Head nurse characteristics and patient safety: The mediating role of patient safety climate

Yael Livne[1], Sarit Rashkovits[2], Ilana Peterfreund[3], Janna Sheps[3]

[1](Department of Human Services, Yezreel Valley College, Israel)
[2](Department of Health Systems Management, Yezreel Valley College, Israel)
[3](Nursing Management, Bnai Zion Medical Center, Haifa, Israel)

Abstract: *Nursing leadership is a major factor in affecting nurses' behavior in hospital wards. As such, it should be considered in the efforts to improve patient safety. This study aims to identify different characteristics of the head nurse which enhance the level of patient safety by means of creating a patient safety climate. We examine the mediating role of three dimensions of patient safety climate (i.e. safety norms, team learning and safety-promoting communication) in the relationship between characteristics of the head nurse (i.e. safety leadership, staff's trust, and psychological empowerment) and patient safety levels in the ward (nurses' safe behavior and adverse events). 299 nurses from 26 units in one hospital participated in the study. Data were collected from self-reporting of nurses and head nurses as well as hospital data on adverse events. The results partly support the hypotheses, indicating that different dimensions of patient safety climate mediate the effect of the head nurse's characteristics on the level of safety in the ward. The findings suggest that a safety-promoting leadership style leads to safety norms which promote nurses' perceptions of safe behaviors, whereas the head nurse's sense of autonomy on the job encourages team learning, thus may reduce adverse events.*
Keywords - *adverse events, autonomy, nursing leadership, patient safety climate, team learning, trust*

I.   Introduction

Patient safety is an issue that has occupied health organizations since the publication of the World Health Organization's report "To Err is Human"[1], which highlights the vast scope of preventable errors that occur in the provision of treatment. However, the health care system is having difficulties achieving a significant improvement in this all-important field[2,3,4], and this is largely due to the concentration of energies on patient- and caregiver-related factors, rather than on organizational factors[5]. Nowadays there is a growing recognition of the importance of the organizational culture as a means to improving patient safety[6]. A culture of safety emphasizes the safety of the treatment as a value and unites all employees in the belief that there is a vital necessity to minimize harm to patients during treatment[7]. The present study focuses on the behavioral expression of safety culture, namely: the patient safety climate, and examines managers' characteristics that may influence this climate. It also examines the relationship between three dimensions of patient safety climate and the levels of safety in the hospital's units.

II.   Literature Review

Safety culture and safety climate are similar constructs, often interchanged in the scientific literature[8]. While culture is defined as the shared values, beliefs and basic assumptions of an organization's employees[9], climate refers to common perceptions of the employees regarding policies, procedures and practices in their workplace[10]. A climate of patient safety describes the employees' perception of what are the required and rewarded patient safety behaviors in their work environment[11]. Organizational culture and climate can be seen as complementary concepts: climate is a behavioral expression of culture, which in turn reflects a deeper level of attributes of the workplace[12,11].

Climate perceptions are formed when employees assess the priority of patient safety compared with other organizational goals, while being able to distinguish between the declared policy and the actual one, and taking into account the consistency of the policy and procedures between different organizational units[11]. In each unit, the employees interpret the behavior of their direct supervisor based on the daily interactions between them[10]. A consistent preference of the direct supervisor for certain strategic goals (i.e. preferring efficiency over treatment safety), conveys a message to the employees regarding the importance of these goals, and thus shapes their perception of the climate in the unit.

Patient safety climate can influence employees' behavior, as they learn what the desired behaviors are in their workplace and act in ways that will lead to positive results for themselves (e.g., recognition, feedback,

recommendations for promotion). Since the direct supervisor's reactions are a major source of reward[10], it is to be expected that in a hospital, the head nurse in the ward will have a significant influence on the behavior of the subordinate nursing staff. Furthermore, the nursing staff has a significant influence on the quality and safety of patient care, as a result of their direct contact with the patients, and of the nurses' ongoing monitoring of their condition[13,14]. Therefore, this study focuses on the nursing staff, and on the characteristics of the head nurse as a central factor influencing the nature of the climate on a hospital ward.

1.1 The Characteristics of the Head Nurse in the Ward

The direct supervisor holds a vital role among the factors that influence the development of a patient safety culture.[15,16] In light of this, the present study examines three characteristics of the head nurse which may influence the patient safety climate: safety leadership, employee trust and psychological empowerment.

