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KNOWLEDGE, ATTITUDE AND PRACTICES OF HEALTH WORKERS TOWARDS COLD CHAIN MANAGEMENT AT WAKISO HEALTH CENTER IV, WAKISO DISTRICT, A CROSS-SECTIONAL STUDY.

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ABSTRACT

Purpose of the study

The purpose of the study was to assess the knowledge, attitude, and practices of health workers towards cold chain management at Wakiso Health Center IV, Wakiso district.

Methodology

The study employed a cross-sectional descriptive study design and a simple random sampling technique. Data was collected from a sample of 50 respondents using a semi-structured questionnaire and analyzed manually and entered in a computer using Microsoft Excel program to generate tables, pie charts, and graphs.

Results

The results on the knowledge of health workers towards cold chain management revealed that 90% knew the correct definition of cold chain, 70% knew the recommended temperature range for vaccine storage and 70% had ever been trained on cold chain.

Regarding the attitudes all 50(100%) had the correct reason for temperature monitoring, the majority (70%) didn't think it was tiresome to fill temperature charts and more than half (60%) didn't think it tiresome to pack vaccines in their right position in the vaccine carrier.

Results on practices revealed that most (40%) always performed the shakes test, 40% could place light-sensitive vaccines in the correct position, and all (100%) respondents worked under supervision. and the identified breaches in areas of practice were in temperature maintenance during transportation (42%), poor working conditions of cold chain equipment(28%), and inconsistency of health workers (10%).

Conclusion

The study concluded that generally according to the findings, the majority of the respondents had high knowledge of cold chain management, and a positive attitude however fair practices.

Recommendations

The Ministry of Health to set more policies governing cold chain management, and the government to ensure the upgrade of cold chain to the latest technology present and ensure sufficient resource mobilization. Wakiso Health Center IV should increase training and retraining sessions on cold chains to bridge knowledge gaps.

***Keywords**: Cold chain, Vaccine, Shakes test.*
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Background of the study

The ability to monitor vaccines for optimal temperatures throughout the supply chain is a cornerstone of successful immunization programs as stated in the WHO Vaccine Management Handbook 2017.

According to WHO, a vaccine is a biological preparation that improves immunity to a particular disease. A vaccine typically contains an agent that resembles a disease-causing microorganism and it is often made from a weakened or killed form of the microbe, its toxoid, or one of its surface proteins. This agent stimulates the body's immune system to recognize the agent as foreign, destroy it, and keep memory to increase resistance if the body

encounters any of the microorganisms again. Immunization is the most important gift a health worker can give a child and it remains the most effective preventative health intervention presently known (WHO, 2015).

Proper vaccine use during the cold chain is a suitable way of handling vaccines conforming to the established standards from the time of manufacturing to the time of vaccination to maintain vaccine potency. Health workers must ensure that the vaccine administered to the patient during vaccination is potent enough to elicit the desired results. Vaccine usage can be calculated as:

$$\text{Vaccine Usage} = \frac{number\ of\ does\ administered}{number\ of\ doses\ issued} \times 100\%$$

A cold chain is where a vaccine is stored in good condition (WHO, 2015). It consists of a series of storage and transport links all designed to keep vaccines within an acceptable temperature range until they reach the users (CDC. Vaccine Storage &Handling Toolkit, 2016). A proper cold chain management system is the backbone for the success of an Expanded Program on Immunization (EPI) and thus there is a crucial need to preserve the potency and safety of the vaccine to ensure a reduction in childhood deaths due to Vaccine Preventable Diseases (VPDs).

However according to a cross-sectional study of assessment of vaccine wastage in tertiary care centers of central India, vaccine wastage could be expected in all programs and some level of wastage is unavoidable (Bagdey P et al, 2017).

The World Health Organization (WHO) developed guidelines for cold chain storage in the early 1900s, outlining the importance of proper vaccine storage and handling, appropriate methods of immunization, adequate equipment options, and suggestions for alternative equipment.

Following numerous documentations of incidents of improper vaccine handling and storage, the CDC created a vaccine storage and handling toolkit that describes the vaccine cold chain and provides guidelines for managing vaccines appropriately (CDC, 2016). However, it was been reported that maintaining the quality of vaccines has been one of the main challenges of immunization in Africa (R Rappuoli, 2014).

Globally the World Health Organization (WHO) set the Immunization Agenda 2030 an ambitious, overarching global vision and strategy for vaccines and immunization for the decade 2021-2030 that states “Strengthen supply chains to ensure that high-quality vaccines are always available in the right quantity and form at the right time, in the right place and stored and distributed under the right conditions (WHO, 2024). Promote integration with other supply chains for more effective delivery of PHC. Invest in systems and infrastructure to safely manage, treat, and dispose of vaccine waste to help reduce their environmental footprint” (Andiç-Mortan & Kochan., 2019).

