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Full Length Research Paper

The impact of health facility monitoring on cold chain management practices in Lagos, Nigeria

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About 1000 privately owned health facilities (HFs) were (re)-visited between September 2007 and September, 2009. A total of 2,100 health workers (HWs) were interviewed in these HFs to evaluate their knowledge on vaccine management and administration. Cold chain assessment form was completed for each HF revisited. Health Workers that were deficient in cold chain management knowledge were given on the spot training. Between September 2007 and March 2009, 90% of fridges in the HFs monitored were non-functioning. 95% of HWs interviewed had little or no knowledge about vaccine vial monitor (VVM) while 80% of vaccines screened were either in stage 3 or 4 of VVM or with VVM indicator removed. During revisits, between March - September, 2009, 92% of fridges were in good functioning state, 84% of HWs had good knowledge of VVM with 9.3% of vials in stage 3 or 4 of VVM or with VVM indicators removed.

Key words: Vaccine, monitoring, cold chain, VVM, immunization.

INTRODUCTION

The use of vaccination to prevent diseases is the greatest public health success of the last century. Efforts have been intensified by many researchers/scientists, companies and Governments all over the world to improve and manage available vaccines as well as develop new ones. Preventing loss of vaccine potency during storage and handling is increasingly important as new, more expensive vaccines are introduced, with at least one case requiring a different approach to storage. Little information is available about the extent to which staff in private physicians' offices meet quality assurance needs for vaccines or have the necessary equipment (Bell et al., 2001).

To maintain vaccines perfectly conserved from its manufacture through administration requires an adequate cold chain infrastructure, compliance to standards and effective management (Omilabu et al., 1999; Oyefolu et el., 2007). At the end of the chain, primary health care providers must have adequate knowledge to manage the cold chain (Cherivan, 1993; WHO, 2004; Zuckerman, 2006). To improve management, the World health organization (WHO) has created a set of practice guidelines for different service levels, which include immunization techniques, vaccine monitoring, cold chain management and reporting systems (Cherivan, 1993). Maintaining the vaccine cold chain is an essential part of a successful immunisa - tion programme because vaccines lose their immunological

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potency on exposure to extreme temperatures (UNICEF,, 1998).

The presence of vaccine vial monitor is an indicator that guarantees that potency of vaccines have not been compromised due to repeated exposure to heat. This has been an important global strategy to prevent damage to vaccines due to heat (Dambadarjaa et al., 2007). According to WHO, at stage 1 of VVM, the square box in the purple circular background on the VVM label must be white in colour while in stage 2 the white colour gradually changes to off -white or cream. At these two stages, it is recommended that the vaccines should be used, but with the one in stage 2 being recommended for use earlier before the one in stage 1. However WHO recommended that vaccines in VVM stages 3 and 4 should not be used. That is a situation in which either the colour of the square box on the label blends with the background purple colour or it is darker than the background colour. Inadequate cold chain control or improper storage of vaccines of the Expanded Program on Immunization (EPI) has been reported in both developed and developing countries of the world, including the UK (Chee et al., 2004; WHO, 1998), Italy (Ahmad, 2004), Australia (Otten et al., 2005), Hungary (Unicef, 1998), Malaysia (WHO, 2002) and the US (Gottberg, 2006).

In Africa including Nigeria, the burden of childhood preventable diseases cannot be over emphasized. The attention had been on public health institutions in the management and administration of potent vaccines to the populace. However, many privately owned health facilities (HFs) both in urban and rural settings offer immunization services without adequate knowledge on vaccine administration and management, moreso where the essential monitoring organ of the Government is either missing or ineffective.

The consequence of this will be the administration of non-potent vaccines to the populace especially the children with the tendency for re-emergence of those diseases thought to be under control, causing a rise in morbidity and mortality rates. The health workers in these HFs need to be continuously educated and monitored on vaccine administration and management.

Moreover, the Lagos State Government of Nigeria through the Health Facility Monitoring and Accreditation Agency has launched a special war against poor standard of practice including poor vaccine management and administration in (HFs) in the State. Hence, this work aims at reviewing the cold chain management in HFs and evaluating the knowledge of health workers (HWs) on vaccine management in Lagos, Nigeria.

