings but overall satisfactory reliability of the subscales. When assessing safety climate, a multi-dimensional and profession-related approach must be explicitly considered.

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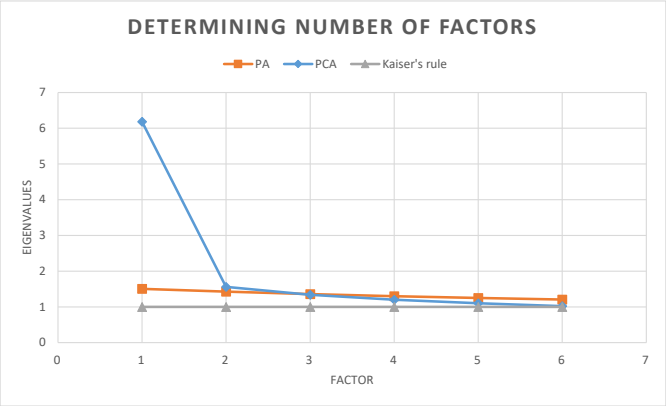

Figure 1 Scree diagram to compare the methods for determining the number of components to be retained. The Scree test uses the Eigenvalues from the Principal Component Analysis (PCA), where the threshold value is the point where this line divides from the line of Eigenvalues (decision: two factors). The threshold value of the Parallel Analysis (PA) is present if the Eigenvalues from the PA are greater than those from the PCA (decision: two factors). The Kaiser's rule retains all components with Eigenvalues >1 and would retain six factors.

Table 1 Sample characteristics

Characteristic	Total sample (n=933)	NM (n=713, 76.4%)	P (n=124, 13.3%)	TH (n=96, 10.3%)
Age in years, mean ±SD	41.91±10.4	41.41±10.4	44.77±10.7	41.94±9.5
Gender, % (n)				
Female	78.4 (698)	84.4 (573)	44.1 (52)	78.5 (73)
Male	20.6 (192)	15.6 (106)	55.9 (66)	21.5 (20)
Work/subject area, % (n)				
Surgical ward	28.0 (261)	30.3 (216)	25.8 (32)	13.5 (13)
Operation room	10.4 (97)	9.8 (70)	21.0 (26)	1.0 (1)
Internal medicine ward	61.6 (575)	59.9 (427)	53.2 (66)	85.5 (82)
Managerial function, % (n)				
Yes	17.3 (157)	15.9 (110)	30.6 (37)	10.5 (10)
No	82.7 (751)	84.1 (582)	69.4 (84)	89.5 (85)
Professional experience, % (n)				
Less than 5 years	14.8 (135)	15.3 (107)	10.8 (13)	16.1 (15)
5 to <10 years	14.1 (130)	13.5 (95)	19.2 (23)	12.9 (12)
10 to <15 years	14.8 (135)	13.1 (92)	19.2 (23)	21.5 (20)
15 to <20 years	14.0 (128)	13.8 (97)	14.2 (17)	15.1 (14)
20 years and more	42.3 (387)	44.3 (311)	36.7 (44)	34.4 (32)

Abbreviations: NM, Nurses and Midwives; P, Physicians; TH, Therapists; SD, Standard deviation; %,valid percent; n, absolute number.

Table 2 Explorative Factor Analysis – Principal Component Analysis (total sample, muster matrix)

Items	†Factor Loading						Communality
	F1	F2	F3	F4	F5	F6	
4. The doctor and nurse leaders in my area listen to me and care about my concerns.	0.837						0.596
1. The culture of this clinical area makes it easy to learn from the mistakes of others.	0.748						0.540
2. Medical errors are handled appropriately in this clinical area.	0.744						0.548
3. The senior leaders in my hospital listen to me and care about my concerns.	0.648						0.617
8. I am encouraged by my colleagues to report any safety concerns I may have.	0.544						0.505
10. I receive appropriate feedback about my performance.	0.539						0.458
15. This institution is doing more for patient safety now than it did 1 year ago.		0.920					0.632
5. Leadership is driving us to be a safety- centered institution.		0.706					0.643
7. Management/leadership does not knowingly compromise safety concerns for productivity.		0.621					0.668
6. My suggestions about safety would be acted upon if I expressed them to management.		0.531					0.526
14. a. I am satisfied with the availability of clinical leadership: Physicians			0.786				0.673
14. b. I am satisfied with the availability of clinical leadership: Nursing			0.841				0.723
14. c. I am satisfied with the availability of clinical leadership: Pharmacy			0.823				0.648
18. Personnel frequently disregard rules or guidelines that are established for this clinical area.				0.800			0.668
17. The personnel in this clinical area take responsibility for patient safety.				0.539			0.529
19. Patient safety is constantly reinforced as the priority in this clinical area.				0.491			0.524
12. Briefing personnel before the start of a shift is an important part of patient safety.					0.847		0.660
13. Briefings are common here.					0.730		0.660

