



## “We’re potentially worsening health inequalities”: Evaluating how delivery of the 2022 London polio booster campaign was tailored to Orthodox Jewish families to reduce transmission vulnerability

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### ABSTRACT

A polio booster campaign targeting all children aged 1–9 was implemented across London between August–December 2022 as part of a national enhanced poliovirus incident response. Orthodox Jewish (OJ) children were particularly vulnerable to transmission due to disparities in childhood vaccination coverage and the transnational spread of poliovirus affecting linked populations in New York and Israel. This study aimed to evaluate how the polio booster campaign was tailored to increase uptake and enable access for OJ families in northeast and north central London boroughs, and the impact of the campaign on local-level vaccine inequities. Semi-structured in-depth interviews ( $n = 36$ ) were conducted with participants involved in the implementation and delivery of the polio booster campaign, and OJ mothers. Site visits ( $n = 5$ ) were conducted at vaccine clinics, and rapid interviews ( $n = 26$ ) were held to explore parental perceptions of the poliovirus incident and childhood immunisations. Enablers to vaccination during the campaign included the production of targeted printed communications and offering flexible clinic times in primary care settings or complementary delivery pathways embedded in family-friendly spaces. Barriers included digital booking systems. Mothers reported being aware of the poliovirus incident, but the majority of those interviewed did not feel their children were at risk of contracting polio. Healthcare provider participants raised concerns that the vaccine response had limited impact on reducing disparities in vaccine uptake. While OJ families were recognised as a priority for public health engagement during the poliovirus incident response, this evaluation identified limitations in reducing transmission vulnerability during the booster campaign. Lessons for future campaign delivery include effectively conveying transmission risk and the urgency to vaccinate. Priorities for mitigating vaccine inequities include public engagement to develop messaging strategies and strengthening the capacity of primary care and complementary delivery pathways to serve families with higher-than-average numbers of children.

### 1. Introduction

The United Kingdom Health Security Agency (UKHSA) announced a national enhanced poliovirus incident on 22 June 2022, following multiple detections of vaccine derived poliovirus type 2 (VDPV2) isolates in London sewage since February 2022 (Klapsa et al., 2022).

VDPV2 detections were concentrated in north central (NCL) and northeast (NEL) London boroughs, where 2021–22 hexavalent (polio-containing) vaccination coverage rates by 12 months of age ranged from 64.0% to 87.2% (Klapsa et al., 2022; United Kingdom Health Security Agency, 2022a; National Health Service England, 2022a, 2022b). This constituted the first evidence of poliovirus transmission in the UK since

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1984 (United Kingdom Health Security Agency, 2013).

It is likely that VDPV2 emerged following viral shedding by an individual who was recently vaccinated overseas with oral poliovirus vaccines (OPV), and transmission had subsequently been sustained in separate social networks with lower-level vaccination coverage (United Kingdom Health Security Agency, 2022b). OPV is a live-attenuated vaccine that enables passive immunisation. Yet, the attenuated poliovirus contained in OPV pose a small risk of mutation if allowed to circulate widely among un or under vaccinated individuals (Centres for Disease Control and Prevention, 2022). These mutations can precipitate the return of neurovirulence in the virus and cause paralysis in unvaccinated individuals. Routine use of OPV was replaced with inactivated poliovirus-containing vaccines (IPV) in England's routine immunisation schedule in 2004 (United Kingdom Health Security Agency, 2013). The full course of IPV-containing vaccines in the current National Health Service (NHS) childhood vaccination schedule includes hexavalent doses at 8, 12 and 16 weeks, a pre-school booster at age 3 years and 4 months, and an adolescent booster at age 14 (National Health Service, 2019).

Following the UKHSA announcement of the enhanced poliovirus incident, the NHS immediately advised all eligible individuals to complete the recommended course of IPV-containing vaccines. Partially immunised and unimmunised children in London were invited to catch-up on the NHS childhood vaccination schedule. The Joint Committee on Vaccines & Immunisation (JCVI) convened an extraordinary meeting on 25 July 2022 to determine the appropriate vaccine strategy. The JCVI recommended that on-going catch-up should be complemented by offering an additional IPV-containing 'booster' vaccine to all children aged 1–9, who were resident in London and were up to date with their vaccinations, to enhance immunity, reduce the risk of paralysis and interrupt transmission (Joint Committee on Vaccines & Immunisation, 2022). The total cohort of children eligible to receive an IPV-containing vaccine (catch-up or booster) was estimated to be 950,000 (Joint Committee on Vaccines & Immunisation, 2022).

