THE IMPACT OF NURSING SAFETY CLIMATE ON REPORTING PATIENT SAFETY EVENTS IN SOME EGYPTIAN NURSING UNITS

Nagah Abd El-fattah Mohamed Aly
Nursing Administration Department, Faculty of Nursing,
Alexandria University – Matrouh Branch, Egypt

Abstract

Background: Although, the reporting of events has been the first priority and has received most attention in health care, many events are underreported for some reasons. So, implementing appropriate safety climate is necessary for managing reporting of events.

Objectives: The main objective of this study is to examinethe impact of nursing safety climate on reporting patient safety events

Methods: A cross-sectional descriptive correlational design amongst 314 nurses was used in this study. Also, two adopted and three developed instruments were used.

Results: Valid and reliable instruments were used to assess nursing safety climate and barriers to report events. Underreporting of events among nurses was related to some barriers. There was a significant negative correlation between reporting climate barrier and nurses' attitude towards the models of reporting events. Also, there was a significant positive correlation between reporting process dimension and barriers towards nurses' attitudes to reporting events.

Conclusion: Two developed instruments could only be generalized in Egyptian nursing units. Reporting rates and attitudes can be greatly enhanced by overcoming the barriers to reporting events and improving nursing safety climate.

Keywords: Safety, Climate, Reporting, Patient, Events

Introduction

Patient safety programs are a system of reporting patient safety events which is aimed at identifying serious events shortly after they occur (Stanhope et al. 1999). Reporting of patient safety events have become an important data collection tool and an essential activity for improving patient safety in healthcare (Elder et al. 2007). Fast reporting of patient safety

events means that emergency measures can be taken, undesirable complications can be prevented, and consequently protecting patient from harm (Spencer et al. 1983, Williams et al. 1996). Despite its strengths, many events are not reported. This could be because of omitted medical records, lack of recognition, fears that staff would be blamed and punished, worry about litigation and disciplinary actions, high workload, attitudes to reporting events, and the belief that reporting can be harmful to the reporter or his /her colleagues and that it will not improve the quality of care but rather be judged negatively (Singer 2009, Elder et al. 2007, Evans et al 2006, Firth-Cozens 2002, Vincent 1999).

Improving reporting of patient safety events has been successfully done through appropriate implementation of safety climate including leadership, organizational structural characteristics, work design, group behavior, and quality emphasis (Hughes 2005). Safety climate is a subset of safety culture and refers to staff attitudes about patient safety within the organization. Measuring safety climate is important because the climate of an organization and the attitudes of teams have been found to influence patient safety outcomes. These measures can be used to monitor change over time and to implement intervention programs aimed at improving patient safety.It may be easier to measure safety climate than to measure safety culture (ASHP 1993, Stone et al. 2006). Several safety climate instruments have been developed for measuring safety climate in health care (Health Foundation 2011 , Flin et al . 2006 , Flin et al 2000), whereas two safety climate instruments have been developed for exploring safety climate related to medication safety on patient care units (Blegon 2005, Chinag 2005).Two hospital unit safety climate instruments have limitations related to generalization. In the first instrument, the safety climate scale was created for use in the national study hospitals which participated in the study. Though, it needed further reliability and validity testing (Blegan 2005). For the second instrument, it could not be generalized for other health care institutions because the instrument did not achieve cronbach's alpha coefficient of .70 for internal consistency (Chinag 2005). Therefore, it is a pressing necessity to start an action for developing nursing safety climate to assess safety climate in nursing units of Egyptian hospitals.

Based on our knowledge, the two studies only examined relationships between safety climate and barriers to reporting medication administration errors (MAEs) in some Egyptian hospitals (El Din et al. 2013, Abou Hashish et al 2013). However, no previous studies of safety climate and its connection to barriers of and attitudes to reporting patient safety events have been conducted in Egypt.

The aims of this study were

To develop a safety climate scale, a frequency of events reported scale and, barriers of reporting patient safety events questionnaire.

To describe nursing safety climate, frequency of events reported, and nurses' perceived barriers to reporting patient safety events in some Egyptian nursing units;

To identify patterns of reporting patient safety events among nurses, including attitudes and preferred models of reporting patient safety events;

To investigate the relationship between barriers to reporting patient safety events and patterns of reporting patient safety events among nurses; and

To examine the impact of nursing safety climate on nurses' attitudes towards reporting of events and perceived barriers to reporting patient safety events in nursing units.

Material and Methods

Study Design, Setting and Sampling: The study adopted a cross-sectional questionnaire based on descriptive correlational design amongst 314 nurses working in in-patient medical and surgical wards of the Main University Hospital.

Data Collection Process*:* The researcher developed three tools and adopted two tools to collect data in this study.

<u>**The adopted tools**</u> were developed by Andersen et al. (2002) and involved:

1*) **Nurses' attitudes towards reporting patient safety events,*** enclosed attitudes and reactions of nurses in terms of reporting self-made mistakes. For instance, when a patient has suffered from a nurse's mistake, would his or her response be to keep it to his or herself, talk in confidence with a colleague, talk to several colleagues, write in the patient's case-record, inform her/ his superior, inform the physician or report to the local reporting system? The nurses were asked to describe their possible actions and attitudes when patient safety events occur. They were also asked to indicate their response by marking on a five point scale which ranged from 1 for "do not know" to 5 for "definitely yes".

*2) **Models of reporting system*** contained anonymous, confidential and conditionally confidential models. Anonymous model means that name and identity remains unknown to everybody, while confidential model indicates that the recipient knows the identity of the reporter and may not transmit this to others. In the same vein, conditionally confidential means that the recipient knows the identity of the reporter and will transmit this to regulators only in the event of a violation of criminal law (Andersen et al. 2002). The nurses were asked to indicate which of the three models of reporting system they preferred and to simply state their choice of model by

113

using a four point scale (1 = not at all acceptable and 4 = highly acceptable).

