Impact of Implementing Surgical Safety Checklist on Patients' Health Outcomes in a Public Hospital in Kuwait

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Abstract: Background: Surgical care is an integral part of healthcare throughout the world. Moreover, studies have estimated that about 50% to 66% of hospital adverse events are attributable to surgical care. It appears that it is not only technical skills and technological innovation but also the behavioral patterns and nontechnical skills of the surgeon that affect surgical outcomes. **Objective:** To examine the impact of applying the surgical safety checklist on surgical outcomes andsafety attitudes of operating room professionals. **Methods:** An interventional study was carried out in a randomly selected public hospital in Kuwait using a specially designed form to collect data on each operation. A total number of 600 patients was enrolled during both the baseline period and after implementation of the checklist. All surgical team members working in the study operating rooms were included to assess their safety attitudes using Safety Attitudes Questionnaire. **Results:** Adherence to the items of surgical safety checklist increased significantly after checklist implementation. Moreover, introduction of the Checklist into operating rooms was associated with improvement in surgical outcomes. There was no statistically significant difference in safety attitudes after implementation of checklist. **Conclusions:** To successfully manage the surgical safety checklist, the support of senior staff is very important. This study serves as a starting point for initiating policy changes to address several issues such as improving job satisfaction and working conditions.
[Samaa Zenhom Ibrahem, Buthaina Al Mudaf, Talal Al Fadalah, Maha AlMajed, Hesham Kalender and Hanan Badr. **Impact of Implementing Surgical Safety Checklist on Patients' Health Outcomes in a Public Hospital in Kuwait.** *Life Sci J* 2018;15(10):21-35]. ISSN: 1097-8135 (Print) / ISSN: 2372-613X (Online). http://www.lifesciencesite.com. 3. doi:10.7537/marslsj151018.03.

Keywords: Kuwait, Public hospital, surgical safety checklist, safety attitudes

1. Introduction

Large proportion of hospital adverse events are attributable to surgical care. A systematic review has shown that 1 in every 150 patients admitted to a hospital dies as a consequence of an adverse event and that almost two thirds of in-hospital events are associated with surgical care. (De Vries et al., 2008)

Prevention of complications and incidents of iatrogenic harm are deemed feasible for nearly 50% of such incidents. (Gawande et al, 1999 and Kableetal,2002) several interventions have been proposed to increase patient safety and introduction of checklists in surgery can intercept and prevent such incidents. (Arriagaetal,2013, Blissetal,2012 and De Vries et al, 2012) and may reduce both morbidity and mortality. (De Vriesetal,2010, Haynesetal,2009, Van Klei et al, 2012 and Weiseretal,2010, a)

In 2008, the World Health Organization (WHO) introduced the Surgical Safety Checklist (SSC) designed to improve consistency of care. (Weiseretal,2010, b) The checklist was pilot-tested in a global study across 8 hospitals in the developed and developing world. The results were published in January 2009 and showed that, implementation of the 19-item World Health Organization (WHO) Surgical Safety Checklist substantially reduced the rate of surgical complications, from 11.0% to 7.0%, and reduced the rate of in-hospital death from 1.5% to 0.8%. (Haynes et al, 2009) Insufficient use of and/or missing items in the WHO checklist may provide a false sense of security for the operating team. (Rydenfalt et al,2014)

To reduce complications and improve results after surgery both technical and non-technical skills are required. (Flin et al, 2008) A number of subsequent studies to date have reported improved patient outcomes with use of checklists. (Borchard et al, 2012) Furthermore, checklists have also been shown to improve communication, (Fudickar et al, 2012, Kearns et al,2011, Nilsson et al, 2010 and Takaletala,2011), preparedness, (Bohmer et al,2013) teamwork, (Bohmer et al, 2012 and Helmio et al, 2011) and safety attitudes. (Haynes et al, 2011)

Objectives

The study aimed at examining the impact of applying the surgical safety checklist on the surgical outcomes in non-casualty operations in a randomly selected governmental hospital in Kuwait.

Furthermore, the study assessed the attitudes and opinions toward surgical safety among operating room professionals before and after implementation of surgical safety checklist.

2. Material and Methods

This interventional study utilized a specially designed form to collect data on each operation and Safety Attitudes Questionnaire (SAQ) which has been customized to fit the context of Kuwait.

Setting and participants

The study carried out in a randomly selected governmental hospital (757 beds) in Kuwait. Eight operating rooms in the selected hospital were identified as study rooms.

According to a hospital report, a monthly average number of surgeries was considered for pre-intervention phase (before applying surgical safety checklist) and a similar number of surgeries was considered for post-intervention phase (after applying surgical safety checklist).

A total number of 600 patients was enrolled during the baseline period and 600 patients after implementation of the checklist. Enrolment included all non-Cardiac operations for patients 16 years age or older in which the checklist was used.

All surgical team members including surgeons, anaesthesia providers and nurses working in the study operating rooms in the selected hospital were included in the study.

Study tools

1- A specially designed form to collect data on each operation was developed. It includes the following items: Demographic characteristics of patients, Procedure data, Type of anaesthesia used, Items of the three parts of WHO surgical safety checklist (Kuwait version), Post-operative complications and length of stay for all patients.

2- Safety Attitudes Questionnaire (SAQ): this tool was used to assess the surgical team safety attitudes and opinions regarding the implementation of surgical safety checklist as a standard care for all surgeries. The questionnaire comprise two parts: The first part contains questions that address health professionals' perceptions of surgical safety in the operating rooms. The second part contains questions about participants' characteristics including age, gender, position and experience in current job.

SAQ contains six domains includingTeamwork climate. (6 items), Safety climate. (9 items), Job satisfaction. (5 items), Stress recognition. (4 items), Perceptions of management. (10 items), Working conditions. (3 items) As well as some questions about communication and collaboration between surgical staff. (3 items).