In Africa approximately one in five children do not receive all their necessary vaccines due to poor location; remote areas where electricity is unavailable, temperature control infrastructure is typically inadequate. Addressing these supply and cold chain issues is imperative. Many vaccines must be stored at precise temperatures for safety reasons and to maintain efficacy. There is also a need to close gaps between vaccine equality across the region (www.pharmaceuticaltechnology.com).

According to UNICEF, the lack of cold chain facilities in some parts of Uganda is increasingly leading to what health professionals refer to as “zero doses” which means children under the age of five years who have not been vaccinated or have not completed their doses (www.UNICEF.org).

Other studies in Uganda show that cold chain systems are struggling to effectively support national immunization programs in ensuring the availability of safe and potent vaccines and cold chain storage (Ashok, A., Brison, M., & LeTallec, Y., 2017)

The purpose of this study is to assess the knowledge, attitude, and practices of health workers toward cold chain management at Wakiso Health Center IV, Wakiso district.

Specific Objectives

- To assess the knowledge of health workers towards cold chain management at Wakiso Health Center IV, Wakiso district.
- To find out the attitude of health workers towards cold chain management at Wakiso Health Center IV, Wakiso district.
- To identify the practices of health workers towards cold chain management at Wakiso Health Center IV, Wakiso district.

METHODOLOGY

Research design

This study employed a descriptive cross-sectional research design to quantify the distribution of certain variables in a study population at one point in time. This design helped the researcher to systematically collect and analyze the data to give a clear picture of the problem at hand.

Study area

This study was carried out from Wakiso Health Center IV in Wakiso district in central Uganda from April to November 2023. Wakiso Health Center IV in Wakiso, Busiro County, and the central region of Uganda is approximately 44km southwest of Mulago National Referral Hospital in Kampala. It is about 18.5km southwest of Kampala district. The health center receives referrals from nearby health centers such as Wattuba Health Center III, Wamala Health Center II, and Mudduma Health Center III. Wakiso Health Center IV receives an average number of 250 patients per day from several departments; OPD, inpatients, ART, dental, laboratory, pharmacy, ANC clinic, diabetic clinic, and pediatrics. The researcher selected Wakiso Health Center IV because it is a health facility with a bigger cold chain among health facilities within the researcher's reach.

Study population

The target population of the study was health workers working within Wakiso Health Center IV, Wakiso district.

Sample size determination

The sample size was determined using the standard formula of QR/O (Burton, 1965) where;

Q=Total number to be spent on data collection

R=maximum time to be taken by the interviewer per day

O=maximum time to be taken by the interviewer.

Therefore if, R=5 respondent, Q=5-day, O=1/2 hours

QR/O= (5×5)/ (1/2)

=25×2

= 50 respondents

Study variables

Dependent variable

The dependent variable was practiced towards cold chain management by health workers at Wakiso Health Center IV, Wakiso district.

Independent variables

The independent variable was the knowledge, and attitude of health workers at Wakiso health center IV, towards cold chain management.

Selection criteria

Inclusion criteria

This was composed of health workers at Wakiso Health Center IV, Wakiso district who were present during the period of data collection, capable and voluntarily willing to provide information.

Sampling technique

A simple random sampling technique was used to select respondents. The technique was preferred because it accorded each of the groups an equal chance of participation and therefore this helped the researcher to get the statistical analysis related to sample distributions, hypothesis testing, and sample size.

Data collection method

The researcher used semi-structured and close-ended questionnaires written in the English language to collect data from respondents. The questionnaire was designed based on the specific objectives of the study. The questionnaire was preferred over other methods because it is relatively a simple method of collecting data.

Pre-testing the questionnaire

The questionnaire was pretested in Kiira Health Center III among 15 respondents who filled it in a time relapse of one day to establish consistency in responses. The pre-tested instrument produced consistent scores and it was repeatedly measured under the same group of individuals. The results from the pretest were used to modify the items in the instruments.

Data collection procedure

After the approval of the research proposal, an introductory letter from the Kampala School of Health Sciences research

committee was issued to the study area seeking permission to carry out the study. When permission was granted, two research assistants with good knowledge were trained on research methodology and study objectives before data collection. The data collection process was done in a way that alphabet letters written on a paper were given to respondents and those who picked "A" were interviewed first after consenting and the process was continued until the required sample size was attained. The respondents were asked questions following the designed questionnaires to avoid being biased. After the interview, each respondent was appreciated for participating in the study.

Quality control

The validity and reliability of the study were ensured by pretesting tools and training of research assistants for collecting data.

Data analysis and presentation

From the field, data was manually sorted, edited, and arranged according to the themes based on the specific objectives of the study to generate frequency and percentages using a scientific calculator. Data was later presented in a Microsoft Excel computer program to generate figures and tables for easy interpretation of the study findings.