The developed tools included:

    A) Afrequency of events reported scale which was designed by the researcher and based on Quality Indicators sensitive to the nursing staff (Savitz et al .2014 , Millar et al 2004 , Pichert et al 2008) was used to describe reporting rates of ten patient safety events. The ten patient safety events were: 1) patient injury related to falls ; 2) decubitus / pressure ulcer; 3) medication administration errors (MAEs) such as omission errors and commission errors (wrong patient, wrong drug, wrong route, wrong time, wrong dose and wrong administration); 4) blood transfusion errors (wrong amount, wrong transfusion technique, wrong time, wrong blood type); 5) unexpected complications of MAEs; 6) blood transfusion reactions; 7) hospital acquired infections, including urinary tract infection, central line catheter associated with blood stream infection, ventilator associated pneumonia and surgical wound infection; 8) restraint related injuries; 9) equipment fault resulting in patient harm; and 10) patient complaints. To measure frequency of reporting events among nurses, the nurses were asked to rate the frequency of reporting the above ten patient safety events which represents nursing sensitive quality indicators. Each event provided on a Likert-type, 5 point scale going from 1= never to 5 = always.

    B) Barriers of reporting patient safety events questionnaire was also developed by the researcher and is based on a literature review (Elder et al. 2007, Vincent 1999,Andersen et al 2002, Evans et al. 2007, Kostopoulou et al. 2007 , Blegen et al. 2004 , Uribe et al. 2002 , Kim et al. 2006) for identifying barriers that hinder nurses' willingness to report patient safety events.

    C) Nursing safety climate dimensions were developed by the researcher and is based on a literature review (AHRQ 2004 , Sexton et al. 2006 , Parker et al. 2010 , Wakefield et al. 1999) for describing safety climate in nursing unit. The nurses were asked to indicate their agreement and disagreement on barriers to reporting patient safety events and nursing safety climate statements by marking on a 5 point, Likert-scale (1= strongly disagree to 5 = strongly agree).

    The face and content validity of the questionnaire were evaluated by five Egyptian experts. Based on the recommendations of these experts, the questionnaire was modified. Some of the alternatives suggested by the experts included removing a small number of questionnaire items and making minor changes to some sentences. Inter-rater reliability was assessed using Kendall's test which resulted in a coefficient of r=0.89 for safety climate, r=0.82 for barriers to reporting patient safety events and r = 0.75 for frequency of events reported. The final questionnaire consisted of three

parts namely, part i: frequency of events reported and patterns of reporting patient safety questionnaire which included attitudes towards reporting events and preferred models of reporting; part ii: barriers to reporting patient safety events; and part iii: nursing safety climate dimensions. The questionnaire was translated into Arabic and back translated into English.A pilot study was carried out to evaluate the test–re-test reliability using a sample of nurses. Approximately 3 weeks later, the same nurses completed the same questionnaireat the end of the class period. The correlation (Pearson's r) of scores from time 1 to time 2 was used to assess test-re-test reliability. 20 participants completed the survey at both time 1 and time 2. The correlation between test and the retest was 0.86.

The researcher met with nurses to describe the study, answer the questions and clarify questionnaire items. A total of 394 questionnaire copies were distributed, 344 were returned of which 314 were suitable for statistical analysis. Response rate was 79.7%. To measure construct validity, 71 nursing safety climate items and 25 barriers to reporting patient safety events were exposed to factor analysis based oncomponent analysis with varimax rotation method and an Eigen value of more than one. This analysis resulted in 44 nursing safety climate items which were extracted into 8 dimensions, and 18 barrier items which were extracted into 6 factors. These dimensions and factors were labeled by interpretation from highly loaded items and termed in accordance with their meaning. The 44 nursing safety climate items, covering 8 dimensions, were head nurse's role (8 items), nursing management's role (3 items), physician's role (5 items), peer relationship (4 items), quality efforts (11 items), blame free and non–punitive culture (5 items), reporting process (3 items) and working climate (5 items). While, the 18 barriers, measuring 6 aspects of obstacles, were blaming culture (3 reasons), management's response (4 reasons), awareness (3 reasons), fear (3 reasons), reporting climate (2 reasons) and burden efforts (3 reasons). The Kaiser-Meyer-Olkin value (KMO value) and Bartlett's Test were also estimated for two instruments and each component as well as the cronbach's alpha was used to measure inter-item consistency reliability. The reliability coefficient was 0.88 for nursing safety climate scale, 0.79 for barriers questionnaire and 0.67 for frequency of events reported scale. These data were analyzed by the Statistical Package for Social Sciences (SPSS) version 15.
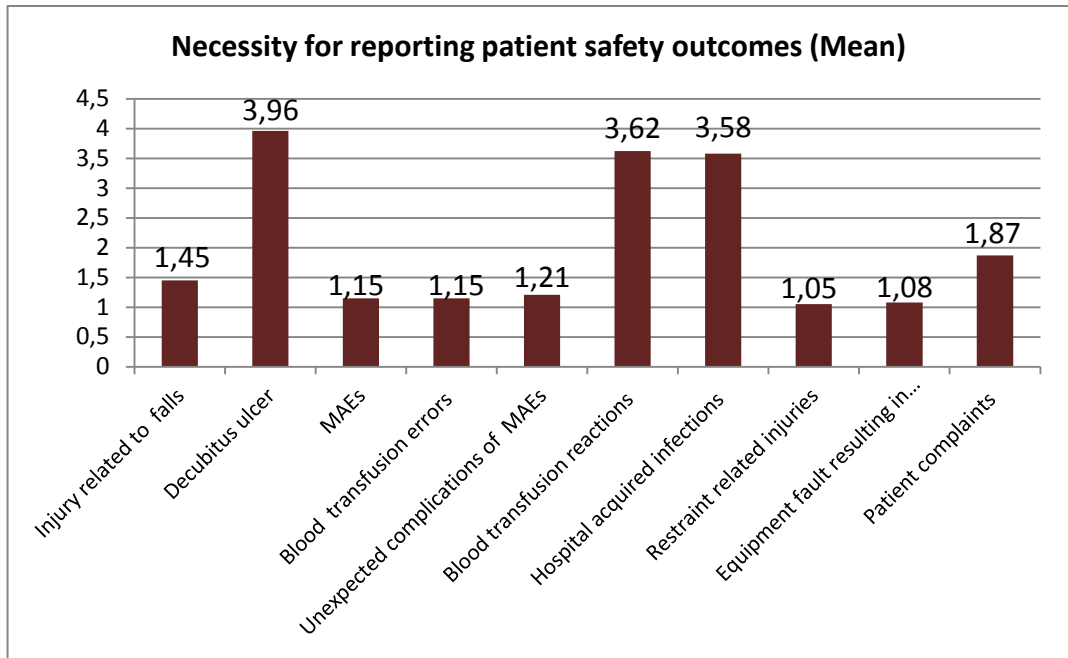
Results