Table 3 Final six-factor structure for SCS (shared factor structure for NM and MD)

Factor structure (reduced, unambiguous, Nurses and Midwives and Physicians)
Factor 1: Communication culture and support
1. The culture of this clinical area makes it easy to learn from the mistakes of others.
2. Medical errors are handled appropriately in this clinical area.
3. The senior leaders in my hospital listen to me and care about my concerns.†
4. The doctor and nurse leaders in my area listen to me and care about my concerns.
8. I am encouraged by my colleagues to report any safety concerns I may have.†‡□§
10. I receive appropriate feedback about my performance.
11. I would feel safe being treated here as a patient.†§
Factor 2: Organizational safety concerns
5. Leadership is driving us to be a safety- centered institution.
6. My suggestions about safety would be acted upon if I expressed them to management.
7. Management/leadership does not knowingly compromise safety concerns for productivity.▶
15. This institution is doing more for patient safety now than it did 1 year ago.
Factor 3: Clinical leadership
14. a. I am satisfied with the availability of clinical leadership: Physician
14. b. I am satisfied with the availability of clinical leadership: Nursing
14. c. I am satisfied with the availability of clinical leadership: Pharmacy
Factor 4:Briefings
9. I know the proper channels to direct questions regarding patient safety.†□‡□§
12. Briefing personnel before the start of a shift is an important part of patient safety.
13. Briefings are common here.
Factor 5: Patient safety promotion
17. The personnel in this clinical area take responsibility for patient safety.
18. Personnel frequently disregard rules or guidelines that are established for this clinical area.
19. Patient safety is constantly reinforced as the priority in this clinical area.
Factor 6: Adverse events
9. I know the proper channels to direct questions regarding patient safety.‡□§
16. Adverse events occur as a result of system failures/not attributable to one individual's actions.

Notes: grey font indicates excluded items (items 3, 8, 9,11)

†Item loads on a different factor in NM and MD samples.

‡□ Ambiguous factor loadings (cross-loadings).

§ Factor loading <0.40.

▶Theoretically assigned despite of cross-loadings.

Table 4 Psychometric properties

Psychometric properties and differences by profession	Sample NM	Sample P	Total sample
Factor 1: Communication culture and support, 1 (do not agree at all) to 5 (fully agree), 4 items			
Mean (±SD)	3.97 (0.75)	3.78 (0.87)	3.94 0.76)
Cronbach α	0.691	0.794	0.710
p-value (T statistic, df), CI	p<0.05* (-2.33, 156), -0.35; -0.29		
Factor 2: Organizational safety concerns, 1 (do not agree at all) to 5 (fully agree), 4 items			
Mean (±SD)	3.94 (0.86)	3.67 (0.95)	3.90 (0.88)
Cronbach α	0.700	0.768	0.712
p-value (T statistic, df), CI	p<0.001** (-3.25, 828), -0.45; -0.11		
Factor 3: Clinical leadership, 1 (do not agree at all) to 5 (fully agree), 3 items			
Mean (±SD)	4.130.83)	4.29 (0.73)	4.15 (0.81)
Cronbach α	0.747	0.766	0.752
p-value (T statistic, df), CI	p<0.05* (1.98, 817), 0.01; 0.31		
Factor 4: Briefings, 1 (do not agree at all) to 5 (fully agree), 2 items			
Mean (±SD)	4.33 (0.87)	4.34 (0.86)	4.31 (0.87)
Cronbach α	0.639	0.535	0.613
p-value (T statistic, df), CI	p>0.05 (0.16, 806), -0.15; 0.18		
Factor 5: Patient safety promotion, 1 (do not agree at all) to 5 (fully agree), 3 items			
Mean (±SD),	4.34 (0.67)	4.21 (0.68)	4.32 (0.66)
Cronbach α	0.593	0.614	0.595
p-value (T statistic, df), CI	p>0.05 (-1.93, 835), -0.25; 0.01		
Factor 6: Adverse events, 1 (do not agree at all) to 5 (fully agree), 1 item			
Mean (±SD)	3.51 (1.13)	3.56 (1.08)	3.48 (1.13)
Cronbach α	n.a	n.a	n.a
p-value (T statistic, df), CI	p>0.05 (0.93, 685), -0.18; 0.27		

Abbreviations: NM, nurses/midwives; P, physicians; SD, Standard Deviation; Cronbach α, internal consistency; df, degrees of freedom; CI 95%, confidence interval; n.a, not applicable.