The 'polio booster campaign' was publicly announced on the 10th August, and NHS and UKHSA staff commented that to achieve 100% offer of an IPV-containing vaccine to all children aged 1–9 in London, 'targeted interventions to enable high uptake in traditionally under-vaccinated communities are likely to be needed' (National Health Service & United Kingdom Health Security Agency, 2022). Haredi Jewish (often referred to as 'ultra-Orthodox') residents in NEL and NCL boroughs were considered a priority for public health engagement because of low-level vaccination coverage in their neighbourhoods, and the risk of exposure to VDPV2 via linked outbreaks in New York and Israel (Link-Gelles et al., 2022; Zuckerman et al., 2022). The aim of this study was to evaluate: how the polio booster campaign was communicated, implemented and delivered; how parents engaged with the campaign (and childhood immunisation services more broadly); and the impact of the campaign on documented disparities in routine childhood vaccination coverage in these areas.

### 1.1. Background: local and transnational context of poliovirus circulation

Not confined to London, genetically linked VDPV2 isolates were detected in sewage in Israel (April–July 2022), in multiple New York counties (April–August 2022), and in specimens collected in Canada in August 2022 (Link-Gelles et al., 2022; Pan American Health Organization, 2022; Zuckerman et al., 2022). The New York State Department of Health reported a confirmed case of paralysis in an unvaccinated adult in Rockland County in July 2022 (Link-Gelles et al., 2022). IPV coverage by 24 months is profoundly low in the Rockland County ZIP codes of Monsey (37.3%) and Spring Valley (57.1%), where a significant Haredi Jewish population resides (New York State Department of Health, 2022a, New York State Department of Health, 2022b). Widespread detections of VDPV2 in sewage continued to be reported in Israel in 2023 (Israel Ministry of Health, 2023). In February 2023, a confirmed case of

paralysis was reported in an unvaccinated child in Tzfat, a largely Haredi locality in northern Israel (Israel Ministry of Health, 2023). Prior to these events, public health agencies in the UK, US, and Israel had reported frequent outbreaks of vaccine preventable diseases (VPD) affecting under and un-immunised Haredi children (Baugh et al., 2013; Letley et al., 2018; Stein-Zamir et al., 2020), and some of these outbreaks have become associated with larger regional, national and international spread (McDonald et al., 2019; Patel et al., 2019).

Hackney is located in NEL and is home to the largest Haredi population in Europe (numbering approximately 30,000), and one in four children in the borough are Haredi (City and Hackney, 2018). Larger child demographics place additional pressures on immunisation and primary care services (Letley et al., 2018). The growth of the Haredi population has led families to move into the Seven Sisters ward of Haringey (located in NCL), which borders Hackney and is close to Stamford Hill and Stoke Newington, where Haredi schools are located (Flint Ashery, 2020). Compared with a 91.8% national average in 2021–22, hexavalent vaccination coverage at 12 months of age in Hackney was 64% but higher in Haringey (82.7%) (National Health Service Digital, 2022). Vaccine coverage data in England cannot be disaggregated by religion. Hence, lower vaccine uptake among Haredi children is inferred from the select numbers of GP surgeries that serve Haredi neighbourhoods in Hackney (which have larger numbers of registered child patients).

Haredi Jewish groups are diverse, and are distinguished by ethnicity and place of origin, and differences in customs and stringencies that influence social organization and how religious law (*halachah*) is interpreted. Haredi social networks extend across Europe, North America and Israel.

Hackney and Haringey are home to a broad range of populations, and disparities in vaccine uptake are not specific to Haredi minorities. Yet, the 2014–16 WHO Tailoring Immunisation Programme (TIP) study conducted in north London documented widespread delayed acceptance among Haredi families in Hackney, and barriers to accessing vaccines including inflexible clinic times and waiting areas that are not practical for larger families (Letley et al., 2018). Printed community-specific information, ease of access to booking appointments, and delivery via children's centres were described as enablers to access (Letley et al., 2018). However, there is evidence to suggest that the ability to sustain implementation of TIP recommendations, particularly around complementary delivery pathways, have been hampered by systems restructuring (Kasstan et al., 2022).