Figure 1: Nursing staff perceptions on frequency of reporting patient safety events

Table (1): Factor analysis of barriers to reporting patient safety events based on Principal Component Analysis with Varimax Rotation Method

Barriers to reporting patient safety events	Factors					
	1	2	3	4	5	6
(9) Fear of being blamed for patient safety events	.810					
(18) Fear of being reprimanded	.805					
(25) Persistence of the culture of blame/shame	.830					
(7) Response of management to the outcome of patient safety events often make reporting unnecessary		.779				
(8) Reporting of patient safety events makes little contribution to the quality of care		.698				
(22) Extra work involved in reporting		.708				
(24) Fear of appearing as an incompetent nurse		.808				
(6) Not knowing which event to report			.888			
(17) Fear of patients developing a negative attitude			.817			
(20) Unaware of the occurrence of a patient safety event			.594			
(1) Fear of disciplinary action for future employment or career				.889		
(2) Fear of litigation				.599		
(15) Fear of getting into trouble				.718		
(4) Not knowing who is responsible for precipitating a patient safety event					.550	
(13) Fear of un-anonymous reportage					.838	
(2) Nurses are too busy that they forget to make a report						.720
(5) My colleagues may be supportive						.659
(10) Lack of feedback on reported errors in the past						.553

Note: Factor loading > 0.50-Eigen value > 1.

Table (2): Factor analysis of nursing safety climate scale based on Principal Component Analysis with Varimax Rotation Method

Safety climate scale	Factors							
	1	2	3	4	5	6	7	8
(20) My head nurse seriously considers staff suggestions for improving patient safety	.979							
(27) In this unit, we discuss ways of preventing events from happening again	.911							
(40) The culture of this clinical area makes it easy to learn from the mistakes of others	.925							
(41) Patient safety events are handled appropriately in this clinical area	.926							
(42) The senior leaders in my nursing unit listen to me and care about my concerns	.974							
(49) I received appropriate feedback about my performance	.967							
(44) My head nurse is driving use to be a safety centered institution	.984							
(59) My head nurse consults with the nursing staff on daily problems they encounter when following safety practices	.998							
(29) My nurse manager provides a work climate that promotes patient safety		.926						
(36) The actions of my nurse manager show that patient safety is a top priority		.913						
(60) Nursing management support event reporting		.928						
(61)Physicians in this unit listen to me and respond to reporting events			.628					
(62)Physicians and nurses have a good working relation			.611					
(63)A lot of team work exists between nurses and physicians			.609					
(64)The physicians in this unit reinforce patient safety as a top priority			.549					
(65)Physicians in this unit have an understanding of the systems' components causing errors			.564					
(1) People support one another in this unit				.946				
(3) When a lot of work needs to be done quickly, we work together as a team to get the work done				.945				
(4) In this unit, people treat each other with respect				933		.		
(47) I am encouraged by my colleagues to report patient safety events				.965				
(5) Staff in this unit work longer hours such as is best for patient care					.975			
(6) We are actively doing things to improve patient safety					.952			
(13) After we make changes to improve patient safety, we evaluate their effectiveness					.976			
(18) Our procedures and systems are good at preventing errors from happening					.973			

117

(25) We are informed about events that happen in this unit				.942			
(55) I believe that most events occur as a result of multiple system failure and hence, are not attributable to one individual's actions				.905			
(57) Personnel frequently follow rules or guidelines that are established for this clinical area				.950			
(56) The personnel in this clinical area take responsibility for patient safety				.990			
(67) In this hospital, there is an quality improvement program concerning patient safety				.906			
(68) My head nurse rewards nurses who report events				.918			
(71) The nurse manager uses reporting to identify patient safety events				.986			
(8) Mistakes have led to positive changes here					.933		
(10) It is just by chance that more serious mistakes do not happen around here					.946		
(16) Nursingstaff worry that mistakes they make are kept in their personnel file			.		.998		
(24) Nurses will freely speak up if they see something that may negatively affect patient care					.974		
(28) Nursing staff are afraid to ask questions when something does not seem right					.929		
(12) The case of when an event is reported, and it feels like the person is being written up, is not the problem						965	
(23) We are given feedback about changes put into place based on event reports						.946	
(48) I know the proper channels to direct questions regarding patient safety						.987	
(2) We have enough staff to handle the workload							891
(33) Important patient care information is often maintain during shift changes							840
(53) I am satisfied with the availability of my head nurse							.891
(69) The presence of adequate support services in this unit allows me to spend more time with my patients							.888
(70) Nurses have opportunities to discuss patient safety problems with colleagues							.840

Note: Factor loading > 0.50-Eigen value > 1.

Table (3): Mean scores of nurses' perceptions on nursing safety climate and barriers to reporting patient safety events and its construct validity and inter-item consistency reliability for each instrument.

Components	Mean scores of nurses' perceptions	Rank	Construct validity			KMO (Bartlett's Test) for each component	KMO (Bartlett 's Test) for all items	Cronbach's Alpha	Cronbach's Alpha for all items
			Initial Eigen values						
			Eigen value	% of Variance	Cumulative %				
Barriers			6.754	27.016	27.016	.61(.000)		.68	
Blaming culture	4.63	3	2.966	11.863	38.879	.65(.000)		.69	
Management response	4.69	2	2.762	11.046	49.925	.58(.000)		.67	
Awareness	3.58	6	2.291	9.163	59.088	.64(.000)		.77	
Fear	4.72	1	1.462	5.849	64.937	.50(.000)	.70(.000)	.79	**.79**
Reporting climate	4.42	4	1.274	5.098	70.035	.62(.000)		.60	
Burden efforts	3.73	5	6.754	27.016	27.016	.61(.000)		.68	
Safety climate dimension Head nurse role	4.17	7	11.478	23.424	23.424	.71(.000)		.79	
Nursing management role	4.55	2	8.499	17.345	40.769	.55(.000)		.77	
Physician's role	4.34	5	4.702	9.596	50.365	.61(.000)		.84	
Peer relationships	3.63	8	4.356	8.890	59.255	.69(.000)		.83	
Quality efforts	4.39	4	3.289	6.713	65.968	.70(.000)		.78	**.88**
Blame free & Non-punitive culture	4.65	1	2.663	5.434	71.402	.68(.000)	**.64 (.000)**	.81	
Reporting process	4.41	3	2.555	5.213	76.616	.50(.000)		.81	
Working climate	4.28	6	2.104	4.295	80.910	.58(.000)		.80	

119

Table 4: Mean score of attitudes to reporting events and preferred models of reporting among nurses and their connection with perceived barriers in reporting patient safety events.

