

ORIGINAL ARTICLE

Survey of human factors and patient safety in operation theatres of a peripheral teaching hospital

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ABSTRACT

Background: Operating room non-technical skills of surgeons are directly related to safe surgical performance. The reason of this relation is not clear. The attitudes of surgical teams towards nontechnical skills may allow educationists to elaborate on this relationship and will further help in development of training and assessment programs.

Objective: To know the attitudes towards non-technical skills in operation theatre among surgical and allied postgraduate trainees of Aziz Bhatti Shaheed Teaching hospital (ABSTH), Gujrat, Pakistan.

Methods: Descriptive cross-sectional survey. Thirty post graduate trainees working in ABSTH theatres completed the Operating Room Management Attitudes Questionnaire (ORMAQ).

Results: Post graduate trainees have positive views on all aspects of ORMAQ survey except on procedural compliance and error disclosure indicating discrepancies in implementation and awareness.

Conclusions: The results are on the large part aligned with previous ORMAQ surveys of surgical teams in other countries. The differences emphasize potential threat to the patient safety due to sketchy systematic working and cultural norms. The findings support implementation of protocols and guidelines through the use of team interventions and human factor training. Finally, this survey helps in data collection for a hospital's quality assurance program.

Keywords: Non-technical skills, ORMAQ, patient safety, surgery, human factors

Introduction: In the operation theatre surgeon needs technical as well as non-technical set of surgical skills for safe surgical outcome. A technical skill is any psychomotor action with related mental knowledge. The technical skills e.g. good hand-eye coordination, manual dexterity, is required for good surgical outcome (Agha, Fowler, & Sevdalis, 2015). Moreover, these skills tend to improve with experience. These are the main focus of standardized training and assessment (Geraghty, Reid, & McIlhenny, 2014; Kim et al., 2015) Non-technical skills (also called human factors) are not related directly to use of drugs, equipment or medical expertise (Agha et al., 2015). The Royal College of Surgeons, Edinburgh describes non-technical skills as a collective term for teamwork, communication, situational awareness, decision

making and leadership. Non-technical skills are also defined along three dimensions; (Agha et al., 2015; Arias et al., 2014; Flin, Yule, McKenzie, Paterson-Brown, & Maran, 2006) The interpersonal skills (e.g. communication, teamwork), cognitive skills (e.g. situational awareness, decision making) and personal resource skills (e.g. managing stress, fatigue & workload). WHO has declared safe surgical practice as a public health priority (Lives). The prioritization of patient safety is also desperately needed across all hospitals in Pakistan. In industrialized countries 3-16% surgical adverse events occur in hospital based surgical procedures that cause permanent disability or death in 0.4 - 0.8% cases. About 45% of medical errors involve surgical patients and 35 - 66% of these occur in operation theatre. Operation theatres are highly complex areas in a hospital because different people with different learning aims and level of expertise come together as a team. Hence there is frequent occurrence of errors (47.7-50.3%) (Ugur, Kara, Yildirim, & Akbal, 2016) attitudes of healthcare professionals in case of errors and educational needs of professionals. METHODS The descriptive study was conducted at a university hospital in Turkey from January 25 to February 14, 2011, and comprised operating room staff, including physicians, nurses, anaesthesia technicians and perfusion technicians. Data was obtained using

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a questionnaire. RESULTS Of the 69 respondents, 45(65.2%). It was recognized in Scottish Audit of Surgical Mortality that the magnitude of technical errors (only 4.3%) was far less than the poor decision making (Scotland, 2013) In other studies lack of non-technical skills was a contributing cause in 70 -80% of surgical mortality and morbidity.(Ugur et al., 2016) Asad Ali Toor et al, highlighted the efficacy of use of WHO checklist in operation theatres and identified lack of formal team introduction and briefing in 88.3% cases. (Toor, Nigh-e-Mumtaz, Syed, Yousuf, & Syeda, 2013)Attia Barri et al, identified that human factors were responsible in 10-66% cases of medical errors committed by residents(Bari, Khan, & Rathore, 2016) . It is also observed in operation theatres that non-technical skills are grounded in surgical expertise of high performance efficient doctors(Carthey, de Leval, Wright, Farewell, & Reason, 2003). The surgeons non-technical skills in operation room are a measure of safety habits and are gained through informal learning(Flin, Fletcher, McGeorge, Sutherland, & Patey, 2003). The current structured system of training demands an explicit and tangible transfer of non-technical skills in a specified period of time(Agha et al., 2015). The teaching and learning of non-technical skills requisite identification of existing areas of concern and deficiency in surgical safety environment of operation theatres. Before embarking on in-depth direct observation and/or interviews, it is imperative to look into current attitudes towards safe surgical practice in operation theatre (Arias et al., 2014; Hull et al., 2012) . An attitude is the value a person assigns to something or someone. Attitudes towards non-technical skills (safety habits) not only depend upon individual's personality, beliefs and culture but also on group's characteristics, national culture, individual hospital culture, and health care management of country (Jafree, Zakar, Zakar, & Fischer, 2017; Speroff et al., 2010) A diagnostic survey to understand the existing attitudes of surgeons towards non-technical skills in operation theatre, will provide a vantage point for planning of surgical education. (Ugur et al., 2016)

