Effectiveness of Training on Isolation Precaution Measures at Public Hospitals Khartoum State – Sudan

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Abstract

Background: Isolation rooms play a critical role in hospitals during epidemics or pandemic events. Non – compliance to isolation precautions by the medical cadre could be attributed to poor knowledge, practices and awareness about isolation precautions. Failure to fully implementation and adherence could lead to hospital infections and propagation of the outbreak known with Healthcare-Associated Infections (HCAIs). Objective: to assess the effectiveness of training on isolation precautions measures among health care providers at Khartoum State Governmental Hospitals, Sudan in 2012. Also, to understand the factors those hinder compliance with standard precautions in isolation rooms. Methodology: Interventional study (Pre and Post-Study) has been conducted in three phases.

Methodology: 18 selected hospitals within Khartoum State and 159 medical cadres (doctors, nurses and sisters) were selected as the main participants for this study.

Results: Among selected hospitals (18) and participants (159); the pre-Knowledge mean was 6.35 and Post-Knowledge was 6.76, {CI 95%, (-1.07) – (-.02)}. Post assessment of attitude and practices were conducted among 10 hospitals out of 18. Pre– attitude mean was 13.4 and post– attitude mean was 14.4, {CI 95%, (-1.54) – (-.27)}, while pre –practice mean was 5.1 and the post – practice was 7.6, {CI 95%, (-2.99) – (-2.07)}.

Conclusion: Maintaining continuous educational training programs with providing protocols, PPEs and supervision is a crucial requirement.

Keywords: Standard precautions, Compliance, Hospital infection, Isolation Precaution, Knowledge, Attitude Practices, Hand Hygiene, Hospital Isolation, Infection Control

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Introduction:

World Health Organization (WHO) defined isolation as a measure designed to control of infection and prevent infected patients from infecting others (source isolation), and/or prevent susceptible patients from being infected (protective isolation).Universally there are two levels of precautions. The first level is Standard Precautions Level; It's defined as group of infection prevention practices that should be apply to all patients, regardless of suspected or confirmed infection status, in any setting in which healthcare is delivered. The second level of precautions is Transmission-Based Precautions Level(TBPs); are designed for patients suspected to be infected with highly transmissible or epidemiologically important pathogens and cover four types of infection transmission [1].Human (patients, working personnel, or visitors) are the most important element sources for infection transmission in isolations rooms, at the same time are more difficult to be controlled or prevented. Therefore failure to fully implementation and adherence to isolation precautions and using of personal protective equipment (PPEs) such as masks, gowns, eye protection and gloves with special emphasis on hand washing is will cause what known with Healthcare-Associated Infections (HCAIs). It's defined as infection acquired during the process of health care delivery or the time of admission, from patients to HCPs or/and reverse versa [2].Health Care – Associated Infections could be considered as significant public health problem around the world; its economic burden was estimated to be 6.7 and 1.7 billion US$ in USA and UK respectively during 2002[3].The overall prevalence of (HCAIs) in the developed countries ranges between 5% - 10%, while in developing countries is 20 times higher or exceed 25% [3].The Eastern Mediterranean Region has one of the highest frequencies 11.8%. Nevertheless, during the resent Ebola Outbreak Crisis in West Africa, between 2014 and 2015; about 3.9% (815/20,955)

health workers accounted as high risk and probable Ebola cases. Hence, such tragic events can affect the local healthcare system and extending the economic impact as well.

Within the same context; Sudan reported three Ebola Hemorrhagic Fever outbreaks, of which; 76 HCPs were infected during care delivery in 1976, two in 1979 and three in 2004. According to hospital statistics; (HCAIs) in Khartoum State – Sudan; 5.5% of health worker personnel develop adverse event and 37% develop disability, due to non – compliance to Standard Precautions SOPs or use of the PPEs [4].

Khartoum State characterized with large population density and open borders with other states within the country, besides having large bulk of public hospitals. This makes it vulnerable to different types of infectious diseases like; Meningococcal Meningitis, Measles and cholera /AWD, in addition to DHFs and YFs and recently $H_1N_5$and N_I H_1. Yet, these hospitals are still suffering from low compliance rate to isolation precautions by its working health cadre. This could be influenced by many factors including; poor resources, inability of provide the required (PPEs) and/ or no intact functioning isolation rooms. Moreover, poor knowledge about communicable disease transmission, lack of, awareness, building capacity and rapid turnover of working staff plus selfefficacy, could also be considerable factors [5]. Non – compliance issues have been considered seriously in many studies and International Health Regulations (IHR) 2005 also recommended applying all infection control measures for the containment of events that may constitute a public health emergency of international concern [6]. On the other hand, other studies recommended carrying out an educational and training program on isolation precautions among health cadre as routine in-service to reduce the impact of the problem [7]. Nevertheless at (national /local) level studies within the same context still not fully covered. Thus this assessment study was conducted to identify the existing gaps in knowledge, attitude and practice among working health cadre and provide an evidence-based on the importance of education and training program in prevention of HCAIs. Also, to understand the factors that contributing in non- compliance with standard precautions in the isolation rooms

