

Title: Battle of Polio eradication in the Western Pacific Region in the transition to COVID-19 endemicity

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Dear editor,

We have read with great interest a letter published in this journal entitled “The emergence of mumps after the COVID-19 pandemic in Pakistan: Time to consider MMR vaccination strategies” by M.S. Rana, M. Usman, M.M. Alam and colleagues [1]. Authors reported record-breaking numbers of mumps outbreaks after the COVID-19 pandemic in Pakistan and advocated for mumps vaccination promotion to protect the population from the vaccine-preventable disease. We agreed with the authors that the COVID-19 pandemic and vaccine hesitancy have led to mumps vaccination reduction around the globe, and we would like to highlight a similar challenge facing poliovirus vaccination in the Western Pacific Region (WPR).

The Global Polio Eradication Initiative was launched in 1988 to eradicate all types of polioviruses, including wild-type and vaccine-related [2]. The WPR has been wild polio-free for the past two decades but is at risk of circulating vaccine-derived polioviruses (cVDPVs). cVDPV is related to the weakened poliovirus in oral polio vaccine (OPV) and has recently been detected in London, New York State, and Israel [3]. While many countries have adopted full inactive polio vaccine (IPV) schedules to prevent cVDPV emergence, low- to middle-income countries such as Laos, Cambodia, Vietnam, and the Philippines still implement combination schedules with IPV and OPV (Figure 1). As international travel resumes, unvaccinated and under-vaccinated populations are at risk of contracting the paralytic disease [4,5].

In this report, we described landscape of polio vaccine uptake and identified factors associated with polio vaccine hesitancy during the COVID-19 pandemic in WPR countries.

We reviewed 24 polio vaccine immunogenicity and efficacy studies (Table S2) and estimated a beta distribution for poliovirus vaccine efficacy (VE) (Text S1 and Figure S1) based on the pooled VE estimates. We calculated the critical vaccination coverage (V_c) considering the basic reproduction number (R_0) of poliovirus:

$$V_c = \frac{\left[1 - \left(\frac{1}{R_0}\right)\right]}{VE}$$

The critical coverage required ranges from 89.1% (95% CI: 80.0% to 100%) for a basic reproduction number of 5, to 95.5% (95% CI: 85.7% to 100%) for a basic reproduction number of 7. Compared to the countries’ actual vaccination coverages among 1-year-olds in 2021, Vietnam (81%), Laos (74%), and the Philippines’s (56%) vaccine uptakes fall under our estimated range of critical coverage required (Figure S2 and S3).

To better understand the general public’s knowledge, perceptions, and attitudes towards polio vaccination, we conducted a repeated cross-sectional questionnaire-based survey in nine WPR countries: Cambodia, China (mainland), Japan, Laos, Malaysia, Mongolia, the Philippines,

South Korea, and Vietnam (Text S2). We randomly interviewed 18,442 participants aged 18 or above, of which 8,030 participants with children under 18 reported their child's polio vaccination status. Compared to World Health Organization's official figures on polio vaccination coverage amongst 1-year-olds from 2004 to 2021 (Figure S3), the self-reported uptake rates were lower in all nine countries, with Japan, Malaysia, Mongolia, and South Korea reporting over 50% below the official data. The self-reported vaccination coverages of children below 2 years old in Cambodia, China, Japan, Malaysia, and South Korea were lower than that of other age groups (Figure S4). This suggests that parents of children under 2 years old are less aware of polio vaccination or have delayed their child's polio vaccination due to the COVID-19 pandemic, and there should be more focus on polio vaccine education and resources support amongst new parents in the post-pandemic era.