Ethical considerations

The ethical considerations involved an understanding of the ethical code and guidelines for protecting the rights of research subjects. Before the collection of data for the study, permission to carry out the study was sought from the administrators of Wakiso Health Center IV, using an introductory letter from Kampala School of Health Sciences addressing it to the administrators of Wakiso Health Center IV, requesting for permission to conduct the study on knowledge, attitude and practice of health workers towards cold chain management. When permission was granted, the researcher introduced and explained the study objectives to the participants, and a written consent form was presented and signed by each respondent before participation in the study. Respondents were free to withdraw from the study any time they wished unconditionally and information obtained from the respondents was kept confidential.

RESEARCH FINDINGS

Demographic data

From table 1, most of the respondents (42%) were aged 30 years and above while the least (18%) were aged 20-24 years. Majority of the respondents (64%) were female while the minorities (36%) were male. Half of the respondents (50%) were certificate holders while the least (20%) were degree holders.

Regarding form of profession, majority of the respondents (72%) were nurses /midwives while minority (6%) were medical officers.

Regarding years of experience, more than half of the respondents (56%) had more than 5 years of experience while least (44%) had less than 5 years of experience.

Knowledge of health workers on cold chain management

From figure1, most of the respondents (40%) acquired their knowledge through training on cold chain management while the least (10%) acquired their knowledge through unspecified sources.

From table 2, majorities of the respondents (90%) had a correct definition of cold chain while minority (10%) didn't know the correct definition.

From table 3, majority of the respondents (70%) knew about a vaccine vial monitor and its importance, while the minority (20%) didn't know anything.

SJ Public Health Africa
Vol. 1 No. 10 (2024): October 2024 Issue
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Original Article

Table 1: Shows the distribution of respondents by their demographic data

N=50

Characteristics	**Frequency**	**Percentage (%)**
Age group(years)		
20-24	9	18
25-29	20	40
≥30	21	42
Total	50	100
Gender		
Male	18	36
Female	32	64
Total	50	100
Level of education		
Certificate	25	50
Diploma	15	30
Degree	10	20
Total	50	100
Profession		
Nurse/midwife	36	72
Clinical officer	11	22
Medical officer	3	6
Total	50	100
Years of work experience		
<5	22	44
≥5	28	56
Total	50	100

Table 2: Shows the distribution of respondents according to their knowledge on the definition of cold chain

N=50

Response	Frequency	Percentage (%)
A set of rules that ensure safe vaccine and food delivery in health facilities.	1	2
A set of rules and procedures that ensure proper storage and distribution of vaccines to health facilities from national to local level.	45	90
Anything that ensures that vaccines are used for immunization.	0	0
People and devices that keep vaccines viable	4	8
Total	50	100

SJ Public Health Africa
Vol. 1 No. 10 (2024): October 2024 Issue
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Original Article

Figure 1: Shows the distribution of respondents according to their source of information