Methods:

A mixed research method was used for implementing; qualitative and quantitative approach. In the quantitative section an interventional study design (Pre and Post) with 6 months interval period was conducted [8]. The study phases: Phase I: (Pre-Intervention): to assess the general situation of isolation rooms, Phase II: to conduct the Intervention Training Program and Phase III: (Post – Intervention): to measure the effect of training program. The Study Area was Khartoum State, which is the capital and commercial center of Sudan From the study frame that included 52 governmental hospitals,461 Health Center and 74 Dispensary; only 22 of them had isolation room Study population was doctors, nurses and sisters, in addition to some other related health care providers as the quality control medical officers. Inclusion criteria was any governmental public hospital or health center inside Khartoum State with a temporal or permanent functioning isolation room, included for both phases of the intervention. The total number of sample population size was 159participants (65 doctors, 63 nurses, 22 sisters and 9 others (technical nurses or infection control officers), however; 15% oversampling was considered to minimize the non – response rate. For study population in pre–intervention phase; a simple random sampling technique was used, while a full coverage sampling technique was used in post–intervention phase. For the health facility (Hospitals) within selected geographical area; a full coverage sampling technique was conducted in pre–intervention phase. Conversely, in post–intervention phase; the sampling technique was considered according to the obtained practice mean score by hospitals. Consequently of each governmental area (GA)(Khartoum, Khartoum North & Omdurman)Teaching Hospitals were divided into; hospitals above the mean score, within the mean score and below the mean score. Taking into considerations a proportion of **1:2** (above or within/below the mean score), i.e. one hospital above or within mean score compared to2 hospitals below mean score. For the qualitative method, a contents analysis design was used to achieve the qualitative research objective. Observation and focus group discussion tools were used to collect more data from study participants, which cannot be obtained by quantitative methods. During Observation, working health cadre in the isolation rooms was not aware that observation was going on. For the FGD, a total number of 4 focus group discussions were formed and divided according to health cadre's job title, and regardless the working hospital, each group was interviewed for at lasted 30-45 minutes.

Data Collection

Designed questionnaire was used to collected data after validation. Demographic information in addition to knowledge, attitude, and practice variables were included in the data collection tool. Training session was conducted for health cadre by dividing them in to different groups. Simulation exercises had been used to assess health cadres' practices in post phase; using defined health problem related to infectious diseases isolation measures.

For the training program a modified syllabus was developed according the WHO and CDC guidelines. The program scheduled for 3 days training (17 hours) to cover hospitals, with average participants of 25 – 35. Training materials included interactive lectures, and practical session (video and scenarios). The interactive lectures component involved the ways of infection transmission, aseptic techniques, hand washing, and standard transmission precautions. The practical session was based on hand hygiene, and personal protective equipment (PPE).

For the qualitative data collection, a purposive sampling technique was used to collect data from study participants. Study participants were included doctors, nurses and others health cadre working at isolation rooms in different selected hospitals. Each focus group discussion had moderator and note taker to notes taking during discussion. Moreover, all FGD were conducted in a conversational form and tape or digital audio recording have been taken

Ethical clearance has been obtained from the ethical committee in the Sudanese Medical Specialization Board and Ethical Committee from Khartoum State Ministry of Health and hospitals.

Data Management and Analysis (Pre and Post Phases):

Data analyzed by using Statistical Package for Social Sciences (IBM SPSS statistics 20) [9]. A general descriptive statistical analysis with frequencies was obtained for all study participants. To make comparison between tow observations paired T test with confidence interval 95% and p. value less than 0.05 considered statistically significant. Quantitative analysis included: Knowledge section, which was analyzed by applying scoring system; to end with total score of 12 points, accordingly classified into 3 main level; high level (12 – 8),

Moderate level (7.9 – 4) and Low Level (less than 3). For Attitude section, the analysis was done by using Liker t-type scale; very important (3 points), important (2 points), and not importance (1 point) to have overall scale of 15. While for practices section, a dichotomous approach was used; always and sometimes had (1 point) and never(0 points), except for the last question that had (1) point for never answer.

