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Environmental Infection Control in Intensive Care Units at Gaza Governorates: KAP Study

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Abstract
Background*:** Patient safety is one of the most important aspects in evaluating the quality of healthcare. However, healthcare associated infection is a major cause of morbidity and mortality in the intensive care units (ICUs). Undoubted, adhering to recommended infection prevention and control (IPC) practices could decrease most of these infections through IPC strategies. These strategies have been shown to be both clinically effective and cost-effective. It is anticipated that all healthcare providers (HCPs) adhere to standards in their practices. The standards must be part of the knowledge, attitude, and practice KAP of all the health facilities to obtain the clients safety and protection. This study aimed to evaluate the KAP of the HCPs at general ICUs toward environmental infection control (EIC) in Gaza. ***Methodology*:** A three-months descriptive cross sectional study was done to evaluate the KAP of the two main general ICUs in Gaza "Shifa Complex and European Gaza Hospital (EGH)". Self-administered questionnaire was fulfilled by 73 HCPs to assess the knowledge and attitude toward EIC. Furthermore, 68 HCPs practices were evaluated through an observation checklist. ***Results: Self-administered questionnaire results revealed that nearly 40% of the HCPs acquired influenza followed by chest infection more than twice in the same year. In addition, about 58% of their answers confirm knowledge deficit. Regarding HCPs attitude headed for EIC, 80.68% agreed to use hand rub instead of hand washing (**P=0.001**). HCPs practices were in about 50% compliance. However, nurses were more adherent than physicians in about 7.5%. Nearly 80% of HCPs hadn't experienced supervision of their practices regarding IPC implementation. The study discovered insufficient level of performance for hand hygiene, and cleaning of environment, both hand hygiene practices and invasive procedures IPC measures were not applied in a percentage of 60%. Moreover, healthcare waste disposal and laundry system remained the highest malpractices reported. ***Conclusions:*** The study recommend educational courses and applying of monitoring and auditing programs depending on checklist system. Written Arabic protocols have to be available. Influenza vaccination for all ICUs HCPs should be mandatory to decrease earn rate of influenza. Advanced healthcare waste and laundry systems necessitate to be developed. The study recommend sufficient level of performance for hand hygiene, and cleaning of environment.
Key words: Infection, Knowledge, Attitude, Practices, environment, hand hygiene.

1.Introduction

Gaps between knowledge and actual clinical practice have not been sufficiently analyzed. They assessed knowledge and compliance with guidelines for prevention of VAP among physicians, nurses, and students in adult ICUs. All adult ICU health care workers (HCW) were invited to complete a 20-point questionnaire. The first part assessed personal knowledge of international guidelines for prevention of VAP; the second part assessed daily clinical practice. Personal knowledge and daily practice were scored from 0 to 10 points. They invited 257 ICU-HCWs to participate in the study, and 167 (65%) accepted (32/54 physicians, 108/176 nurses, and 27/27 students). The median (IQR) personal knowledge scores for physicians, nurses, and students were 6 (5-7), 5 (4-6), and 5 (4-7). The median scores for daily clinical practice for physicians and nurses were 5 (4-6) and 4 (3-5), respectively. HCWs with more than 1 year of ICU experience scored significantly better in personal knowledge than those with less experience: 6 (5-7) vs 4 (3-6); p=0.004 (Pérez-Granda et al., 2012). Many researchers conducted this factor and revealed the relations between the knowledge and attitude and the IPC protocol. In a study conducted at Nigeria about the awareness, knowledge, attitude and practice of blood and body fluid precautions among radiographers, the study explores the awareness, knowledge, attitude and practice of universal precautions among radiographers as well as their sensitivity towards the possibility of being occupationally exposed and extent of their exposure to infections. A total of 24 radiographers were assessed. The index used to assess the awareness was how they knew about universal blood and body fluid precautions. 20.8% (n= 5) of radiographers knew about universal precautions through books, 8.4% (n=2) knew through someone, 58.3% (n=14) through seminar/ symposium, while 12.5% (n=3) knew through mass media. Only 37.5% (n=9) was against recapping of needles and 29.2% (n=7) rated their knowledge very good. 45.8% (n=11) of the radiographers have received occupational training on. The attitude radiographers towards patients with blood and body fluid-borne pathogens were positive (Okaro et al., 2010).