Attitudes & reporting Models	Mean scores of nurses' perceptions	Blaming culture	Management response	Awareness	Fear	Reporting climate	Burden effort
Attitude							
Keep it to myself	3.85	.121(*)	.252(**)	.205(**)	.509(**)	-.147(**)	.036
Talk in confidence with a colleague	4.29	.180(**)	.249(**)	.212(**)	.515(**)	-.147(**)	-.038
Talk to several colleagues	3.71	.157(**)	.214(**)	.180(**)	.526(**)	-.145(*)	.007
Write in the patient's case-record	2.24	-.021	.096	.106	-.379(**)	-.141(*)	.097
Inform my superior	2.73	-.031	.103	.112(*)	-.405(**)	-.169(**)	.096
Inform the physician	2.44	.019	.130(*)	.136(*)	-.409(**)	-.136(*)	.108
Report to the local reporting system	1.37	-.031	-.010	.003	-.320(**)	-.127(*)	.056
Reporting models							
1. Anonymous	3.62	.247(**)	.317(**)	.266(**)	.460(**)	-.087	-.026
2. Confidential	3.36	.166(**)	.243(**)	.211(**)	.506(**)	-.155(**)	-.034
3. Conditionally confidential	1.15	-.019	- .114(*)	.080	-.366(**)	-.116(*)	.102

** Spearman's rho Correlation is significant at the 0.01 level (2-tailed).
 * Spearman's rho Correlation is significant at the 0.05 level (2-tailed).

Table (5): Nursing safety climate dimensions and its connection with attitudes towards reporting events and perceived barriers to reporting patient safety events.

Attitudes towards & barriers to reporting patient safety events	Head nurse role	Nursing management role	Physician role	Peer relations	Quality efforts	Blame free &Non punitive culture	Reporting process	Working climate
Attitude Keep it to myself	- .141(*)	-.125(*)	-.007	.044	-.162(**)	-.345(**)	.342(**)	-.120(*)
Talk in confidence with a colleague	-.113(*)	-.117(*)	.046	.038	-.159(**)	-.327(**)	.340(**)	-.121(*)
Talk to several colleagues	-.160(**)	-.111(*)	-.027	.067	-.142(*)	-.347(**)	.361(**)	-.107(*)
Write in the patient's case-record	.162(**)	.010	-.092	.105	.009	.212(**)	.290(**)	.029
Inform my superior	.186(**)	.136(*)	-.079	.005	.012	.229(**)	.036	.267(**)
Inform the physician	-.096	-.016	.156(**)	.103	-.013	.213(**)	.269(**)	-.003
Report to the local reporting system	.199(**)	.042	-.081	.145(*)	.073	.186(**)	.297(**)	.082
Barriers to reporting events	-.186(**)	-.223(**)	-.152(**)	.677(**)	-.188(**)	-.284(**)	.592(**)	-.143(**)

** Pearson Correlation for barriers to reporting events &Spearman's rho correlation aresignificant at the 0.01 level (2-tailed).
* Pearson Correlation for barriers to reporting events &Spearman's rho correlation aresignificant at the 0.05 level (2-tailed).

  Figure 1 demonstratesthe nursing staff's perceptions on the frequency of reporting patient safety events. The greater portion of nurses never reported restraint related injuries and equipment fault resulting in patient harm. They rarely reported MAEs, blood transfusion errors and unexpected complications of MAEs when they occurred. Most of the time, they reported decubitus / pressure ulcer, blood transfusion reactions and hospital acquired infections.

  Table 1 showsfactor analysis of barriers to reporting patient safety events based on Principal component analysis with Varimax Rotation Method. It is clear from the table that barriers to reporting patient safety items were subjected to factor analysis and principle component analysis based on Varimax Rotation Method. The analysis resulted in 18 barriers and 6 loaded factors which ranged from 0.553 to 0.889.

  Table 2 presentsfactor analysis of nursing safety climate scale based on Principal Component Analysis with Varimax Rotation Method. The nursing safety climate items were subjected to factor analysis and principle component analysis based on Varimax Rotation Method. The analysis resulted in 44 items and 8 loaded dimensions which ranged from 0.549 to 0.998.

  Table 3 illustrates mean scores of nurses' perceptions on nursing safety climate and barriers to reporting patient safety events and its construct validity and inter-item consistency reliability for each instrument. It is clear from the table that factors analysis extracted 6 factors from barriers questionnaire with a total 70.035% of variance. The KMO value for the entire questionnaire   was (.70) and ranged from .50 to 0.65 with a statistical significant Bartlett's Test of p = 0.000 for 6 factors. Inter-item consistency reliability for whole tool was .79 and ranged from .60 to .79 for 6 factors. The analysis also extracted 8 dimensions from nursing safety climate scale with a total of 80.91% variance. The KMO value for the entire scale was .64 and ranged from .50 to .71 with a statistical significant Bartlett's Test of 0.000 for all dimensions. Cronbach's Alpha for whole scale was .88 and ranged from .79 to .84 for 8 dimensions.

  According to nurses' perceived barriers to reporting events, the highest mean scores for barriers scale were fear (4.72), management's response (4.69) and blaming culture (4.63).Whereas, the lowest mean scores for these barriers were burden efforts (3.73) and awareness (3.58). In this table, according to nurses' perception on nursing safety climate dimensions, the highest mean scores for nursing safety climate scale were blaming free and non-punitive culture (4.65) and nursing management role (4.55). Whereas, the lowest mean score for nursing safety climate scale was peer relations (3.63).