Considering the qualitative part, conventional approach of content analysis was used to analyze the research data. The analysis was conducted by reading all the data repeatedly to achieve immersion and to obtain the sense of the whole. Moreover, researchers tried to find relation between different sub-categories and combine them into a smaller number of categories.

Results:

The overall respondent rate in pre – phase was 74.8% and in post – phase was 89.3%. The response rate by hospitals showed that; in the pre-phase Khartoum-North and Omdurman hospitalshad82.8% and 81.3% respectively compared to Khartoum hospitals that had response rate of 61.8%. While in post phase response rate showed that Omdurman hospitals had 41.3%, Khartoum hospital had 28.0% and the least record was in Khartoum North hospital with 20.0%.

The study analysis found that about 38% of the total selected hospitals had temporal functioning isolation rooms.61.1% of these rooms were designed to receive more than one patient in a capacity of 3 – 10 patients/room, with no privacy in (72.7%) of them. Tab the pre – intervention phase our sample size comprised 159 participants included in 18 hospitals, but only 119 health cadres attended the training workshop and were assessed for knowledge, attitude and practice, to have an overall respondent rate of 74.8%. The 119 participants were assessed for post – knowledge, while for post-practice& attitude assessment 67 out of 75 cadres within 4 hospitals were assessed, to have post phase respondent rate of 89.3%.

The mean age of participants was 34.2 years old, with female distribution higher than males. As 72% of the study subject had university education unsurprisingly among doctors of and

sisters, while 38 % had secondary education among the nurses group mainly. Other related variables had been considered and found that; although most of health cadre 41.2% had more than one year working experience, but only 17.6% had previous related training programme and 4.5% of health cadres worked as fixed term job. Adding to that, 62.2% of them have not received any protective vaccination before attending the job, Table (1).

Pre phase Knowledge mean was 6.35 and post phase was6.76, with statistically significant difference p–values 0.001.Change in knowledge was highly significant among doctors and nurses; p–values of 0.04 and 0.006 irrespectively, while no significant changes were reported among sisters and others health cadres. Knowledge scoring system had been designed to have three levels, but study result had two levels only; high and moderate levels. The high knowledge level in pre phase was 10.1% and 16.8% in post phase, while moderate knowledge level in pre phase was 89.9% and 83.25% in post phase. Nevertheless Chi – Square showed highly significant shift changes in knowledge levels with p–values of <0.001.

As in Table (3); analysis showed a significant changes knowledge level, when linked with the duration and working experience in isolation rooms. Moreover there was a highly significant change in knowledge mainly among non – previously trained group withp–values of 0.005.On the other hand; knowledge levels showed no significant changes when tested byhealth cadre's job title. Furthermore, knowledge found to be affected by the type of work at isolation room, especially among participants who had temporal –term work, p–values of 0.003, while no significant changes recorded among participants whom had fixed-term work, p–values of 0.09.

Mean score of attitude was 13.5 and practice was 3.5 with maximum score of 15 and 5 consecutively. Results showed significant changes in pre and post phase for attitude and practice to have p-value of 0.006 and 0.001 respectively. Furthermore analysis was applied for attitude and practice according to participants' work type. Attitude showed highly significant changes among temporal work participants(p–values >0.001). Compared to the practice, that showed changes among the fixed work participants with (p–values of > 0.001).Table (3) below summarize further analysis for attitude and practice in relation to

type of work and shift. As the study emphasized on hand washing being one of the main isolation precaution measures, results showed that only 26.9% of participants practiced hand washing accurately, however, this percentage changed to be raised up to 97.0% post - intervention.

Thematic analysis of the focal group discussion (FGD) showed 4 main themes; working environment, equipment and PPEs availability, lack of knowledge and gaining experiences, others influences factors.

Working environment:

Many participants described that working environment is one of a major cause's for non- compliance. One participants comment on the physical or infrastructure of the isolation rooms

"how should we follow isolation precautions and guidelines if the working place itself is not well prepared, what shell I do?!." Although the hospital is big the participants mentioned that the isolation room is very small comparing to other sections. Another finding was that all type of patients infected with dangerous diseases usually keep together. One participant said;

"I do not know what I should wear because all patients are in one place"

"The lack of attention from health authorizes to provide good working environment in different hospitals make us depressed and loss the interest to do even our work properly"

This statement was raised by study participants particularly nursery staff.