In Egypt, a study conducted at the endoscopy units in El-Kasr El-Ani Hospital, to assess the knowledge of health team in relation to infection control measures as well as their 26 level of practice in the application of infection control measures. The study results revealed that 5% of physicians and 10% of nurses had satisfactory knowledge, and 30% of physicians and just 4% of nurses had adequate level of performance, while none of the workers had satisfactory level of knowledge or practice. The study recommended an educational program for the endoscopy staff about infection and infection control measures application for the protection of staff and patients. The researcher found that the factor affecting infection control measures in endoscopy department regarding endoscopy health team level of knowledge and practice is the lack of knowledge in addition to insufficient level of performance during and post procedure as disinfection of endoscope, hand washing, and cleaning of environment post procedure, and few written Arabic protocols for universal precautions (El Shamaa, 2010).

2. Methodology

2.1 Period and place of study

The study carried out in the two main locations in which Palestinian Ministry of Health (MOH) has general ICUs which provide intensive care for most specialties at Gaza hospitals, includes two health centers Shifa complex and EGH. On the other hand, data collected from October to December 2012**.**

2.2 Study population

The total number of the HCPs at the ICUs was 81 persons, distributed as 31 physicians, 44 nurses and 6 physiotherapists, 73 of them responded with a response rate of 90.1 %. However, all of them were observed to fulfill the observation checklist concerning answering the questionnaire. The total number of the observed HCPs was 68 persons (physicians and nurses) who are meeting the eligibility criteria. All of the 68 HCPs who constitute the study population was observed with a rate of 100 %. Therefore, nurses and physiotherapist that didn't work fulltime duties were excluded.

2.3 Study tools

The first tool was self-administered questionnaire that was used to assess knowledge and attitude of HCPs. It consisted of five sections. The first part covered personal and professional information, the second part contains questions that assess HCPs knowledge about policies, education, frequencies of vaccination, diseases and injures. The third part contains questions to assess HCPs knowledge about EIC, and the fourth one covered HCPs attitude toward EIC. The last part identify barriers that decrease HCPs compliance with EIC guidelines.

The second tool was observational checklist for evaluating HCPs practices. It enclosed eight categories which are: keeping air quality at the unit environment, , hand washing practices, wearing uniform, personal protective equipment (PPE) and use of gloves, handle laundry linens in proper way, dealing with instruments and equipments of (patient airway management, central venous catheter(CVC), peripheral venous catheter (PVC), IV fluids and medication, Folly's catheter), the last two categories were using of antiseptics and disinfectant solutions and finally discarding medical waste and sharp disposal properly.

2.4 Data collection

The data was collected through the self-administered questionnaire and the observational checklist during the period of three months for the observational checklist crossing two months for the questionnaire. The observation checklist were filled three times to reflect the actual practices of HCPs. And so, 68 HCPs, 38 nurses and 30 physicians were observed to obtain 204 filled checklist, in a total of 16524 observations for different practices. However, The researcher distributed the questionnaire to HCPs and received it in the same shift in the two ICUs.

3.Results and Discussion

3.1 Structural and Managerial elements

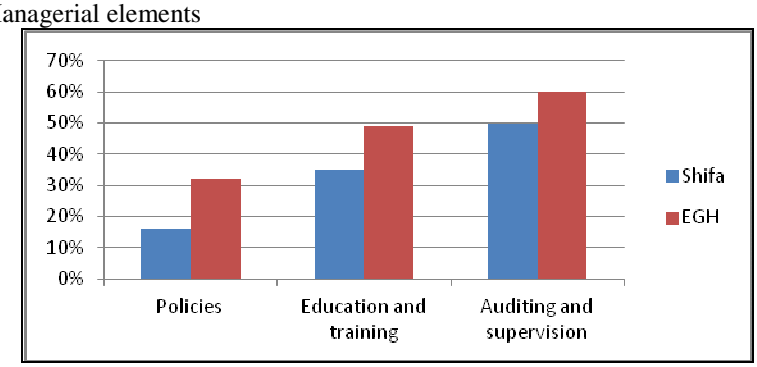


Figure 3.1: Structural and managerial elements knowledge

The researcher set three items to express organizational structural and managerial elements which is Policies, "Education and training" and "Auditing and supervision". In term of policies, the study results indicate that about

75% of the population sample had no knowledge about policies regarding IPC. However, about 60% of the participant were not received any educational and training programs. On the other hand, half of the participant agreed that no tangible auditing and supervision program from managers toward IPC.