N=50

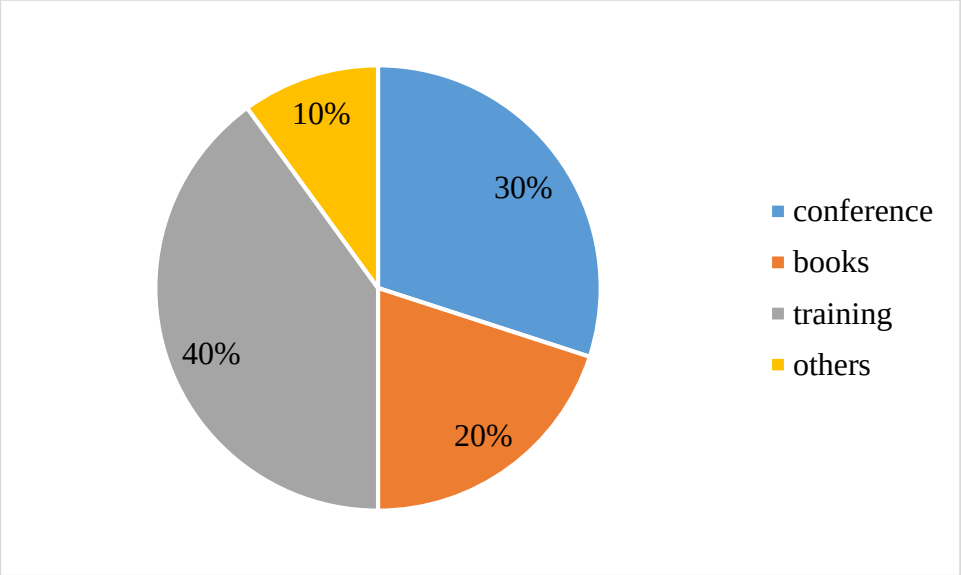


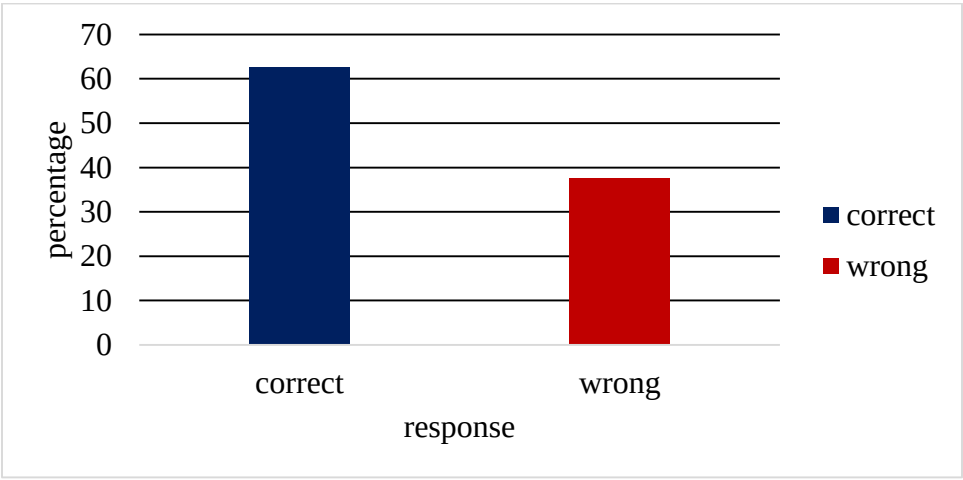
Table 3: Shows distribution of respondents by knowledge on Vaccine Vial Monitors (VVM) and their importance

N=50

Response	Frequency	Percentage
Knew the VVM and its importance	35	70
Knew the VVM but didn't know its importance	5	10
Didn't know	10	20
Total	50	100

Figure 2: Shows distribution of respondents by their knowledge on importance of the Vaccine Vial Monitor

N=40



SJ Public Health Africa
Vol. 1 No. 10 (2024): October 2024 Issue
https://doi.org/10.51168/9j5kpw62
Original Article

Table 4: Shows the distribution of respondents by whether they received training on cold chain

N=50

Response	Frequency	Percentage
Ever	35	70
Never	15	30
Total	50	100

From table 4, majority of the respondents (70%) have ever received training on cold chain management while the minority (30%) had never.

Figure 3: Shows the distribution of respondents by their knowledge on the recommended temperature for vaccine storage

N=50

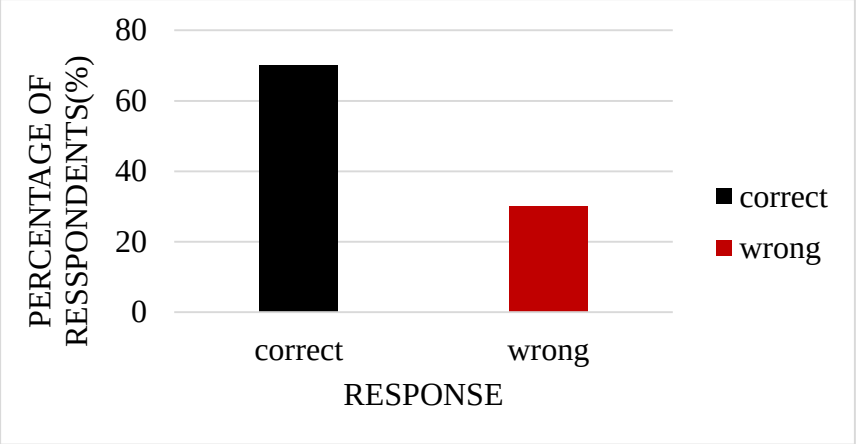


Table 5: Shows the distribution of respondents by their knowledge on effect of heat on vaccine

N=50

Response	Frequency	Percentage (%)
Correct	40	80
Wrong	10	20
Total	50	100

From figure 2, more than half (62.5%) of the 40 respondents that knew about the vaccine vial monitor had correct response for the importance of the Vaccine Vial Monitor while the least (37.5%) of the respondents had a wrong response.

From figure 3, majority of the respondents (70%) knew the temperature range for vaccine storage while minority (30%) of the respondents didn't know.

From the table 5, majority of the respondents (80%) knew the effect of heat on vaccine potency while minority (20%) didn't know.

Attitude of health workers towards cold chain management

Regarding the distribution of respondents by their thought on the reason for monitoring temperature, all the respondents (100%) had the correct reason of rapidly detecting exposure of vaccines to het or freezing temperatures in cold chain and taking corrective actions or to ensure that cold chain equipment were performing according to the recommended temperature standards.

From figure 4, majority of the respondents (70%) disagreed on tiresomeness of filling temperature charts while minority (10%) strongly agreed.

From figure 5, more than half of the respondents (60%) of the respondents disagreed on the tiresomeness of packing vaccines in their positions while the least (10%) of the respondents strongly agreed.

SJ Public Health Africa
Vol. 1 No. 10 (2024): October 2024 Issue
https://doi.org/10.51168/9j5kpw62
Original Article

From table 6, majority of the respondents (80%) strongly agree that the working conditions at the health center negatively affect the cold chain management while minority (10%) were either neutral or disagreed.

Regarding distribution of respondents on their attitude on the use of vaccines after their expiry, all the respondents 50(100%) disagreed with the use of expired vaccines.