Table 4 shows mean score for attitudes to reporting events and preferred models of reporting among nurses and their connection with perceived barriers to reporting patient safety events. The majority of nurses were probably eager to keep their mistakes to themselves as well as to discuss them in confidence with a colleague or several colleagues. In the same vein, they were definitely not eager in reporting their mistakes to doctors nor write them in the patient's record. In addition, a great numbers of nurses were not probably willing to report mistakes to supervisor.

According to the nurses' point of views regarding the models of reporting systems**,** anonymous model was highly acceptable while confidentially model was somewhat acceptable. Likewise, all conditionally model was not acceptable among the nurses. However, it is clear from the table that there was a mild significant positive correlation between the four barriers of reporting events, three nurses' attitudes towards reporting of events and preferred anonymous and confidential models. At the same time, there was also a mild significant negative correlation between reporting climate barrier, nurses' attitude towards reporting events and preferred models of reporting. .

Table 5 presents nursing safety climate dimensions and its relation with attitudes towards reporting events and perceived barriers in reporting patient safety events**.** There was a mild significant negative correlation between five nursing safety climate dimensions and barriers of reporting patient safety events, while there was a moderate significant positive correlation with reporting process, peer relations dimensions and barriers to reporting events. On the other hand, there was a mild significant negative correlation between 5 nursing safety climate dimensions and three nurses' attitudes towards reporting of events. Also, there was a mild significant positive correlation between reporting process dimension and nurses' attitudes to reporting events.

Discussion

To investigate the impact of nursing safety climate on reporting patient safety events, the researcher develop safety climate dimensions related to nursing units and barriers of reporting patient safety events. These instruments must be reliable and valid in several aspects. Factor analysis has been made in an attempt to test the construct validity of each instrument. The high factor loading of safety scales indicated the suitability of 44 items to be included into 8 dimensions: head nurse role, nursing management role, physician role, peer relations, quality efforts, blaming free and non –punitive culture, reporting process and working climate (**Table 2 and 3**)**.** Though, there are a lack of consensus on the key dimensions and sub-constructs for assessing safety climate (Health Foundation 2011 , Flin et al. 2006 , Flin et

al 2000) , the Egyptian nursing safety climate dimensions are similar to but not identical to the hospital unit safety climate dimensions related to medication safety which were designed by Blegen (2005) and Chinag (2005).

The results also showed that 18 barriers of reporting patient safety events were highly loaded into 6 factors. These factors were blaming culture, management response, awareness, fear, reporting climate and burden efforts (**Table 1 and 3**). The barriers items that emerged from this study were confirmed by many researches on reporting adverse events (Elder et al. 2007, Vincent 1999, Andersen et al. 2002, Kostopoulou et al 2007). Moreover, the study revealed that the number of the principle component of two instruments were retained based on the Kaiser`s criterion (Kaiser 1974). It can be explained by the eight dimensions of nursing safety climate which accounted for 80.910% of variance. In addition, six factors of barriers to the reporting of patient safety events accounted for 70 .035 % of variance. However, this was with a statistical significant of Bartlett's Test, and the Eigen value was more than one (**Table 3**). On the other hand, KMO value of the whole two instruments and all factors were within acceptable range (**Table 3**) as recommended by Kaiser, (1974). KMO value of Egyptian nursing safety climate instrument (.64) is different from KMO value of the Chinese version of safety climate scale (.84) (Chinag 2005). The differences between the KMO values of two safety climate scales may be due to the fact that sample size in Taiwan study was 597 nurses while that of Egyptian study was 314 nurses. KMO value is used to assess appropriateness of the sample for factor analysis (Kaiser 1974). The sample size in Egyptian study was adequate for proper factor analysis as published by Gaur et al. (2009). A sample size above 500 was considered to be excellent, and a sample size of 200–300 should be considered to be adequate for a proper analysis (Gaur et al. 2009). This means that these instruments could be only generalized in Egyptian nursing units due to sample size and work unit setting. Therefore, nurses' type, nursing care practice, and patients' characteristics are approximately the same in Egyptian governmental hospitals.

Inter-item consistency reliability of two instrumentswas measured through Cronbach's alpha (**Table 3**). The Cronbach's alpha of nursing safety climate scale and all dimensions was considered high, whereas the reliability of barriers to reporting events questionnaire and all factors was within an acceptable and satisfactory range according to Wallston (2005) and Polit et al. (2010) . In addition, modest reliability ranged from 0.60 to 0.75 and was acceptable in the research. Also, the reliability coefficient higher than 0.70 are often considered satisfactory (Wallston 2005, Polit et al. 2010).Furthermore, Cronbach's alpha of Egyptian nursing safety climate scale (.879) is greater than Blegen version (bigger than .65) and the Chinese

version of safety climate (.60) (Blegan 2005 , Chinag 2005). It is clear that nurses' perceptions of nursing safety climate and barriers to report patient safety events in this study were measured completely.

The results of the current study found that there was an extensive variation in reporting ten patient safety events which considered sensitive indicators to nursing care (**Figure 1**). This variation can result to confusion among nurses regarding what should be reported, as nurses simply do not know which events should be reported .In addition, there was no clear definition of events, thus list of events should be reported. The shortcoming of patient safety programs in the study units can also be represented by lack of disseminated incident reporting policies and procedures and lack of in-service training programs to nursing staff. These results are in accordance with a study in two London obstetric units in UK (Vincent 1999). These findings were also demonstrated by a moderate and mild significant positive correlation between reporting process and barriers to reporting patient safety events and nurses' attitude to keep mistakes to themselves and talk in confidence with a colleague or several colleagues   respectively. In addition , there was a mild significant negative correlation between reporting barrier and nurses' attitudes to keep mistakes to oneself and talk about their mistakes in confidence with a colleague or several colleagues, preferably using confidential and conditional model (**Table 4 and 5**).