3.2.1 Vaccination

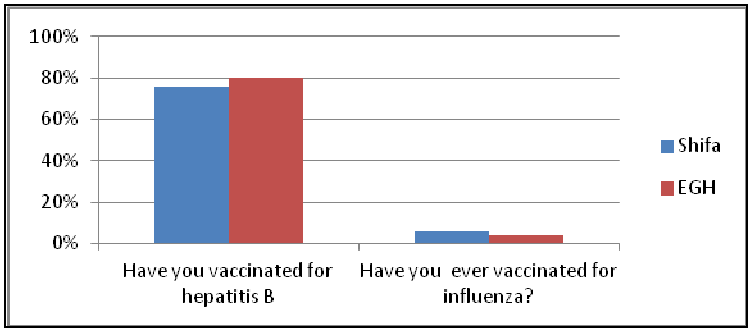


Figure 3.2: Vaccination

The study revealed that 78 % of participant were vaccinated against hepatitis B virus, bout 66% of them received the three doses. In contrast, just about 5% of them were vaccinated against influenza virus. So the researcher decided not to make a total average for vaccination because of the significant difference in between the two vaccinations.

According to literatures, the research results is better than the results of a research conducted in Jordan which revealed that only 36% of HCPs were vaccinated (Al-Omari, Al-Dwairi, 2005), while 11.3% of the respondents had received three doses in Egypt (Ismail et al, 2007). Another study conducted in Iran revealed that 61.5% had received complete vaccination against HBV (Askarian, 2009). Another study conducted in India revealed that 61.2 percent of the dental students had not been vaccinated with hepatitis B (Singh et al, 2011).

On the other hand, influenza vaccination is not considered at all in the system of Palestinian ministry of Health (MOH) to HCPs. However, literature approached to prove the against in the study conducted in Germany by Wicker et al., (2010) which indicate that hospitals policies now toward mandatory vaccination especially for HCWs who care for immunecompromised patients particularly as ICUs. In the study 68.4% of participants supported mandatory vaccinations for HCWs. Nurses had lower vaccination rates, were more likely to reject mandatory vaccinations, and were less likely to be convinced that vaccinations are important for them. With the exception of HBV vaccination, this result was found for influenza vaccination. This result could reflect a higher awareness among physicians regarding the benefits of vaccinations either for patients or for themselves. However, nurses usually have both closer and longer contact with patients than any other professional group of HCWs. Moreover, the previous results are in line with those of published study of a children's hospital in Kansas City, Missouri, in which most of the HCWs (70%) thought influenza vaccination should be mandatory for HCWs (Douville et al., 2010).