Equipment and PPEs Availability:

Participants pointed out that many times they came across a situation where personal protective equipment were not available. A nurse mentioned that

"we had only ten gloves for the whole last month, so every time if I want to follow the rules I wash the gloves to use for the next time, I know this is not right, but this can protect myself and patients "

Another issue of availability is that the suitable size for health staff might not be on hand. One physician said

" I wear size “small” of gloves and often this size is not available, because not many health care professionals use them, so I try to use other sizes, but I can't feel comfort, therefore I prefer not to use them at all "

Lack of Knowledge and Gaining Experiences:

Some participant believe that in some cases wearing is not necessary lab - coats is enough as long as they would not get dirty during work with patients. One physician mentioned that;

" I do not need to wear goggle when needed, because I wear my reading glasses "

Furthermore, one problem was that people with more experiences, especially nurses, they become very confident about their capabilities, thus, certain guidelines may not be followed. One nurse said that;

"the more capable I feel, the less preventive measures I may take "

Others Influences Factors:

Some participants argued that when they come across situations of life or death, they will ration their time to provide care instead of taking time to using protective equipment, despite the fact that this may expose them to microorganisms. Psychological factor was observed for instances a nurse mentioned that he feel embarrassed to follow guidelines, especially if they are not routinely used in the department. Financial factors also have a role in the non-compliance where health staff were in hurry to finish their work in order to join the extra-time work to meet life expense. In addition, many participants said that it is difficult for them to change their behavior due to bad training experience, even though they know that it is not correct. A nurse said;

"We have been trained to work as we do now for example we were trained not to use gloves when giving bed bath or making wound changes, therefore it is difficult after all these years to change"

Table No1: Demographic Data of Participants in an Intervention Study, Sudan 2012

Variables		Frequency	%
Gender	Male	40	33.6
	Female	79	66.4
Occupation / Job Title	Doctors	37	31.0
	Nurse	56	47.0
	Sisters	21	18.0
	Related MC	5	04.0
Educational Level	Secondary	38	31.9
	University	72	60.5
	Postgraduate	9	07.6
Working Area	Omdurman Area	61	51.1
	KH. North Area	24	20.1
	Khartoum Area	34	28.5
Type of work at isolation room	Fixed Term	44	37.0
	Temporal Term	75	63.0
Duration of working experience at isolation rooms per year	less than 1 year	45	37.8
	One year	25	21.0
	More than 1 year	49	41.2
Receiving protective vaccination during work at isolation room	Yes	45	37.8
	No	74	62.2
Receiving previous related training program	Yes	17	17.6
	No	79	82.4

Discussion:

Knowledge showed significant changes when related to the duration of working experiences among health cadres whom had one year working experience {CI 95%, (-1.11) – (-0.08)}, however it was less significant among those worked less than one year and not significant for whom worked more than one year. This may indicate that health cadres are able to get knowledge at first periods of work, then their knowledge increases gradually within the time to reach its maximum, to decrease again when no further knowledge acquired.

Continuality of educational and training programs on isolation precautions and infection control measures had been considered in others studies, such as Hong Kong study that conducted in 2007 reviewing other five studies demonstrated an educational intervention on definite experimental group whom were more knowledgeable than the control group after attending the training program at post-test [10]. Also others three selected trials indicated positive changes in participants' levels of knowledge after receiving educational interventions, just when are sustained and systemic [11 , 12].

Significant changes also found among whom had temporal work at isolation room {CI 95%, (-0.77) – (-0.15); P= 0.003}, rather than fixed term work, which is also indicates that knowledge regarding isolation precautions is an important key for prevention during working either temporally or permanently[3].

Pre and post knowledge phases were significantly higher among the trained nurse rather than trained doctors and sisters {CI 95%, (-0.73) – (-0.13); P= 0.006}. In comparison between trained health cadres by job title; nurses showed the highest records (high and moderate knowledge levels), followed by doctors and then sisters. This indicates that nurses group is more knowledgeable being had higher percentages in receiving similar training programmes (21.4%), 56.8% of them had fixed term work and had 51.8% were working for more than one year with more than one working shift per day. Some other studies found similar results from a survey administered to nursing and medical doctors [14, 15]

Results showed insignificant changes in attitude, while there was a very high significant change in practices of trained health cadres in the post – phase of the

intervention. However attitude was found to be significantly changed among health cadres whom had temporal type of work in isolation rooms. According to WHO and CDC guidelines that recommended to apply hand washing before and after patient care as a core, study found that only 49 out of 67 (73.1%) of health cadres apply it correctly, after training intervention; 65 (97%) became washing hand according the recommended guidelines. A study was digging for reasons behind this and found that was related to the infrastructures of the hospital itself such lack of continuous water supply or soap or presence of hand washing basin inside isolation rooms. Others reasons were related to lack of the accurate knowledge or information, while minority were others related to medical reasons as skin irritation due frequent time of hand washing. These conclusions were similarly found in study conducted in Karachi [16]

Conclusion:

Educating of health care providers about isolation precautions measures, providing PPEs and proper frequent monitoring; could be critical and integral elements of having effective infection control program. This study revealed opportunities for improvement of baseline data on the knowledge and its levels and practices regarding isolation precautions among HCPs and to relate the obtained results to the working environment. Thus this study can be an added value to identify the gaps in the existing knowledge and strengthen on the importance of education or training programme in prevention of HCAIs among HCPs, making of it as evidence-based practice for further studies to face diseases especially during outbreaks without being vulnerable of infection transmission.