NHS England maintains oversight for services commissioned at regional levels by Integrated Care Systems (ICS). ICS were established in July 2022 and are partnerships of organizations that plan and deliver healthcare in defined geographic areas. Each ICS has an Integrated Care Board (ICB), which is a statutory NHS organisation and is responsible for planning and funding most NHS services in the ICS area (Charles, 2022). Hackney is administered by NEL ICS, and Haringey by NCL ICS. Consequently, vaccine delivery arrangements were not uniform across these neighbouring boroughs during the poliovirus incident response. To address the broader aim outlined above, this evaluation examined barriers and enablers to participating in the booster campaign for Haredi Jewish families in Hackney and Haringey and how the risks posed by the transnational spread of VDPV2 and disparities in vaccination coverage were mitigated.

### 1.2. General division of responsibility between health partners in London during the polio booster campaign

UKHSA led the national polio incident investigation and response, including national communications and developing relevant clinical guidance. The JCVI made vaccine strategy recommendations. NHS London oversaw the commissioning, delivery and monitoring of the polio booster campaign, and worked with a range of local partners to develop a communications plan. ICSs and ICBs coordinated

implementation of the booster campaign across constituent boroughs by managing central notifications and booking and data gathering functions. ICSs were tasked with prioritising campaign promotion in planning to improve access for neighbourhoods and populations known to have lower-level uptake of the NHS childhood vaccination schedule. Local authority public health teams supported the campaign via assessment of needs and priorities for health protection as well as development of resources and supporting access at local levels.

## 2. Methods

This evaluation focuses on the period 10 August, when the campaign was announced, to 23 December 2022, when the offer of a polio booster vaccine was withdrawn. Methods primarily consisted of semi-structured in-depth interviews and site visits to 5 vaccination delivery points across Hackney and Haringey that were involved in the polio booster campaign (Fig. 1) (National Health Service England, 2022a). Site visits lasted 1–4 hours.

Site visits allowed an assessment of enablers and barriers to accessing delivery points. An initial 26 rapid ‘exit’ interviews were hosted with parents attending delivery points to ascertain when and how parents had heard about the spread of VDPV2, whether they were concerned by the incident, and why they came forward for polio booster vaccines or catch-up on the routine immunisation programme if their children were not vaccinated to schedule. Most rapid ‘exit’ interviews (n = 20) were conducted with Haredi mothers, who typically brought their children to catch-up on the routine programme in primary care centres and a weekly clinic held in a Jewish community POD (point of dispensing). The routine immunisations that children required as part of catch-up activities often varied. The remaining rapid ‘exit’ interviews (n = 6) were held with non-Jewish parents attending a NHS vaccine centre or NHS hospital for polio boosters. No Haredi parents were observed accessing these sites during the visits, in contrast to primary care and POD site visits.

In-depth interviews were conducted with a total of 36 participants from 5 key research clusters (Fig. 2) Public health (PH) participants included consultants, immunisation commissioners and programme managers based in UKHSA, ICSs and ICBs, and local authorities. Healthcare provider (HCP) participants were based in NHS vaccination centres and primary care services, NHS England and NHS London region. Linked professional (LP) participants had previously been involved in the 2014-16 TIP study or had been involved in the training of

vaccinators as part of the polio incident response, or worked for public health teams outside the London region. Mothers taking part in in-depth interviews were recruited via a children’s centre that offers a range of family services, and which had been used as a POD during the booster campaign. The children’s centre was not functioning as a POD when the parents were recruited and hence they were not attending the site for vaccination. While all mothers approached at the centre had at least 1 child eligible for the polio booster campaign, most had not accepted the offer (n = 6). Mothers participating in in-depth and ‘exit’ interviews ranged in age, gender, educational and professional background, the number of children they have, and the Haredi movement to which they were affiliated to. All names of participants, and the precise roles of PH, HCP and CP, and particulars of mothers, have been anonymised to protect their identities.

Participants were recruited from professional networks, past research projects, site visits and via snowball sampling. BK and TC conducted interviews using online video conference software. Mothers were interviewed by telephone if without home internet access. Interviews lasted between 20 and 90 min and were recorded with participant consent. The interviews were supported by topic guides that included questions about implementation of the polio booster campaign, and detailed notes were made during interviews and site visits.

Analysis of the data was inductive and thematic, whereby theoretical insights emerge from prolonged engagement with the data (Green & Browne, 2005). Existing literature was used to frame the research questions, while also allowing insights and implications to emerge from the data. Emergent coding themes were reviewed and discussed extensively between [author initials]. Findings were then organised using critical strands of the public health response.

## 3. Results

The results are organised into three main themes: I) how the campaign was communicated, II) implemented and delivered via tailored means for Haredi families, and III) the impact of the booster campaign in a context of lower-level routine childhood vaccination coverage.