3.2.2 Disease and injuries

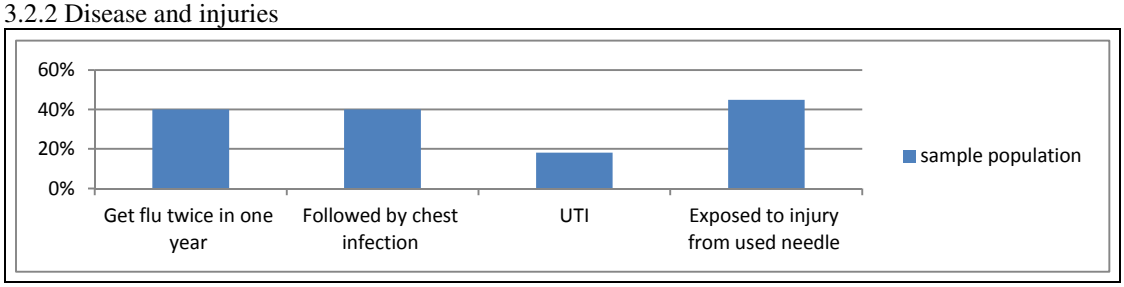


Figure 3.3: Disease and injuries

In studying the frequencies of exposing to earn disease or to get injury during working, the study discovered a total of approximately 46% of the study population exposed to disease and injuries. In more detailed, 80% of them acquired influenza that year, particularly 40 of them% infected twice and followed by chest infection. However, around 44% of the study population exposed to injury from used needle or sharp surgical instrument during working. Literature reported in 2012 that 10 ICU nurse earn sever chest infection in Jordan hospital, one of them had died and the other hospitalized for several days tell complete cure. This result is better than that which was conducted by Hassan et al., (2004) at Assiut University and recorded that 97.2% of participants were exposed to needle sticks. While the result of another study conducted at a German University Hospital by Wicker et al., (2007) which reported better results as 31.4% of the participants were injured by needle stick. Another study conducted at Gharbiya Governorate, Egypt by Ismail et al., (2007) and showed that females HCPs were more likely to experience needle-stick injuries than males. HCPs who graduated from nursing school or

who had lower levels of education were more likely to experience needle-stick injuries than those who had graduated from medical or nursing institutes or higher levels of education. HCPs who give injections were more likely to experience needle-stick injuries than those who do not give injections. These differences were statistically significant. However, HCPs who had received training are less likely to have a needle stick injury than those who had not ($P < 0.05$). Two-hand recapping of needles was the commonest cause of such injuries.

3.3 Healthcare Providers Knowledge

Table 3.1: Summary of HCPs Knowledge

No.	Item	Shifa hospital				EGH			
		f	%	f	%	f	%	f	%
		Non Correct		Correct		Non Correct		Correct	
1	**Air & ventilation system**	293	77.9	83	22.1	170	81.7	38	18.3
2	**Water quality and hand washing**	75	53.2	66	46.8	43	55.1	35	44.9
3	**Environmental surfaces**	102	54.3	86	45.7	52	50.0	52	50.0
4.1	**Instruments and Equipments**	72	51.1	69	48.9	49	62.8	29	37.2
4.2	**Suctioning of sputum secretion**	74	52.5	67	47.5	48	61.5	30	38.5
5	**Laundry** " Linen and pillows".	55	26.1	57	73.9	37	31.7	93	68.2
6.1	**Healthcare waste disposal**	63	67.0	31	33.0	37	71.2	15	28.8
6.2	**Sharp disposal**	83	58.9	58	41.1	40	51.3	38	48.7
7	**Disinfection and Antiseptic**	176	62.4	106	37.6	98	62.8	58	37.2
	Total	**993**	**57.1**	**746**	**42.89**	**574**	**59.66**	**388**	**40.3**

The researcher evaluate HCPs knowledge about EIC concepts and the proper standard precautions (SP) needed**,** table 3.1 shows that the items of evaluation were seven items nominated as above. A total percentage of 57.1% of the participant answered non correct answers in Shifa ICU, similar to the percentage of EGH ICU of 59.66%. This result is opposition with a study conducted in Iran by Motamed et al., (2006) which showed that 65.8% of the total population was familiar with SP. Another study reported a high knowledge of SP where 92% of the respondents claimed knowledge about universal precautions (Hesse et al, 2006). A recent study conducted in Tehran showed that the percentages of participants with good and acceptable knowledge regarding infections control in three hospitals were 64.91, 60 and 66.7 respectively. Distribution of respondents with good knowledge by gender shows 54.5% in men and 25.8% in women. By marital status, 62.5% in singles and 64.2% in married (Amerion et al, 2010).