The study also revealed that pressure ulcer, hospital acquired infections and blood transfusions were highly reported by nurses because these conditions are highly noticed by a broad range of hospital personnel (**Figure1**). However, majority of nurses knew that pressure ulcer and hospital acquired infections might be present on admission. These results confirm those found in two studies by Bahl et al (2008) and Glance, et al. (2008). They argued that patient safety indicators rate might include false positive cases. Therefore, this may be due to large percentage of the decubitus ulcer and infections due to medical care present at the time of admission to the hospital. Moreover, the nurses may believe that causes of blood transfusion reactions can be related to blood group incompatibility and not related to nursing care during transfusion such as increasing patient body temperature and administering medications. Aly etal (2009) in her research observed that nurses usually stop blood transfusion, administer the medication and then resume the transfusion. Consequently, drugs should never be added to blood or blood products (plasma, platelets concentrate) (Bader 1988, Ibrahim 1990, Wetlerneck et al 2011).   This could be explained by what Gibson (1989) said that "nurses are sometimes unaware of their mistakes".

The Harvard Medical Practice reported that there was a general reluctance of nurse to report errors (Carthey 2002 , Ridge et al. 1995) . The

present study found that there were low rates of reporting MAEs, unexpected complications of MAEs, blood transfusion errors, restrained related injuries, injuries related to falls, equipment fault resulting in patient harm and patient complaints (**Figure 1**). These finding are congruent with Cullen et al (1995)who argued that 6% of adverse events that occurred were actually identified. Underreporting between nurses in these units can be explained by the fact that these conditions are not greatly observed. Thus, they are not easily discovered by variety of hospital personnel. Underreporting also occurs due to fear of interpersonal reactions of physicians, supervisors and patients. Nurses in the study hospital said that they did not disclose any mistake to family members because they worried about their action if any harm would occur to the patient as the nurse would usually be held responsible even if she was not the one who did the harm. Also, she /he will be considered as an incompetent nurse, would get into trouble and litigation and finally loses his /her job. Besides, the nursing staff feels less supported by their colleagues. Thus, when nurse makes mistakes,they still feels threatened from reporting their mistakes to supervisors and physicians (**Table1 and 3**). Supervisors in this study adopted the culture of blaming and punishing nurse as the cause of the events. Nurses would be more willing to report events if they were supported by their co-workers and supervisors (Adboullah 2010). Thus, these findings can be verified by a moderate significant positive correlation between barriers to reporting events and peer relations dimension (**Table 5**).

Consequently, fear of reporting events among nurses has increased (**Table1 and 3**).Hence, the nurses in this study preferred anonymous reporting (**Table 4**). Punishing an individual does not prevent the next person from making the same mistake. Nevertheless, error prevention therefore requires systems improvement, and not people improvement (Leap 1998, Leap 1994).Fletcher 1997 has suggested that individualswho report their own errors should be thanked rather than blamed. The results of the present study are in vein with the studies from 1999 to 2004 in several countries (Vincent1999, Singer 2009, Firth-Cozens 2002). Although, measuring the frequency of events and implementing interventions are effective in improving patient safety, the supervisors at the study units do not identify underlying causes of events. This is used for preventing reoccurrence, changing of nursing practice and educating nursing staff. At the same time, there was an imbalance between head nurse's response and severity of events making. The majority of nurses felt that when nurses reports events to their head nurse, nothing would be done and no feedback on what action to be taken would be gotten. This finding is different from what Leape LL (1994) hasstated, as most mistakes do not resultfrom carelessness. They are caused by faulty systems and processes that `set us up' to make errors. Event reports

should not be used for punitive purposes but to achieve correction or change. Information gained from event reports should serve as an effective man-agement and educational tool in staff development or if necessary, modification of job functions (Itoh et al . 2011, Colla et al. 2005).

Consequently, others reasons that might contribute to underreporting of patient safety events among nurses were misconception regarding the importance of reporting events. The nurses in the study units thought that events are not important enough to be reported. Thus, reporting events cannot provide any benefit for them and their patients. Reporting contributes to a little improvement in the quality of nursing care, considers extra paper work, and leads to an increase in nurses' workload. Increasing nurse to patient ratio especially in the night and evening shifts can lead nurses to forget reporting of events **(Table 1 and 3).** These findings are explained by a mild significant negative correlation between work climate dimension and nurses' attitude to keep mistakes to themselves and talk about events in confident to colleague and several colleagues. The results of this present study is similar to that reported by Vincent et al (1999) and with the study in six South Australian hospitals from 2001 to 2003 (Elder et al 2007).

It is evident from this present study that these reasons whether personal or organizational, may have a direct effect on nurses' attitudes towards reporting of events. The majority of nurses in the hospital tends to keep their mistakes to oneself and to discuss the mistakes in confidence with a colleague or several colleagues. They were not willing to report their mistakes to their supervisors and doctors and write them in patient records. These can be proven by the nurses in this study as they have highly preferred anonymous model rather than confidentially and conditionally model **(Table 4)**. The disadvantage of anonymous reporting is loss of information, especially information about causes (Isaacc et al. 2002, Shorrock et al 2002). The nurses also preferred confidential model where nurses and wards names were kept confidential and events involving serious harm were reported to supervisor. Also, the supervisor should not release information to physician and nurse manager under certain circumstance. These findings are also incongruent with Andersen HB study in 2002.

Finally, the present study has illustrated that reporting rates and nurses' attitude towards reporting might be greatly enhanced by breaking down the barriers of reporting events and improving head nurse role, nursing management role , physician role and adopting blame free and non-punitive culture . These findings show the intense need to continue the effort of improving nursing safety climate regarding reporting process and peer relations (**Table 3 and 5**). However, these findings are generally similar to two studies conducted in UK in 1998 and 1999 (Stanhope et al 1999, Vincent 1999).

Conclusion

The study developed valid and reliable nursing safety climate dimensions and barriers to reporting patient safety events scale for assessing safety climate and barriers to reporting patient safety events in nursing units. The two instruments were convenient for use and could only be generalized in Egyptian nursing units.

The present study also draws attention to the presence of an extensive variation in reporting patient safety events. Reporting of events rarely occurred and is not part of routine nursing work in nursing units. Many barriers whether personal factors or organizational factors have been proposed for underreporting and are associated with increasing nurses' willingness to keep their mistake to oneself or talk in confidence with colleague or several colleagues, as well as increasing nurses' preference to anonymous reporting.