1.1.1 Safety Leadership

Leadership in nursing is one of the factors that influence the safety and quality of the care in hospitals[17]. Safety leadership means that the direct supervisor advocates values inherent in safety and communicates these values to the staff, by prioritizing patient safety; employees who follow safety procedures are rewarded, open communication regarding mistakes is encouraged and mistakes are responded to with a fair evaluation of their causes. This leadership style is rewarding in its nature, clearly defining the demands and expectations for the employees, and providing support in carrying out tasks appropriately[18]. The manager's support of safety is an essential condition in creating a patient safety climate[15]. For example, a study that included 1644 nurses from 35 hospitals in Switzerland found a positive correlation between leadership that supports patient safety and communication and feedback regarding mistakes, team learning and the evaluation of patient safety levels in the ward[19]. Therefore, we hypothesize that:

Hypothesis 1: The higher the degree of safety leadership of the head nurse, the higher the level of patient safety climate in the ward.

1.1.2 Employee Trust

Employee trust in management is an important factor in generating a patient safety climate[20]. Trust is vital for creating norms of safe behavior which prioritize the safety of the patient. Thus, to encourage a climate of patient safety, the staff must have faith in their manager and trust that mistakes will be treated fairly and sensitively, that the person who reported the mistake will be treated fairly and not suffer any negative consequences, and that the information will be used to improve the patient care. Trusting the supervisor contributes considerably to the management of safety-promoting communication, as it allows the nursing staff to report mistakes as a matter of course and to discuss them openly, in order to learn how to prevent them in the future, without fearing unfair consequences[21].

Studies show that trust in a supervisor is related to concepts of safety climate. For example, a Canadian study on a sample group of 600 nurses[22] found that the closer the relationship between the nurses and their supervisor, and the more it is based on mutual commitment and trust, the greater the safety climate. Another study found that the head nurse's integrity in safety-related matters is positively related to the staff's prioritizing safety, which in turn, is negatively related to the number of mistakes occurring in the ward[23]. Moreover, a study of patient safety climate in a Chinese hospital, found a high positive correlation between the nursing staff's level of trust in their supervisors and their safety climate perceptions[24]. Another study carried out in 78 wards in 10 hospitals in the US revealed that a safety culture's ability to reduce errors in drug administration is greater when the nurses trust their supervisors[20]. Therefore, we hypothesize that:

Hypothesis 2: The higher the staff's level of trust in the head nurse, the higher the level of patient safety climate in the ward.

1.1.3 Psychological Empowerment

Psychological empowerment is a state of increased intrinsic motivation, manifested in four dimensions[25]: Meaning (the employees' belief that their work is valuable), Competence (the employees' belief in their ability to carry out their job well), Self-determination (the employees' feeling that they have free choice and the discretion to make decisions regarding the manner in which they perform their jobs) and Impact (the extent to which the employee has influence over operational, managerial and/or strategic outcomes at work).

Studies show that the empowerment of nurses, by granting them autonomy, involving them in decision making and allowing them to control their work environment, enables them to act in accordance with their professional standards, thus encouraging a better climate of patient safety[26]. These findings are reinforced by a study that was carried out on 257 nurses from intensive care units in the US, which found that the greater the

empowerment of nurses, the higher the climate of patient safety[27]. It was also found that empowerment promotes proactive behavior, which is likely to increase effectiveness at work[28].

With regard to the empowerment of the supervisor, it was found that managers who reported higher levels of empowerment were perceived by their subordinates as being more innovative, as having influence over the senior management of the organization, and as being inspiring[29]. In light of this, it can be expected that the greater the head nurse's psychological empowerment, the more she feels her work is important and of value, and the higher her intrinsic motivation to succeed in her role, the greater her influence on the staff; this in contrast to head nurses who report low psychological empowerment. Therefore, we hypothesize that:

Hypothesis 3: The greater the head nurse's psychological empowerment, the higher the level of patient safety climate in the ward.

1.2 Patient safety climate as a multi-dimensional concept

Employees' perceptions of the importance of safety in their ward, i.e. the patient safety climate, is based on various aspects of treatment safety[15]. Different studies relate to several key components. For example, Sammer et al.[30] developed a model for improving patient safety, based on leadership, teamwork, evidence-based treatments, communication, learning, fairness and focusing on the patient. According to Singer et al.[31], a culture of patient safety is a construct that includes such dimensions as: commitment of senior management, safety norms in the ward and learning. The present study focuses on the following three dimensions: safety norms, team learning and safety-promoting communication.