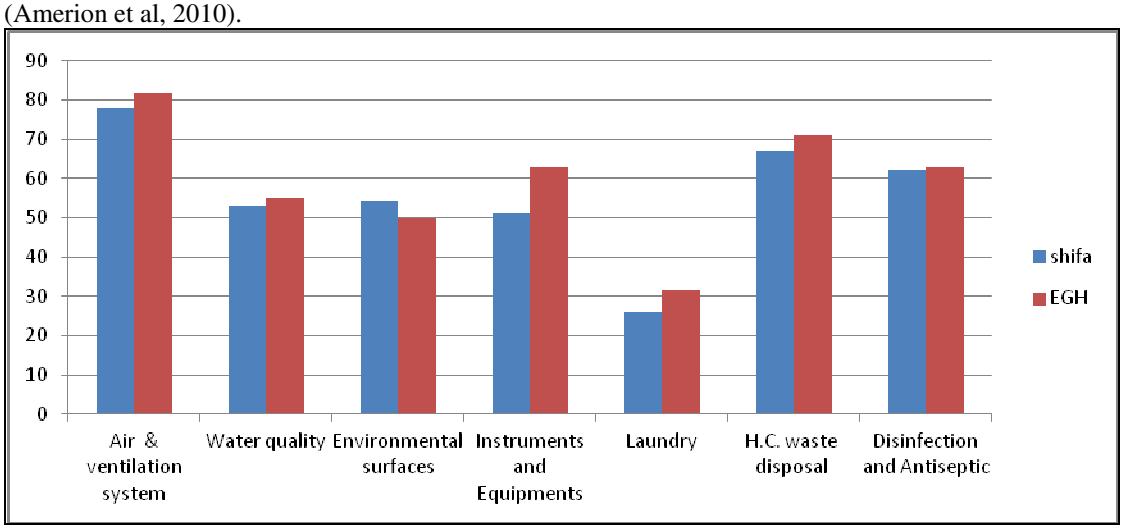


Figure 3.4 : HCPs knowledge deficit

3.4 Health care Providers Attitude

This part of the questionnaire was directed to ask the respondents about their attitude and the scale was

1.Strongly disagree 2. Disagree 3. Undecided 4. Agree 5. Strongly agree

In the following table we use a one sample t-test to test if the opinion of the respondent in the content of the sentences are positive (weight mean greater than "60%" and the p-value less than 0.05) or the opinion of the respondent in the content of the sentences are neutral (p- value is greater than 0.05) or the opinion of the respondent in the content of the sentences are negative (weight mean less than "60%" and the p-value less than 0.05)

Table 3.2: Summary of HCPs Attitude

No.	Items	Mean	standard deviation	Weight mean	t-value	P-value
1	**Air & ventilation system**	3.6	0.57	71.8	8.8	0.000
2	**Water quality and hand washing**	3.99	0.86	78.1	7.3	0.001
3	**Environmental surfaces cleaning**	3.91	0.78	68	6.6	0.000
4.1	**Instruments and Equipments disinfection**	3.41	0.98	68.2	3.6	0.001
4.2	**Equipments of suctioning of sputum secretion**	3.45	0.67	68.9	5.7	0.000
5.1	**Laundry**. Linen	3.90	0.72	78.0	10.6	0.000
5.2	**Laundry :** Pillows and mattress	4.11	0.71	82.1	13.3	0.000
6.1	**Healthcare waste management**	4.19	0.83	83.8	12.3	0.000
6.2	**Sharp disposal**	3.01	1.13	60.1	0.05	0.959
7	**Disinfection and Sterilization**	3.25	0.64	65.0	3.3	0.001

In the above table 3.2 we use a one sample t test to illustrate the opinion of the respondent about environmental infection control EIC concepts. The results in table 3.2 indicate that all ICU HCPs in this census study had positive attitude toward EIC (weight mean greater than "60%" and the p-value less than 0.05) except in sharp disposal. The sign of the test is positive, so the mean of these statements is significantly greater than the hypothesized value "3". We conclude that the respondents agreed to these statements and their answers located between agree and strongly agree. However, In a study conducted in the department of surgery, College of Health Sciences, and University of Ghana on Knowledge, Attitude and Practice Universal Basic Precautions by Medical Personnel in a Teaching Hospital, results showed that all respondents except one person said that SPs reduce the risk of HIV transmission. About 96% of the respondents agreed that SPs should be practiced for all patients (Hesse et al, 2006).

Table 3.3: HCPs Attitude about Sharp disposal

No.	Items	Mean	standard deviation	Weight mean	t-value	P-value
1	Used needles should not be removed from syringes before disposal.	3.23	1.54	64.66	1.29	0.20
2	Used needles should not be recapping prior disposal.	2.78	1.62	55.62	-1.15	0.25
3	**Total**	3.01	1.13	60.14	0.05	0.95

However, table 3.3 shows that 64.66% of the participants doubted about removed of syringes from used needles before disposal (**t-value** 1.291 less than 2.0, **P-value** 0.201 more than 0.05). Also, 55.62% of them had negative attitude toward recapping of used needles prior disposal (**t-value** -1.151 less than 2.0, **P-value** 0.253 more than 0.05). Therefore, recapping is not recommended in the WHO, CDC recommendations and the Palestinian IPC Protocol for sharp disposal.

