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Laboratory Containment of Wild Polio Viruses Survey and Inventory in Sudan

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Abstract: The aim of the present study was to evaluate phase-one containment of wild polio virus and laboratory inventory in Sudan according to the WHO plan. A questionnaire was designed for phase one poliomyelitis virus laboratory containment; this questionnaire was used to collect data from 488 laboratories from the whole Sudan. The present study showed that the Sudan country followed all steps of WHO guidance in laboratory containment. The country has succeeded in fulfilling the phase one polio virus laboratory containment; survey and inventory.

Key words: Wild polio, containment, laboratory inventory, WHO plan

INTRODUCTION

Following the world health assembly of the WHO in 1988 to globally eradicate poliomyelitis, the number of countries in which polio is endemic dropped from 125 to 6 by 2003. However in May 2004 polio cases caused by wild polio virus from Nigeria were reported in 11 countries, among them was Sudan (CDC, 2005).

The estimated prevalence of poliomyelitis in Sudan was reported by Olive *et al.* (1982) in a survey which was conducted in Juba and Port-Sudan more than two decades back as 4.0 and 5.6/1000 children for the two towns, respectively

Sudan has made substantial progress in implementing polio eradication strategies, with no WPV reported from May 2001 through April 2004. However, in May 2004, a WPV case was detected in West Darfur (CDC, 2005).

The main requirements for the global certification of the eradication of wild poliovirus are the absence of wild poliovirus, isolated from suspect polio cases, healthy individuals, or environmental samples, in all WHO regions for a period of at least three years in the presence of high-quality, certification-standard surveillance and the containment of all wild poliovirus stocks in laboratories (Smith *et al.*, 2004). In 1999, the World Health Organization had prepared a global plan of action for laboratory containment of wild polio virus and urged regions and countries to implement it. When circulation of the virus stopped in a country, this country should begin phase one polio virus laboratory containment measures (CDC, 2003). These should include survey of different types of laboratories and establish an inventory for laboratory that store wild polio virus infectious or

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potentially infectious materials. Type of laboratory that will be surveyed should include any laboratory that have capacity to store such materials e.g., diagnostics, research, clinical, production and industrial laboratories (Tambini *et al.*, 1997). Polio virus infectious material should include wild polio virus stock, clinical samples collected from patients confirmed positive for wild virus, seeded wild polio virus for vaccine production. While wild polio virus potentially infectious materials includes; stool sample, cerebrospinal fluid and serum collected for other issues in the time of wild polio virus circulation in the community.

The laboratory-containment requirements for global certification of polio eradication are outlined in the WHO global action plan for laboratory containment of WPVs (Dowdle *et al.*, 2004). In phase I, each country conducts a national survey to create an inventory of biomedical laboratories holding WPV-infectious or potentially infectious materials. Phase II will begin after 1 year with no WPV found anywhere in the world. This phase requires destruction of all unneeded stocks of WPV and containment of retained WPV stocks under appropriate bio-safety conditions. Documentation of these efforts from all countries is required for global certification. The Global Action Plan requires each country to alert all biomedical laboratories to the impending eradication of polio, encourage laboratories to destroy all unneeded wild poliovirus infectious and potentially infectious materials, and establish a national inventory of laboratories retaining such materials (Dowdle *et al.*, 2004). This necessitated the conduction of this study.

The aim of this study was to evaluate phase-one containment of wild polio virus and laboratory inventory in Sudan according to the WHO plan.

MATERIALS AND METHODS

This is a cross-sectional analytic study based on the WHO recommendation questionnaire in phase-one poliomyelitis virus laboratory containment. This questionnaire was designed as closed ended questions and used to collect data from laboratories, including variables such as name of lab, type, contact information, responsible personnel and his job. In addition to that, the questionnaire asked inquires about storage of wild polio virus, infectious and potentially infectious material, type of refrigerators and date of storage. The study was conducted in all northern Sudan states during the years 2003 and 2004.

A total number of 488 laboratories of health and medical services were located in 16 different northern Sudan states and selected by cluster sampling where the administrative states were chosen as clusters. Then laboratories were allocated and surveyed for wild polio viruses, for infectious and potentially infectious material. These laboratories were selected to represent all labs that might have the capacity to store these materials. First data were collected from 348 labs (71.31%) in the first survey in the year 2003. This was followed by a second survey in the year 2004 which was designed to include the remaining laboratories. All laboratories allocated for the survey which represented a total of 488 laboratories responded to the survey; 348 during the year 2003 and the rest during the year 2004. This represented 100% response rate. These laboratories included different types of diagnostic, research, clinical and institutes working in the field of medical and health service.

To grantee accuracy and validity of the responses the authors traveled to all selected laboratories in the different states and filled the questionnaire.

RESULTS

Results of the present study showed that after investigating a total number of 488 labs, it was found that 67% of them were governmental labs, 31% belong to the private sector while only 2% were belonging to organizations.

As for the availability of the material, it was found that 26 of the surveyed labs. stored materials infected or potentially infected with Wild Polio Viruses (WPVs). Ten of these labs were in the University of Khartoum, five in National Health Laboratory, two in Tropical Medicine Research Institute, two in the University of El Neilain, three in the private sector and one (3.84%) in four labs, which are Northern Kordofan state veterinary research institute, Khartoum State laboratory directorate, police hospital and University of Gezira (Table 1). As for the storage conditions of the material in the surveyed labs, it was found that there were 22 refrigerators (+4), 20 deep freezers (-20) and seven deep freezers (-70).

