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Commentary

Linked poliovirus incidents in the UK, USA and Israel: Silent transmission or missed warnings of vaccine inequity?

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Several poliovirus incidents were reported in high-income countries (HIC) in 2022, which have required large-scale public health responses. Strategies to address persistent disparities in childhood vaccination coverage will be crucial to prevent and control circulation, and sustain elimination in HIC.

1. Domestic polio

Since 1988 the Global Polio Eradication Initiative has succeeded in interrupting transmission of wild poliovirus in almost every country, and as of 2022, only two countries, Afghanistan and Pakistan, remain polio-endemic. The USA was declared polio-free in 1979 [1], as was the WHO European Region in 2002. Use of oral polio vaccines (OPV) were replaced by exclusive use of inactivated poliovirus-containing vaccines (IPV) in most polio-free HIC [1].

In 2022, public health agencies reported genetically-linked poliovirus incidents in Jerusalem, London, and New York (NY) [2]. Laboratory analysis first confirmed the detection of vaccine-derived poliovirus type 3 (VDPV3) in Jerusalem in March [3], isolated from one unvaccinated index case in an exclusively Orthodox Jewish (Haredi) neighbourhood of Jerusalem and at least six asymptomatic cases. Unrelated to this incident, vaccine-derived poliovirus type 2 (VDPV2) was detected through environmental surveillance [2] in three Israeli cities with large Haredi Jewish populations in April. Detection of VDPV2 in London sewage was announced in June [3]. VDPV2 was isolated from an index case in NY in July [1,2], which the press disclosed as an unvaccinated Haredi adult from Rockland County (NY). It is likely that VDPV2 has emerged following viral shedding by individuals, who were vaccinated overseas with OPV, and transmission has subsequently been sustained in undervaccinated populations [4]. Following on-going detection of VDPV2 for a period of two months, the UK and USA met the WHO definition for circulating VDPV2 [2]. A disaster or public health emergency was declared in NY on 9th September 2022, which reflects the serious nature of the polio outbreaks.

Public health agencies in the UK, USA and Israel have implemented poliovirus vaccination responses to interrupt chains of transmission and prevent further cases of paralysis. In Israel, the vaccination response to the VDPV3 incident focused on IPV catch-up followed by bivalent OPV (bOPV) for all children from 6 weeks to 17 years of age, first in Jerusalem and then nationwide

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[3]. The approach in NY is to recommend residents ensure they are up to date with their routine vaccinations, with an IPV booster recommended for a small selection of risk groups. In the UK, people have been reminded of the need to be up to date with their routine vaccinations, and in addition, all children in London aged 1–9 were offered an IPV-containing booster vaccine [5].

As only 0.5 % or less of polio infections result in acute flaccid paralysis, the spread is often described as "silent" and one confirmed case indicates that there may be hundreds or more that are asymptomatic or unidentified. Silent transmission of poliovirus, however, also indicates that persistent warnings of inequity in vaccination coverage need to be prioritised as part of programme delivery. Minorities with lower-level vaccination coverage, who may be underserved by routine vaccination programmes, are most vulnerable to polio spreading.

The term 'underserved' foregrounds the importance of delivering routine vaccination programmes in ways that are equitable, and which account for intersectional inequalities of race, socioeconomic status, and gender. Vaccine inequity in Israel, the UK and US is not specific to Haredi Jewish populations. In the UK and the USA, children from most ethnic groups achieve lower vaccine coverage compare to children of White ethnicity [6,7]. Haredim, however, are among the least vaccinated population groups in Israel [8], and areas with significant Haredi populations are vulnerable to vaccine-preventable disease outbreaks in the UK [9] and USA.

Haredi Jewish women have higher total fertility rates (estimated to be three times that of the national UK average) raising questions about what accessible services mean in this context. It is important to note that Haredi Jews are not homogenous and form diverse movements (sub-groups) that are distinguished by ethnicity and place of origin. Despite these differences, there is a common approach to stringency in how Jewish law (*halachah*) is interpreted, and selective engagement with the internet, education and formal employment sector. Hence, vaccine engagement activities need to be responsive to the self-protective nature of Haredi Judaism.

Areas that are home to significant Haredi populations in Israel, the UK and USA maintain lower than average coverage for routine childhood immunisation. Compared with a 92 % national average in 2020–21, IPV-containing hexavalent vaccination coverage at 24 months in the London borough of Hackney, where 22 % of children belong to the Haredi community, was 77.8 % [10]. By August 2022, coverage for 3 doses of IPV at 24 months in Rockland County was 60.3 % compared with the 79 % state average [11]. The ZIP codes within Rockland County with the lowest-level coverage were Monsey and Spring Valley, which are home to significant Haredi populations [11]. In Jerusalem in 2016, 3rd dose coverage of IPV at 24 months was more than 10 percentage points lower among Haredi Jews than among non-Haredi Jews [8]. Outbreaks of vaccine-preventable diseases (VPDs), such as measles (all settings) and mumps (NY), have disproportionately affected Haredi children across these settings. Uptake levels signal population-level differences in responses to services.

