Vaccine introduction in the Democratic People's Republic of Korea.

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Editorial

Vaccine introduction in the Democratic People's Republic of Korea

A R T I C L E   I N F O

Keywords:
DPR Korea
Japanese encephalitis
Vaccination
Disease burden
DPRK

A B S T R A C T

The feasibility of mass vaccination campaigns for Japanese encephalitis and Haemophilus influenzae type b infections was explored in the Democratic People's Republic of Korea using pilot vaccination studies. The experiences from these initial studies were then used to support larger vaccination campaigns in children at risk of these infections. We discuss the challenges and requirements for the inclusion of additional vaccines into the existing expanded program on immunization in the country.

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Targeted vaccinations have proven to be a most cost-effective public health intervention [1]. However, establishing sustainable immunization programs in resource-limited settings remains a challenge requiring political commitment, trained staff and adequate laboratory facilities. The International Vaccine Institute (IVI) has supported the authorities of the Democratic People's Republic of Korea (DPRK) with preparations for a pilot vaccination campaign against Japanese encephalitis (JE) and Haemophilus influenzae type b (Hib) to determine the feasibility of mass-campaigns and to collect data for future introduction of new-generation vaccines.

The DPRK runs the Expanded Programme on Immunization (EPI) established by WHO in 1974 to ensure basic immunizations throughout the world [2]. Initially, the overall goal was to provide available immunizations against diphtheria, pertussis, tetanus, poliomyelitis, measles and tuberculosis to every child by 1990. The program was extended to include a wider range of vaccines such as those against hepatitis A, hepatitis B (Hep B), Hib, rotavirus, pneumococcus, meningococcus, and human papilloma virus. The EPI was launched in DPRK in 1980 and made available to all target groups by 1990. The national immunization coverage in DPRK remains high; BCG coverage reached 98%, DTP3 93%, OPV3 99%, and MCV1 99% in 2013. Following the worldwide EPI recommendation, the DPRK-EPI was expanded to include vaccination against Hep B, which was added in 2004 and included in the tetravalent diphtheria-tetanus-pertussis-Hepatitis B (DTP-HepB) formulation in 2006. A second dose of measles vaccine was introduced in 2008 at the age of 15 months [3].

JE accounts for a high rate of morbidity and mortality in Asia and Hib remains a cause of death among children in some geographic areas [4–6]. JE and Hib vaccinations have substantially reduced morbidity and mortality in countries that have introduced them into their immunization programs [7–9]. A locally produced JE vaccine was administered to selected risk groups in the south of the DPRK in the 1990s. In 2008, IVI supported the DPRK government with a pilot demonstration project in order to assess the feasibility of mass JE and Hib vaccination campaigns through the DPRK's public health infrastructure. This project was accompanied by efforts to strengthen laboratory capabilities for diagnosing infectious diseases with the goal of establishing appropriate surveillance for these and other pathogens.

A total of 6427 children were targeted in urban settings (3021 with live-attenuated SA 14-14-2 JE vaccine in Sariwon; 3406 with Hib-conjugate vaccine Shan Hib-Liquid® in Nampo). These vaccination target children were selected from Sariwon and Nampo by the Ministry of Public Health of the DPRK (Fig. 1). Operational procedures and training materials were provided and standardized instruments were applied for program evaluation. Posters and flyers were distributed to inform participants about the vaccine and the disease. Several parameters were appraised through the course of vaccination. The cold chain infrastructure was investigated, local staff received training courses and sites were prepared for vaccinations.

Commonly, children under ten years are at highest risk for JE with the highest incidence in the 0–5 years age group. Given the unknown disease burden of JE in the DPRK, children aged one to under six years were eligible to receive JE vaccine. A total of 2987 children received a single dose of JE vaccine after exclusion of 34 children due to receipt of the locally produced JE vaccine or contraindications such as history of hypersensitivity, anaphylactic shock, convulsions and allergic reaction to any previous vaccination, acute moderate to severe illness, presence of high temperature, recent immunosuppressant therapy, persistent crying. The compliance rate was 98%. For Hib vaccination, children were stratified by age to conduct age-appropriate vaccination, three doses or two doses or a single dose were administered to children 6 weeks to 6 months, 7 months to 11 months and 12 months to 36 months of age, respectively. For all three doses of Hib vaccine, compliance rates were 92% or higher. The high participation rate may be explained by the opportunity for children to be protected against two diseases, combined with significant and dedicated efforts put
forward by the DPRK team to mobilize the target population. However, this pilot campaign was relatively small and limited to two cities in close proximity to Pyongyang to facilitate vaccine distribution.