Moreover, the results for this study highlight nursing safety climate dimensions especially reporting process and peer relations dimension as a major area that needs to be addressed to increase reporting of patient safety events in nursing units. Nursing safety climate has many benefits in overcoming barriers that hinder nurses' willingness to report events, enhancing nurses' attitudes towards reporting events, accelerating implementation of reporting system and improving peer relations. Therefore, it helps nurse managers and nursing staff to improve the quality of nursing care and get better patient safety outcomes.

Recommendations

Based on the study findings, the researcher suggests the following:

1. Try to reach consensus on clear definition of events to be reported, and list of events should be reported and made available to nursing staff.
2. Support reporting system both mandatory and voluntary with non-punitive culture
3. Design and the use of friendly incident reports to save time and eliminate unnecessary paper work.
4. Incident report should be activated instead of written and verbal reports in nursing units.
5. Conducting educational training for nursing staff on incident report, its aims and importance.
6. Assign one person in each shift for checking any event occurring and receiving any incident reports.
7. Reports should be analyzed to suggest patient safety interventions and help prioritize among these interventions.

8. Analyzing reports should include what exactly happened and why, and the factors that contributes to the event.
9. Provide continuous feedback to nursing staff on what actions were taken
10. Disseminating and implementing patient safety programs to promote positive nurses' attitudes and behaviors to reporting events as well as overcoming the barriers of reporting patient safety events.

References:
Stanhope N, Crowley-Murphy M, Vincent C, O'Connor IS, Dalby K., Taylor-Adams SE. An evaluation of adverse incident reporting. Journal of Evaluation in Clinical Practice. Journal of Evaluation in Clinical Practice. 1999; 5(1)5-12.

Elder NC, Graham D, Brandt E, Hickner J. Barriers and motivators for making error reports from family medicine offices: A report from the American Academy of Family Physicians National Research network (AAFP NRN). J Am Board FAM Med. 2007; 20:115-23.

Spencer TR, Michols WL, Waterhouse PH, West M, Bankert GE. Clinical pharmacology and nursing management. 2nd Ed.London and New York: Lippincott Company; 1983. p.25-223

Williams A. How to avoid mistakes in medicine administration. Nursing times. 1996 April; 92(13):41.

Singer S, Lin S, Falwell A, Gaba D, Baker L. Relationship of safety climate and Safety Performance in Hospitals. Health Services Research. 2009 April; 44(2): 399-421.

Firth-Cozens J. Barriers to incident reporting. Qual Health Care 2002; 11:7.

Evans SM, Berry JG, Smith BJ, Esterman A, Selim P, O'Shaughnessy J, DeWit M. Attitudes and barriers to incident reporting: a collaborative hospital study. Qual Saf Health Care. 2006; 15:39-43.

Vincent C, Stanhope N, Crowley-Murphy M. Reasons for not reporting adverse incidents: an empirical study. Journal of Evaluation in Clinical Practice. 1999; 5 (1): 13-21.

Hughes GR, Edgerton AE. First, does no harm: Reducing pediatric medication errors: Children are especially at risk for medication errors. American Journal of Nursing. 2005 May; 105 (5): 79 – 84.

ASHP Report. ASHP guidelines on preventing medication errors. Am J Hosp Pharm .1993 ; 50 : 305-11

Stone PW, Cowell, R, Amsterdam N, Helfrich TA, Linn RW, Mojica L A. Comparison of nurse, system and quality patient care outcomes in 8-hour and 12-hour shifts. Med Care. 2006; 44(12): 1099-1106.

The Health Foundation Inspiring Improvement in UK. Evidence scan: Measuring safety culture; 2011. Available from :

http://www.health.org.uk/public/cms/75/76/313/2600/Measuring%20safety%20culture.pdf?realName=rclb4B.pdf (accessed 14 July 2013)

Flin R, Burns C, Mearns, K., Yule S, Robertson EM. Measuring safety climate in health care. Quality and Safety in Health Care. 2006; 15: 109–115.

Flin R, Mearns K., O'Connor P, Bryden R .Measuring safety climate: Identifying the common features. Safety Science. 2000;34 (1-3): 177–192.

Blegen A, Pepper A, Joseph R. Safety climate on hospital units: A new measure, advances in patient safety. Advances in patient safety From Research to Implementation. 2005; 4: 429-33. Available from : http://www.ahrq.gov/professionals/quality-patient-safety/patient-safety-resources/resources/advances-in-patient-safety/vol4/Blegen.pdf   (accessed 14 July 2013)

Chinag HY. Nurses' demographics of safety climate, work environment and barriers to medication administration reporting in Southern Taiwan. Doctor of Philosophy. College of Nursing. University of Utah; 2005. Available from:
http://content.lib.utah.edu/utils/getfile/collection/etd1/id/1695/filename/1278.pdf. (Accessed 14 July 2013)

El Din YK, Abd El Aal NH. The relationship between perceived safety climate, nurses' work environment and barriers to medication administration errors reporting. Life Science Journal. 2013; 10(1): 950-61.

Abou Hashish E A, El-Bialy G. Nurses' Perceptions of Safety Climate and Barriers to Report Medication Errors. Life Science Journal. 2013; 10(1): 2160-8.

Andersen HB, Madsen MD, Hermann, N, Schiøler T, Østergaard, D. Reporting adverse events in hospitals: A survey of the views of doctors and nurses on reporting practices and models of reporting. Proceedings of the Workshop on the Investigation and Reporting of Incidents and Accidents (IRIA) in UK; 2002 July. P.127–136. Available from : http://www.dcs.gla.ac.uk/~johnson/iria2002/IRIA_2002.pdf   (Accessed 25 July 2013)

Savitz L A, Jones CB, Bernard S. Quality Indicators Sensitive to Nurse Staffing in Acute Care Settings. Agency for healthcare research and quality; 2014. Available from. www.ahrq.gov/.../patient-safety-resources/resources/advances-in-patient-safety/vol4/savitz.pdf - 80k - 2014-08-10 (Accessed 25 Aug. 2014)

Millar J, Mattke S. Selecting Indicators for Patient Safety at the Health Systems Level in OECD Countries; 2004. Available from : http://www.oecd.org/health/health systems/33878001.pdf (Accessed 25 July 2013)

Pichert, JW; Hickson G; MooreI. Using Patient Complaints to Promote Patient Safety. Agency for healthcare research and quality; 2008. Available

from. http://www.ahrq.gov/professionals/quality-patient-safety/patient-safety-resources/resources/advances-in-patient-safety-2/vol2/Advances-Pichert_51.pdf. (accessed 25 July 2013)

Evans SM, Smith BJ, Esterman A. Evaluation of an intervention aimed at improving voluntary incident reporting in hospitals. Qual Saf Health Care. 2007; 16:169-75.

