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The ConCom Safety Management Scale: developing and testing a measurement instrument for control-based and commitment-based safety management approaches in hospitals

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ABSTRACT

Background Nursing management is considered important for patient safety. Prior research has predominantly focused on charismatic leadership styles, although it is questionable whether these best characterise the role of nurse managers. Managerial control is also relevant. Therefore, we aimed to develop and test a measurement instrument for control-based and commitment-based safety management of nurse managers in clinical hospital departments.

Methods A cross-sectional survey design was used to test the newly developed questionnaire in a sample of 2378 nurses working in clinical departments. The nurses were asked about their perceptions of the leadership behaviour and management practices of their direct supervisors. Psychometric properties were evaluated using confirmatory factor analysis and reliability estimates.

Results The final 33-item questionnaire showed acceptable goodness-of-fit indices and internal consistency (Cronbach's α of the subscales range: 0.59–0.90). The factor structure revealed three subdimensions for control-based safety management: (1) stressing the importance of safety rules and regulations; (2) monitoring compliance; and (3) providing employees with feedback. Commitment-based management consisted of four subdimensions: (1) showing role modelling behaviour; (2) creating safety awareness; (3) showing safety commitment; and (4) encouraging participation. Construct validity of the scale was supported by high factor loadings and provided preliminary evidence that control-based and commitment-based safety management are two distinct yet related constructs. The findings were reconfirmed in a cross-validation procedure.

Conclusion The results provide initial support for the construct validity and reliability of our ConCom Safety Management Scale. Both management approaches were found to be relevant for managing patient safety in clinical hospital departments. The scale can be used to deepen our understanding of the influence of patient safety management on healthcare professionals' safety behaviour as well as patient safety outcomes.

INTRODUCTION

Nurse safety leadership is considered an important factor in improving and ensuring patient safety in hospitals.[1] Nurses have a pivotal role in patient safety because of their proximity to patients, which enables the early detection of errors and the prevention of adverse events.[2] Nurse managers may, in turn, provide guidance on safety issues related to nursing care delivery. In this context, at an executive level, managers have a central role in inspiring excellence and giving directions through their participation in policy-making.[3 4] At an operational level, nurse managers may engage their nursing staff in safety behaviours by showing role modelling behaviour or stressing the importance of safety regulations.[5] Nurse safety management is found to be associated with fostering a climate for safety,[6 7] inspiring safety behaviours[8 9] and improving patient safety outcomes.[10]

To ensure that organisational (safety) goals are met, managers employ a wide array of leadership behaviours and management practices.[11] So far, studies on patient safety and nursing management have primarily focused on relationship-oriented or trust-based leadership styles,[3] particularly transformational styles characterised by showing commitment, inspiring followers and engaging employees in patient safety. However, research has shown that regulating work processes and monitoring safety behaviours form important aspects

of managing patient safety as well.[5] These more formalised management practices seem to be particularly valuable in the context of lower level managers because direct supervisors try to inspire their followers to comply with safety rules and monitor and control employees' behaviour.[12] Furthermore, it can be questioned whether charismatic and inspirational leadership styles, such as transformational leadership, best characterise the leadership role of nurse managers at an operational level. As Hutchinson and Jackson[13] stated, '*It is increasingly evident that leadership occurs at all levels of an organization, reducing the importance of traditional charismatic, heroic and strategic interpretations of leader-led behaviour*'. In line with this, nurse managers act more like a '*primus inter pares*' rather than the traditional charismatic leader, as they frequently have a nursing background themselves and often work in close collaboration with their followers. Moreover, according to some scholars, '*there is a pressing need for much stronger conceptualizations of leadership that clearly define leadership practices*'.[10] These findings inspired us to look for other conceptualisations of safety management and to focus more on concrete management practices and leadership behaviours.

In human resource management (HRM) literature, a distinction is made between two management approaches: control-based and commitment-based management.[14 15] A management approach encompasses both the personality and behaviour of the leader, as well as the broader spectrum of management practices and devices used to ensure that employees show appropriate behaviours. Control-based management is a formalised, top-down approach that focuses on regulating, monitoring and controlling employees' behaviour, whereas commitment-based management is characterised by creating awareness and facilitating an internalisation of an organisation's mission, vision and goals to ensure that employees show appropriate behaviour.[14 16] These management approaches resemble transactional and transformational leadership, but their focus is somewhat different. Central to a transactional leadership style is the exchange process between a leader and his/her followers, in which the leader clarifies performance criteria and the rewards that employees will receive when they meet the expectations.[17] The basis of a control-based management approach is, in contrast, provided by safety rules and regulations, which give direction to appropriate safety behaviours. Transformational leadership is characterised by leaders who hold strong moral values, are charismatic and inspire their followers. This style is criticised for treating '*leadership as a personality trait or personal predisposition rather than a behaviour that people can learn*'.[17] Commitment-based safety management presumes, in contrast, that every leader can create an intrinsic motivation in employees. This management approach focuses more on concrete management practices and leadership behaviours that every leader can exhibit rather than personal characteristics that are reserved for a few. Therefore, we expect the concepts of control-based and commitment-based safety management to be relevant for lower level management as well. Initial support for the relevance of control-based and commitment-based safety management was found in a qualitative study in five hospitals, which showed that hospitals often use a combination of both approaches depending on the safety issues at hand and the specific contextual features.[5] Whether hospital managers emphasise a control-based or commitment-based management approach depends, for example, on the urgency of safety matters, external pressure and consequences when safety requirements are not met, as well as managers' expectations of the intrinsic motivation of healthcare professionals for certain safety behaviours.