Data collection

Three trained quality nurses together with the circulating nurse in the surgery department in the study hospital were assigned to collect data from the 8 study operating rooms.

The observers attended and monitored the surgeries performed by the surgical team and collected the data on each operation using a specially designed form to monitor the degree of adherence of the surgical team members to the use of WHO surgical safety checklist (Kuwait version) and to measure outcomes related to patients' morbidities and mortalities during both pre-intervention (before implementation of surgical safety checklist) and post-intervention (after implementation of surgical safety checklist) phases.

- Each patient undergone a monitored surgery, will be followed up on daily basis by the trained nurse to check for any post-operative adverse events on a predesigned "post-operative adverse events checklist". The post-operative follow up period will be up to either patient release from the hospital or for 30 days whichever the earliest.
- Complications were defined as they are in the American College of Surgeons' National Surgical Quality Improvement Program including acute renal failure, blood transfusion, cardiac arrest requiring cardiopulmonary resuscitation, coma of 24 hours' duration or more, deep-vein thrombosis, myocardial infarction, unplanned intubation, pneumonia, pulmonary embolism, disruption of wound, infection of surgical site, unplanned return to the operating room, fever, ICU, peripheral nerve injury, and death.
- Self-admitted questionnaire "SAQ" distributed to all surgical team members participated in all monitored surgeries in both phases of the study to assess their attitudes towards safety procedure in their operating rooms.

Intervention

❖ After collecting baseline data (before implementation of WHO surgical safety checklist, Kuwait version), Quality and Accreditation Directorate, Ministry of Health in Kuwait support the implementation of surgical safety checklist and increase awareness among staff regarding safe surgery. The process of implementation was as follow:

- A "surgical safety checklist team" was formed consisting of a representative from each of the following departments namely General Surgery, Urology, Obstetrics and Gynecology, Orthopedics, ENT, Dental, Anesthesia and Nursing who are primarily responsible to follow implementation of the surgical safety checklist in coordination of the quality department of the study hospital.
- The supporting team from the Quality and Accreditation Directorate provided training for the

implementation of the Surgical Safety checklist in the form of lectures with the use of handouts, CDs, audio-visual presentations and open discussions.

The official use of the surgical safety checklist for surgeries started on one elective OT room. After successful implementation, it was decided to add one elective OT room weekly to facilitate continuity of the implementation until all the elective OT rooms were included.

Implementation of the surgical safety checklist progressed to the evening schedule of surgeries and later further included the emergency cases as well.

For the commencement of the phase II of the study, head of supporting team from Quality and Accreditation Directorate provided a lecture to the team designated to collect data to measure the percentage of post-operative complications after implementation of surgical safety checklist.

Ethical issues

Ethical approval to conduct the study was provided by the standing Committee for Coordination of Health and Medical Research inKuwait.

Data management and analysis

Data was analyzed using SPSS 20.0. The items of SAQ are both positively and negatively worded and scored using a five –point scale reflecting respondent agreement (including a neutral category).

Negatively worded items were reversed prior to conducting analysis.

Descriptive statistics using frequency distribution tables were carried-out. Characteristics of the study subjects including patients, health professional and procedures conducted in the study operating rooms were compared between both pre- intervention and post – intervention phases using Pearson exact X2 test (categorical data). Whenever chi-square test was not valid (more than 20% of expected values have count less than 5), Fisher's exact test was used instead.

Z test was used for comparing two proportions. Non-parametric tests (Mann-Whitney and Kruskal-Wallis H tests) were used as tests of significance for comparison of means.

Difference in No. of complication per category was calculated between the two study phases using pearsons exact X2 test. Comparing rates of post-operative complications and death before and after surgical safety checklist implementation was done using Pearson exact X2 test.

Comparison of length of stay before and after surgical safety checklist implementation was done using Mann-Whitney test.

SAQ domains mean scores compared before and after surgical safety checklist implementation using independent sample t- test. Association between compliance with WHO surgical safety checklist items, Kuwait version and post-operative complications rates and length of stay was estimated using the Spearman correlation coefficient.

3. Results

We enrolled 600 patients during the baseline period and 600 patients after implementation of the checklist.188 healthcare providers during pre-intervention phase and 196 healthcare providers during post-intervention phase were included in the study.

Measuring adherence to selected process measures and rates of post-operative complications, death and length of stay before and after the implementation of surgical safety checklist.

Table 1 lists characteristics of the patients; there were significant differences between the patients in the two phases of the study for all items except pre-operative ICU and type of surgery. The higher percentage of patients were females in both pre-intervention (60.5%) and post-intervention (52.8%) phases. Majority of patients did not admitted to ICU before the operation in both pre-intervention (87.1%) and post-intervention (95.8%) phases. In addition, most of patients undergo elective surgery in both pre-intervention (66.7%) and post-intervention (66.8%) phases with around 80% of them received general anesthesia in both phases. Patients in both pre-intervention and post-intervention phases were more likely to undergo surgery for Obstetrics and gynecology conditions or for general conditions and less likely to undergo surgery for ophthalmic, thoracic or vascular conditions.

Total compliance with the elements of the surgical safety checklist was significantly (p=0.000) increased from the median of 5 before the implementation of the surgical safety checklist to the median of 27 after the implementation of the surgical safety checklist. (Table 2).

Changes in the percentages of patients for whom checklist items were checked after the implementation of the surgical safety checklist are fully detailed in Tables (3-5).