Methods: It was a descriptive cross-sectional survey using ORMAQ. The "Operating Room Management Attitude Questionnaire (ORMAQ)" has been extensively used with surgical teams(Flin et al., 2003; Geraghty et al., 2014; Kim et al., 2015) This was adapted from the Cockpit and Flight Management Attitudes Questionnaires (CMAQ, FMAQ) for measuring safety attitudes in aviation (Helmreich, Sexton, & Merritt, 1997) . ORMAQ is used to determine the attitudes towards behaviors i.e. leadership, communication, teamwork, stress and fatigue, work values, and organizational climate, related to teamwork and safety (Flin et al., 2006; Sexton, Thomas, & Helmreich, 2000). The questions were randomly distributed for resident trainees but for the purpose of analysis Kim et al grouped

them under related themes i.e. Leadership structure, Confidence assertion, Information sharing, Teamwork, Work values, Stress and fatigue, Error/procedural compliance and Organizational climate(Kim et al., 2015). Aziz Bhatti Shaheed Teaching Hospital (ABSTH) is a five hundred bed institution, located in Gujrat city of Pakistan. It is in transition from a district level hospital to tertiary care teaching hospital with increasing number of postgraduate trainees. There are discernable changes in culture and organizational set up. The ORMAQ forms were distributed to all of the postgraduate trainees (thirty in number) of surgical and allied specialties of ABSTH, Gujrat. All the residents filled the anonymous forms and returned. Information also collected regarding gender, specialty, training program and year of training. The responses were rated on a five-point Likert scale between disagree strongly (0) to agree strongly (4). The responses are further aggregated on a three-point Likert scale i.e. Strongly/slightly disagree as Disagree (D), Neutral (N) and strongly/slightly agree as Agree (A) categories to assess the trend. Quantitative data was collected and analyzed on SPSS 25.0 version.

Results: Response rate was 100%. Original item numbers are shown to indicate the order they were set in the questionnaire. Results are shown in Figures 1, 2.1 to 2.8, 3 and 4

Table 1; Demographic profile of target surgery and allied post graduate trainees (Total= 30)

Demographic Features		Number	Percentage %
Gender	Male	13	43
	Female	17	57
Training Program	FCPS	21	70
	MS	05	17
	MCPS	04	13
Experience	1 st year	10	34
	2 nd year	06	20
	3 rd year	04	13
	4 th year	06	20
	5 th year	04	13
Specialty	General Surgery	07	23
	Orthopedic Surgery	04	13
	GYN/AE / OBS	18	60
	Neurosurgery	01	04

Table 2.1 to 2.8; Trainee Surgeons' responses towards "Operation Theatre Management Attitudes".