The findings from our qualitative study formed the basis for developing a questionnaire for control-based and commitment-based safety management of nurse managers in hospital care.[5] The newly developed questionnaire distinguishes itself from existing questionnaires in that it combines control-based and commitment-based management approaches, is specifically targeted at patient safety management in hospitals, and focuses on concrete management practices and leader behaviours of direct supervisors at an operational level. The current study describes the development and testing of psychometric properties of the ConCom Safety Management Scale in a sample of nurses working in clinical hospital departments.

Background

The basic principle underlying a control-based safety management approach is that workers lack the intrinsic motivation to naturally follow required practices or procedures[18]; hence, exercising control and strengthening extrinsic motivation in employees are considered crucial. Therefore, a control-based safety management approach is first characterised by enforcing compliance with specified rules and procedures.[14 15] In hospitals, a wide range of detailed clinical guidelines, protocols and checklists are used to ensure safe care delivery. The vast majority of these safety regulations are established by professional associations of medical specialists, paramedics or nurses.[19] Nurse managers stress the importance of compliance with the rules and procedures and increasingly use them as a tool for managerial control.[5] In fact, safety regulations structure work processes and increase predictability, thereby enabling managers to check whether healthcare professionals adequately follow safety rules and procedures. Accordingly, control-based safety management is also characterised by actively monitoring employee behaviour.[14 16] Nurse managers observe employee behaviours and monitor compliance during audits and based on registrations

in (electronic) patient records.[5] Based on these monitoring results, employees are provided with feedback on their compliance with safety regulations.[14 16] In the case of recurrent non-compliance, hospitals have established formal sanction policies targeted at specific safety issues. Healthcare professionals who repeatedly ignore the rules and procedures face warnings from their direct supervisors, reprimands from the board of directors and are, ultimately, dismissed or fired.[5]

In contrast, commitment-based safety management is a management approach that focuses on facilitating an internalisation of safety norms and values.[15 16] The philosophy of this approach is that fully committed and intrinsically motivated employees are capable of self-discipline, willing to assume responsibility and will deliver better performances.[14] Therefore, the approach is first characterised by leaders who give priority to delivering safe care and who clearly communicate their vision to employees, for example, by demonstrating that patient safety is highly valued and prioritised over other organisational aspects such as production. Second, the importance of patient safety is emphasised by nurse managers who show commitment to safety issues, coach workers in safety behaviours and take improvement initiatives.[5] Hence, patient safety is recurrently brought to employees' attention, and employees are also given practical advice on desired safety behaviours. Furthermore, direct supervisors show role modelling behaviour, which is considered crucial in ensuring their credibility. If role models practise what they preach, they may encourage healthcare professionals to imitate desired behaviours.[20] Fourth, managers encourage employees to participate in managerial decision-making and to demonstrate initiative.[14 15] They actively invite employees to make safety recommendations, to question the feasibility of safety initiatives and to apply their medical expertise to safety matters.[5] By doing so, managers sharpen employees' sense of personal responsibility and their shared ownership for patient safety.[21] Finally, nurse managers attempt to increase consciousness of safety issues by making employees aware of potential safety risks and deficiencies in their own performance.[5 14] Healthcare professionals usually bear great responsibility for delivering safe care but are frequently not aware of safety risks that care delivery entails. Therefore, nurse managers may increase this awareness by discussing safety incidents, providing insight in patient outcome measures and comparing data with similar units in other hospitals.

In HRM literature, it is generally assumed that organisations primarily rely on either control-based or commitment-based management.[14 15] However, in the case of patient safety management, both management approaches seem to be complementary rather than mutually exclusive.[5] Developing a measurement instrument for control-based and commitment-based safety management may help to gain further insight in the use of both management approaches.