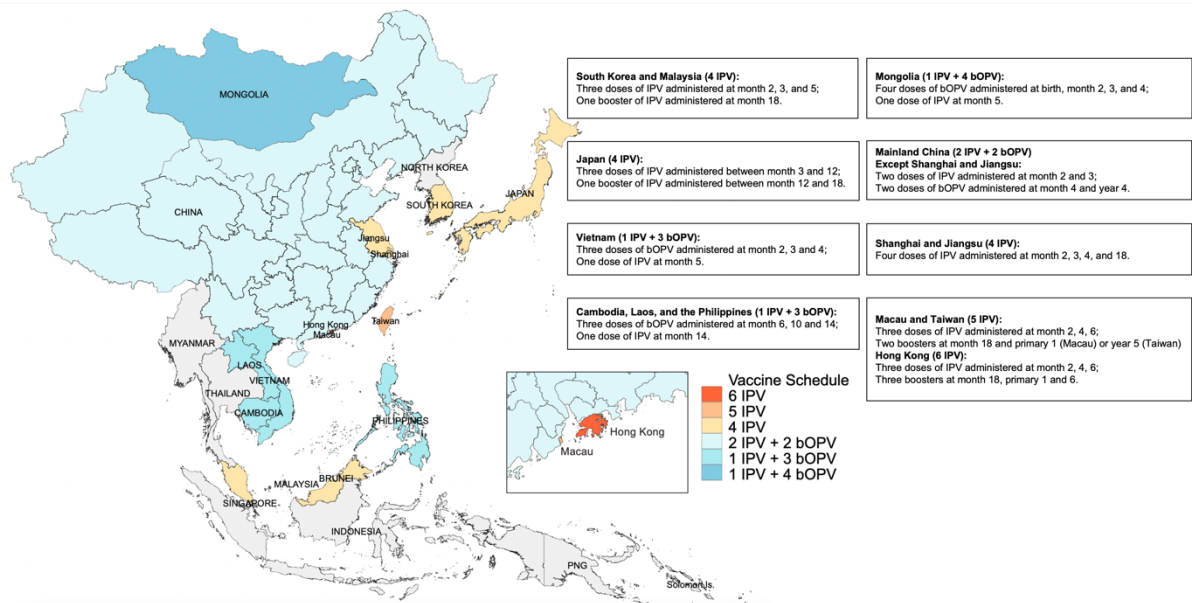
We found that 59.0% of parents who reported that their child had not been vaccinated against polio reported that the pandemic made them more likely to get their child vaccinated. We conducted binary logistic regression to examine factors associated with self-reported polio vaccination status (Text S3 and Table S3). Older parents are more likely to report that their children had been vaccinated against polio. Parents without formal education were less likely to report that their child had been vaccinated against polio compared to parents with undergraduate education (adjusted OR = 0.64 [0.42-0.97], $p = 0.037$). Compared to Catholics, Buddhists (aOR = 0.64 [0.47-0.86], $p = 0.003$) were significantly less likely to report that their children had been vaccinated against polio. The vaccine hesitancy among Buddhists could be explained by the incompatibility between Buddhist belief to harm no living things and misinformation on polio vaccine production [6]. Since a sizable proportion of the Asia-Pacific population is Buddhist, it is important to establish efficient communication strategies between local health authorities and religious groups; the tailored communication should aim to improve understanding of polio vaccines and tackle misinformation.

We included four Vaccine Confidence Index™ statements in the model to examine whether parents' perception of general vaccines determines self-reported child poliovirus vaccination status [7]. Parents who perceived vaccines as being important for their children were significantly more likely to report that their children had been vaccinated against polio (aOR = 1.31 [1.04-1.66], $p = 0.023$). Accessibility of general vaccines (aOR = 1.21 [1.00-1.46], $p = 0.046$) was also associated with increased odds of self-reported vaccination against polio. Therefore, health authorities and non-governmental organizations should provide extensive training for community health workers and nurses on polio vaccine education, promotion, and outreach to increase public awareness. As the production and supply of IPV remain a big challenge during the transition from OPV to IPV uses [8], local authorities should strengthen the collaboration with manufacturing and logistics companies to coordinate resource allocation and increase polio vaccine accessibility.

Our results highlighted how people from different socioeconomic and religious backgrounds demonstrate vaccine hesitancy and called for establishment of efficient communication strategies to improve understanding of polio vaccines, tackle misinformation, and promote vaccination. As childhood polio vaccination has been disrupted during the COVID-19

pandemic and the gradual resumption of travel has made polioviruses a more imminent threat, governments and health authorities should address the unvaccinated issues while the willingness for polio vaccination during post-pandemic is running high. Other measures to tackle the polio vaccine misinformation should be incorporated simultaneously to increase vaccination intent and boost population immunity. Continuous surveillance and active engagement from stakeholders should be strategically put in place to prepare for the final battle of polio eradication after the COVID-19 pandemic.

Figure 1. Poliovirus vaccination schedules in the Western Pacific Region countries or regions*



* Regions with lowercase letters denote provinces, municipality, or special administrative regions of China. Grey areas indicate countries or regions not included in our study. IPV = inactivated polio vaccine, bOPV = bivalent oral polio vaccine. Data Source: World Health Organization (WHO) vaccination schedules and Ministry of Health of Western Pacific Region countries.

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Contributors

The study was conceived and curated by KL, LKL, and JTW, with important inputs from EHYL. LKL, THKL, RM, and SLLK collected data. RM and SLLK reviewed the literature, analysed data, and drafted the manuscript. KL led the study design and supervised the data analysis with EHYL. KL, LKL, JTW, EHYL, and THKL contributed to data interpretation, provided critical review, and commented on revisions of all text. All authors approved the final version of the manuscript.

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Declaration of interests

The authors declare no competing interests.

Data sharing statement

We collated data from publicly available secondary data sources. The sources of all secondary data included in the analyses are available in the main text or supplementary materials. Anonymised survey data will be made available to others upon request to the corresponding author with proposed data needs.

Ethics

This study was approved by the Institutional Review Board at the London School of Hygiene and Tropical Medicine (LSHTM 26636).

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