Divided into nine themes. Original item numbers are shown to indicate the order they were set in the questionnaire. ("D" Disagree, "N" Neutral, "A" Agree)

Table 2.1-Leadership Structure							
ORMAQ questions	% D	% N	% A	ORMAQ questions	% D	% N	% A
3. Senior staff should encourage questions from junior medical and nursing staff during operations if appropriate	03	03	94	42. Leadership of the Operating Theatre team should rest with the medical staff	23	37	40
10. Doctors who encourage suggestions from Operating Theatre team members are weak leaders	87	10	03	50. There are no circumstances where a junior team member should assume control of patient management	27	47	26
27. Successful Operating Theatre management is primarily a function of the doctor's medical and technical proficiency	13	20	67				

Table 2.2-Confidence-Assertion							
ORMAQ questions	% D	% N	% A	ORMAQ questions	% D	% N	% A
1. The senior person, if available, should take over and make all decisions in life threatening emergencies	03	7	90	36. I sometimes feel uncomfortable telling Operating Theatre members from other disciplines that they need to take some action	10	30	60
14. Junior Operating Theatre team members should not question the decisions made by senior personnel	47	10	43	38. Team members should not question the decisions or actions of senior staff except when they threaten the safety of the operation	20	33	47
32. If I perceive a problem with the management of a patient, I will speak up, regardless of who might be affected	10	40	50	60. I always ask questions when I feel there is something I don't understand	13	30	57
34. In critical situations, I rely on my superiors to tell me what to do	24	03	73				

Table 2.3-Information Sharing							
ORMAQ questions	% D	% N	% A	ORMAQ questions	% D	% N	% A
12. A regular debriefing of procedures and decisions after an Operating Theatre session or shift is an important part of developing and maintaining effective team co-ordination	7	16	77	16. I am encouraged by my leaders and co-workers to report any incidents I may observe	14	10	76
13. Team members in charge should verbalize plans for procedures or actions and should be sure that the information is understood and acknowledged by others	00	7	93	19. The pre-session team briefing is important for safety and for effective team management	00	17	83

Table 2.4-Team Work							
ORMAQ questions	% D	% N	% A	ORMAQ questions	% D	% N	% A
17. The only people qualified to give me feedback are members of my own profession	33	20	47	44. To resolve conflicts, team members should openly discuss their differences with each other	17	13	70
18. It is better to agree with other Operating theatre team members than to voice a different opinion	33	37	30	48. All members of the Operating Theatre team are qualified to give me feedback	17	13	70
22. The doctor's responsibilities include coordination between his or her work team and other support teams	00	10	90	54. The concept of all Operating theatre personnel working as a team does not work at this hospital	17	37	46
25. Operating Theatre team members share responsibilities for prioritizing activities in high workload situations	17	17	66	56. Effective Operating Theatre team co-ordination requires members to take into account the personalities of other team members	17	33	50
31. I enjoy working as part of a team	03	17	80				

Table 2.5-Work Values							
ORMAQ questions	% D	% N	% A	ORMAQ questions	% D	% N	% A
6. Senior staff deserve extra benefits and privileges	13	27	60	26. As long as the work gets done, I don't care what others think of me	20	27	53
7. I do my best work when people leave me alone	10	43	37	28. A good reputation in the Operating Theatre is important to me	13	07	80

9. It bothers me when others do not respect my professional capabilities	10	07	83	35. I value the goodwill of my fellow workers- I care that others see me as friendly and co-operative	17	03	80
15. I try to be a person that others will enjoy working with	03	10	87	40. It is an insult to be forced to wait unnecessarily for other members of the Operating Theatre team	06	37	57
20. It is important that my competence be acknowledged by others	03	07	90	52. In the Operating Theater I get the respect that a person of my profession deserves	13	30	57
23. I value compliments about my work	03	33	64				

Table 2.6-Stress and Fatigue

ORMAQ questions	% D	% N	% A	ORMAQ questions	% D	% N	% A
4. Even when tired, I perform effectively during critical phases of operations	24	13	63	43. My performance is not adversely affected by working with an inexperienced or less capable team member	43	17	40
5. We should be aware of, and sensitive to, the personal problems of other team members	30	10	60	45. Team members should monitor each other for signs of stress or tiredness	20	10	70
8. I let other team members know when my workload is becoming (or is about to become) excessive	16	17	60	46. I become irritated when I have to work with inexperienced medical staff	27	23	50
11. My decision making is as good in emergencies as it is in routine situations	00	10	90	49. A truly professional team member can leave personal problems behind when working in the Operating Theatre	20	17	63
21. I am more likely to make errors in tense or hostile situations	17	27	56	51. Team members should feel obligated to mention their own psychological stress or physical problems to other Operating Theatre personnel before or during a shift or assignment	10	47	43
39. I am less effective when stressed or tired	17	23	60	55. Personal problems can adversely affect my performance.	30	37	33