METHODS

About 1000 privately owned HFs were (re)- visited between September 2007 and September, 2009. A total of 2,100 health workers (HWs) were interviewed in these HFs to evaluate their knowledge on vaccine storage temperature, VVM indicator, expiry dates dates of vaccine and vaccine administration. One thousand HFs were monitored during first visit, with the same number being monitored during revisits.

Cold chain assessment form was also completed for each HF (re)-visited. The questions provided answers to in the form included availability of storage equipment, functioning or non-functioning of storage equipment, availability of regular electricity supply to storage equipment, presence or absence of temperature monitoring device, presence or absence of temperature chart, expiry dates of vaccines and conditions of the VVM indicator.

On the spot education or training was given individually or collectively to any of the HW(s) in each HFs (re)-visited in the state on vaccine management, depending on the level of knowledge or understanding of the HWs on the subject matters as assessed by the monitors.

RESULTS

Between September 2007 and March 2009, during the first monitoring visits, a total of 900 (90%) out of 1000 vaccine storage equipment (fridge) in the HFs either had mechanical failure with virtually non-existent electricity supply (Table 1). A total of 2000 (95%) HWs had little or no knowledge of VVM indicator (Table 2). A common practice was the sharing of same fridge for vaccines with other things such as laboratory reagents and drugs. A total number of 12,000 (80%) vials were either in stage 3 or 4 of VVM or had VVM indicator removed (Table 3). Thermometer was only sighted in 200 (20%) fridges with no temperature charts on the storage devices (Table 1). Expiry dates of all vials screened were intact. However, between March and September, 2009 during revisits, 480(92%) out of 520 fridges screened in the HFs had good mechanical functions (Table 1) with back up electricity supply where national electricity failed. A total of 1050 (84%) out of 1250 HWs interviewed now had good knowledge of VVM indicator with only 280 (9.3%) out of the 3000 vaccines vials found in stock in stage 3 or 4 of VVM or had the VVM label removed (Tables 2 and 4). Vaccine expiry dates were intact but no temperature charts were available on all the 180 (35%) fridges that had thermometer for temperature measurement (Table 1). Of note was the fact that the average time spent in each facility during first visit which was about 40 min, was almost reduced by two-third during revisits. Most of the HWs interviewed and possibly trained during first visit were also met during revisits, but a few others who were not met during first visit were met during revisits.

However, there knowledge was similar. Furthermore, majority of the HWs in the HFs claimed they no longer stock more vaccines than what they could use for each immunization day and that excess was always returned to the Public Health centres in the nearest Local Government Areas (LGAs) for effective storage.

DISCUSSION

Careful attention to storage and handling is essential to

Table 1. Comparing functioning and non-functioning fridges with or without thermometer and temperature chart in HFs in the period Sept. 2007-March 2009 and March 2009-September 2009.

Period (in years)	Total no. fridges sampled	Total no. fridges in functioning state (%)	Total no. fridges in non-functioning state (%)	No. fridges with thermometer (%)	No. fridges with temperature chart on them (%)
Sept 2007-March 2009	1000	100 (10)	900 (90)	200 (20)	0 (0)
March-September 2009	520	480 (92.3)	40 (7.7)	180 (34.6)	0 (0)

Table 2. Comparison of the knowledge of HWs on VVM indicator during First (Sept. 2007-March 2009) and Revisit (March-Sept. 2009) to HFs.

Health workers	First visit Sept. 2007-March 2009			Revisits March –Sept. 2009		
	Adequate knowledge (%)	Little/no knowledge (%)	Total interviewed (%)	Adequate knowledge (%)	Little/no knowledge (%)	Total interviewed (%)
Registered nurses	50 (7.1)	650 (92.9)	700	540 (98.2)	10(1.8)	550
Medical Doctors	35 (10.0)	315 (90.0)	350	285 (95.0)	15(5.0)	300
Auxiliary nurses	0 (0)	1000 (100)	1000	184 (51.4)	174(48.6)	358
Community health extension workers	10 (28.6)	25 (71.4)	35	29 (97.0)	1 (3.0)	30
Pharmacists/ Pharmacy Technicians	5 (33.3)	10 (66.7)	15	12 (100)	0 (0)	12

Table 3. Showing state of vaccines checked (Sept. 2007-March 2009).