### 3.1. How the campaign was communicated

NHS England (via the Child Health Information Service) immediately began to notify parents by post that their children were eligible to receive an IPV-containing booster vaccine, or to catch-up on routine IPV-containing vaccines (15 August). In addition, parents with eligible children that were unregistered at a primary care centre were contacted again on 23 September. A second universal notification was sent to parents of all eligible children who had not yet received an IPV-containing vaccine (4 November), including a synopsis in Yiddish and additional languages. On behalf of NEL and NCL ICS, NHS England then sent out specific letters giving families more detailed information on vaccine delivery sites in their areas. Primary care teams also continued running their standard call/recall invitation processes for catch-up on the routine schedule and were signposted to in all NHS England notifications. Local authority public health teams supported the tailored delivery of communications and engagement activities, signaling a



Fig. 1. Delivery plans for the IPV booster campaign according to age bands when the campaign was announced, and number of site visits conducted at delivery points during the evaluation.

	Public health (PH): Consultants; immunisation commissioners and programme managers based in UKHSA, ICB, and local authorities	Healthcare providers (HCP): Healthcare professionals based in NHS vaccine centres, primary care services, hospitals; managers at NHS London region and NHS England	Community groups / partners (CO): Managers of Jewish community services; Jewish community outreach workers	Linked professionals (LP) Vaccinator trainers, Public health and healthcare professionals involved in serving Haredi populations outside London	Haredi Mothers All had at least 1 child eligible for the IPV booster campaign
No. of participants	10	12	3	4	7

Fig. 2. Participant clusters and numbers of interviews.

**Poliovirus is spreading in Hackney**

Poliovirus is a life-threatening infection that can cause paralysis.

**Immunisation is the best protection against this disease and the NHS is offering all children aged one to nine years the polio booster vaccine.**

It is important for your family and community to immunise your children against preventable childhood illnesses such as measles, polio, meningitis and pneumonia.

**Routine immunisations and what your child should have:**

<p>Get a vaccine for 6 diseases including polio when your child is</p> <p>8 weeks + 12 weeks + 16 weeks</p>	<p>Then get a vaccine for 4 diseases including polio when your child is</p> <p>3 years + 4 months</p>	<p>Then get a vaccine for 3 diseases including polio when your child is</p> <p>14 years</p>
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Check your child's red book to see if your child is up to date.

**You can get your child vaccinated at:**

**Homerton University Hospital**  
**Children aged 5 to 9**, Mon, Weds and Fri – 3pm to 6pm

**St. Leonard's Hospital, Nuttall Street**  
**Children aged 5 to 9**, Tue – 12.30pm to 6.30pm and Thurs – 9.30am to 6pm

**For children under 5**, please contact your GP.

**Over 14-year-olds and adults** who have not received a polio vaccine can also get one for **free**.

Scan the QR code to find out where you can get your child immunised.

**NHS Hackney**

Fig. 3. Public notice in Hackney, North East London.

coordinated response.

National communications produced by UKHSA conveyed that ‘Most of the UK population will be protected from vaccination in childhood, but in some communities with low vaccine coverage, individuals may remain at risk’ (National Health Service & United Kingdom Health Security Agency, 2022). This message was intended for the national audience, but required tailoring at regional (London) and borough levels by relevant stakeholders (e.g. ICS; local authority public health teams). HCP participants, however, felt the campaign messaging was not conducive to promoting urgency to vaccinate, “I kind of object to that. You’re going to say that the risk is there for you – otherwise what’s the motivation?”(HCP1). An additional challenge described by HCP was conveying the origins of the poliovirus incident, “This whole issue in itself around the fact that this is vaccine derived poliovirus and that in itself needed some unpacking” (HCP1).

The IPV campaign was advertised via street posters across Hackney to convey localised transmission risk, ‘Poliovirus is spreading in

Hackney’ (Fig. 3). A PH participant perceived the national communications surrounding the incident to be less impactful compared to public health responses in New York, where a state-wide disaster emergency was declared on 9 September 2022 following the confirmed case of paralysis and continued detection of VDPV2 isolates in sewage (Office of the Governor of the State of New York, 2022):

“There wasn’t any real sense of ‘this is a public health crisis.’ In New York, they announced a public state of emergency to do with polio [...] there are dire consequences of polio and I just felt that there wasn’t that sense of importance” (PH9).

