

## Identification of Factors Associated with Cold Chain in Makkah Primary Health Care Centers

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### ABSTRACT

**Background:** In some settings in Saudi Arabia, many health facilities offer immunization without adequate knowledge of vaccine administration and management. This may cause possible administration of nonpotent vaccines to the population.

**Objectives:** To assess cold chain system in immunization clinics in a sample of governmental primary health care centers (PHCC) nurses in Makkah and to identify factors associated with the cold chain system.

**Subjects and Methods:** This cross-sectional study was conducted in Makkah city, Saudi Arabia. It included all nurses working at immunization clinics. Self-administered questionnaire was adopted and modified by the researcher from many references, mainly PHC administrations in Jeddah and Makkah. Furthermore, the researcher reviewed questionnaire from WHO.

**Results:** All nurses had full marks in the knowledge test. Younger age group, graduates of Health College and lower numbers of years of experiences were found to have better practice regarding cold chain. Some nurses failed to practice

what they knew; they were older age group and graduated from nurse institution.

**Conclusion:** This study concluded that all nurses of immunization clinics who worked in primary health care centers in Makkah were excellent in their knowledge (100%) and practice (>90%).

**Keywords:** Cold Chain, Vaccine, Knowledge, Practice.

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### INTRODUCTION

Vaccines are heat-labile medications, and to guarantee their immunogenicity and safeguarding effectiveness as part of immunization programs, it is absolutely essential that the "cold chain" go unbroken.<sup>1,2</sup>

In Saudi Arabia, the appointment system in the immunization clinics is different from one center to another. Some centers were running immunization clinics 2 days per week and other center were 3 days per week.<sup>3</sup>

For vaccine delivery system to be successful, essential vaccine needs to be available and of good quality because it is only when potent and efficacious vaccines are administered that successful immunization can be actualized. Hence, the quality of immunization delivered, can only be ensured by a functional cold chain system.<sup>4</sup>

In some settings in Saudi Arabia, many health facilities offer immunization without adequate knowledge of vaccine administration and management. This may cause possible administration of nonpotent vaccines to the population.<sup>5</sup>

Reports from developing countries indicate that health workers seem to be overwhelmingly concerned with only raising vaccination coverage oftentimes to the detriment of vaccine potency.<sup>6</sup>

This study was designed to assess cold chain system in immunization clinics in 16 primary health care centers and their nurses in Makkah, and to identify factors associated with the cold chain system.

### SUBJECTS AND METHODS

This cross-sectional study was conducted in Makkah city, which is one of the major urban and relatively populated cities in the Kingdom of Saudi Arabia (KSA). It is also a destination of millions of visitors to perform Hajj and Omrah each year. Makkah is the place that captures the heart of billions of Muslims all over the world. Makkah includes 82 primary health care (PHC) centers distributed on seven health sectors: four inners (Al-zaher, Al-Kakeiah, Al-adel, Al-Sharee) and three outers (Al-Gomoom,

Khalees, and Al-Kamel. In each center, there is an immunization clinic with one nurse. Vital signs and anthropometric measures are taken first by the nurse in well baby clinic for the child before taking the vaccine in the immunization clinic. There is a basic vaccination schedule for children in each clinic.

The total numbers of Saudi nurses in immunization clinics in Makkah City were 25 nurses. Expected frequency of improper cold chain was 80% depending on a study conducted in Nigeria, 2018. <sup>7</sup>Therefore, by using EPI info program the sample size was estimated based on confidence interval of 90% and worse acceptable frequency of 10%. The sample size was calculated to be 16 out of 25 nurses.

Self-administered questionnaire was adopted and modified by the researcher from many references, mainly PHC administrations in Jeddah and Makkah. Furthermore, the researcher reviewed questionnaire from WHO,<sup>1</sup> and some articles discussed about cold chain.<sup>2, 5-7</sup>

The researcher phoned the centers first and asked about the immunization days, which were different from one center to another. Thereafter, he had a full morning session in the clinic (8:00 a.m. – 12:00 noon). In break time (12:00 noon – 1:00 p.m.), he gave the questionnaire to the nurse to fill it and retrieved at 12:30 p.m. in the same day.