From figure 6, more than half of the respondents (64%) agreed that foods and drinks can be placed in the vaccine refrigerator while the least (14%) strongly disagreed.

Figure 4: Shows the distribution of respondents by their thought of how tiresome filling a temperature chart is N=50

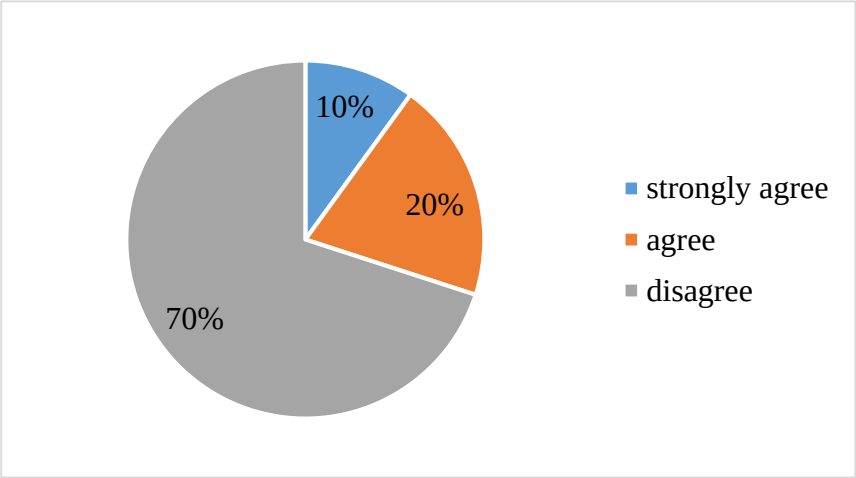
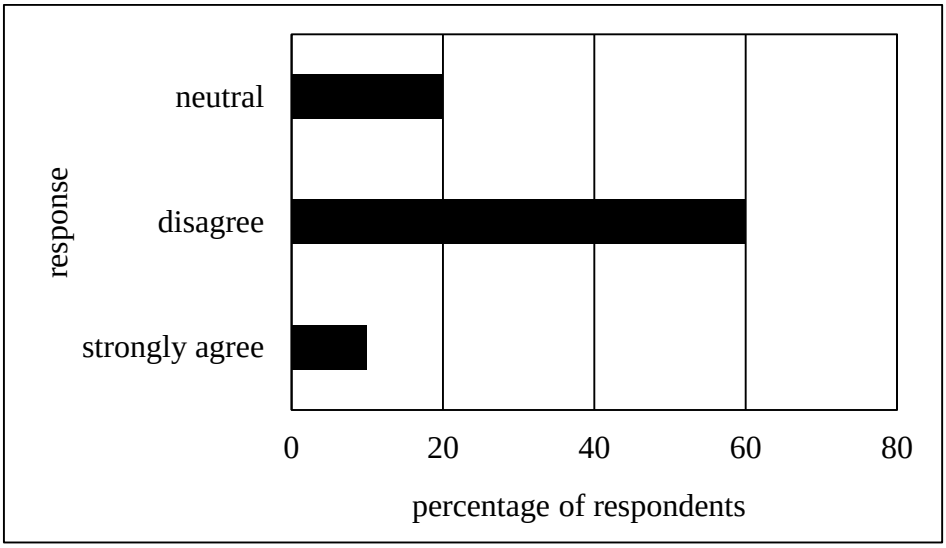


Figure 5: Shows the distribution by their attitude towards how packing vaccines in their positions in a vaccine carrier is tiresome N=50



SJ Public Health Africa
Vol. 1 No. 10 (2024): October 2024 Issue
https://doi.org/10.51168/9j5kpw62
Original Article

Table 6: Shows distribution of respondents by their attitude on how working conditions affect cold chain management N=50

Response	frequency	Percentage (%)
Strongly agree	40	80
disagree	5	10
neutral	5	10
Total	50	100

Figure 6: Shows the distribution of respondents by their attitude towards placing foods and drinks in the vaccine refrigerator