METHODS

Measurement instrument development

The above-described conceptualisations of control-based and commitment-based safety management (see also definitions in table 1) formed the basis for developing the ConCom Safety Management Scale. A set of three to six survey items per subdimension was developed, addressing nurses' perceptions of the management practices and leadership behaviours shown by their nurse managers.[22] When available, statements were derived from previously published scales. First, items of two frequently used questionnaires to assess a safety culture—the Safety Attitudes Questionnaire[23] and the Dutch version of the Hospital Survey on Patient Safety Culture[24]—were screened for statements that correspond with our conceptualisation of both management approaches. To measure formalisation, the climate for formalisation scale was used (Cronbach's α=0.77).[25] The nurse managers' commitment to patient safety was measured using a selection of items of the transformational leadership questionnaire (Multifactor Leadership Questionnaire-5), which are adapted to specifically fit patient safety management.[26] To assess the nurse managers' role modelling behaviour, we used the Behavioural Integrity Scale (α=0.93).[6] Finally, based on insights derived from our qualitative study on control-based and commitment-based safety management, 12 additional items were formulated by the research team.[5]

The content validity of the instrument was assessed by the authors, who individually reviewed draft versions of the questionnaire.[27] The authors assessed the relevance of formulated items in relation to the conceptualisations of the subdimensions of both safety management approaches and offered suggestions for elements that were not yet sufficiently captured in the questionnaire. Differences of opinion between the authors were discussed in the research team until consensus was reached, and all authors agreed that the questionnaire accurately reflects the conceptualisation of control-based and commitment-based safety management. Furthermore, face validity of the initial set of items was assessed by a group of nine practitioners thoroughly familiar with safety management in hospitals (including patient safety officers, nurse managers and project leaders involved in safety improvement projects). Finally, three nurses were interviewed to check the wording and comprehension of items, resulting in some suggestions for rephrasing. The final set of items presented to participants in this study consisted of 37 statements, using a 4-point or 5-point Likert scale plus the option 'I don't know' (see table 1). Items derived from previously published scales were answered using their original response scale. Scale scores were recalculated on a 20-point

Table 1 Subscale definitions and descriptive statistics per item (n=2627)

	Item statements	Mean	SD	Minimum	Maximum	% 'I don't know' answers
Control-based safety management						
Formalisation: A supervisor stresses the importance of compliance with safety rules and regulations.						
1	In this department, it is considered extremely important to follow safety rules and procedures (eg, regarding hand hygiene). (1a)	3.35	0.563	1	4	0.2
2	In this department, people can ignore formal safety rules and procedures if it helps to get the job done. (1a*)	2.91	0.712	1	4	3.1
3	In this department, everything has to be done by the book. (1a)	2.83	0.590	1	4	1.1
4	In this department, it is not necessary to follow safety rules and procedures to the letter. (1a*)	3.26	0.705	1	4	1.0
5	In this department, nobody gets too upset if people break safety rules and procedures. (1a*)	3.26	0.618	1	4	2.1
Monitor compliance: A supervisor monitors compliance with safety rules and regulations during care delivery and audits, as well as based on registrations in (electronic) patient records.						
6	When my supervisor is in the department, he/she monitors whether we comply with safety rules and procedures (eg, regarding hand hygiene). (6b)	3.22	0.966	1	5	4.0
7	Whether we comply with safety rules is monitored based on information registered in (electronic) patient records (eg, information regarding pressure ulcers, pain, frail elderly). (6b)	3.72	0.841	1	5	2.9
8	In this department, it is rarely monitored whether employees comply with safety rules and procedures. (6b*)	3.57	0.858	1	5	1.9
9	In this department, employees' compliance with safety rules and procedures is monitored on a regular basis, for example during safety audits or walk rounds. (6b)	3.73	0.866	1	5	2.1
Provide feedback on (non-)compliance: A supervisor provides employees with either positive or negative feedback on their compliance with safety rules and regulations and uses formal sanction policies in case of recurrent non-compliance.						
10	My supervisor says a good word when he/she sees a job done according to established patient safety procedures. (2c)	3.42	1.021	1	5	1.1
11	In my department, anyone who violates safety rules or procedures is swiftly corrected. (6c)	3.30	0.860	1	5	2.7
12	When we repeatedly do not comply with safety rules or procedures, disciplinary actions will be taken. (6c)	3.21	0.882	1	5	9.5
13	Compliance with safety rules and procedures (eg, regarding hand hygiene) does substantially contribute to a positive assessment in our department. (6c)	3.44	0.875	1	5	2.8
Commitment-based safety management						
Prioritise patient safety: A supervisor gives priority to delivering safe care and demonstrates this to employees, both in words and deeds.						
14	My supervisor overlooks patient safety problems that happen over and over. (2c*)	3.90	0.858	1	5	2.2
15	Whenever pressure builds up, my supervisor wants us to work faster, even if it means taking shortcuts. (2c*)	3.60	0.977	1	5	1.2
16	The actions of my supervisor show that patient safety is a top priority. (2c)	3.45	0.911	1	5	4.3
Show commitment on patient safety: A supervisor shows determination to ensure patient safety by encouraging employees to deliver safe care to patients, coaching workers in safety behaviours and taking improvement initiatives.						
17	My supervisor provides continuous encouragement to do our jobs safely. (3b)	3.85	0.942	1	5	1.2
18	My supervisor shows determination to maintain a work environment where we deliver safe care to our patients. (3b)	4.05	0.858	1	5	1.4
19	My supervisor behaves in a way that displays a commitment to patient safety. (3b)	3.98	0.870	1	5	1.4
20	My supervisor suggests new ways of doing our jobs more safely. (3b)	3.28	1.033	1	5	2.4
21	My supervisor spends time showing me the safest way to do things at work. (3b)	2.95	1.210	1	5	3.4
Show role modelling behaviour: A supervisor is a role model for employees in regard to patient safety and practises what he/she preaches.						
22	Regarding safety, my supervisor delivers the consequences he/she describes. (4c)	3.75	0.830	1	5	2.8
23	When my supervisor lays out safety protocols, he/she makes sure people follow it. (4c)	3.67	0.788	1	5	2.9