Soon after, he had a full afternoon session in another center in the same day (1:00 p.m. – 3:30 p.m.) and filled the checklist by observing the whole session of immunization concentrating on cold chain till discarding it (end of session). At the end of the session, he gave the questionnaire to the nurse at 3:30 p.m. to fill it and retrieved it at 4:00 p.m. in the same day.

The researcher took 9 days to do this study. He visited 2 centers every day; one was in the morning, and another one in the afternoon with full organization with these centers.

#### Data Entry and Analysis

Data was entered to the researcher's computer using SPSS version 25 software. Chi Square and t-test were used for statistical analysis. P. value < 0.05 was adopted for significance.

#### RESULTS

The response rate was 100% of randomly selected 16 nurses in immunization clinics in PHCC. All 16 (100%) nurses involved in this study were female and Saudis and had four PHC courses: basis of primary health care, maternity and children, quality, and vaccinations courses. 81.3% of nurses had nurse institution certificates; the remaining 18.7% had health college certificates.

All nurses had full marks in the knowledge test Cold Chain. Twenty one out of 23 (91.3%) of items regarding cold chain practice were performed in satisfactory way by all nurses. The remaining 2 (8.7%) of items were enough distance between refrigerator and the clinic wall; and use of plaster to fix the refrigerator electric plug. The distance between the refrigerator and the clinic wall was adequate in 10 out of 16 (62.5%) of centers. The use of plaster to fix the refrigerator electric plug was noticed among 12 out of 16 (75%) of centers.

The mean age of nurses who had enough distance between the refrigerator and the clinic wall was 38.7 years compared to 43.3 years among those nurses who did not have enough distance. However, this difference was statistically not significant. The mean age of nurses used plaster to fix the refrigerator electric plug was

39.7 years compared to 42.8 years among those who did not use plaster. However, this difference was statistically not significant.

There was no gender difference because all nurses were female. Three out of 10 (30%) of nurses who had enough distance between the refrigerator and the clinic wall were graduates of Health College compared to no college graduate among those who did not have enough distance from the wall. Three out of 12 (25%) of nurses who used plaster to fix the refrigerator plug were graduates of Health College compared to no college graduate among those nurses who did not use plaster.

The mean years experiences of nurses who had enough distance between the refrigerator and the clinic wall was 11.6 years compared to 15 years among those nurses who did not have enough distance. This difference was statistically not significant.

The mean year's experiences of nurses who used plaster to fix the refrigerator electric plug were 12.3 years compared to 14.5 years for those who did not use plaster. However, this difference was statistically not significant.

All 16 (100%) nurses had all 4 courses: basics of primary health care, maternity and children, quality, and vaccinations courses.

#### DISCUSSION

The response rate was high; it was expected due to the permission paper from PHC administration in Makkah Al-Mukarramah, which was obtained and helped the researcher too much in his study.

Other studies<sup>7-9</sup> showed high response rates, ranging from 80.9% to almost 100% however none of them gave an explanation for these high rates.

All 16 (100%) of nurses had full marks in the knowledge test. This result was expected and can be explained by continuous vaccinations courses for nurses given in educational and training center in Makkah. This agrees with what has been reported by others in Malaysia.<sup>9</sup> However, comparing with other studies<sup>7,8,10,11</sup>, the knowledge of staff worked in immunization clinics about vaccinations and cold chains were often inadequate due to lack of education and training courses in vaccinations.