N=50

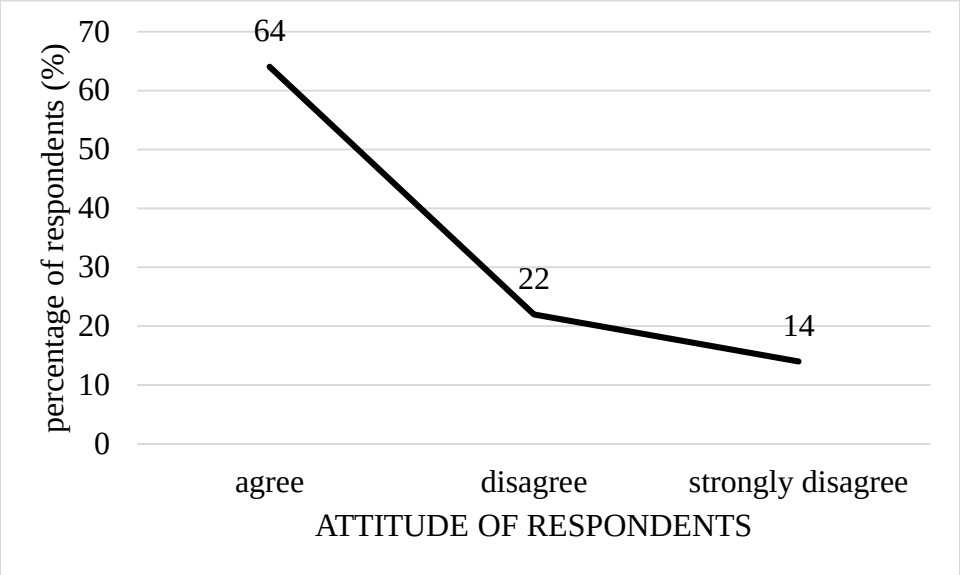


Table 7: Shows the attitude of respondents on using vaccines after 6hours of reconstitution

N=50

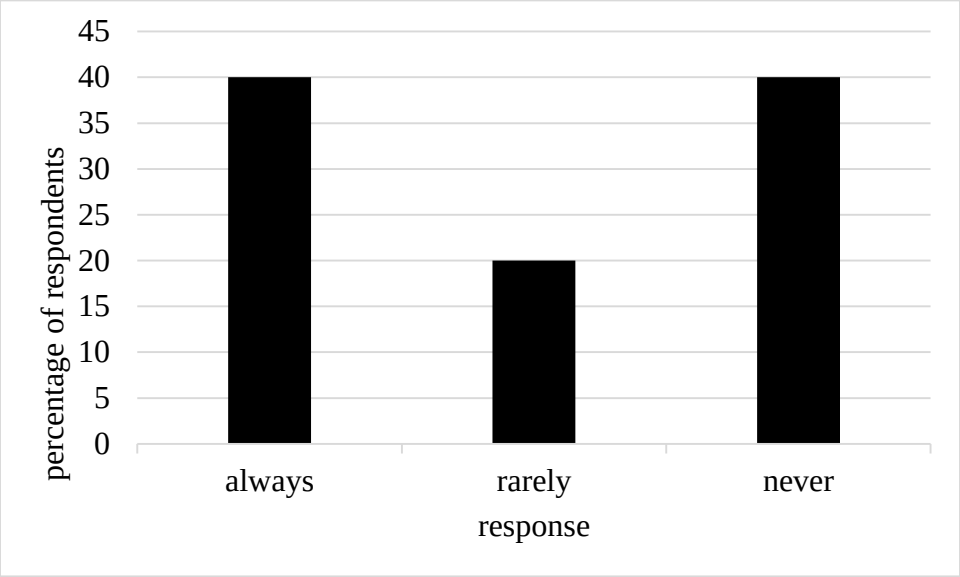
Response	Frequency	Percentage (%)
Agree	10	20
Disagree	40	80
Total	50	100

From table 7, majority (80%) of the respondents disagreed on using vaccines after 6hours of reconstitution while minority (20%) agreed.

SJ Public Health Africa
Vol. 1 No. 10 (2024): October 2024 Issue
https://doi.org/10.51168/9j5kpw62
Original Article

Figure 7: Shows the distribution of respondents by how often they perform the shakes test

N=50



Practices of health workers towards cold chain management

From figure 7, most (40%) of the respondents either always perform the shakes test or never while the least ((20%) of the respondents rarely perform the shakes test.

From table 8, most of the respondents (40%) placed light sensitive vaccines in the middle in a polythene bag while the least (10%) placed them near the ice packs.

From table 9, more than half of the respondents rarely chart temperature on a temperature chart while the least (10%) chart temperature on a temperature chart every day.

From figure 8, majority respondents (70%) label vaccines time and date every time they open them while minority (10%) rarely label vaccines when they open them.

From the table 10, majority of the respondents (80%) don't put food and other drugs in the vaccine refrigerator while minority (20%) do.

Regarding distribution of respondents by practice under supervision, all respondents (100%) practice under supervision.

From Figure 9, most of the respondents (42%) noticed a breach in the freezing temperature during transportation while the least (10%) noticed a breach in the inconsistence of health workers managing cold chain.