Continued

Table 1 Continued

	Item statements	Mean	SD	Minimum	Maximum	% 'I don't know' answers
24	My supervisor enforces the safety protocols he/she describes. (4c)	3.53	0.806	1	5	3.8
25	My supervisor always practises the safety protocols he/she preaches. (4c)	3.58	0.791	1	5	13.2
26	My supervisor does not actually prioritise safety issues as highly as he/she says he/she does. (4c*)	3.99	0.860	1	5	2.7
27	Regarding safety, my supervisor's words do not match his/her deeds. (4c*)	3.73	0.925	1	5	2.6
Encourage participation: A supervisor encourages employees to take initiative on improving patient safety and to participate in decision-making processes on safety issues.						
28	My supervisor seriously considers staff suggestions for improving patient safety. (2c)	3.87	0.851	1	5	1.1
29	In this department, staff is involved in decision-making processes. (5c)	3.20	0.950	1	5	0.5
30	My supervisor encourages me to express my ideas and suggestions regarding patient safety improvement. (6c)	3.93	0.836	1	5	0.8
31	My supervisor encourages us to take initiative on improving patient safety whenever it is possible. (6c)	3.89	0.806	1	5	1.4
Create safety awareness: A supervisor attempts to increase consciousness of safety issues by making employees aware of the potential safety risks and deficiencies in their own performance.						
32	We are informed about errors that happen in this department. (2b)	3.86	0.878	1	5	0.5
33	We are given feedback about changes put into place based on event reports. (2b)	3.97	0.964	1	5	0.4
34	In this department, we discuss ways to prevent errors from happening again. (2b)	3.94	0.883	1	5	0.3
35	We are generally informed about the patient outcomes available for our department. (6b)	3.85	1.003	1	5	4.0
36	In this department, performance indicators for patient safety (eg, pressure ulcers, hospital-acquired infections) are discussed. (6b)	3.85	1.074	1	5	4.4
37	We compare our patient outcomes with results of other departments, and results of this benchmark are discussed. (6b)	3.40	1.186	1	5	15.4

1: climate for formalisation scale; 2: items from the Dutch Hospital Survey on Patient Safety Culture; 3: items adapted from Multifactor Leadership Questionnaire-5; 4: Behavioural Integrity Scale; 5: items derived from Safety Attitudes Questionnaire; 6: items formulated by the research team.[6 23–26]
a: 4-point Likert scale ranging from 'definitely false' to 'definitely true'; b: 5-point Likert scale ranging from 'never' to 'always'; c: 5-point Likert scale ranging from 'completely disagree' to 'completely agree'.
*Reverse-scored items.

scale: answers on a 4-point Likert scale were multiplied by 5, answers on a 5-point Likert scale by 4.

Sample and data collection

A cross-sectional survey design was used to test the psychometric properties of the instrument. Via hospital associations, all of the Dutch hospitals were invited to participate, resulting in a sample of 15 general hospitals and 2 university medical centres (respectively 20% and 25% of all hospitals in the Netherlands).[28] Within each hospital, nurses working in clinical departments (ie, medical wards, surgical wards, day care units and intensive care units) were approached to participate. All of these nurses hold a staff position; they provided direct patient care and were not directly involved in managerial tasks within their department. Between September 2014 and May 2015, a total of 11 809 nurses were invited to complete a questionnaire, yielding a sample size that well exceeds the minimum number required for scale development.[29] The total number of nurses that were approached to participate may be somewhat overestimated because in six hospitals we were unable to differentiate between occupational groups and, therefore, counted all of the healthcare professionals who received a questionnaire rather than only the nurses. Potential participants received a letter or email with a link to the online questionnaire and were informed about the study purpose and asked to participate anonymously. Nurse managers were asked to further inform their nursing staff about the study and to encourage their employees to complete the questionnaire. Two reminders were sent to non-responders after 2 and 4 weeks. No incentives in the form of money or gifts were offered.

Only fully completed questionnaires were included in the analysis, resulting in a sample of 2627 surveys (response rate 22%). We were unable to conduct a non-response analysis because we did not have insight in the relevant characteristics of all of the nurses invited to complete a questionnaire. The characteristics of nurses in our sample do, however, resemble the characteristics of the nursing workforce in all Dutch hospitals.[30] Correspondence with non-responders and contact persons within the hospitals identified various

reasons for non-response: too busy, not working at a clinical department anymore or fatigued by oversurveying. Furthermore, in two hospitals the online survey programme was blocked at some of the computers, which might have reduced possibilities for participation in the study.