Post-operative length of stay decreased significantly (p=0.000) from the median of 3 during pre-intervention phase to the median of 2 during post-intervention phase. (Figure 1)

The post-operative rate of death dropped from 0.9% before implementation of surgical safety checklist to 0.3% after implementation of surgical safety checklist. The rates of post-operative admission to ICU, blood transfusion, fever and unplanned return to surgery also declined significantly after implementation of surgical safety checklist (p=0.006, p=0.000 and p=0.011 respectively) The rates of remaining post-operative complications including infection of incision, acute renal failure, cardiac arrest,

unplanned intubation, ventilator use for 24hrs or more, pneumonia, Pulmonary embolism, peripheral nerve injury and systematic sepsis declined insignificantly after implementation of surgical safety checklist. (table 6)

Table (1): General information of the participants before and after implementation of surgical safety checklist.

Variable	Pre-intervention phase (n=583)		Post-intervention phase (n=597)		Test	p
	n	%	n	%		
Gender						
Male	181	31.0	240	40.2	$\chi^2_{(1)}$= 10.029	0.002
Female	353	60.5	315	52.8		
Age (years)						
Median	33.00		31.00		M-W Z=5.460	0.000
(Q1-Q3)	(26-42)		(21-39)			
Pre-operative ICU						
Yes	5	0.9	10	1.7	$\chi^2_{(1)}$= 1.116	0.291
No	508	87.1	572	95.8		
Surgical Specialty						
None	6	1.0	10	1.7	LLR$\chi^2_{(11)}$= 40.967	0.000
General surgery	205	35.2	171	28.6		
Orthopaedic surgery	67	11.5	66	11.1		
Urology	40	6.9	21	3.5		
Colon and rectal surgery	10	1.7	12	2.0		
Dental surgery	0	0.0	10	1.7		
Obstetrics and gynaecology	207	35.5	216	36.2		
Ophthalmic surgery	1	0.2	1	0.2		
Otolaryngology	35	6.0	78	13.1		
Plastic surgery	9	1.5	9	1.5		
Thoracic surgery	1	0.2	1	0.2		
Vascular surgery	2	0.3	2	0.3		
Type of surgery						
Elective	389	66.7	399	66.8	$\chi^2_{(1)}$= 0.006	0.938
Urgent	189	32.4	192	32.2		
Type of anaesthesia						
General	477	81.8	534	89.4	$\chi^2_{(2)}$= 18.021	0.000
Spinal	86	14.8	50	8.4		
Local	12	2.1	3	0.5		

Table (2): Compliance with surgical safety checklist items before and after implementation of surgical safety checklist.

Stage	Pre-intervention phase		Post-intervention phase		Mann- Whitney z	P
	n	Median (Q1-Q3)	n	Median (Q1-Q3)		
Before induction of anesthesia	582	2 (1-3)	594	12 (11-12)	28.385	0.000
Before skin incision	583	1 (0-2)	596	11 (11-11)	28.577	0.000
Before patient leaves operating room	583	1 (1-2)	596	5 (4-5)	25.144	0.000
Total compliance	582	5 (3-7)	594	27 (26-28)	27.900	0.000

Table (3): Adherence rates to "Before induction of anaesthesia" stage elements before and after implementation of surgical safety checklist.

1st stage Items		Pre-intervention phase (n=583)		Post-intervention phase (n=597)		$\chi^2_{(1)}$	p
		n	%	n	%		
Patient identity confirmation	performed	65	11.1	571	95.6	849.138	0.000
	Not performed	517	88.7	25	4.2		
Patient procedure confirmation	performed	39	6.7	572	95.8	940.985	0.000
	Not performed	544	93.3	24	4.0		
Patient site confirmation	performed	583	100.0	596	100.0	-	-
Patient consent	performed	41	7.0	571	95.6	930.366	0.000
	Not performed	542	93.0	25	4.2		
Site Marked	performed	130	22.3	545	91.4	575.718	0.000
	Not performed	453	77.7	51	8.5		
Anaesthesia machine check	performed	146	25.0	570	95.5	615.856	0.000
	Not performed	437	75.0	26	4.4		
Pulse oximeter used	performed	222	38.1	556	93.1	400.254	0.000
	Not performed	361	61.9	40	6.7		
Patient allergy	performed	37	6.3	564	94.6	919.166	0.000
	Not performed	546	93.7	32	5.4		
Difficult Airway evaluation	performed	45	7.7	563	94.5	887.916	0.000
	Not performed	538	92.3	33	5.5		
Risk Blood loss evaluation	performed	30	5.1	558	93.6	922.865	0.000
	Not performed	553	94.9	38	6.4		
Antibiotic given appropriately	performed	197	33.8	432	72.6	178.275	0.000
	Not performed	386	66.2	163	27.3		
Venous thromboembolism	performed	166	28.5	472	79.3	306.741	0.000
	Not performed	417	71.5	123	20.6		

Table (4): Adherence rates to "Before skin incision" stage elements before and after implementation of surgical safety checklist.

2nd stage items		Pre-intervention phase (n=583)		Post-intervention phase (n=597)		$\chi^2_{(1)}$	p
		n	%	n	%		
The team introduced themselves	performed	26	4.5	533	89.3	853.404	0.000
	Not performed	557	95.5	63	10.6		
Team confirm Patient name	performed	77	13.2	567	95.0	798.068	0.000
	Not performed	506	86.8	29	4.9		
Team confirm Patient procedure	performed	63	10.8	566	94.8	838.744	0.000
	Not performed	520	89.2	30	5.0		
Team confirm incision site	performed	31	5.3	562	94.1	933.343	0.000
	Not performed	552	94.7	34	5.7		
Critical steps to surgeon	performed	1	0.2	553	92.6	1014.821	0.000
	Not performed	582	99.8	43	7.2		
How long the case will take by surgeon	performed	11	1.9	554	92.8	979.324	0.000
	Not performed	572	98.1	42	7.0		
Blood loss by surgeon	performed	2	0.3	554	92.8	1014.335	0.000
	Not performed	581	99.7	42	7.0		
Patient concerns to anaesthetist	performed	4	0.7	552	92.5	999.523	0.000
	Not performed	579	99.3	44	7.4		
Nursing staff confirm sterility	performed	319	54.7	566	94.8	255.069	0.000
	Not performed	264	45.3	30	5.0		
Equipment concerns to nursing staff	performed	13	2.2	537	89.9	914.334	0.000
	Not performed	570	97.8	59	9.9		
Imaging displayed	performed	300	51.5	556	93.3	259.263	0.000
	Not performed	283	48.5	40	6.7		

Table (5): Adherence rates to "Before patient leaves operating room" stage elements before and after implementation of surgical safety checklist.