1.2.1 Safety Norms

A climate of patient safety is based on rules of conduct in treatment safety, which are shared by the organization's employees and agreed upon by them. The employees' perception of the desirable and acceptable behavior in the organization and in their ward are the cornerstones of the patient safety climate[10]. Therefore, when nursing teams take it upon themselves to adhere to key safety procedures such as the prevention of falls or infections, safety norms are created which shape this climate. This study focuses on norms related to hygiene, prevention of falls and placing patients at the center of focus and caring for their well-being.

1.2.2 Team Learning

The development of group learning mechanisms is essential for organizations that wish to promote a culture of safety[32]. Flawed teamwork has been found to be a significant reason for the occurrence of errors in treatment[33]. One of the ways to improve patient safety is to ensure the teams learn from their mistakes, as well as their successes, and initiate improvements in their work methods. Team learning is defined as a continuous process of thinking and acting, characterized by raising questions, seeking feedback, experimenting, reflecting on results and discussing mistakes or unexpected results of actions[34,35]. This process occurs in a proactive manner and is driven by team members with an aim to improve their performance[35,36]. Accordingly, team learning has been shown to improve nursing team's outcomes such as decreased medication administration error, e.g.[37]; innovation implementation[38,39], and the team performance effectiveness as rated by team supervisors[40,41]. As a mechanism for learning lessons of the past and continually improving, team learning is of great importance as a dimension of safety.

1.2.3 Safety-promoting Communication

Patient treatment in health organizations is provided by teams composed of various professionals, with varied skills, different occupations and diverse backgrounds. Despite this, they must be coordinated in order to provide quality treatment which is also safe. The more sophisticated the treatment methods, the more likely the failures in communication and in the coordination of the care provision[42]. Indeed, studies show that failures of communication among caregivers cause the most harm to patients[43] and that many errors are unreported due to concerns regarding blame or retribution by the manager or by colleagues[44].

Effective communication is a key attribute of organizations that maintain a culture of safety[15], and its importance is particularly prominent in situations in which the value of safety conflicts with other values or standards, such as the avoidance of openly expressing interpersonal criticism, or compliance with rules of professional hierarchy between physicians and nurses. Since the level of the climate represents the degree of importance of patient safety compared to other objectives[10], a climate of patient safety reflects the importance of this topic especially in case of a conflict between competing goals. In these situations, assertive communication with other team members or professionals from outside the team, such as physicians, is critical for maintaining patient safety. In order to ensure quality treatment which is also safe, it is essential that nurses exchange information effectively with other caregivers[45].

1.3 The effect of patient safety climate on safety levels in the ward

The relationship between the climate of patient safety and the actual degree of treatment safety is based on the employees' tendency to act according to the accepted norms of behavior at their workplace, as they perceive them, in order to achieve the desired results[10]. This relationship has been documented in studies which found correlations between patient safety climate and outcomes such as: treatment errors[46,47,23], medication errors[20,22], the rate of repeat hospitalizations[48] and so on. Therefore, we hypothesize that:

Hypothesis 4: The higher level of patient safety climate in the ward, the higher degree of patients' safety.

A number of studies have reported the mediating effect of patient safety climate or its dimensions. For example, Auer and colleagues[19] found that safety-promoting communication partially mediates the relationship between management's support of patient safety and the levels of patient safety (according to self-reporting)[19]. Another study found that safety climate mediates the relationship between organizational features (the flow of information regarding safety and the matching of safety procedures to work processes) and treatment errors[49]. In the present study, we seek to examine the mediating effect of patient safety climate in the relationship between the head nurse's characteristics and the safety levels in the ward. Following hypotheses 1-3, which claim that the head nurse's characteristics will be related to the patient safety climate, and hypothesis 4, which claims that the patient safety climate will be related to the level of safety in the ward, we can hypothesize that the head nurse's characteristics will be indirectly related to the level of safety in the ward through the level of patient safety climate. Therefore, we hypothesize that:

Hypothesis 5: The head nurse's characteristics will be related to the level of treatment safety in the ward mediated by the level of patient safety climate.