Table 2.7- Procedural Compliance

ORMAQ questions	% D	% N	% A	ORMAQ questions	% D	% N	% A
29. Errors are a sign of incompetence	50	17	33	41. Mistakes are handled appropriately in this hospital	47	23	30
33. I am ashamed when I make a mistake in front of other team members	30	30	40	53. Human error is inevitable	20	20	60
37. Procedures and policies are strictly followed in our Operating Theatre	33	34	33	59. Team members frequently disregard rules or guidelines (e.g. hand washing, treatment protocols/clinical pathways, sterile field) developed for our Operating Theatre	13	33	54

Table 2.8-Organizational Climate

ORMAQ questions	% D	% N	% A	ORMAQ questions	% D	% N	% A
2. The department provides adequate, timely information about events in the hospital which might affect my work	03	30	67	47. I am proud to work for this hospital	23	17	60
24. Working in this hospital is like being part of a large family	10	33	57	57. I like my job	07	17	76
30. Departmental leadership listens to staff and cares about our concerns	50	07	43	58. I am provided with adequate training to successfully accomplish my job	34	23	43

Table 3: Post graduate trainee Surgeons' attitudes towards error in medicine.

Error in medicine							
ORMAQ questions	% D	% N	% A	ORMAQ questions	% D	% N	% A
67. I rarely witness an error where one or more team members lack the knowledge to perform the needed action	20	43	37	70. Medical errors are discussed to prevent recurrence	10	13	77
68. Errors committed during patient management are not important, as long as the patient improves	40	37	23	71. a confidential reporting system that documents medical error is important for safety	00	23	77
69. I make errors in theatre	40	40	20	("D" Disagree, "N" Neutral, "A" Agree)			

Table 4: Trainee Surgeons' attitudes towards perception of quality of work.

Perception of quality of team work							
Team Members	% Low	% Adequate	% High	Team Members	% Low	% Adequate	% High
61. Consultant Surgeon	13	37	50	64. Anesthetist	23	30	45
62. Senior Trainee	07	27	66	65. OT Nurse	36	40	24
63. Junior Trainee	07	37	56	66. OT Assistants	27	37	36

Discussion: This survey diagnosed target areas of concern and discrepancies in attitudes towards non-technical skills in ABSTH operation theatres; procedural compliance, personalized supervision, error disclosure, stress and fatigue management

The ABSTH organizational setup and local culture underpins these attitudes. The study of (Geraghty et al., 2014) was conducted in UK which has advanced health care systems and cultural norms. The study was done on Urological residents, consultant surgeons and nurses. The study by (Flin et al., 2006) was done in same settings but the residents were from General surgery. Our study was done in a newly establishing tertiary care hospital under developing country's health care system. The sample size was limited to residents only but included residents from multiple surgical specialties. In the study by (Prati & Pietrantoni, 2014) ORMAQ survey was done in Italy but the sample includes only consultant surgeons and nurses. In another study (Kim et al., 2015) ORMAQ survey involved acute care areas. The response towards leadership structure is very positive. There is acceptance of hierarchical arrangement of lines of authority and communication is clearly positive and in line with other studies. But the trainees are not clear about specific roles in some areas of operation theatre management like trainees are not decisive (Q42, Q50 37% & 47% selected neutral response). In other studies, the perception of responsibility is clear cut i.e. Q50 the response is 78% Disagree in (Geraghty et al., 2014) and 77% Disagree in (Flin et al., 2006), which

signifies clearer appreciation of role distribution. There is a confusion relating to attitudes towards clearer job description and clarity of command and control in ABSTH. The trend towards confidence assertion is positive but can be overvalued because the trainees are reluctant and are not specific in their reaction in confusing situations (Q32, Q36) and also are not very open to ask questions to seniors (Q38, Q60). This finding is also not aligned to above mentioned studies and needs further probing. There is a very positive perceived value of information sharing (briefing/debriefing as in aviation) almost similar to aforementioned studies (Flin et al., 2006; Geraghty et al., 2014). As most of time this is not happening in our OT and possible resultant confusion with negative effects on patient safety witnessed by trainees may have caused this positive response. This finding emphasizes initiation of regular preoperative meeting and discussion on procedures. The trainees are generally positive about teamwork. They are very clear about coordination, participation and conflict resolution for positive outcome. The response is split over importance of constructive feedback, inter-professional education and role of individual personality in teamwork (Q17, 18, 56). This is not aligned to (Flin et al., 2006; Geraghty et al., 2014). There is a need for formal education and training in teamwork to create more awareness.