What is already known on this topic?

1- Isolation precautions measures have a great role in protecting working health care and prevent Healthcare-Associated Infections (HCAIs) in isolation units during outbreaks.

2-Previous studies indicated the importance of the related training programmes for health care providers to apply standard precautions in isolation units.

3- Enhancing Knowledge, attitudes and practice of working health cadres and proper uses of PPEs have great prevention and control role in isolation units.

What this study adds:

1- First study was conducted at national level where most of the highly populated government teaching hospitals were included and trained.

2- The study revealed the importance to prevent health care workers working in isolation units

3- This study standed as evidence based practice to express the importance of the compliance to isolation standard measures and PPEs, in particular during outbreaks.

Competing interests:

Me as amain authors to the study, I declare on conflict of interests.

Author's contribution:

All authors contributed actively in all aspect of this study including data collection, analysis, writing and editing of the final version of it. All authors were agreed on the final version of the manuscript.

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Table 2- Pair t-test for Knowledge, Attribute, and Practice of Health Care Staff

Job	Knowledge			Attitude			Practice		
	T. test	P value	C I	T. test	P value	C I	T. test	P value	C I
Doctor	-2.131	0.039	(- 1.07201 , -0.02799)	-1.276	0.217	(- 0.87830 , -0.21163)	-7.531	0.000	(- 3.40534 , -1.92800)
Nurse	-2.870	0.006	(- 0.73740 , -0.13053)	-1.917	0.065	(- 1.29012 , -0.4012)	-1.276	0.000	(- 2.92349 , -1.36223)
Sister	-2.131	0.605	(- 0.47348 , -0.28301)	-1.170	0.276	(- 1.65014 , -0.53903)	-6.074	0.000	(- 4.29224 , -1.92998)
Other	-2.870	0.704	(- 1.5601 , -1.16017)	-1.153	0.368	(- 17.34823, -10.01490)	-1.000	0.423	(- 5.30265 , -3.30265)

Table 3- Pair t-test for Knowledge, Attribute, and Practice of Work shit, Type of Work and Experience

Work Shift									
Item	**Knowledge**			**Attitude**			**Practice**		
Work shift	**T. test**	**P value**	**C I**	**T. test**	**P value**	**C I**	**T. test**	**P value**	**C I**
One shift	-2.131	0.039	(- 1.07201 , -0.02799)	-1.276	0.217	(- 0.87830 , -0.21163)	-7.531	0.000	(- 3.40534 , -1.92800)
Two shift	-2.870	0.006	(- 0.73740 , -0.13053)	-1.917	0.065	(- 1.29012 , -0.4012)	-1.276	0.000	(- 2.92349 , -1.36223)
Three shift	-2.131	0.605	(- 0.47348 , -0.28301)	-1.170	0.276	(- 1.65014 , -0.53903)	-6.074	0.000	(- 4.29224 , -1.92998)
	-2.870	0.704	(- 1.5601 , -1.16017)	-1.153	0.368	(- 17.34823 , -0.01490)	-1.000	0.423	(- 5.30265 , -3.30265)
Type of Work									
Temporal work	-3.018	0.003	(-0.77473 , -0.15860)	-2.379	0.024	-1.2770 , -0.08900	-6.475	0.000	(-2.95050 , -1.53226)
Fixed work	-1.730	0.091	(-0.63979 , 0.04889)	-1.287	0.209	-1.42970 , -0.32625	-7.337	0.000	(-3.29053 , -1.85233)
Work Experience									
Less than one year	-2.030	0.048	(-0.75285 , -0.00271)	-1.727	0.096	(-0.81126 , -0.07052)	-5.517	0.000	(-3.15190 , -1.44069)
One year	-2.384	0.025	(-1.11940, -0.08060)	-1.058	0.000	(-3.38796, 1.20614)	-4.796	0.001	(-3.06234, -1.11947)
More than one year	-2.030	0.084	(-0.69914 , 0.04608)	-2.214	0.063	(-1.50002, -0.05554)	-8.186	0.000	(-3.37858 , -2.01273)