3rd stage items		Pre-intervention phase (n=583)		Post-intervention phase (n=597)		$\chi^2_{(1)}$	p
		n	%	n	%		
Nurse verbally confirms procedure name	performed	121	20.8	528	88.4	548.059	0.000
	Not performed	462	79.2	68	11.4		
Nurse verbally confirms instruments count	performed	413	70.8	540	90.5	74.295	0.000
	Not performed	170	29.2	56	9.4		
Nurse verbally confirms specimen labelling	performed	255	43.7	527	88.4	263.467	0.000
	Not performed	328	56.3	69	11.6		
Nurse verbally confirms if there are any equipment problems	performed	4	0.7	526	88.1	913.289	0.000
	Not performed	579	99.3	70	11.7		
recovery concerns to surgical team	performed	13	2.2	449	75.2	660.953	0.000
	Not performed	570	97.8	147	24.6		

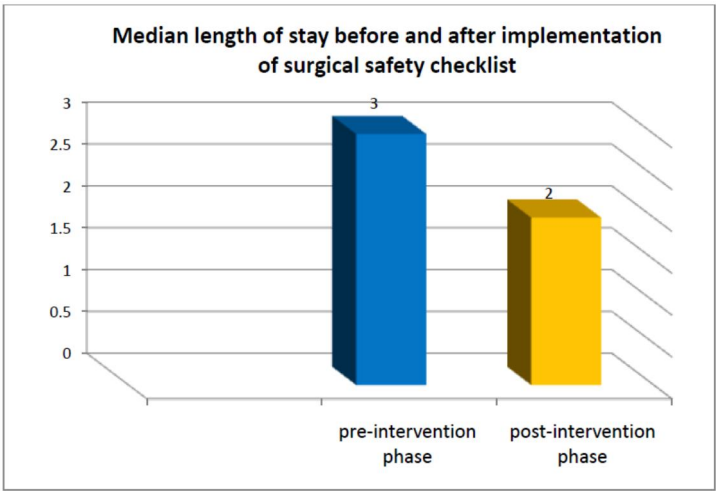

Fig. 1 Median length of stay before and after implementation of surgical safety checklist

Table (6): Post-operative complication rate before and after implementation of surgical safety checklist.

Complications	Pre- intervention phase (n=583)		Post-intervention phase (n=597)		Test	P
	n	%	n	%		
I.C.U.	24	4.1	6	1.0	$\chi^2_{(1)}$=11.494	0.001
Blood Transfusion	14	2.4	3	0.5	$\chi^2_{(1)}$=7.471	0.006
Fever	36	6.2	11	1.8	$\chi^2_{(1)}$=14.432	0.000
Infection of incision	7	1.2	2	0.3	FET	0.104
Acute renal failure	2	0.3	0	0.0	FET	0.244
Cardiac arrest	1	0.2	0	0.0	FET	0.494
Coma for 24hrs or more	0	0.0	0	0.0	-----	
DVT	0	0.0	0	0.0	-----	
MI	0	0.0	0	0.0	-----	
Unplanned intubation	2	0.3	0	0.0	FET	0.244
Ventilator use for 24hrs or more	8	1.4	3	0.5	$\chi^2_{(1)}$=2.407	0.121
Pneumonia	1	0.2	0	0.0	FET	0.494
Pulmonary embolism	1	0.2	0	0.0	FET	0.494
Peripheral nerve injury	1	0.2	0	0.0	FET	0.494
Systematic sepsis	2	0.3	0	0.0	FET	0.244
Stroke	0	0.0	0	0.0	-----	
Wound disruption	1	0.2	1	0.2	FET	1.000
Unplanned return to surgery	9	1.5	1	0.2	FET	0.011
Death	5	0.9	2	0.3	$\chi^2_{(1)}$=1.361	.243

Figure (2) shows that, the change in the number of complications per patient from the pre-implementation period to the post-implementation period was statistically insignificant (p=0.191). Review of the table reveals that, the number of patients with two or more complications decreased from 3.3 % before implementation of surgical safety checklist to 1.8% after implementation of surgical safety checklist.

Compliance with surgical safety checklist items was negatively correlated with rate of post-operative complications during both phases except for "Before induction of anaesthesia stage" during pre-intervention phase (r=.015) and for "Before skin incision stage" during post-intervention phase. (table 7)

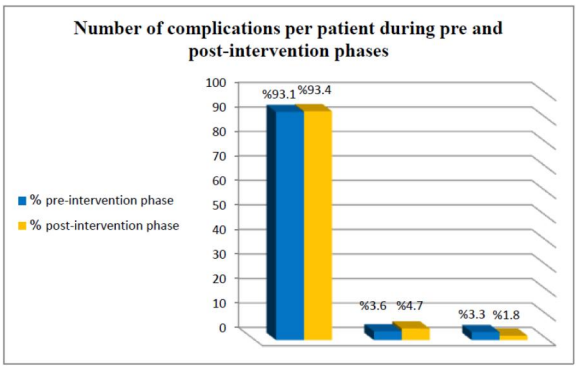

Fig. 2 Number of complications per patient during pre and post-intervention phases

Table (7): Correlation between compliance with surgical safety checklist items and rate of complication per patient before and after implementation of surgical safety checklist.