Kostopoulou O, Delaney B. Confidential reporting of patient safety events in primary care: results from a multilevel classification of cognitive and system factors. Qual Saf Health Care. 2007; 16:95–100

Blegen MA, Vaughn T, Pepper G , Vojir C, Stratton K..Patient and staff safety: voluntary reporting. Amer J Med Qual. 2004; 19(2):67-74.

Uribe CL, Schweikhart SB, Pathak DS, Dow M, Marsh GB. Perceived barriers to medical-error reporting: an exploratory investigation. J Health Care Manag. 2002; 47(4):263-80.

Kim J, Bates DW. Results of a survey on medical error reporting systems in Korean hospitals. Int J Med Imform. 2006; 75:148-55.

The Agency for Healthcare Research and Quality (AHRQ). Hospital survey on patient safety; 2004. Available from: http://www.ahrq.gov/professionals/quality-patient-safety/patientsafetyculture/hospital/resources/index.html(Accessed 14 July 2013)

Sexton B, Thomas E, Helmreich B. Safety climate Questionnaire. Center for Healthcare Quality & Safety ; 2006. University of Texas. Available from : https://med.uth.edu/chqs/surveys/safety-attitudes-and-safety-climate-questionnaire/ (Accessed 14 July 2013)

Parker, Deborah, Tuckett, Anthony, Eley, Robert, Hegney, Desley. Construct validity and reliability of the Practice Environment Scale of the Nursing Work Index for Queensland nurses. International Journal of Nursing Practice. 2010; 16 (4): 352-58.

Wakefield SD, Wakefield JB, Uden-Holman T, Boders T , Blegen M, Vaughn T. Understanding why medication administration errors may not be reported . American Journal of medical Quality. 1999 April; 14(2): 81-7.

Kaiser H. "An index of Factorial Simplicity". Pschometrika. 1974; 39: 31-6.

Gaur AS, Gaur SS. Statistical methods for practice and research: A guide to data analysis using SPSS. 2nd ed. London, New Delphi, Washington; 2009.

Wallston KA: The validity of multidimensional health locus of control scales. J Health Psychol. 2005; 10:623-31.

Polit DF, BeckCT. Nursing research: Appraising evidence for nursing practice. 7th ed. Philadelphia, London, New York: Wolters Kluwer / Lippincott Williams and Wilkins; 2010.

Bahl V, Thompson MA, Kau TY, Campbell. DA. . Do the AHRQ Patient Safety Indicators Flag Conditions That Are Present at the Time of Hospital

Admission?. Medical Care. 2008; 46 (5): 516–22.

Glance LG, Li Y, Osler TM, Dick AW. Impact of date stamping on patient safety measurements in patients undergoing CABG: experience with AHRQ Patient Safety Indicators. BMC Health Serv Res. 2008 Aug 13; 8:176.

Aly N. Drug administration errors and their determinates in Intensive Care Units of El-Shatby Pediatric University Hospital in Alexandria. PhD of Public Health sciences (Hospital Administration), High Institute of Public Health, Alexandria University; 2009.

Bader F. Problems encountered by nurses during drug Administration to cardiac patients in Military Hospital in Cairo .Master thesis of High Institute of Nursing , Cairo University ;,1988.

Ibrahim S. Assessment of nurse's knowledge and practice about drug interaction during drug administration. Master degree of High Institute of nursing (medical- surgical nursing), University of Cairo , 1990 .

Wetlerneck T, Paris B, Blosky MA, Cartmill R, Walker J, Carayon P. Error recovery in the ICU medication use process. Paper presented at the Healthcare Ergonomics Systems and Patient Safety (HEPS) Conference, Oviedo, Spain; 20011 Available from :http://www.timeoutintensiva.it (Accessed 10 January 2014)

Gibson J . A new approach to better medication compliance. Nursing. 1989; 2: 49-51.

Carthey J. Medication errors: Causes, prevention and reduction .British Journal of Hematology. 2002 Feb; 116(2): 255- 65.

Ridge KW, Jenkins Db , Royce PR, Barber ND. Medication errors during hospital rounds. Quality in Health Care . 1995; 4 : 240-43.

Cullen DJ, Bates DW, Small SD, Cooper JB, Nemeskal AR. , Leape LL. The incident reporting system does not detect adverse drug events: a problem for quality improvement. Joint Commission Journal on Quality Improvement. 1995; 21:541-48.

Leape LL. Why should we report adverse incidents?. Journal of Evaluation in Clinical Practice. 1998; 5(1): 1-4.

Leape LL. Error in medicine. Journal of the American Medical Association. 1994; 272: 1851-7.

 Adbullah M. Barriers to Incident Reporting Among Doctors and Nurses In Hospital Sultan Abdul Halim. Available from : http://hsah.moh.gov.my/v2/uploads/PDdownloads/barriers_in_incident_reporting_among_nurses_doctors_hsah.pdf (Accessed 10 January 2014)

Fletcher C E. Failure Mode and Effects Analysis: An Interdisciplinary Way to Analyze and Reduce Medication Errors. The Journal of Nursing Administration. 1997 December; 27(12): 19-26

Itoh K, Andersen BH. Dimensions of healthcare safety climate and their correlation with safety outcomes in Japanese hospitals.Reliability, Risk and

Safety*;* 2011. Available from:http://www.me.titech.ac.jp/~itohlab/ronbun_copy/c1-2010-itoh.pdf. (Accessed 12 July 2013)

Colla JB, Bracken AC, Kinney LM, Weeks WB. Measuring patient safety climate: A review of surveys. Quality & Safety in Health Care. 20005; 14: 364–6.

Isaac A, Shorrock S, Kirwan B. Human error in European air traffic management: the HERA project. Reliability Eng Syst Saf .2002. 75: 257 -72

Shorrock S, Kirwan B. Development and application of a human error identification tool for air traffic control. Appl Ergon. 2002. 33: 319–36.