Cold Chain practice was satisfactory among 90% of nurses. This result was expected and can be explained by active vaccinations courses given to the nurses in education and training center. Comparing with other studies<sup>7-13</sup>, all of them gave comments on one or more of the following in their studies: whether a thermometer was present, temperature (2-8 degrees C), whether vaccines were stored in the door of the refrigerator, whether food or drinks in the refrigerator, expired dates for vaccines, cleanliness of the refrigerator, vaccination lists on the refrigerator door; and presence of good equipment's in immunization clinics.

These items were performed in satisfactory way (>80%) in some studies<sup>9-13</sup> and in unsatisfactory way (<80%) in other studies.<sup>7,8</sup> The researcher was unable to obtain any study covering the distance between the refrigerator and the clinic wall; and use of plaster to fix the refrigerator electric plug to compare between his study and other studies. Therefore, he could not give comments on these 2 items.

The nurses who were graduated from the health college were better than nurses who were graduated from nurse institution and this result was expected. This could be due to higher level in education at health colleges.

In all reviewed studies<sup>7-13</sup>, the researcher failed to lay hand on studies on qualification of nurses. Therefore, comparison was not feasible in this area. The nurses who were graduated from the health college were better than nurses who were graduated from nurse institution and this result was expected. This could be due to the same reasons mentioned above in qualification of nurses in relation to enough distance between the refrigerator and the clinic wall.

The nurses who had fewer years of experiences were better than nurses who had more years of experiences. This result showed that years of experiences had no relation in the improvement of practice. This result was not expected and may probably be due to lack of encouragement, acknowledgement and incentives. In all reviewed studies<sup>7-13</sup>, the researcher was unable to obtain any study addressing this area. Therefore, he could not give comments to compare this study with other studies. The nurses who had less years of experiences were better than nurses who had more experiences; this result showed that years of experiences had no relation to the improvement of practice. This result was not expected and may probably be due to the same reasons mentioned above in years of experiences of nurses in relation to enough distance between the refrigerator and the clinic wall.

Some nurses failed to practice what they knew, they were older in their age and they were graduates of nurse institution. This might be explained by the following reasons: the work was boring for them because of same daily routine work, no appreciation, no encouragement, no acknowledgement and no incentives.

#### LIMITATIONS

1. Sample size was 16 out of 25 centers because of limitations in time and resources.
2. Some nurses might tell others about researcher's visit and the questionnaire. Therefore, this might increase possibility of bias.
3. The researcher observed as perceived as an outside investigator. Therefore, they may act more professionally.
4. Data collection was soon before Hajj. Readiness and performance were usually high.

#### CONCLUSION

All nurses who were involved in this study had full marks in the knowledge test. Saudi nurses, younger age group, graduated from Health College and lower numbers of years of experiences were found to have better practice regarding cold chain.

Some nurses failed to practice what they knew, regarding plaster plug and the distance between the refrigerator and clinic wall. They were older age group and graduated from nurse institution. At the end, all nurses of immunization clinics who worked in PHCC in Makkah City were excellent in their knowledge and practice.

#### RECOMMENDATIONS

Recommendations of this study were forwarded to all those concerned about cold chain; administration of primary health care, education and training center and managers of PHCC.

##### Administration of Primary Health Care

- Accepting only Nurses graduated from Health College to be assigned in immunization clinics.
- Posting Saudi young nurses in immunization clinics.

- Continuous encouragement, acknowledgement, incentives and support for nurses, working in immunization clinics.
- Concentrate more on older nurses for education and training courses.

##### Education and Training Center in Al-Eksan PHCC

- Concentrate during cold chain and vaccinations courses for nurses on the appropriate distance between the refrigerator and the clinic wall and use of plaster to fix the refrigerator electric plug.
- Concentrate more on non-Saudi and older nurses for education and training courses.
- Increase the number of cold chain and vaccination courses for nurses per year.

##### Managers of Primary Health Care Centers

- Concentrate more on non-Saudi and older nurses to send them for cold chain and vaccination courses.
- Continuous encouragement, acknowledgement, incentives and support for nurses working in immunization clinics.

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