1.4 Study Aims:

The purpose of this study is threefold: first, to identify the head nurse's characteristics which are associated with climate of patient safety: safety leadership, employee trust and psychological empowerment; second, to examine the relationship between patient safety climate and the ward's safety levels; third, to examine the mediating role of the patient safety climate in the relationship between the characteristics of the head nurse and the level of patient safety. Fig. 1 is a schematic display of the hypothesized research model (excluding hypothesis 5).
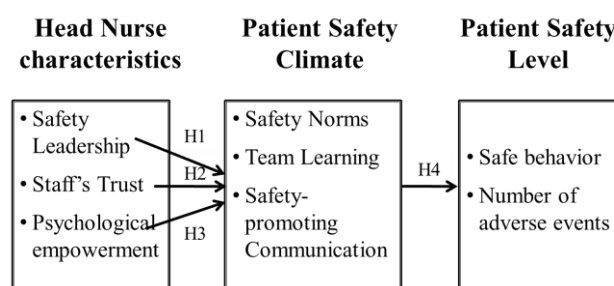

Figure 1: The research Model

III. Method

1.5 Subjects

299 nurses from 26 wards in one hospital (274 nurses and 25 head nurses) participated in the study. Their average age was 41.4 and their average length of service was 11.7 years. 52% of them work full time and 41% part-time; 20% are registered nurses and 72% have an academic education. The average age of the head nurses was 49.2 and their average tenure in the ward was 15.5 years. All have had an academic education and work full time.

1.6 Procedure

The questionnaires were handed out to the nurses by research assistants during staff meetings and were collected after being filled out. The head nurse from each ward received a separate questionnaire, in which the question content and wording were adjusted to suit their position. Participation in the study was voluntary, and the participants were guaranteed anonymity.

Reports were received from the hospital for each of the participating wards with regard to any adverse events. Of all the reported occurrences, only the ones that reflected the safety behavior of the nursing staff, or those that were a direct result of such behavior (for example: "a fall", "switching ID tags"), were selected.

1.7 Measures
1.7.1 Characteristics of the head Nurse

Safety Leadership: 7 items describing the nurses' perception of the head nurse's leadership, with regards to patient safety (based on [50]). A sample item: "The head nurse compliments behaviors that promote patient safety". The response scale ranged from 1 (strongly disagree) to 5 (strongly agree). The internal reliability that arose for this scale (Cronbach's alpha): $\alpha=0.940$.

Staff's Level of Trust: 7 items describing the nurses' level of trust in the head nurse of the ward (based on [51]). A sample item: "My head nurse keeps her promises". The response scale ranged from 1 (strongly disagree) to 5 (strongly agree). The internal reliability of this scale $\alpha=0.947$.

The Head Nurse's Psychological Empowerment: 12 items describing the level of empowerment that the head nurse experiences in her position (based on [25]). A sample item: "My job is meaningful to me". The response scale ranged from 1 (strongly disagree) to 5 (strongly agree). The internal reliability of this scale $\alpha=0.792$.

1.7.2 Patient Safety Climate

Safety norms: 11 items representing the norms of behavior in the ward from three aspects: medication safety and prevention of falls, prevention of infections, and patient care (based on [52]), as reported by the nurses. A sample item: "When you hear that it is important to communicate well with the patient and their family, to what extent do you feel that this is meant sincerely in your ward?" The response scale ranged from 1 (slightly sincere) to 5 (very sincere). The internal reliability of this scale was $\alpha=0.819$.

Team learning: 10 items describing the staff's tendency to examine its behavior in order to improve outcomes (based on [53] and [34]). This was reported by both the nurses and the head nurses. A sample item: "The nurses bring unsafe behavior to each other's attention". The response scale ranged from 1 (strongly disagree) to 5 (strongly agree). The internal reliability of this scale for the nurses was $\alpha=0.90$, and for the head nurses - $\alpha=0.75$.

Safety-promoting Communication: 6 items describing the communication patterns in the ward regarding safety – between the nurses, between nurses and physicians and between nurses and patients (based on [52]). This was reported by the head nurses. A sample item: "In my ward we insist that physicians rewrite unclear instructions before we carry them out (For example: incomplete orders, illegible handwriting)". The response scale ranged from 1 (hardly ever insist) to 5 (insist all the time). The internal reliability of this scale was $\alpha=0.66$.

1.7.3 Safety Levels

Nurses' Safe behavior: 6 items describing the nurses' perception of the extent of their personal meticulousness regarding patient safety (based on [52]). A sample item: "During the past two weeks, what percentage of the time did you lock the bed brakes during your routine work?" The answers were given as a percentage according to the following categories: 50-70%, 71-85%, 86-90%, 91-95%, 96-100%. The internal reliability of this scale $\alpha=0.731$.

Adverse events: the total number of adverse events reported at the hospital in each ward in the last two years.