Type of vaccines	Total vaccine vials screened	Expiry date adequate	VVM 1 or 2 (%)	VVM 3 or 4 (%)	VVM indicator removed (%)
TT	6030	6030	400 (6.6)	4830 (80.1)	800 (13.3)
BCG	930	930	250 (26.9)	180 (19.4)	500 (53.8)
DPT	940	940	270 (28.7)	200 (21.3)	470 (50.0)
OPV	6130	6130	1780 (29.1)	3350(54.7)	1000(16.3)
MV	970	970	300 (30.9)	170 (17.5)	500 (51.6)
Total	15000	15000	3000 (20)	8730 (58.2)	3270 (21.8)

Table 4. Showing state of vaccines checked (March-Sept. 2009)

Type of vaccines	Total vaccine vials screened	Expiry date adequate	VVM 1 or 2 (%)	VVM 3 or 4 (%)	VVM indicator removed (%)
TT	600	600	510 (85)	55 (9.2)	35 (5.8)
BCG	300	300	275 (91.7)	20 (6.7)	5 (1.7)
DPT	500	500	455 (91)	35 (7)	10 (2)
OPV	1520	1520	1440 (94.7)	55 (3.8)	25 (1.6)
MV	80	80	40 (50)	10 (12.5)	30 (37.5)
Total	3000	3000	2720 (90.7)	175 (5.8)	105 (3.5)

ensure optimal potency of vaccines and to maximise the resulting efficacy of immunization as observed in this study and others elsewhere (Omilabu et at., 1999; Bishai et al., 1992; Oyefolu et al., 2007). However, the cold chain still remains a highly vulnerable element of any immunisation programme, both in developing and developed countries (Grasso et al., 1999).

This is about the first comprehensive and detailed information about vaccine management in privately owned HFs in Nigeria. The observation in this work was that continuous monitoring and education of HWs during (re)-visits in HFs improved their knowledge and attitude and

and provided opportunity for on the spot corrections of errors on vaccine management, which will guarantee the administration of potent vaccines to the populace, thereby preventing vaccine preventable diseases as supported by (Bell et al., 2001). The average time spent in each HFs during revisit was reduced by almost two-third of the time spent during first visit because Know-ledge of HWs about key issues of vaccine management had been improved upon, therefore there was little or no errors to be corrected. Hence time was conserved. Furthermore, most of the HWs interviewed and possibly trained during first visit were also met during revisits, but a few others who were not met during first visit were met during revisits. However, their knowledge was similar, which could be due to the fact that those who were trained were involved in passing the knowledge gained to those who were not available for training during the first visit. Ideally, the storage equipment containing vaccines should not be used to store other products.

However, our study showed that vaccines were sharing space with laboratory reagents, drugs and others and consequently it was difficult to maintain the required temperature ranges. Hence overwhelming number of vaccines with either VVM in stage 3 or 4 or VVM indicator removed were observed in these HFs. This finding is supported by other studies (Bell et al., 2001; Joao Carlos and Gunnar, 2007, Molina et al., 2002) in the context of vaccine management. The reduction in the number of Auxiliary nurses interviewed during revisits in this study could be attributed to the fact that there was a steady compliance to the state legislation limiting the use of already trained auxiliary nurses and banning the training of new auxiliary nurses in HFs.

Furthermore, the lowered number of fridges and vaccines screened during the revisit period would not be unconnected to the fact that many of the HFs now preferred to obtain their vaccines directly from public health centres nearest to them for each immunization day and returning excess immediately after immunization or would not want to stock more than what they could use during each immunization day. This could be to avoid the problem of vaccines likely losing their potency in their HFs. The results obtained from each HF in this study could not be said to be biased because administrators of the HFs were not pre-informed of our visits unlike the outcome of the study by other authors elsewhere (Bell et al, 2001). However, the observed results could be worse in other states in the country where there might not be in place any outfit to monitor vaccine management and administration in private HFs.

In conclusion, we recommend a minimum of three times per year of continuous training and retraining of HWs during monitoring and supervision of the activities of these personnel in the HFs as the key measures to address the lapses observed in cold chain management in HFs in this study as supported by (Joao Carlos and Gunnar, 2007). Furthermore, due to peculiar storage problems in some HFs, we recommend that no vaccine without VVM label should be used in developing Countries of the World especially Africa.