Compliance	Pre-intervention phase			Post-intervention phase		
	n	Correlation Coefficient Spearman's rho	p	n	Correlation Coefficient Spearman's rho	p
Compliance with Before induction of anaesthesia stage	506	0.015	0.732	546	-0.029	0.502
Compliance with Before skin incision stage	507	-0.049	0.270	548	0.039	0.368
Compliance with Before patient leaves operating room stage	507	-0.036	0.418	548	-0.020	0.644
Total Compliance	506	-0.016	0.717	546	-0.021	0.619

Assessment of the attitudes and opinions toward surgical safety among operating room professionals before and after implementation of surgical safety checklist.

Table 8 shows characteristics of the participating healthcare providers; there were no significant differences between the healthcare providers in the two phases of the study for all items exceptfor gender (p=0.000). The higher percentage of participating healthcare providers were males in both pre-intervention (70.2%) and post-intervention (50.0%) phases. Regarding age, "40 to less than 50" was the age group of the highest frequency in both pre-intervention (41.0%) and post-intervention (38.3%) phases followed by "30 to less than 40" age group in both pre-intervention (33.0%) and post-intervention (32.1%) phases. The highest percentage of participants were surgeons in both pre-intervention (46.8%) and post-intervention (35.7%) phases followed by scrub nurses in both pre-intervention (23.9%) and post-intervention (18.9%) phases. Concerning experience in current job, the highest percentage of participants had the experience of 11 to 20 years (38.8%) followed by 5 to 10 years in 26.6% of participants in pre-implementation phase. In post-implementation phase highest percentage of participants had the experience of 5 to 10 years (38.8%) followed by the experience of 11 to 20 years in 31.6% of participants. On the other hand, the lowest percentage of participants had the experience of less than 1 year in both pre-intervention (2.1%) and post-intervention (0.5%) phases.

Table 9 displays mean scores of the different safety attitudes domains before and after implementation of surgical safety checklist. Mean score of all domains increased after implementation of surgical safety checklist. This increase was insignificant except for stress recognition domain (p=0.000). Perception of management had the highest mean score compared with other domains in both pre-intervention (mean=38.94) and post-intervention (mean=39.75) phases. On the other hand, working condition had the lowest mean score compared with other domains in both pre-intervention (mean=11.99) and post-intervention (mean=12.12) phases.

Changes in mean scores of the different items of safety attitudes domains after the implementation of the surgical safety checklist are fully detailed in tables (10-16).

Table (8): Characteristics of participating surgical team members before and after implementation of surgical safety checklist.

Variable	Pre-intervention phase (n=188)		post-intervention phase (n=196)		Test	Value	p
	n	%	n	%			
Gender							
Male	132	70.2	98	50.0	$\chi^2_{(1)}$	14.444	0.000
Female	54	28.7	91	46.4			
Age							
20 to less than 30	8	4.3	20	10.2	M-W Z	-1.256	0.209
30 to less than 40	62	33.0	63	32.1			
40 to less than 50	77	41.0	75	38.3			
50 to less than 60	25	13.3	26	13.3			
60 and more	9	4.8	7	3.6			
Position							
surgeon	88	46.8	70	35.7	$\chi^2_{(1)}$	13.195	0.067
Surgical trainee	6	3.2	4	2.0			
Anesthesia professional	17	9.0	19	9.7			
Anesthesia trainee	5	2.7	10	5.1			
Circulating nurse	14	7.4	32	16.3			
Scrub nurse	45	23.9	37	18.9			
Recovery nurse	13	6.9	15	7.7			
Experiencein current job							
Less than 1 year	4	2.1	1	0.5	M-W Z	-0.824	0.410
1-2 years	9	4.8	5	2.6			
2-5 years	30	16.0	31	15.8			
5-10 years	50	26.6	76	38.8			
11-20 years	73	38.8	62	31.6			
More than 20 years	22	11.7	18	9.2			

Table (9): Mean scores of Safety attitudes' domains before and after implementation of surgical safety checklist.

Domain	pre-intervention phase		post-intervention phase		t-test	p
	n	Mean (SD)	n	Mean (SD)		
Teamwork climate	181	23.11±3.50	188	23.43 ±2.77	0.962	0.337
Safety climate	172	33.82±4.64	179	34.96 ±3.42	2.617	0.009
Job satisfaction	181	21.09± (3.73	190	21.72 ±3.51	1.671	0.096
Stress recognition	182	13.89±4.76	186	15.60 ±3.69	3.861	0.000
Perception of management	165	38.94± 5.82	181	39.75 ±5.23	1.367	0.173
Working conditions	186	11.99±2.47	195	12.12 ±2.23	0.555	0.579

Table (10): Mean scores of teamwork climate dimension' items before and after implementation of surgical safety checklist.

Teamwork climate items	pre-intervention phase		post-intervention phase		t-value	p
	n	Mean (SD)	n	Mean (SD)		
1. Nurse input is well received in this operation room	188	3.90±1.100	196	4.19±0.778	2.936	0.004
2. In this operation room, it is difficult to speak up if I perceive a problem with patient care	187	3.19±1.341	195	3.49±1.181	2.362	0.019
3. Disagreements in this operation room are resolved appropriately	186	3.91±1.072	195	4.06±0.820	1.461	0.145
4. I have the support I need from other personnel to care for patients	186	4.15±1.034	195	4.17±0.819	0.250	0.803
5. It is easy for personnel here to ask questions when there is something that they do not understand	185	4.18±0.918	192	4.17±.790	0.074	0.941
6. The physicians and nurses here work together as a well-coordinated team	187	4.07±0.959	195	4.23±0.746	1.719	0.086

Table (11): Mean scores of safety climate dimension' items before and after implementation of surgical safety checklist.