There is positive attitude towards work values (such as acknowledgment as a future consultant, dependability and acceptability). Response to (Q7) is split equally and shows that trainee's learning curve and style is different and hence need of individual supervision. In (Q 40) there is a split response in our study because delay in start of OT lists is a common cause of personal disputes. This is not considered as a cause of much concern in (Flin et al., 2006; Geraghty et al., 2014). This finding highlight lack of punctuality may generate negative attitudes in smooth working of operation theatres. Trainees do perceive that Stress and fatigue due to work over load and personal problems reduce efficiency (Q21, Q39, and Q45). But they are not clearly accepted that stress can affect decision making (Q11, Q8). The trainees don't feel sharing stress with team members should be an obligation (Q51). The results are similar to (Flin et al., 2006; Geraghty et al., 2014). There is a need to educate trainees about psychological dimensions of stress including the coping strategies and its relation to surgical errors. In the error/procedural compliance sections the trainees agree that errors are inevitable and are not a sign of incompetence (Q53, Q29), but at the same time they perceive it as a degrading act (Q33). This attitude is similar in other studies of (Flin et al., 2006; Geraghty et al., 2014). This attitude can be detrimental and may result in cover up of mistakes. The trainees identified attitude towards procedural compliance (Q37) and guidelines (Q59) is somewhat casual at the team level as well as at the individual level. Moreover, majority thinks that mistakes are not appropriately handled (Q41). These findings are almost in contrast to that of (Flin et al., 2006; Geraghty et al., 2014). There is a need to look into the validity of existing protocols, checklists and the efficiency of surveillance system in ABSTH operation theatres. The attitude towards organizational climate is positive as for as job satisfaction (Q30, Q47, Q57). The dissemination of information by administration (Q2) is assessed as good which is similar to (Geraghty et al., 2014) but different to (Flin et al., 2006). There is less positive attitude towards concerns about trainees queries (Q30) at departmental level as well as amount of on job training (Q58) as compared to (Flin et al., 2006; Geraghty et al., 2014). This finding emphasizes more attention and care towards trainee's personal problems and training needs. The attitude towards error reporting system and discussion to reduce recurrence is very positive as in (Flin et al., 2006; Geraghty et al., 2014). Trainees show reluctance to accept errors (Q69) and consider it unnecessary to report if no harm done (Q68) and are not sure (Q67) in assessment of nontechnical cause of any witnessed error. These findings are not aligned to (Flin et al., 2006; Geraghty et al., 2014). This finding identifies lack of open environment and education about error disclosure in ABSTH operation theatre. The trainees find that the quality of team work is highest with immediate senior. The quality drops to just adequate with OT

Nurses and OT Assistants. While (Flin et al., 2006; Geraghty et al., 2014) show highest with consultant surgeon and then rest are equal. These results show perception of quality of learning is enhanced under close supervision of seniors.

Conclusion: Patient safety and error reduction in operation theatres needs formal education in non-technical skills. The success of any program depends upon local and organizational culture. It can be safely concluded that formal non-technical skills education and implementation of protocols/guidelines are needed in ABSTH operation theatres. This study identifies the two significant area of concern i.e. discrepancy in error reporting and procedural compliance. This diagnostic survey will help us to develop/revise strategies towards these weak areas specifically and non-technical skills education as a whole. The study is limited to single teaching hospital and is not generalizable. Consultant surgeons, nurses and other staff were not included affecting the sample size and scope. The themes in ORMAQ are arbitrary and are not validated yet (Kim et al., 2015), which is why individual items were discussed. Direct observation and interviews will be needed to fully understand the existing culture and attitudes. Work is to be done in non-surgical skills training and assessment as a part of surgical and allied training programs.

Declaration of interest:

The authors report no conflict of interest.

Author's contribution:

- Dr. Sajid Aziz : Conception and design of the work; & the acquisition, analysis, & interpretation of data for the work
- Dr. Rehan Ahmed Khan : Final approval of the version to be published
- Dr. Gohar Wajid : Critical Review of the version to be published

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