1.7.4 Control Variables

Size of the ward: Number of patients the ward serves. Ranged from 1 (smallest wards) to 3 (largerst wards). This was reported by the hospital nursing management.

Workload in the ward: The average ratio between the number of nurses and the number of patients on a shift, based on observations

Head nurse's tenure: The number of years the head nurse has held the position.

It must be noted that the use of data from different sources (self-reporting of the nurses and the senior nurses, objective observations in the wards, and hospital reports of adverse events) provides an important advantage, as it conveys a broader and more accurate picture of the study variables and reduces unwanted influences, such as a single source bias.

IV. Results

All data were gathered at the ward level or have been aggregated to the ward level (N=26) in order to perform statistical analysis.

1.8 Descriptive Statistics

Table 1 presents the means and standard deviations of the study variables. It can be inferred that the levels of safety leadership ascribed to the head nurse by the other nurses, and the trust they have in her, are relatively high (an average score of 4.37 and 4.28 respectively, on a scale of 1-5). The three dimensions of the

patient safety climate were also relatively high (an average of over 4 for all dimensions, on a scale of 1-5). The levels of safety in the wards as perceived by the nurses were also high (an average score of 4.62 on a scale of 1-5), Additionally, it can be seen that the average of adverse events is 19.27 and the deviation is relatively high (17.55). When calculating the Pearson correlation coefficient of the variables (see Table 2), a distinctly positive correlation can be seen between the adverse events and the size of the ward (r=0.54, p<0.01). This is due to the fact that the larger the ward, the greater the scope of activity, and consequently the higher the likelihood of adverse events. Therefore, this variable (the ward size) will be used as a control variable in the regressions where the dependent variable is the number of adverse events. Table 2 shows a distinctly positive correlation between the nurses' safety behaviors and team learning (a dimension of patient safety climate) (r=0.46, p<0.05), as well as between safety behavior and the tenure of the head nurse (r=0.48, p<0.01). Therefore, the head nurse's tenure will be used as a control variable in the regressions where the dependent variable is patient safety climate. In addition, distinctly positive correlations were found between safety norms (a dimension of the climate) and the team learning (r=0.47, p<0.05) and safety leadership (r=0.51, p<0.01). Distinctly positive correlations were found between the safety climate dimension of team learning and safety leadership (r=0.82, p<0.001) as well as staff trust level (r=0.58, p<0.01), and also between team learning and workload (r=0.54, p<0.05). The climate dimension of safety-promoting communication was found to have a distinctly positive correlation with psychological empowerment of the head nurse (r=0.52, p<0.01) and her tenure (r=0.50, p<0.01). Safety leadership was found to have a distinctly positive correlation with staff trust level (r=0.71, p<0.001), a distinctly positive correlation with workload (r=0.57, p<0.05) and a distinctly negative correlation with the tenure of the head nurse (r=0.40, p<0.05).

Table 1: Means and standard deviations of the study variables

	N	Mean	SD
Head nurse characteristics:			
Safety leadership	26	4.37	0.29
Staff's trust	26	4.28	0.40
Psychological empowerment	25	4.41	0.37
Patient safety climate:			
Safety norms	26	4.61	0.16
Team learning	26	4.01	0.27
Safety-promoting communication	25	4.58	0.44
Safety level:			
Safe behavior	26	4.62	0.20
Adverse events (frequency)	26	19.27	17.55
Control variables:			
Ward size (1-3)	26	2.19	0.85
Workload (0-1)	16	0.21	0.09
Head nurse tenure (years)	25	15.54	11.04

N=sample size; SD=standard deviation

Table 2: Pearson correlations between the study variables

		Safety level		**Patient safety climate**			**Head nurse characteristics**			**Control variables**		
		1 Adverse events	2 Safe behavior	3 Safety norms	4 Team learning	5 Safety commun.	6 Safety leadership	7 Staff's trust	8 Psych. Empower-ment	9 Ward size	10 Workload	11 Head nurse tenure
1	Corr.	1										
	N	26										
2	Corr.	-.29	1									
	N	26	26									
3	Corr.	0.02	.29	1								
	N	26	26	26								
4	Corr.	.19	.46*	.47*	1							
	N	26	26	26	26							
5	Corr.	-0.35†	.21	-.23	-.12	1						
	N	25	25	25	25							
6	Corr.	.26	.25	.51*	.81**	-.30	1					
	N	26	26	26	26	25						
7	Corr.	.25	-.06	.13	.58**	-.26	.71**	1				
	N	26	26	26	26	25	26					
8	Corr.	-.17	-.08	-.10	.00	.52**	-.11	.00	1			
	N	25	25	25	25	25	25	25				
9	Corr.	.54**	-.16	-.25	-.05	-.17	-.11	-.16	-.14	1		
	N	26	26	26	26	25	26	26	25			
10	Corr.	.14	.36	.40	.54*	-.08	.57*	.30	.14	-.10	1	
	N	16	16	16	16	15	16	16	15	16		
11	Corr.	-.25	.48**	-.19	-.11	.50**	-.39*	-.28	.15	-.13	-.12	1
	N	25	25	25	25	25	25	25	25	25	15	