Safety climate items	pre-intervention Phase		post-intervention Phase		t	p
	n	Mean (SD)	n	Mean (SD)		
1. I would feel being treated here as a patient	186	3.99±0.891	191	4.16 ±0.792	1.871	0.062
2. Briefing operation room personnel before a surgical procedure is important for patient safety	186	4.36±0.847	194	4.42 ±0.739	0.767	0.444
3. Medical errors are handled appropriately in this operating room	185	4.02±0.994	194	4.20 ±0.757	1.925	0.055
4. I know the proper channels to direct questions regarding patient safety in this operation room	187	3.95±0.963	195	4.19 ±0.760	2.686	0.008
5. I receive appropriate feedback about my performance	183	3.43±1.220	193	3.80± 1.012	3.268	0.001
6. In this operation room, it is difficult to discuss errors	184	3.26±1.249	194	3.61± 1.166	2.797	0.005
7. I am encouraged by my colleagues to report any patient safety concerns I may have	182	4.05±0.968	192	4.02 ±0.924	0.402	0.688
8. Personnel frequently disregard rules or guidelines that are established for the operation room	184	3.39±1.363	194	3.66 ±1.283	1.973	0.049
9. The culture in this operation room makes it easy to learn from the errors of others	187	3.82±1.003	193	4.00 ±0.952	1.759	0.079

Table (12): Mean scores of Job satisfaction dimension' items before and after implementation of surgical safety checklist.

Job satisfaction items	pre-intervention phase		post-intervention phase		t	p
	n	Mean (SD)	n	Mean (SD)		
1. I like my job	186	4.41±0.860	195	4.47±0.762	0.760	0.448
2. Working here is like being part of a large family	187	4.29±0.952	194	4.49±2.288	1.112	0.267
3. This is a good place to work	188	4.18±0.979	196	4.30±0.767	1.344	0.180
4. I am proud to work in operation room	187	4.17±0.963	196	4.34±0.798	1.893	0.059
5. Morale and ethics in this operation room is high	184	4.01±0.899	193	4.12±0.798	1.238	0.216

Table (13): Mean scores of stress recognition dimension' items before and after implementation of surgical safety checklist.

Stress recognition	pre-intervention phase		post-intervention phase		T	p
	n	Mean (SD)	n	Mean (SD)		
1. When my workload becomes excessive, my performance is impaired	187	3.69±1.299	192	3.96±1.072	2.196	0.029
2. I am less effective at work when fatigued	186	3.60±1.333	194	4.08±1.023	3.952	0.000
3. I am more likely to make errors in tense or hostile situations	187	3.34±1.402	192	3.82±1.186	3.608	0.000
4. Fatigue impairs my performance during emergency situations	186	3.28±1.403	196	3.71±1.241	3.134	0.002

Table (14): Mean scores of perception of management dimension' items before and after implementation of surgical safety checklist.

Perception of management	pre-intervention phase		post-intervention phase		T	p
	n	Mean (SD)	n	Mean (SD)		
1. Managements supports my daily efforts (unit management)	186	3.96±0.926	196	4.01±0.877	0.518	0.604
2. Managements supports my daily efforts (hospital management)	182	3.77±0.957	193	3.94±0.933	1.671	0.096
3. Management doesn't knowingly compromise patient safety (unit management)	185	3.55±1.281	194	3.80±1.006	2.144	0.033
4. Management doesn't knowingly compromise patient safety (hospital management)	183	3.56±1.238	186	3.78±0.974	1.964	0.050
5. Management is doing a good job (unit management)	186	4.22±0.856	191	4.13±0.851	0.957	0.339
6. Management is doing a good job (hospital management)	175	4.03±0.928	193	4.14±0.870	1.127	0.261
7. Problem personnel are dealt with constructively by our (unit management)	183	3.96±0.886	194	3.93±0.840	0.324	0.746
8. Problem personnel are dealt with constructively by our (hospital management)	178	3.77±0.973	191	3.90±0.886	1.352	0.177
9. I get adequate timely info about events that might affect my work, from (unit management)	185	4.01±0.860	193	3.98±0.813	0.306	0.760
10. I get adequate timely info about events that might affect my work, from (hospital management)	179	3.72±0.984	192	4.01±0.822	3.089	0.002

Table (15): Mean scores of working conditions dimension' items before and after implementation of surgical safety checklist.

Working conditions	pre-intervention phase		post-intervention phase		T	p
	n	Mean (SD)	n	Mean (SD)		
1. The level of staffing in this clinical area are sufficient to handle the number of patients	187	3.86±1.115	196	3.89±1.001	0.297	0.767
2. This hospital does a good job of training new personnel	187	3.96±1.044	196	4.08±0.902	1.196	0.232
3. All the necessary information for diagnostic and therapeutic decisions is routinely available to me	186	4.15±0.850	195	4.15±0.929	0.036	0.971

Table (16): Mean scores of other safety attitudes' items before and after implementation of surgical safety checklist.

Safety attitudes items	pre-intervention phase		post-intervention phase		T	p
	n	Mean (SD)	n	Mean (SD)		
1. I experience good collaboration with nurses in this operation room	188	4.23 ±0.850	195	4.24 ±1.049	0.126	0.900
2. I experience good collaboration with staff physicians in this operation room	187	4.25 ±0.785	196	4.23±0.788	0.140	0.888
3. Communication breakdowns that lead to delays in delivery of care are common	186	3.45 ±1.226	196	3.66 ±1.206	1.700	0.090

Table 17 indicates that, during pre-intervention phase a significant difference was found between the mean scores of surgeons, anesthesia providers and nurses for job satisfaction (p=0.000), stress recognition (p=0.000), working conditions (p=0.000) and safety climate subscales (p=0.003). The results did not show any significant difference between the mean scores of surgeons, anesthesia providers and nurses with regard to the teamwork climate (p=0.183) and perception of management subscales (p=0.617). During post-intervention phase, there was no any significant difference between the mean scores of surgeons, anesthesia providers and nurses with regard to all safety attitudes subscales except for job satisfaction (p=0.015). Review of table reveals that, nurses anddoctors differed in their safety attitudes perception. Overall, the nurses perceived higher job satisfaction compared with doctors.