Passive consent was obtained from all participants as they voluntarily agreed to complete the questionnaire and were free to quit at any time during the research.

Statistical analysis of the measurement model

First, the descriptive statistics for each item were examined, including item means, SD and interitem correlations. If respondents answered less than 10% of the items with 'I don't know', these items were imputed using the multiple imputation procedure in SPSS V.23.0. Respondents who answered more than 10% of the items with 'I don't know' were excluded from the analyses. This led to a final sample of 2378 nurses (91% of the completed surveys). To test the psychometric properties of the instrument, the final sample was randomly divided into two subsamples: one sample (n=1165) was used to test and revise our initial structural model; the second sample (n=1213) was used in a cross-validation procedure.

Subsequently, confirmatory factor analysis (CFA) with structural equation modelling was conducted to analyse the relationships between the observed variables and latent constructs underlying the measurement instrument.[31] The analyses were based on the sample variance-covariance matrix using a maximum likelihood estimation method and carried out in Lisrel V.8.80. No double-loading indicators or correlated measurement errors were allowed in the model. We first tested our initial, theoretical model consisting of eight latent factors (ie, the subdimensions described in table 1) and two second-order constructs (ie, control-based and commitment-based safety management). The model's goodness-of-fit was evaluated using the likelihood ratio χ^2, root means square error of approximation (RMSEA) and its 90% CI, comparative fit index (CFI), Tucker-Lewis index (TLI) and standardised root mean square residual (SRMR). The cut-off criteria for the different fit indices were based on suggestions of Hu and Bentler.[32] A well-fitting model would provide a non-significant χ^2 value; however, χ^2 is highly sensitive to sample size, and therefore it is difficult to obtain non-significant values in large samples.[33] Furthermore, RMSEA $\leq$0.06 indicates acceptable fit; for both CFI and TLI—which are relatively independent of sample size[34]—the cut-off values of $\geq$0.95 are recommended; and finally for SRMR, values $\leq$0.08 are generally deemed acceptable.[32]

After testing our initial, theoretical model, we used a stepwise CFA approach to successively analyse and optimise the measurement models of each proposed subdimension as well as the two different safety management approaches. During an iterative process, modifications to the model were respectively guided by factor loadings, modification indices, internal consistency of each subscale (Cronbach's α), descriptive statistics of the items and conceptual arguments; all modifications were discussed by the research team and had to be theoretically plausible. Revisions continued until no more indications for improvement were found or further modifications were not theoretically plausible. We also compared the proposed model with two second-order constructs for control-based and commitment-based safety management and a model with only one second-order construct (ie, one single safety management approach). All of the models were compared using a χ^2 difference test ($\Delta\chi^2$) in which $P<0.05$ was deemed significant. During a cross-validation procedure, our final model was retested in the second sample of 1213 respondents. Finally, the correlations and reliability estimates were analysed to assess internal consistency of (the subdimensions of) our final model. Furthermore, one-way ANOVA was conducted in SPSS, and intraclass correlation coefficients (ICC) were calculated to further test whether the instrument has the ability to detect variation in safety management approaches across hospitals and clinical departments. One-way ANOVA and ICC values were calculated based on the data of departments with a minimum response of eight nurses. This cut-off value reflects 20% of the median number of nurses who were invited to complete a questionnaire per department (ie, 20% of an average of 40 invited nurses per department) and was used because we were unable to calculate a response rate per department.

RESULTS

Table 2 provides an overview of the sample characteristics of the 2627 nurses who completed the

Table 2 Sample characteristics (n=2627)

Characteristics		
Age	Mean (range)	SD
Age in years (n=2450)	40.2 (18–65)	11.6
Gender	n	%
Male	320	12.2
Female	2225	84.7
Missing	82	3.1
Job position	n	%
Registered nurse	2512	95.6
Student nurse	63	2.4
Nurse practitioner	52	2.0
Years of experience	Mean (range)	SD
In the organisation (n=2540)	14.2 (0–46)	10.3
In the clinical department (n=2506)	10.0 (0–45)	8.5
Average workweek	n	%
<20 hours	188	7.2
20–39 hours	2369	90.2
>40 hours	24	0.8
Missing	46	1.8

Table 3 Goodness-of-fit indices*

	Model†	χ^2	df	RMSEA (90% CI)	CFI	TLI	SRMR
Initial model (n=1165)	2Fa	3500	620	0.063 (0.061 to 0.065)	0.978	0.976	0.064
Revised model (n=1165)	2Fb	2426	487	0.059 (0.056 to 0.061)	0.981	0.979	0.058
	1Fb	2647	488	0.062 (0.059 to 0.064)	0.979	0.977	0.064
Cross validation (n=1213)	2Fb	2642	487	0.060 (0.058 to 0.063)	0.979	0.977	0.066