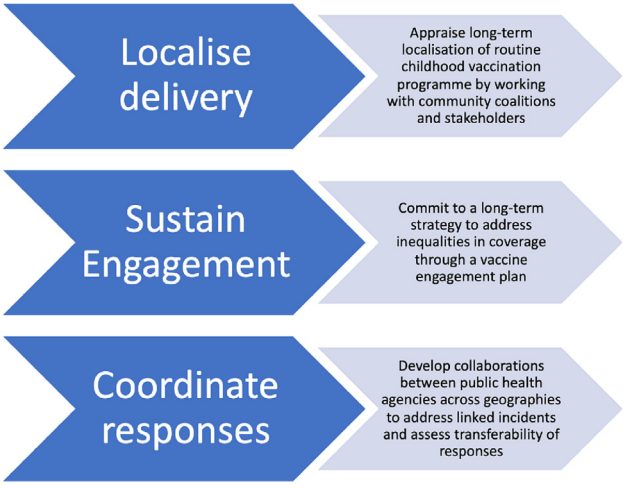

Fig. 1. Short and long-term approaches to address inequalities through vaccine engagement strategies.

2. Addressing vaccine inequalities

These linked polio incidents illustrate the need for a strategic shift towards addressing persistent disparities in vaccine coverage through tailored approaches as part of a re-appraisal of vaccine engagement, which is premised on a relationship between public health, primary care, and populations. While routine services must be accessible to facilitate uptake, additional funding and capacity is required to offer tailored services for underserved populations (Fig. 1).

The World Health Organization has provided guidance for tailoring immunisation programmes (TIP), and one of the first pilots was conducted in 2014–16 in north London's Haredi minority [9]. However, the ability to act on recommendations for long-term change was hindered by short-term funding and complex commissioning arrangements [12]. The ongoing polio incidents are yet another failure to address vaccine inequity in a systematic way and as a matter of priority.

3. Localised approaches

Localised delivery approaches may help to address disparities in vaccination coverage. Localised vaccination programmes involve communication and/or implementation strategies, which involve community partners [12]. Communication strategies can be operationalised in collaboration with reputable partners to produce targeted material. During the 2018–19 measles outbreaks, a coalition of Orthodox Jewish nurses in the USA developed a task-force named the E.M.E.S. (Hebrew, truth) Initiative, or Engaging in Medical Education with Sensitivity, and produced a myth-busting guidebook to support vaccine engagement efforts and influence relationships between parents, paediatric providers and public health services (https://emesinitiative.org) (Fig. 2).

Localised services allow responsibility for delivery (booking appointments; administering vaccines) to be shared, and can impact confidence and convenience. An example of 'localised services' includes a collaboration between London public health teams and a Haredi volunteer ambulance service, *Hatzolah*, to co-deliver a select number of COVID-19 vaccination clinics in Hackney in 2020–21 [12]. However, localised vaccination services do not need to be confined to a short-term arrangement with insecure or specific funding allocation. Localised services are not cost neutral, but may be an investment in areas that are susceptible to VPD outbreaks.

The linked-polio incidents are being managed via designated vaccination sites (DVS) or primary care, and by generating demand through widespread campaigns, at the regional (London; NY) or national levels (Israel). In London, IPV boosters (or catch up on the routine programme if required) were typically being offered to children aged 1–4 via primary care services, and to children aged 5–9 via DVS across the capital. DVS can deal with large volume delivery in mass vaccination campaigns but are less equipped to address inequalities in tailored ways. However, local healthcare providers serving Haredi neighbourhoods have offered vaccines to children aged 0–9 to address the challenge of accommodating multiple closely-spaced births. Programmatic flexibility is an