Table (17): Mean scores of safety attitudes' domains for surgeons, anesthesiologists, and nurses before and after implementation of surgical safety checklist.

		Pre-intervention phase			Post-intervention phase		
		n	Mean (SD)	F (p)	n	Mean (SD)	F (p)
Teamwork climate	Surgeon team	90	22.96±3.32	1.714 (.183)	67	23.84±3.31	1.494 (.227)
	Anaesthesia team	21	22.10±3.55		29	22.83±2.00	
	Nursing team	70	23.61±3.66		92	23.32±2.51	
Job satisfaction	Surgeon team	89	20.81±3.38	14.011 (.000)	72	20.88±3.08	4.265 (.015)
	Anaesthesia team	22	18.00±4.91		29	21.52±2.29	
	Nursing team	70	22.41±3.06		89	22.46±3.99	
Stress recognition	Surgeon team	89	15.53±2.97	21.627 (.000)	67	15.76±3.63	.644 (.526)
	Anaesthesia team	21	15.81±4.41		29	16.14±2.92	
	Nursing team	72	11.31±5.48		90	15.31±3.96	
Perception of management	Surgeon team	83	38.92±6.09	.484 (.617)	66	39.94±5.57	.516 (.598)
	Anaesthesia team	16	40.25±6.59		27	40.48±5.29	
	Nursing team	66	38.65±5.30		88	39.39±4.98	
Working conditions	Surgeon team	93	11.18±2.35	17.661 (.000)	74	12.24±2.20	1.424 (.243)
	Anaesthesia team	21	11.29±3.20		29	12.62±1.80	
	Nursing team	72	13.24±1.82		92	11.87±2.37	
Safety climate	Surgeon team	83	33.16±4.87	6.170 (.003)	64	34.94±3.87	0.003 (.997)
	Anaesthesia team	20	31.80±4.83		29	34.93±2.69	
	Nursing team	69	35.20±3.91		86	34.98±3.33	

Table 18 presents the inter-correlations among the safety attitudes subscales before implementation of

surgical safety checklist. The table shows that the correlation ranged from -0.117 to.567 and that five of the six factors correlations were significant. Safety attitudes subscales were positively correlated with each other. Teamwork climate was more positively correlated to with the perceptions reported for management (r=0.402) job satisfaction (r=0.411), safety climate (r=0.522). Safety climate was more positively correlated with job satisfaction (r=0.567) and working conditions (r=0.545). Stress recognition subscale was negatively correlated to teamwork climate (r=-.138), safety climate (r=-.117) and job satisfaction subscales (r=-.186). Moreover it was not significantly related to teamwork climate (p=0.068) and safety climate (p=0.135).

Table (18): Correlation matrix for the Safety Attitudes Questionnaire (SAQ) subscales before implementation of surgical safety checklist.

		Teamwork climate	Safety climate	Job satisfaction	Stress recognition	Perception of management
Safety climate	Pearson Correlation	.522**				
	Sig. (2-tailed)	.000				
	n	170				
Job satisfaction	Pearson Correlation	.411**	.567**			
	Sig. (2-tailed)	.000	.000			
	n	175	166			
Stress recognition	Pearson Correlation	-.138	-.117	-.186*		
	Sig. (2-tailed)	.068	.135	.013		
	n	175	166	177		
Perception of management	Pearson Correlation	.402**	.435**	.272**	.201*	
	Sig. (2-tailed)	.000	.000	.001	.011	
	n	160	154	159	159	
Working conditions	Pearson Correlation	.288**	.545**	.546**	-.294**	.440**
	Sig. (2-tailed)	.000	.000	.000	.000	.000
	n	179	171	179	180	165

Table19 presents the inter-correlations among the safety attitudes subscales before implementation of surgical safety checklist. The table shows that the correlation ranged from 0.076 to.490 and that most factors correlations were significant. Safety attitudes subscales were Positively correlated with each other. Stress recognition subscale was negatively correlated to teamwork climate (r=-.235) and job satisfaction (r=-0.062) subscales. Moreover it was not significantly related to safety climate (p=0.109) and job satisfaction (p=0.408) subscales. Review of table reveals that, teamwork climate subscale was not significantly related to Perception of management (p=0.055) and Working conditions (p=0.301) subscales. Teamwork climate was more positively correlated to with the perceptions reported for safety climate (r=0.451). Working conditions subscale was more positively correlated to with the perceptions reported for management (r=0.490) and safety climate (r=0.423).

Table (19): Correlation matrix for the Safety Attitudes Questionnaire (SAQ) subscales after implementation of surgical safety checklist.

		Teamwork climate	Safety climate	Job satisfaction	Stress recognition	Perception of management
Safety climate	Pearson Correlation	.451**				
	p	.000				
	n	175				
Job satisfaction	Pearson Correlation	.274**	.207**			
	p	.000	.006			
	n	183	175			
Stress recognition	Pearson Correlation	-.235**	.122	-.062		
	p	.001	.109	.408		
	n	181	173	181		
Perception of management	Pearson Correlation	.145	.316**	.203**	.330**	
	p	.055	.000	.007	.000	
	n	175	168	176	173	
Working conditions	Pearson Correlation	.076	.423**	.188**	.145*	.490**
	p	.301	.000	.009	.049	.000
	n	187	178	189	185	180

4. Discussion

This is the first study assessing the implementation of the surgical safety checklist in public hospitals in Kuwait. Study findings will act as baseline data regarding the implementation of the surgical safety checklist in Kuwait.