All χ^2 P<0.001.
*χ^2 goodness-of-fit statistic: assessment of magnitude of discrepancy between sample and fitted covariance matrices; RMSEA: population-based error of approximation index that assesses the extent to which a model fits reasonably well in the population; CFI: reflects the difference between the independence model and the estimated model; TLI: resembles CFI but compensates for the effect of model complexity; SRMR: reflects the difference between residuals of the sample covariance matrix and the hypothesised covariance model.[31–33]
†2Fa=model with eight latent factors and two second-order constructs (ie, control-based and commitment-based safety management); 2Fb=model with seven latent factors and two second-order constructs (ie, control-based and commitment-based safety management); 1Fb=model with seven latent factors and one second-order construct (ie, safety management approach).
CFI, comparative fit index; RMSEA, root means square error of approximation; SRMR, standardised root mean square residual; TLI, Tucker-Lewis index.

questionnaire. The vast majority of respondents were registered nurses (95.6%), mostly female (84.7%), on average 40.2 years of age and had 10 years' work experience in their clinical department. The nurses were affiliated to 269 different departments. Per department, an average of 10 nurses (SD: 6) completed the questionnaire. Almost all of the respondents (n=2476, 95.3%) mentioned a nurse manager as their main supervisor.

Descriptive statistics (table 1) show that most of the items had relatively high mean scores, although none of the items had poor discriminative abilities (ie, >75% of respondents gave the same score; a cut-off value that is even more strict than the often used cut-off value of 95%).[35] Furthermore, some items had a relatively high number of 'I don't know' answers, especially items 25 and 37 (13% and 15%, respectively). Assessment of interitem correlations revealed some items with relatively low (<0.30) interitem correlations, particularly within control-based safety management subscales. These findings were taken into account during the stepwise CFA procedure.

Our initial, theoretical model showed acceptable goodness-of-fit indices (table 3), although, as expected based on the sample size, a significant χ^2 value was found (P<0.001). The modification indices, factor loadings (see online supplementary appendix A for the factor loadings of the initial model) and reliability estimates provided some indications that the model could be improved. During a stepwise CFA approach, items 24, 23, 29 and 10 (see table 1) were eliminated successively due to high modification indices and their negative impact on the reliability estimates. Furthermore, the subscales 'Prioritise patient safety' and 'Show role modelling behaviour' were highly correlated (r=0.998), and high modification indices were found for items within these subscales. Therefore, we combined both subscales into one factor. Combining the subscales sounds theoretically plausible because nurse managers should show that they prioritise patient safety both in words and deeds. Hence, the final version of the measurement instrument consisted of 33 items related to seven subscales and two second-order constructs (ie, control-based and commitment-based safety management). Overall, the fit of the revised model (slightly) improved compared with the initial model. The χ^2 value significantly decreased to 2426 ($\Delta\chi^2(1)=221$, P<0.001), the RMSEA was just below the cut-off value of 0.06, the CFI and TLI were well above 0.95, and the SRMR was below the recommended critical value of 0.08. The model with two second-order constructs also showed a significantly better fit than a model with one second-order construct ($\Delta\chi^2(133)=1074$, P<0.001), which supports the distinction between control-based and commitment-based safety management. The results were reconfirmed in a cross-validation procedure because similar fit indices were found in the second set of data (n=1213).

Table 4 reports the descriptive statistics and reliability estimates of the subscales in the final model. The factor loadings of all individual items exceeded the critical value of 0.3 as recommended by Field,[36] and the loadings between the first-order and second-order constructs were also high (average $\lambda=0.86$, range 0.64–0.96), providing support for the construct validity of our measurement instrument. As expected, all of the subdimensions were significantly and positively correlated (ranging from r=0.29 to r=0.76). Furthermore, a correlation of 0.57 was found between the second-order constructs control-based and commitment-based safety management, indicating that both management approaches were strongly related but should be seen as distinct constructs. This finding was