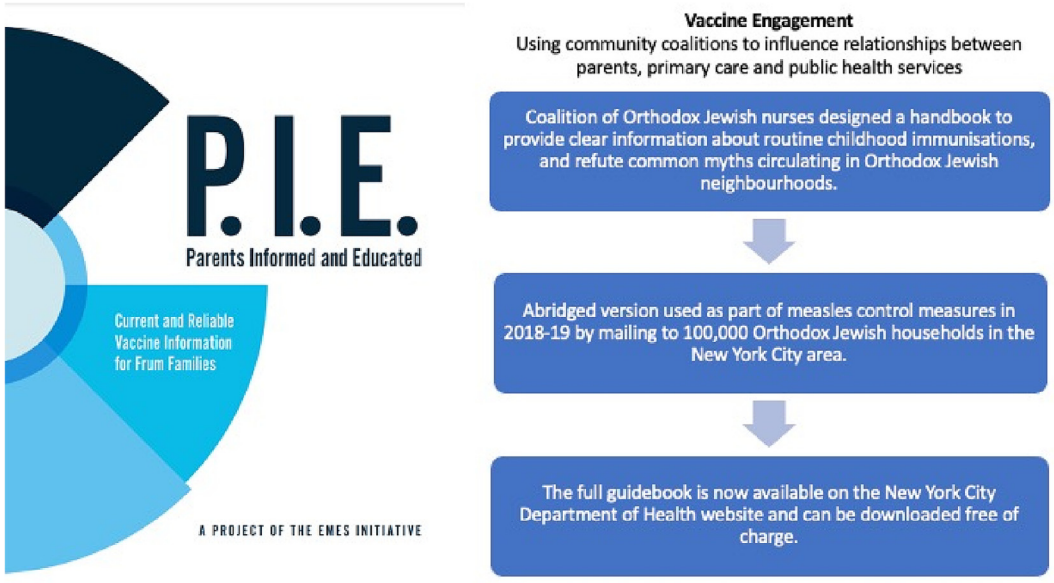

Fig. 2. Vaccine engagement material produced by EMES (https://www1.nyc.gov/assets/doh/downloads/pdf/imm/parents-informed-and-educated-booklet.pdf.).

essential component of addressing inequities in service provision as part of outbreak and routine vaccine delivery.

Future incidents are likely to recur without localising and tailoring routine programmes for underserved populations to ensure routine services are fit-for-purpose. Lower-level vaccination coverage leading to incidents of VPD is not specific to Haredi neighbourhoods, but reflects an imperative to address inequities proactively and sustainably. Accessible universal services are a core goal of national immunisation programmes, but they need to be complemented by tailored services in routine or alternative settings informed by needs-based assessments and consultation with partnering organisations that hold buy-in in minority populations.

Embedding the tailoring of routine programmes and community engagement in local provision can support the delivery of responsive and appropriate outbreak vaccination campaigns. Community engagement with those most vulnerable to the circulation of poliovirus is essential to ensure the campaigns successfully reduce the risk of the virus continuing to spread and prevent cases of paralysis in the communities most at risk.

4. Coordinating responses in linked incidents

The linked-polio incidents offer an opportunity for regional public health agencies in HIC to collaborate by reinforcing messages and coordinating responses, and understanding how lessons learnt translate into improved vaccine coverage and reduced health inequalities. Knowledge sharing approaches are key to addressing the vaccination needs of populations who are closely connected across regions and countries. Building networks of public health agencies has the potential to facilitate knowledge exchange and sharing of evidence, which may yield benefits for a proactive and long-term strategy of vaccine engagement. The political economies of healthcare, however, will ultimately shape the management of outbreaks and translation of lessons. Commitment to analysing the political economy of each health system in the UK, USA and Israel could lead to specific recommendations being adapted to country contexts.

Comparing how public health teams collaborate with community-level coalitions to meet the needs of minority populations can support transnational networks by helping to illustrate the building-blocks required for domestic polio strategies that will help achieve global goals. Ensuring representation of protected characteristics in community-level coalitions is critical if serving as models in a global strategy.

5. Implications for practice and policy

Commentators have offered three recommendations to prevent the poliovirus incidents from threatening progress towards polio eradication: i) surveillance to understand the extent of VDPV transmission worldwide; ii) commitment to improving vaccination coverage; and iii) evaluation of interventions [4]. We argue that this needs to be augmented by prioritising population-level differences in vaccination coverage. The linked incidents are a stark illustration of the consequences of not seeking to understand and address the vaccination needs of underserved populations. Public health systems need to be adequately funded and agile for VPD like polio to become 'things of the past.' Immunisation programme commissioners and managers need to be able to provide universally accessible programmes that incorporate tailored services to underserved communities where required. Essential to this is sustainable financial investment and adaptive health system planning mechanisms that support vaccine engagement activities. Countries across the world, even those with robust immunisation programmes, will remain vulnerable to the diseases we seek to eradicate until tracking and addressing inequalities becomes as routine as measuring vaccine coverage.

The WHO 'Immunization Agenda 2030' explicitly cites vaccine equity as a global strategic priority [13]. As countries consider the practical implications of this strategic shift, the linked polio outbreaks affirm the urgency of addressing differences in vaccination coverage. Immunisation services must be provided in an equitable manner – which should include localised methods and networks – to ensure that 'nobody is left behind.'.

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Data availability

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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