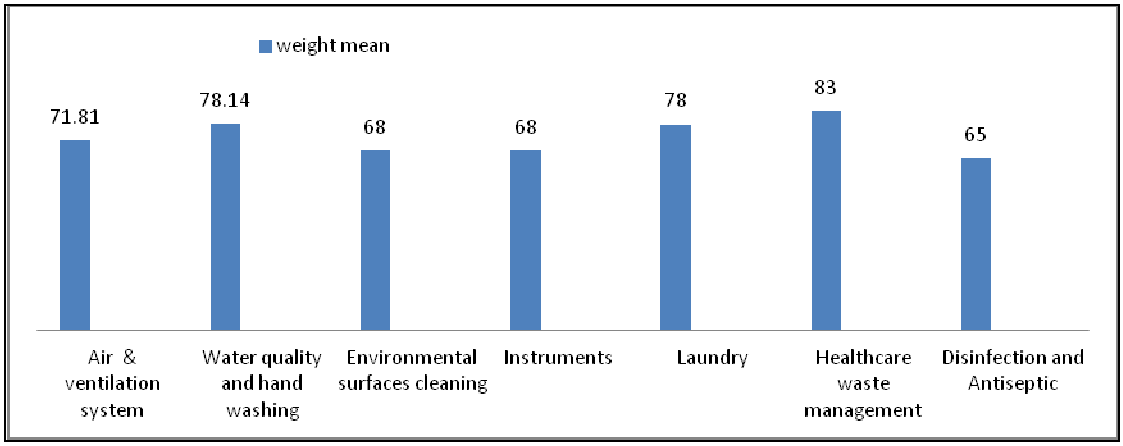


Figure 3.5 : HCPs Attitude "weight mean greater than "60%" and the p-value less than 0.05"

3.4 Evaluation of healthcare providers practices toward EIC

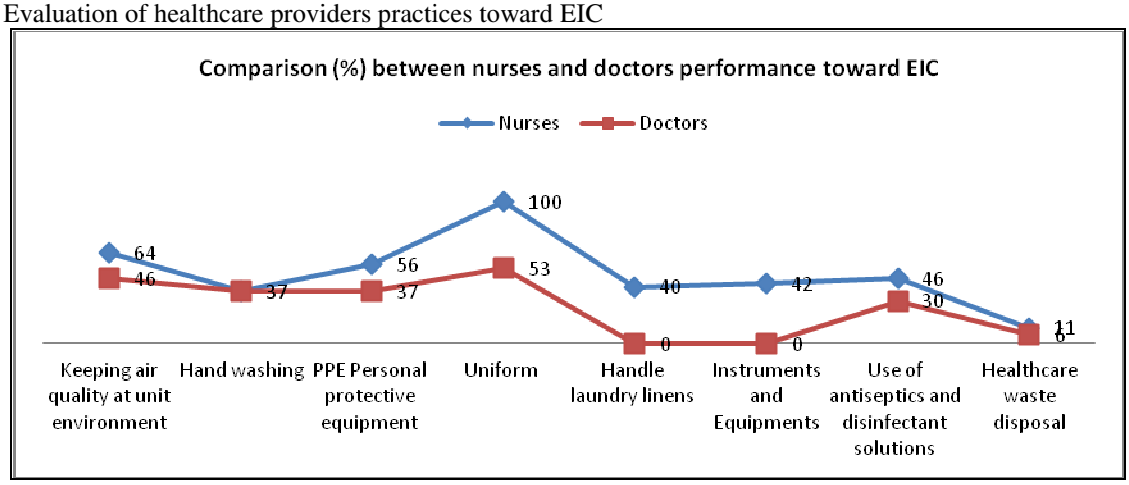


Figure 3.6 : HCPs practices toward EIC

3.4.1 Keeping air quality at unit environment

Concerning keeping air quality at unit environment, 64.5% of the respondents nurses adhered to keep air quality at unit environment. However, just 46.7% of the physician did. For example, in term of keeping windows and doors closed as much as possible nurses adhered in percentage of 78.9%. In contrast, 76.7% of the physicians did not.