Table 4 Descriptive statistics and correlations of subscales (revised model)†

		Items (n)	α	Scale mean (SD)‡	Average λ (minimum, maximum)	Average interitem correlation (minimum, maximum)	F	ICC(1)	ICC(2)	Correlations						
										1a	1b	1c	2a	2b	2c	2d
1	Control-based safety management		0.79	14.38 (1.91)			4.478*	0.192	0.777	0.759*	0.796*	0.847*	0.522*	0.471*	0.492*	0.419*
1a	Stress the importance of safety rules and regulations	5	0.70	15.60 (2.14)	0.65 (0.51, 0.80)	0.32 (0.21, 0.52)	2.902*	0.115	0.655							
1b	Monitor compliance	4	0.59	14.29 (2.33)	0.56 (0.45, 0.69)	0.27 (0.16, 0.43)	4.052*	0.172	0.753	0.408*						
1c	Feedback on (non-)compliance	3	0.64	13.24 (2.64)	0.64 (0.55, 0.73)	0.37 (0.30, 0.42)	3.272*	0.134	0.694	0.473*	0.511*					
2	Commitment-based safety management		0.94	15.04 (2.55)			8.278*	0.332	0.879	0.421*	0.506*	0.437*	0.882*	0.735*	0.894*	0.859*
2a	Role modelling behaviour	7	0.90	14.84 (2.82)	0.80 (0.67, 0.89)	0.56 (0.37, 0.72)	8.072*	0.325	0.876	0.419*	0.442*	0.401*				
2b	Create safety awareness	6	0.86	15.26 (3.08)	0.76 (0.65, 0.85)	0.52 (0.37, 0.68)	5.232*	0.224	0.809	0.356*	0.429*	0.353*	0.483*			
2c	Leader's safety commitment	5	0.90	14.51 (3.36)	0.85 (0.77, 0.94)	0.66 (0.58, 0.79)	6.726*	0.281	0.851	0.355*	0.443*	0.386*	0.759*	0.523*		
2d	Encourage participation	3	0.82	15.53 (2.85)	0.84 (0.84, 0.85)	0.60 (0.57, 0.66)	5.405*	0.231	0.815	0.288*	0.388*	0.331*	0.753*	0.459*	0.708*	

*P<0.01 (two-tailed).
†Reliability estimates, scale means, average λ and correlations were determined based on the data of our second sample (n=1213). One-way ANOVA and ICC values were calculated based on the data of departments with a minimum response of eight nurses in the complete data set (n=2378).
‡Scale scores were recalculated on a 20-point scale: answers on a 4-point Likert scale were multiplied by 5, answers on a 5-point Likert scale by 4.
ANOVA, analysis of variance; ICC, intraclass correlation coefficient.

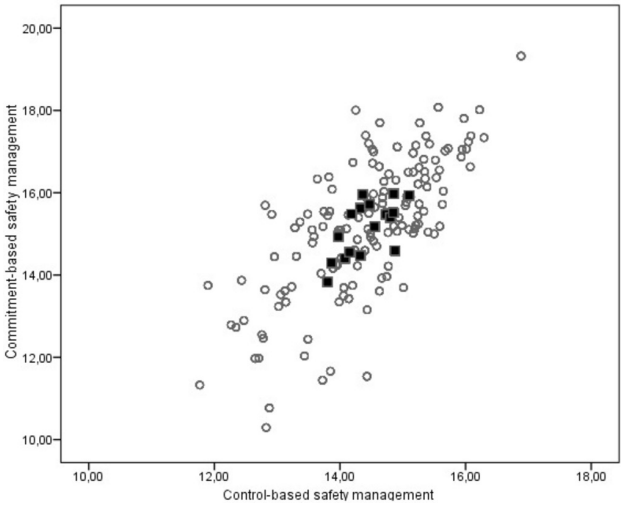

Figure 1 Mean scores of control-based and commitment-based safety management: (■) hospitals; (○) clinical departments (minimum response of eight nurses).

further supported by the fact that higher correlations were found between the factors allocated to the same safety management approach compared with correlations across management approaches. Nevertheless, nurses in all departments reported a combination of control-based and commitment-based safety management rather than either one of them (see figure 1). Assessment of the internal consistency showed that the subscales 'Monitor compliance' and 'Provide feedback on (non-) compliance' had relatively low reliability estimates, α is 0.59 and 0.64, respectively. However, deleting items from these subscales did not improve their reliability. The reliability estimates of the other subscales ranged from 0.70 to 0.90, reflecting acceptable to very good internal consistencies.[27] Results of descriptive statistics and reliability estimates of the subscales were comparable across the two subsamples of the cross-validation procedure.

All of the items in our measurement instrument refer to management practices and leadership behaviours of supervisors at a departmental level (ie, ward level). Accordingly, one-way analysis of variance (ANOVA) showed that at a departmental level, between-group variance was significantly greater than within-group variance for the subdimensions as well as the two management approaches. In addition, ICC(1) signals that 12%–33% of the individual-level variance could be attributed to the department level. As most of the ICC(2) values well exceeded the minimum value of 0.70, aggregation of individual scores to a department level is justified.[37] The same holds for aggregation to a hospital level (ICC(2) range 0.752–0.911). However, because only 2%–7% of the individual-level variance can be attributed to this level, aggregation to a hospital level would not be meaningful.