REFERENCES

Ahmad K (2004). Kano to recommence vaccination against poliomyelitis. Lancet Neurol. 3: 388.

Bell KN, Hogue CJ, Manning C, Kendat A (2001). Risk factors for improper vaccine storage and handling in private provider offices. Paediatrics pp. 107: E100.

Bishai DM, Bhatt S, Miller LT, Hayden GF (1992). Vaccine storage practices in paediatrics offices. Paediatrics 89: 193-196.

Chee G, Fields R, His N, Schott W (2004). Evaluation of GAVI Immunization services support finding. 13th GAVI Board meeting, Washington, Available at www.gavialliance.org/Government/Board_Reports/13_board_ISS findings.php.

Cheriyan E (1993). Monitoring the vaccine cold chain. Arch. Dis. Child. 69: 600-601.

Davaalkham D, Ojima T, Wiersma S, Lkhaguasuren TS, Nymadawa P, Uehara R, Watanabe M, Oki I, Takahashi M, Okamoto H, Nakamura Y (2007). Administration of hepatitis B vaccine in winter as a significant predictor of the poor effectiveness of vaccination in rural Mongolia: evidence from a nationwide survey. J. Epidemiol. Comm. Health 61: 578-584

Grasso M, Ripabelli G, Sammari ML, Manfredi Salvaggi TM, Quaranta A (1999). Vaccine storage in the community: a study in central Italy. Bull. World Health Organ. 77: 352-355.

Gottberg von A, Gouveia de L, Madhi SA, du Plessis M, Quan V, Soma K, Huebner R, Flannery B, Schuchat A, Klugman KP, Rabago M, Pardo J, Rojas V (2006). Respiratory and Meningeal disease surveillance in South Africa; Impact of conjugate *Haemophilus influenza* type b (Hib) vaccine introduction in South Africa. Bull. World Health Organ. 84: 811-818.

Joao Carlos de TM, Gunnar B (2007). Cold chain management: Knowledge and practices in primary health care facilities in Niassa, Mozambique. Ethiop. J. Health Dev. 21(2): 130-135.

Molina PO, Arbiza PA, Vicente R, Rabago M, Pardo J, Rojas V (2002). Vaccine storage cold chain at primary care centres in one area of Madrid: Keeping the cold chain intact and degree of knowledge. Rev. Esp. de Salud Publica 76: 333-346.

Omilabu SA, Oyefolu AO, Ojo OO, Audu RA (1999). Potency status and efficacy of Measles vaccine administered in Nigeria: a case study of Lagos, Nigeria. Afr. J. Med. Med. Sci. 28(2-4): 209-212.

Oyefolu AO, Nwaeke AC, Audu RA, Akinyemi KO, Salu OB, Muller CP, Omilabu SA (2007). Evaluation of Measles vaccine cold chain in Lagos state, Nigeria. Afr. J. Clin. Exp. Microbiol. 8(1): 1-7.

Otten M, Keraola R, Fall A, Masresha B, Martin R, Cairns L, Eggers R, Biellik R, Grabowsky M, Strabel P, Okwo-Bele JM, Nshimirimana D (2005). Public-health impact of accelerated measles control in the WHO Africa Region 2000-2003. Lancet 366(9488): 832-839.

UNICEF (1998). Integration Vitamin A Supplementation with Immunization policy and programme implications report of a meeting. Unicef. 1998 (WHO/EPI/GEN/98.04). Available at http//www.who.int/vaccines-documents/DocsPDF/www 9837.pdf.

WHO (1998). Expanded Programme on Immunization (EPI) in African Regions, Harare.

WHO (2002). Haemophilus influenza type b (Hib) meningitis in the pre-vaccine era: a global review of incidence, age distributions, and case fatality rates. Geneva:WHO (WHO/V&B/02.18).

WHO (2004). Vaccine preventable diseases monitoring system. Global summary. Geneva.

Zuckerman JN (2006). Protective efficacy immunotherapeutic potential, and safety of hepatitis B vaccines. J. Med. Virol. 78: 169-177.