Corr=correlation; N=sample size
†p<0.1; *p<0.05; **p<0.01

1.9 Hypotheses Testing

To examine hypotheses 1-4, multiple regression analyses were performed, which included the independent and the control variables (see Table 3). Due to the limited size of the sample at the unit-level (26 wards), only the control variables that were considered most significant, based on previous examinations, were chosen for each regression: i.e. the size of the ward when the dependent variable was the number of adverse events, and the tenure of the head nurse when the dependent variable was one of the safety climate dimensions.

Table 3 (model 1) shows a significant effect of safety leadership on two of the three dimensions of the patient safety climate: Safety norms (B=.721, $p<0.05$) and team learning (B=.839, $p<0.001$). These findings partly support hypothesis 1, which states that the higher the level of safety leadership of the head nurse, the higher level the patient safety climate.

Table 3 (model 2) shows that the staff's degree of trust in the head nurse has no significant effect on the safety climate dimensions. Thus hypothesis 2, which states that the higher the staff's level of trust in the head nurse, the higher the climate of patient safety in the ward, was not supported.

Table 3 (model 3) shows that the head nurse's psychological empowerment has a clear effect on the climate dimension of safety-promoting communication (B=.466, $p<0.05$). An additional regression (in which 'ward size' was used as the control variable), found that the autonomy component of the empowerment dimension significantly predicts the climate dimension of team learning (B=0.44, $p<0.05$; $R2=0.22$). These findings partly support hypothesis 3, which states that the greater the head nurse's psychological empowerment, the higher the climate of patient safety in the ward.

Table 3: Predicting patient safety climate by head nurse characteristics

	Patient safety climate					
	Model 1:		Model 2:		Model 3:	
	Safety norms		Team learning[a]		Safety-promoting communication	
	(N=25)		(N=25)		(N=25)	
	R^2=.25		R^2=.73		R^2=.48	
Head nurse characteristics	Beta	Sig.	Beta	Sig.	Beta	Sig.
tenure	.123	.567	.238	.076	**.402**	**.034**
Safety leadership	**.721**	**.032**	**.839**	**.000**	.054	.839
Staff's trust	-.299	.330	.104	.568	-.189	.458
Psychological empowerment	.027	.895	.058	.630	**.466**	**.011**

[a] reported by the nurses; [b] Control variable

Hypothesis 4 claimed that the higher the climate of patient safety in the ward, the greater the patients' safety. This hypothesis was examined against both dimensions of safety levels: nurses' safety behavior as stated in self-reporting, and the number of adverse events. Table 4 (model 1) shows that, in support of hypothesis 4, the safety norms were found to be significantly predictive of the nurses' safety behavior as reported by them (B=0.731, $p<0.05$). Moreover, as seen in model 2, team learning was found to have a significant effect on the number of adverse events (B=0.349, $p<0.05$), thus supporting hypothesis 4.

To test hypothesis 5, we examined the indirect effect of the autonomy experienced by the head nurse on the number of adverse events reported in the ward, through the nursing staff's team learning, we used model 4 in SPSS PROCESS[54] with the size of the ward as a control variable. As expected, we found that autonomy has an indirect effect on the number of adverse events, through team learning (ab=-5.16, CI 95% [-12.02, -1]).

1.10 Additional Findings

Although the staff's trust of the head nurse was found to have no direct effect on the climate of patient safety, the interactions between trust and safety leadership had a distinct and significant effect on the 'safety norms' climate dimension (B=0.13, $p<0.001$). As shown in Fig. 2, when trust of the head nurse is high, the effect of the safety leadership on the safety norms is stronger than when that trust is low.