These experiences were taken up and carried forward by DPRK authorities for the implementation of large-scale JE vaccination campaigns with the live, attenuated JE vaccine, SA 14-14-2 (80–95% protective effectiveness). In 2009, 500,000 children between the ages of 12 and 35 months were vaccinated in five provinces and Pyongyang City followed by 1,000,000 eligible children aged 1 year and 4–6 years (2 and 3 year old children received JE vaccination in 2009) in 2010. A third campaign was conducted in 2013 that covered the remaining 3 million eligible children aged between 1–3 years, 9–10 years and 11–16 years in 2013–2014. The five provinces targeted for this JE vaccination campaigns besides Pyongyang included South Hwanghae, North Hwanghae, South Pyongan, North Pyongan, and Kangwon. South Hamkyong and Nampo were added for the 2013–2014 vaccination campaign. Efforts are currently underway to introduce JE vaccines into the routine EPI program, at best to be concomitantly administered with 1st dose of measles vaccine at the age of 9 months.

As the Hib vaccine in pentavalent formulation (hepatitis B, Hib, diphtheria, pertussis, tetanus) had not been approved by the GAVI Alliance in 2008, the mass campaign was conducted using a monovalent formulation. In the meantime, the tetravalent formulation has been further upgraded in 2012 to a pentavalent formulation.

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Fig. 1. Map of the Korean peninsula. Nine provinces, directly-governed cities (Pyongyang and Rason), and the Kaesong special administrative region are outlined. The star indicates the capital city of Pyongyang. The cities of Nampo (Nampo city) and Sariwon (North Hwanghae Province), where vaccination campaigns were conducted, are indicated. Provinces where domestic epidemiology training workshops were conducted are highlighted in gray.
IVI has, in collaboration with AMS and MOPH, equipped a laboratory on the premises of the Institute of Microbiology (IMB), one of the 26 institutes under AMS, to enable diagnosis of selected diarrheal, enteric, and neurological diseases (JE, infections with Vibrio cholerae, Campylobacter jejuni, rotavirus, Shigella spp., Salmonella spp., Hib). Furthermore, training programs have been conducted both in-country and abroad to augment epidemiology and laboratory skills of DPRK scientists. Five hospitals, located in two provinces (North Hwanghae Province: Pediatric Hospital, Hwangju County People’s Hospital in Sariwon City; South Pyongan Province: Pediatric Hospital, Anju City People’s Hospital, Pyongwon County People’s Hospital) have been selected to start systematic diarrheal and meningeval disease surveillance; once established, surveillance activities could be extended to include diagnoses of invasive bacterial bloodstream infections and beyond such as viral infections.

The international community in the DPRK represented by governmental and non-governmental organizations such as UNICEF, WHO, IVI and others support and collaborate with both MOPH and AMS in public health research and data analysis. A long-term roadmap aiming at a systematic partnership among the participating agencies and stakeholders is essential [13]. All these efforts should, under the leadership of the MOPH, lead to a refinement of the disease surveillance system in order to better define the vaccine-preventable diseases. Incremental development will eventually help prioritize public health needs of children and high-risk populations and provide a sound basis for the evaluation of the effectiveness of existing and newly introduced vaccines.

Conflict of interest statement

None.

Funding

The program was supported by a donor of the Republic of Korea and the Swedish International Development Cooperation (Sida).

Acknowledgments

We would like to acknowledge the contributions of personnel from the Ministry of Public Health, the Academy of Medical Sciences and the Institute of Microbiology in the DPRK. We further acknowledge the scientists at the Bernhard Nocht Institute for Tropical Medicine, Hamburg, Germany and the National Institute for Hygiene and Epidemiology, Hanoi, Vietnam for the planning and conduct of the training courses.

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Please cite this article in press as: Marks F, et al. Vaccine introduction in the Democratic People’s Republic of Korea. Vaccine (2015), http://dx.doi.org/10.1016/j.vaccine.2015.03.005
Please cite this article in press as: Marks F, et al. Vaccine introduction in the Democratic People’s Republic of Korea. Vaccine (2015), http://dx.doi.org/10.1016/j.vaccine.2015.03.005