Table 8: **Shows the distribution of respondents by how they place light sensitive vaccines in a vaccine carrier**

N=50

Response	Frequency	Percentage (%)
Near the ice packs	5	10
Far from the ice packs	10	20
Middle in a polythene	20	40
I don't know	15	30
Total	50	100

Table 9: **Shows the distribution of respondents by how often they chart temperature on a temperature chart**

N=50

Response	Frequency	Percentage (%)
Everyday	5	10
Rarely	30	60
Never	15	30
Total	50	100

Figure 8: Shows the distribution of respondents by practice of labeling vaccines time and date after opening

N=50

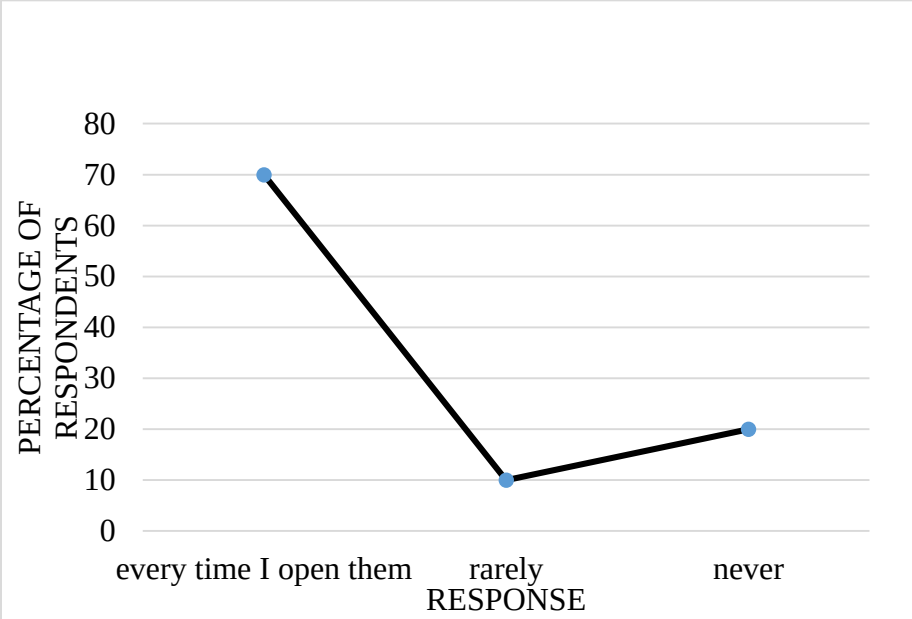


Table 10: Shows distribution of respondents by their practice of placing foods and other drugs in the vaccine refrigerator

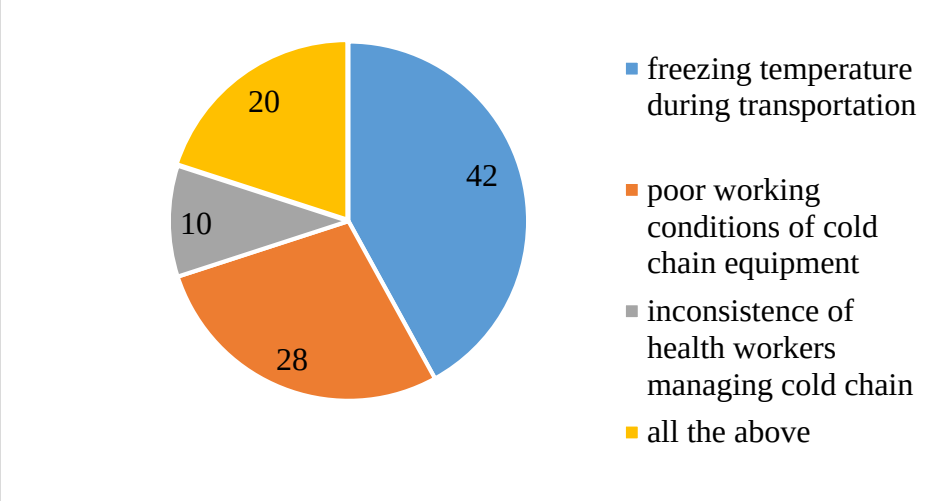
N=50

Response	Frequency	Percentage (%)
Yes	10	20
No	40	80
Total	50	100

SJ Public Health Africa
Vol. 1 No. 10 (2024): October 2024 Issue
https://doi.org/10.51168/9j5kpw62
Original Article

Figure 9: Shows the distribution of respondents by the breaches they notice during practice

N=50



DISCUSSION

Knowledge of health workers towards cold chain management

The current study findings revealed that the majority (90%) of the respondents could correctly define cold chain management as rules and procedures that ensure proper storage and distribution of vaccines to health facilities from national to local level. This implies that respondents had high knowledge of cold chain management as was in a study (Esohe O.O, 2018) which revealed that 82.6% of the respondents knew the correct definition of cold chain.

The current study reported that the majority (70%) of the respondents had ever been trained on cold chain indicating that they had high knowledge. This agrees with (Esohe O.O et al, 2018) study that revealed 82.6% of the respondents knew the definition of the cold chain.

The current findings revealed that the majority (80%) of the respondents knew what Vaccine Vial Monitors are, these findings indicate that their knowledge of Vaccine Vial Monitors was satisfactory. This is consistent with a study by (Namuhaywa, M.M, 2013) whose findings show that 60% of the respondents knew the Vaccine Vial Monitors.

Furthermore, the current study revealed that out of the 80% who knew about the vaccine vial monitor, the majority (70%) knew its importance indicating high knowledge. These findings disagree with (Namuhaywa, M.M., 2013) whose finding showed that none of the respondents knew the importance of the Vaccine Vial Monitors.