Table 4: Predicting patient safety levels[a] by patient safety climate dimensions[b]

	Patient safety levels			
	Model 1:		Model 2:	
	Nurses' safe behavior		Adverse events	
	(N=25)		(N=25)	
	R^2=.54		R^2=.48	
Patient safety climate	Beta	Sig.	Beta	Sig.
Ward size[c]			**.597**	**.005**
Workload[c]	.373	.188		
Safety-promoting communication	-.515	.112	-.222	.198
Team learning	-.172	.458	**-.349**	**.049**
Safety norms	**.731**	**.018**	.049	.793

[a] nurses' safe behaviors (nurses' self-reports) and number of adverse events; [b] Safety-promoting communication, Team learning (head nurses' self-reports), and Safety norms; [c] control variables.
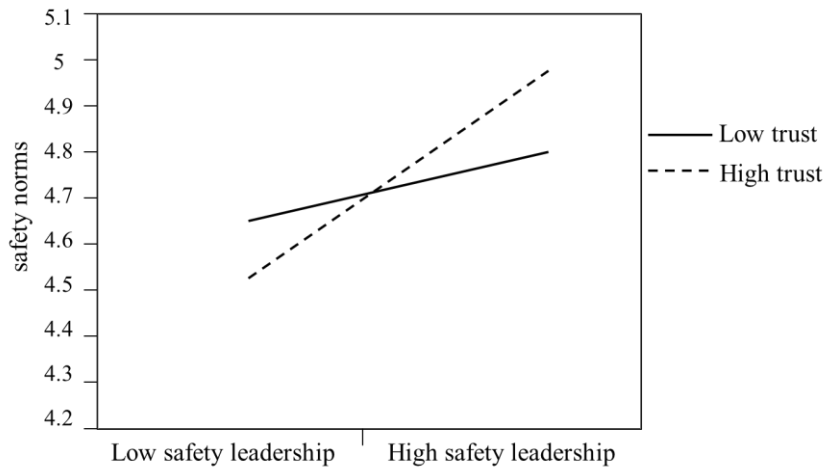

Figure 2: The Staff's trust in the head nurse intensifies the effect of safety leadership on safety norms (a dimension of patient safety climate).

Furthermore, a moderated mediation analysis found that trust worked to reinforce the indirect effect of safety leadership on the safety behavior of the nurses as reported by them, through the 'safety norms' dimension of climate (ab=0.047 CI 95% [.0143, .0801]). When trust is low (3.48) the indirect effect of safety leadership through the mediating variable 'safety norms' is weaker (ab=0.0356 CI 95% [.0070, 0.0836]) than when the level of trust is average (4.25) or high (5.0): (ab=0.0670 CI 95% [0.0220, 0.1288]) and (ab=0.0975 CI 95% [0.0343, 0.1827])] respectively. For examination of this moderated mediation model, the PROCESS model 7 was used [54] with the head nurse's tenure and her psychological empowerment acting as control variables. This model was examined at the individual level of analysis (N=274) and not at the ward level. It should be noted that the dependent variable (the safety behavior of the nurses as reported by them) is suitable for examination at the individual level.

V. Discussion

The study examined the effects of characteristics of the head nurse on the level of patient safety in the ward as mediated by the patient safety climate. The hypotheses were partially supported, as different characteristics of the head nurse predicted different climate dimensions, which in turn partly predicted the levels of safety in the ward. The climate dimensions of safety norms and team learning mediated the association between characteristics of the head nurse (safety leadership and perceived autonomy) and the safety levels as measured by safety behaviors and by the number of adverse events in the ward, respectively.

The literature on patient safety frequently refers to employee empowerment (e.g. [27,26]), but less so to the empowerment of the supervisor. In light of the current study's results, it emerges that this characteristic should be referred to in future studies, as a factor that may promote a climate of patient safety. The sense of autonomy of the supervisor is important for the promotion of team learning, as it requires not only to maintain the present performance levels and to comply with the existing safety procedures, but to go one step further and try to initiate change and proactively prevent adverse events.

The head nurse's characteristic of 'staff trust' was not found to have a significant predictive value for the climate dimensions, in contrast to the findings of previous studies (e.g. [22,24]). A possible explanation concerns the type of statistical analysis that was used: while trust alone was found to have a significant positive correlation with team learning, when included as a predictor variable in the regression equation alongside other predictor variables, its contribution to the prediction of climate dimensions was no longer significant. However, it was found that staff trust significantly strengthened the effect of safety leadership on the safety norms in the ward and on the resulted safety behaviors.