DISCUSSION

This study aimed at developing and testing a questionnaire for perceived control-based and commitment-based safety management of nurse managers in clinical hospital departments. The findings supported construct validity and reliability of the ConCom Safety Management Scale. Our final model consists of seven subdimensions that were allocated to either control-based or commitment-based safety management. Overall, positive and high estimates were found for both item factor loadings and loadings on the two second-order constructs. The reliability coefficients of the management approaches as well as most of the subdimensions well exceeded the generally accepted criterion of 0.70.[29] Only the subscales 'Monitor compliance' and 'Provide feedback on (non-) compliance' had somewhat lower estimates, but we had no conceptual arguments to remove them. The findings on construct validity and reliability were also consistent across the two subsamples used in this study, providing initial support for scale stability.[27] In addition, the results provided preliminary evidence that the measurement instrument had the ability to detect variation in the safety management approaches adopted by nurse managers at different departments and to a slightly lesser extent between hospitals. Considerable congruence was found in the scores of nurses working at the same clinical department. The final model strongly resembled our theoretical model. Only the subdimensions 'Prioritise patient safety' and 'Show role modelling behaviour' were found to be one rather than two separate factors. Apparently, nurses do not distinguish between the message that managers send by words and by deeds; they seem to seek a pattern of alignment.[20] Thus, nurse managers who 'walk the talk' may clearly prioritise patient safety and send an unambiguous message to their employees on appropriate safety attitudes and behaviours.[6]

The results of this study provide support that control-based and commitment-based safety management are two distinct, yet related constructs that are both relevant for managing patient safety. These findings defy a generally accepted idea in HRM literature that organisations primarily rely on either control-based or commitment-based management, and further support the idea that both management approaches are considered complementary rather than mutually exclusive in regard to patient safety management.[5 14 15] This is further emphasised by descriptive statistics that show that nurses clearly recognise aspects of both management approaches in how their nurse managers steer patient safety. Thus, nurse managers frequently combine elements of control-based and commitment-based safety management, although considerable variation is found as well. Future research is needed to deepen our understanding of the reasons underlying this variation. Furthermore, our findings stress the need that elements of both management

approaches are combined in future research. Safety culture assessment tools do, for example, frequently incorporate aspects of safety management, although items predominantly focus on commitment-based management practices such as safety commitment of senior management, managerial support for patient safety, communication openness, leaders' awareness of safety problems and their reactions to reported safety concerns.[23 38–40] Control-based safety management practices are largely overlooked. Our findings make a plea to combine elements of both control-based and commitment-based safety management and to shift the focus towards the broader range of management practices and leader behaviours used to optimise patient safety.

The ConCom Safety Management Scale as developed in this study can be used as a tool to evaluate safety management in practice. Future research may, for example, explore how nurses' perceptions of the management approach adopted by their nurse managers influence employees' safety-related attitudes, behaviour and patient safety performance. Such insights may help to open a dialogue among (nurse) managers and nursing staff on how to further improve patient safety management within their department or organisation. Furthermore, when future research provides insight into the effects of different (combinations of) safety management approaches, the instrument may also serve as a starting point to coach individual nurse managers in regard to patient safety management.

The present study has some limitations. First, we exclusively focused on nurses in clinical hospital departments. Replication research is needed for other settings and occupational groups. The latter may require reframing of the items; physicians may, for example, not identify with a direct supervisor. Furthermore, despite our large sample, the response rate was relatively low, raising some questions about representativeness. However, the characteristics of nurses in our sample do resemble the characteristics of the nursing workforce in all Dutch hospitals.[30] Third, the relatively high number of 'I don't know' answers found for some items in the questionnaire might induce reframing of these statements. Accordingly, variation in the framing of items (ie, 'my supervisor' vs 'this department') as well as response scales may also be reconsidered to further improve the questionnaire. Fourth, our results provide support for the construct validity of the measurement instrument, but the criterion-related validity has not been tested yet. In other words, the operationalisation of control-based and commitment-based safety management used in this study has not been compared with other questionnaires on patient safety management.[27] Finally, the ConCom Safety Management Scale focuses on nurses' perceptions, not on the actual leader behaviours and management practices of supervisors. These perceptions are considered crucial in understanding the linkage between management approaches and employee behaviours or performances, but perceptions are influenced by variation in actual management practices as well as how individuals interpret and perceive the safety management approach.[41]

In conclusion, the current study provides initial support for the ConCom Safety Management Scale as a measurement instrument of control-based and commitment-based safety management. The ConCom Safety Management Scale highlights the importance of frequently mentioned safety-related management practices and leadership behaviours, such as showing commitment, role modelling behaviour, creating awareness and encouraging employees to take initiative. However, in the current study, these practices are applied specifically to the realm of patient safety management at a departmental level. Moreover, the questionnaire also stresses the importance of safety rules and procedures, monitoring compliance and providing nurses with feedback. Thus, the conceptualisation used in this study reveals a more complete picture of patient safety management, in line with how nurse managers manage patient safety in clinical hospital departments.

Contributors CWA, MMHS, JDHvW, JP and RH contributed to the study design. CWA and JDHvW developed the initial set of survey items. MMHS, RH and JP reviewed the draft versions of the questionnaire and commented on the content validity. All authors approved the final set of items used in this study. CWA collected the data and together with MMHS conducted the analyses, in close collaboration with JDHvW, RH and JP. CWA took the lead in drafting the manuscript, while all authors reviewed the paper, commented on various drafts and rewrote parts of it. All authors read and approved the final manuscript.

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Patient consent Not required.

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