3.4.2 Hand washing

Regarding the hand washing, around 37.5% of both nurses and physicians adhered to hand washing protocols and guidelines. However, 62.5% did not. The highest percentage of adherence was in the item of hand washing after touching blood or body fluids in the both groups (88%). In contrast, the lowest percentage of compliance were in the items of turn of water after hand washing using paper towel if elbow mixer not available (100%), followed by washing hands for 15-30 seconds with soap and running water (93%), before touching the patients (98%), after removing gloves (100%), the same in using hand rub in area wherein hand washing sink is not accessible in percentage of (100%) but the reason of last was because of unavailability of the hand rub material. Out of Gaza, in the study conducted in Universities Wijaya Kusuma Surabaya, in Indonesia, hand hygiene compliance was poor (20%; 57/281; 95% CI: 16-25%) (Marjadi, 2010). However, in this study the significant difference between nurses and physician was in the item of hand washing before performing a septic invasive procedures 84.2% for nurses and 30% for physicians

3.4.3 Personal protective equipment

Half of the HCPs (54%) adhered to wear PPE which is considered an essential part to negate the risk of cross infection and to maintain the safety for both providers and patients, with no significant difference between nurses and physicians practices. Moreover, the correct worn and maintained of personal protective equipment as face mask and sterile gowns neither the commitment to wear or use PPE when caring patients were the highest percentage nearly (62%) demonstrate the low commitment of HCPs to wear PPE.

3.4.4 Uniform

Regarding wearing uniform, significant difference between commitment of nurses and physicians in the two units was observed 100% for nurse and less than half (43.3%) for physicians.

3.4.5 Handle laundry linens

This item is away from comparison because it is out of physicians responsibility, except the item of stick needles into the mattress through the cover. However, neither nurses or physician did that, in a percentage of 100% commitment of not applying this bad behavior. And so, slight above half (56%) of nurses just applied proper handling of laundry linens and other soft goods.

3.4.6 Instruments and Equipments

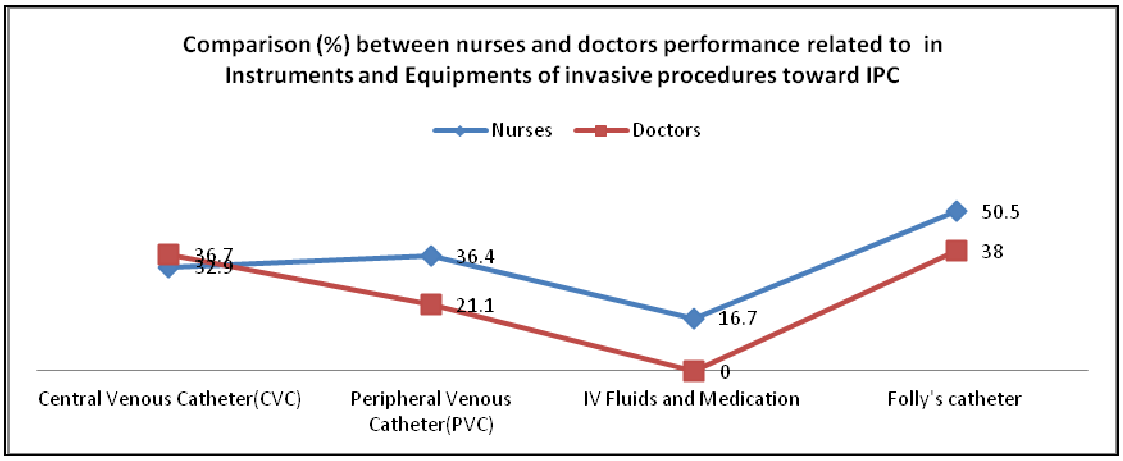
3.4.6.1 General Instruments and Equipments

This item is out of comparison because it is away from physicians responsibility. And so, eight percent below half (42.3%) of nurses just implemented appropriate dealing with instruments and equipments in terms of cleaning and disinfecting.