Introduction of the Surgical Safety Checklist into operating rooms in the study hospitals was associated with improvements in surgical outcomes. The reduction in the rates of death and complications suggests that the checklist implementation can improve the safety of surgical patients. Whereas the improvement in surgical outcomes is not substantial, the exact mechanism of improvement is less clear and most likely multifactorial.

Overall adherence to the elements of the surgical safety checklist was significantly (p=0.000) increased from the median of 5 before the implementation of the surgical safety checklist to the median of 27 after the implementation of the surgical safety checklist. The systemic and behavioral changes could account for the improvements observed. Another mechanism, however, could be the Hawthorne effect, an improvement in performance due to subjects' knowledge of being observed by the study personnel.

Results found no change in compliance with surgical safety checklist with regard to the type of surgery (elective or urgent), or type of anesthesia (general, local, spinal). This was consistent with the findings in the literature. (Haynesetal,2009)

According to the study results stress recognition subscale was negatively correlated to teamwork climate and job satisfaction subscales. These findings complement those of the psychometric testing for the original SAQ. (Gabranietal,2017) Previous study stated that, stress recognition did not show a relationship with the perceptionsof management, the teamwork climate, and job satisfaction. (Sextonetal, 2006)

During pre-intervention phase, a significant difference in the perceived patient safety attitudes was found between the nurses, physicians and anesthesia providers for the subscales of job satisfaction (p=0.000), stress recognition (p=0.000), working conditions (p=0.000) and safety climate subscales (p=0.003). However, there was no any significant difference with regard to the teamwork climate (p=0.183) and perception of management subscales (p=0.617). During post-intervention phase, there was no any significant difference between the mean scores of surgeons, anesthesia providers and nurses with regard to all safety attitudes subscales except for job satisfaction (p=0.015). Overall, the nurses perceived higher job satisfaction compared with doctors.

A study conducted in Albania revealed that, a significant difference in the perceived patient safetyattitudes for the subscales of teamwork, safety climate, job satisfaction and working conditions was foundbetween the nurses and physicians, with the nursesscoring lower mean values. Overall, thenurses perceived lower job satisfaction, worse workingconditions, a lower level of teamwork and poorer perceptionsof management compared with doctors. (Gabrani et al, 2017) Two studies in the USA that used the SAQ showed that nurses anddoctors differed in their perceptions of safety culture, (Rosenetal,2008 and Van Noordetal,2010) possibly because of the personal characteristicsof the caregivers, such as their level of education, socioeconomic status and gender. The traditional hierarchy of physicians has often discouragednurses from speaking up to doctors. Nursesmay be hesitant to confront physicians on issues ofpatient care because they might have less training in orexperience with dealing with patients' medical conditions. (Van Noordetal, 2010).

Another study that examined nurses' jobsatisfaction showed that 41% of nurses were dissatisfiedwith their work in the USA; in England, 38.9% of nursesintended to abandon the profession. Generally, salary, professional growth and autonomy are some of thefactors that influence the nursing professional's job satisfaction. (Needlemanetal, 2002)

The study findings revealed that, working conditions had the lowest mean score compared with other domains in both pre-intervention (mean=11.99) and post-intervention (mean=12.12) phases. Working conditions can be improved by ensuring sufficient level of staffing; identifying optimal provider to patient ratio, skill mix, skill requirement, scope of practice, and resources available (Cartmilletal,2012); training of new personnelto ensure that they gain the experience to provide better care to patients (McCullochetal,2011); and providing staff with necessary information required for diagnostic and therapeutic decisions.

About 30% of surgical team members in pre-intervention phase and 17% in post-intervention phase reported that, it is difficult to speak up if they perceive a problem with patient care. Moreover, around 50% of surgical team members reported that, it is difficult to discuss errors in operating rooms. Only 51.4% of surgical team members during pre-intervention phase and 65.3% during post-intervention phase stated that, they receive appropriate feedback about their performance. Therefore, creating an open climate where everyone is free to speak up and communicate with each other independent of status and profession is very important and can be done through active leadership and administrative support to enhance speak up behaviors of professionals (Open school, IHI,2015) and development of hospital policies which

openly support and encourage professionals to raise their concerns. (Okuyamaetal,2015) Also building a positive safety culture in the organization to encourage care provider to speak up in the team without fear of blaming or punishment (Jansen et al, 2015) and Speaking up training are important. (Martinez et al, 2015)

One limitation of the study is that the documentation of complicationswas limited to the period of admission. Data oncomplications and deaths occurring after dischargewere not collected, resulting in an underestimation of the rates of complications.

Conclusions

The implementation of surgical safety checklist can modify personal attitudes of professionals working in operating rooms and seen as a tool that improve the safety of surgical patients. To successfully manage the checklist, the support of staff in more senior positions is very important.

Measuring safety climate dimensions such as perceived teamwork climate, job satisfaction and the perception of management in hospitals can help to diagnose the underlying safety culture of an entire organization or work unit. Moreover, knowledge about the health care providers' attitudes towards patient safety can help health care planners and policymakers to plan for promoting patient safety in surgical and invasive procedures.

Interventions to improve the safety climate require strong commitment and support by the management and initial education and training of employees. Creating an open climate where everyone is free to speak up and communicate with each other independent of status and profession is very important.

This study serves as a starting point for initiating policy changes to address the issues such as improving job satisfaction, working conditions and providing staff with appropriate feedback about their performance to reduce the impact of these factors on the quality of hospital care.

Acknowledgements

Authors would like to thank the Ministry of Health, State of Kuwait for funding this research. Authors would also like to thank the administrator of the participating governmental health care organization in Kuwait for facilitating this work. Special thanks go to all health professionals and patients who participated in this study.

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10/7/2018