More findings from the study revealed that the majority (70%) of the respondents were able to state the correct temperature range of vaccine storage which is 2°C-8°C indicating that the respondents had satisfactory knowledge. These findings agree with (Woldemichael B et al., 2018) who conducted a study in Ethiopia where the majority (67.8%) of the respondents knew the correct temperature range for vaccine storage, (Yasin et al, 2019) whose results showed that the majority (71.1%) workers mentioned the correct temperature range for vaccine storage and (Nkwako et al, 2019) whose results showed that majority (71.8%) of the respondents knew the correct temperature range for vaccine storage.

The current study revealed that most of the respondents had high knowledge of cold chain may be because more than half (56%) of the respondents had a working experience of 5 years or more and this agrees with (Azira B et al, 2014) who attributed high knowledge score to long work experience of the workers as most were having a work experience of 15years.

The attitude of health workers toward cold chain management

The current study findings revealed that all respondents 100% had the correct reason for monitoring temperature during the cold chain which was to rapidly detect exposure of vaccines to heat or freezing temperatures in cold chain and take corrective measures implying that respondents had a high positive attitude. This study agrees with the (WHO,

2015) study that studied the perception of health workers on monitoring temperature, and the majority (94%) had the correct reason.

The current study showed that the majority (70%) disagreed that filling the temperature chart was tiresome which indicates a highly positive attitude. This study is consistent with (Yakum M et al, 2015) who revealed that health workers always filled temperature charts with only one abnormal temperature during the last two months following data collection.

The results further show that more than half (60%) disagreed with packing vaccines in their positions being tiresome indicating a highly positive attitude. This study disagrees with (Azira B et al, 2014) who revealed that one of the weak attitude items was the placement of vaccines with 11.2%.

The findings also indicate that 80% of the respondents strongly agreed that the working conditions at the health center affected their cold chain management which agrees with (Sylvan F, 2020) study in Burkina Faso which showed that poor working conditions like lack of resources and lack of periodic training appeared to undermine the motivation of the health workers.

Practices of health workers in cold chain management

The current study revealed that out of 50 respondents, 40% always performed the Shake's test indicating poor practices. These findings agree with (Ameen HA et al, 2014) who conducted a study in Nigeria where only 48.4% of the respondents could conduct the Shake's test.

The results of the current study show that more than half (60%) rarely charted temperature on the temperature chart which indicated poor practices. These findings are related to (Abebaw W et al, 2023) who revealed that one of the weak knowledge items was charting the temperature in the temperature chart with 6.7%.

Findings of the current study revealed that 70% always label vaccines time and date when they open them implying good practices. These findings disagree with the study of (Bernard N et al, 2023) who revealed that 60% of the vaccinators had not been labeling the date and time of opening the vaccines with preservatives.

The current study findings showed that the majority (80%) of the respondents do not put food and other drugs other than vaccines in the vaccine refrigerator indicating good practices. These study findings are in line with (El Shazly, 2016) who conducted a study in Quewisna where none of the respondents put food or other drugs in the refrigerator.

The current findings also showed that all respondents 100% practiced under supervision, implying good practices among health workers. These findings are consistent with (B Azira, 2014) who showed that supervision was an area of concern as a way to improve cold chain practices by placing 2 or more persons to supervise.

The study also assessed the breaches the respondents noticed during their practice of cold chain and res most (42%) of the respondents noticed a breach in transportation temperature which is in line with (Craig M.H, 2016) who revealed that Micronesia's cold chain had a history of breaches including freezing temperature during transportation.

Conclusion

The knowledge of health workers about cold chain management was high given majority (90%) of the respondents knew the correct definition of cold chain management, the majority (80%) knew about the vaccine vial monitor, and the majority (70%) knew the correct temperature range for vaccine storage.

The attitude of health workers towards cold chain management was highly positive as all (100%) of the respondents had a correct reason for monitoring temperature, the majority (70%) disagreed with feeling tired when filing a temperature chart, and (60%) disagreed with feeling tired when packing vaccines in the vaccine refrigerator.

The practices of health workers towards cold chain management were fair since only most (40%) of the respondents always performed the Shake's test, the majority (80%) do not put food and other drugs other than vaccines in the refrigerator and all (100%) the respondents worked under supervision.

Recommendations

The researcher recommends that the Ministry of Health set apart more policies governing cold chain activities.

The government to ensure the upgrade of cold chain management to the latest technology suitable in the country and also ensure efficient resource mobilization.

Wakiso Health Center IV should organize training and retraining sessions to add more knowledge to the health workers and fill up the knowledge gaps.

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Abbreviations

CDC: Center for Disease Control

EPI: Expanded Program on Immunization

WHO: World Health Organization

OPD: Out Patient Department

ART: Anti-retroviral Therapy

ANC: Antenatal Care

Source of funding

The study was not funded

Conflict of interest

There was no conflict of interest

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