3.4.6.2 Equipments of patient airway management

Also this item is out of comparison because physicians in ICU are not accountable to care for inpatients airway management equipments, in which most of them are intubated and attached to mechanical ventilators. And so, nurses are accountable for that, however, 66% of them implemented appropriate dealing with equipments in terms of cleaning and disinfecting**.**

3.4.6.3 Invasive procedures practices .



3.4.6.3.1 Central Venous Catheter (CVC)
Regarding practices related to CVC, no significant difference between commitment of nurses and physicians. Unfortunately, 65% of them implemented improper practices toward CVC infection control. However, sterile towels were not available to maintain sterile field during the procedure in both units.
3.4.6.3.2 Peripheral Venous Catheter(PVC)
On the subject of practices related to PVC, considerable difference between commitment of nurses and physicians. Nurses adhered to PVC infection control practices in proportion of 36.4%, also physicians adherent reported just 21% during the study period. Unfortunately, nor of them implemented proper practices toward PVC infection control. However, removal of PVC after 24 hr post admission from emergency room in emergency situations is not considered at all.
3.4.6.3.3 Intravenous (IV) Fluids and Medication
Respecting practices related to IV fluids and medication administration, this item is out of comparison because physicians in ICU are not accountable to administer fluids and medication as one of their routine daily work, adjacent to the accountability of nurses. However, sometimes they " physicians" do, but not in all items of the judgment, so the researcher decided not to compare between the two practices. And so, most of nurses (83.3%) applied incorrect infection control practices toward IV fluids and medication administration.
3.4.6.3.4 Urinary Folly's catheter
Concerning infection control practices related to Folly's catheter indwelling and care. No major difference between commitment of nurses and physicians in maintaining sterility and prevent cross infection. Approximately 49.5%, 62% of nurses and physicians practices respectively were against IPC guidelines. Therefore, sterile towels were not available to maintain sterile field during insertion.

3.4.7 Use of antiseptics and disinfectant solutions
Regarding the proper use of antiseptic and disinfectant solutions, inconsiderable difference between performance of nurses and physicians in the two units. Nurses adhered to proper use of antiseptic and disinfectant solutions in percentage of 53.4%, since physicians performance reported 46.5% during the study observation period. However, allowing skin to dry or dried by sterile gauze before beginning the invasive procedure when alcohol is used was the highest unimplemented performance (96%) among HCPs of the two groups. The same as allowing Betadine to remain over skin 1-2 minutes before proceeding was nearly 72% among HCPs of the two groups.
3.4.8 Healthcare waste disposal
On the subject of practices related to healthcare waste disposal including sharp objects, negligible difference between performance of nurses and physicians was observed in term of discarding waste properly, nearly 90% applied inappropriate performance, while there was a better commitment toward sharp disposal either the two groups, with a minor difference between performance of nurses and physicians, that nurses observations reported 69.1% of accurate implementation, while physicians observations reported 55.3% of accurate implementation. However, recapping used needles reported the highest percentage (65.8 %) for nurses and (80%) for physicians of this inaccurate implementation. While, a significant difference in disposing all sharps in puncture resistance containers was observed between nurses and physicians, that nurses observations reported 84.2% of accurate implementation, in contrast with physicians observations which gave a proportion of just 40% of perfect achievement.

4. Conclusions and Recommendations

4.1 Conclusions

Knowledge deficit is clearly shown by the study. Regarding education and training courses, the study exposed that 80% of the participants of the census study had not been received any IPC training course. The study indicate that all ICU HCPs in this census study had positive attitude toward EIC. Regarding performance, There was relatively more commitment of applied implementations among nurses than physicians in a percentage around 7.5% . However, about 50% of the nurses implementations were unhealthy, particularly, IV fluids and medication administration. However, physicians unhealthy performances in terms of CVC and PVC ranged above 60%. Healthcare waste disposal were the highest poor implementations among nurses and physicians.

4.2 Recommendations

Further education and training courses regarding IPC need to be conducted to improve HCPs knowledge about policies and EIC. Auditing and monitoring programs are advised to be more assertive to ensure that policies have been implemented. Regarding vaccination the researcher recommend to add the influenza vaccine as mandatory for all HCPs working in ICUs. Restricted policy and special design need to be available in order to keep windows and doors closed as much as possible. Hand rub need to be available as alternative of hand washing. Irrigation containers after suctioning procedures should be disposable.

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