As expected, the patient safety climate predicted the level of safety in the ward; however, different dimensions of the climate predicted different aspects of the safety levels. Team learning was found to be a significant component in the improvement of treatment safety when it significantly predicted the number of adverse events reported. The mediation hypothesis also received some support, as the effect of two of the head nurse's characteristics on both indicators of safety levels were mediated by two dimensions of the climate. Firstly, the dimension of 'safety norms' mediated the effect of the head nurse safety leadership on safety

behavior as reported by the nurses. This finding may point to a process in which head nurses who employ a leadership style that supports patient safety succeed in creating norms of safe behavior in their wards. These norms shape the nurses' behavior, in that they strictly implement the patient safety procedures. This finding corresponds with those of previous studies (e.g. [19]) which highlight the importance of the head nurse in promoting patient safety by means of her influence on the nursing team, and the importance of the patient safety climate, including the creation of safety norms, in shaping the nurses' behavior.

Secondly, the head nurse's perception of team learning mediated the relationship between her sense of autonomy and the number of adverse events in the ward. This finding demonstrates the action mechanism of the supervisor's sense of autonomy in affecting the level of safety in the ward. Head nurses that experience higher levels of freedom of action and discretion in the management of the nursing staff, behave in a manner that encourages team learning, which affects the number of reported adverse events. Team learning is a proactive activity, which includes a search for ways to improve the modes of action and the incorporation of improvements in the ward, and therefore, the job autonomy is especially important for it[55].

The two mediating findings point to an interesting phenomenon, whereby the head nurse's safety leadership and autonomy drive different processes, which influence different aspects of patient safety. Whereas safety leadership, which concentrates on a constructive reward and on attaining the required level of performance (but not beyond it), promotes behavior norms that lead to a self-perception of safe behavior, the head nurse's autonomy encourages team learning (tied in with continuing improvement), which reduces the number of reported adverse events.

VI. Conclusion

The health system's aspiration to provide quality treatment to the public necessitates the improvement of the safety levels in hospitals[2]. A considerable decline in the number of treatment errors requires the creation of an organizational climate that emphasizes patient safety as an integral part of the work routine. The findings of this study, which show that safety is influenced by the climate in the wards, which in turn is influenced by the characteristics of the ward's head nurse, underscore the need of adopting a systematic approach for the improvement of patient safety, and the role of the ward's head nurse in promoting it. It should be noted that although the study uses data from multiple resources, some of the results are subject to common source bias.

The findings propose that team learning is an important dimension of patient safety climate and therefore it must be encouraged and developed among nursing teams. This process has been noted in many studies as contributing to the improvement of a team's overall performance in general (e.g. [56,57]) and in health organizations in particular (e.g. [40,41,58]). This study suggests that team learning contributes to a reduction in the number of adverse events.

Additionally, it is essential to establish norms of behavior that emphasize compliance with safety procedures such as maintaining hygiene, preventing falls and caring for the patient, because the nurses' behavior is greatly influenced by these norms. Therefore, it is recommended to train head nurses to have a safety-promoting style of leadership; that is, encouraging, praising and rewarding those behaviors which contribute to the patient safety, to update the team on safety procedures, to guide the nurses on how to implement the procedures and to ensure they are being implemented. Furthermore, the head nurses must be made aware that behaviors that earn them the nurses' trust (fair treatment of the nurses, keeping promises, behavior that suits the declared values and matches what is asked of the nurses), will strengthen the influence of such leadership on the creation of safety norms.

The findings of the study show, however, that safety leadership in itself is not enough to reduce the number of adverse events. In order to achieve that, the head nurses' sense of autonomy must be strengthened; namely to work towards increasing their independence and freedom of action in their position, and hence to encourage them to facilitate team learning in their wards.

Finally, although the climate dimension of 'safety-promoting communication' in this study was not found to be predictive of safety levels, it is likely that it does, in fact, have a tangible contribution to patient safety. Behaviors that represent safety-promoting communication (i.e. being assertive with a physician when presented with unclear instructions, or pointing out another nurse's unsafe behavior to her) may significantly contribute to the prevention of safety hazards. Since the extent to which the head nurse feels psychologically empowered was found to be predictive of safety-promoting communication, the reinforcement of this overall experience among the head nurses is of great importance. Consequently, in addition to reinforcing their sense of autonomy, it is recommended to foster the sense of meaning in their position, the sense of having an impact on what is happening in the hospital, and their sense of competence in successfully performing their jobs.

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