Table 1: Distribution and number of material samples potentially infected with Wild Polio Viruses (WPVs), in 26 different laboratories

Institution	No. of storage WPVs, potentially infected materials	(%)
University of Khartoum	10	38.46
National Health Laboratory	5	19.25
Tropical Medicine Research Institute	2	7.69
University of El Neilain	2	7.69
Private sector	3	11.53
Khartoum State Laboratory Directorate	1	3.84
North Kordofan Veterinary Research Institute	1	3.84
Police Hospital	1	3.84
Gezira University	1	3.84
Total	26	100.00

Table 2: Location, name and year of storage of 26 potentially infectious materials

Place and name of laboratory	No. of storage WPVs	Years of storage
Microbiology Department, Faculty of Veterinary Medicine University of Khartoum, Khartoum	1	1978
Malaria Research Unit, National Health Laboratory, Khartoum	4	1996
Virology Department, Khartoum State Laboratory Directorate		
Molecular Biology, Institute of Endemic Disease, University of Khartoum		
Microbiology Department, Soba Hospital, University of Khartoum		
Immunology Department, Institute of Endemic Disease University of Khartoum	1	1998
Bacteriology Department, National Health Laboratory	3	1999
Molecular Biology Department, Institute of Endemic Disease, University of Khartoum		
Private Lab, Khartoum North		
Virology Department, National Health Laboratory	6	2000
Microbiology Department, Faculty of Medicine, University of Khartoum		
Microbiology Department, Tropical Medicine Research Institute		
Parasitology, Institute of Endemic Disease, University of Khartoum		
National Polio Laboratory, National Health Laboratory		
Molecular Biology Department, El-Neilain University		
Nuclear Medicine Institute, Gezira University, Wad Madani	5	2002
Food and Biosafety Department, Faculty of Public and Environmental Health, University of Khartoum		
Molecular Biology, Institute of Endemic Disease, University of Khartoum		
Histopathology Department, National Health Laboratory		
Parasitology Department, Tropical Medicine Research Institute		
Private Laboratory, Gezira State	6	2003
Epidemiology Department, Faculty of Public and Environmental Health, University of Khartoum		
Laboratory Department, Faculty of Medical Laboratory Science El-Neilain University		
Laboratory Department, Police Hospital, Khartoum		
Veterinary Research Centre, North Kordofan State		
Private Laboratory, Red Sea State		
Total	26	

Table 3: Inventory of laboratory stored wild polio virus potentially infectious materials and level of bio-safety

Sectors	Institution/Department	No. of labs	Bio-safety level
Ministry of Health	Department of Virology, National Health Laboratory	1	Level-2
	National Polio Lab	1	Level-2
University of Khartoum	Institute of Endemic Disease	4	Level-2
	Microbiology Department, Faculty of Medicine	1	Level-2
	Soba Hospital	1	Level-2
Total		8	

This survey found that only 23 labs have registration files for the poliovirus infectious materials or potentially infectious materials. However, during a second survey of these 26 labs, only 14 labs were found to store materials potentially infected with wild polio viruses (Table 2). Eight of these labs were found to retain and store wild polio virus which is potentially infectious material (Table 3).

DISCUSSION

The containment committee reviewed the studied laboratories and destroyed their materials according to their regular destruction program. This policy was applied to the bacteriology department on the National Health Laboratory (NHL). Some labs were intended to retain their materials for a period of time as the Institute of Endemic Disease laboratory. In this case these materials were taken and stored at the National Polio Laboratory according to the recommendations of WHO under specific bio-safety level. These materials were destroyed after passing of one year (CDC, 2004). These measurements adopted by the country, are similar to that conducted at the different regions and countries of WHO. In 2003 United State of America was declared free of wild polio virus after surveying 15000 labs in different institutions all over the country, 500 labs were founded storing wild polio virus infectious materials and potentially infectious materials (CDC, 2004). In addition to that, European region followed the same procedures to declare the region free of wild polio virus. A number of 2000 labs were surveyed including research, diagnostics, industrials and products lab in Europe.

Materials were destroyed according to the WHO recommendations. Labs that stored polio virus infectious material for any reasons was kept under restricted bio-safety procedures (CDC, 2004). In South East Asia, all region countries had prepared their national plan for phase one polio virus laboratory containment and began the containment measurement except Timour (WHO, 2005a, b). But in Africa, seven countries only in the southern and eastern parts of the continent reported the completion of phase one polio virus containment activities.

In Mediterranean Region EMRO, 14 countries were able to stop the circulation of the wild virus, and reported that they have finished phase on laboratory survey and inventory (WHO, 2006; CDC, 2006). Sudan country when imported case of wild polio virus was re-circulated in Darfur state (WHO, 2005a,b), the phase one containment was completed and second survey was conducted and included all laboratories that had capacity to store wild polio virus infectious or potentially infectious materials according to the WHO recommendation. National polio laboratory is the only place stored materials potential to be infected with wild polio virus.

This study showed that the Sudan country followed all steps of World Health Organization (WHO) guidance's in laboratory containment. The country has succeeded in fulfilling the phase one polio virus laboratory containment; survey and inventory.

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