PH and HCP participants recognised that Haredi families in NEL constituted one of the populations most vulnerable to poliovirus transmission, and hence were considered priority beneficiaries for the polio booster campaign:

“When we were doing the planning for the polio vaccination campaign, because we knew that there were genetic links identified in Rockland and in Israel, it was especially important to ensure high uptake in Orthodox Jewish



communities” (PH1).

National and regional UKHSA and NHS teams collaborated to develop an infographic intended for Haredi families in London [Appendix 1]. The infographic made references to the availability of Yiddish translations, the context of transnational spread, and cited that the London polio booster campaign ‘follows a highly successful polio booster campaign in Israel,’ points which would not be relevant for a universal audience. While the infographic was available online via UKHSA, local-level services did not obtain print copies and it was not observed on display during site visits in Hackney or in Haringey – indicating limitations in the flow of assets between incident stakeholders, providers, and intended beneficiaries.

National, regional or local communications did not explicitly detail that Jewish families were vulnerable to the transnational spread of VDPV2 to avoid being stigmatising, or ‘to make the Jewish population look like they weren’t behaving in a kind of right way’ (PH10). Local-level material was produced to engage intended beneficiaries with the campaign. The London Jewish Health Partnership (LJHP), a region-wide initiative developed in 2022 bringing public health and healthcare professionals together with community partners to reduce health inequalities, had coordinated together with NHS and UKHSA communications teams, and local public health teams, the production and dissemination of several assets. These included an online ‘deep dive’ on immunisation delivery (12 September) for Haredi as well as broader Jewish neighbourhoods in Barnet and Brent (NCL) and coverage in local press (23 September). Letters endorsed by national, regional and local health partners (1.2) were produced and disseminated to Jewish households in Hackney via the *Heimisher* (Haredi weekly circular), and by community partners (29 September) [Appendix 2]. The dissemination of these assets occurred near a busy period of Jewish high holy days (beginning 25 September to 16 October).

PH participants viewed the LJHP coalition as enabling responsive and strategic engagement with community partners to inform communications:

“We had already had in place the London Jewish Health Partnership. So, all those people were already there [...] you could almost say ‘we’ve got a campaign, can you look at this tonight?’ and everyone was there to say ‘yes, we’ll look at that.’” (PH10)

These engagement activities were considered impactful and an opportunity to ensure the suitability of language, though PH participants were conscious that these efforts did not translate into higher uptake:

“We had co-production take place in terms of the language that we use, the types of material that we use, we published ads in Orthodox Jewish publications. We’ve done a lot really creative and innovative things and really tried to work with the community [...] but there is obviously still relatively low uptake despite that work.” (PH5)

From mid-September, a childhood immunisations coordinator based in a Hackney PCN developed targeted flyers to advertise key messages focused on polio transmission, and weekly vaccine clinics advertised in the *Heimisher* (supported by local authority public health). Parents attending for childhood vaccinations had engaged with these communications, ‘I did hear about polio spreading, but not in the community.’ It’s been well advertised, always seen it in the *Heimisher*” (Rapid 21). Engagement with Haredi families via the immunisations coordinator was recognised as a major asset by PH participants in Hackney, “we know that engagement role is so important [...] we will need that function to continue” (PH8).

### 3.2. How the campaign was implemented and delivered

The NHS and UKHSA (2022) produced comprehensive guidance for health care workers to support implementation of the supplementary IPV-booster campaign. Children were eligible for a booster vaccine if a minimum of four weeks had elapsed since receiving their last hexavalent vaccine, or 12 months had elapsed since receiving their pre-school booster (United Kingdom Health Security Agency, 2022c). Four

multi-antigen IPV-containing vaccines were utilised according to age, and all formed part of the routine programme. Initially, children aged 1–4 were expected to receive their vaccines via NHS primary care services, and children aged 5–9 via designated vaccine delivery points (Fig. 1). Implementation evolved over the course of the campaign, and sites were able to vaccinate children aged 1–9 depending on capacity and facilities.

A COVID-19 vaccine centre formed a key site to vaccinate the age 5–9 cohort in Haringey, before expanding to ages 1–9. HCPs considered the vaccine centre to be strategic from the perspective of ICS-level reach, ‘we know that the polio vaccine had been found in the sewage in multiple boroughs. So, it’s a really, really good place for people to receive those vaccines from a North Central London sector wide perspective’ (HCP7). However, the vaccine centre was situated in a less deprived area of Haringey, and PH participants were not convinced that the site was suitable for addressing disparities in the more deprived areas of the borough, which includes the Seven Sisters ward, where Haredi families reside:

“There’s a reliance there of people being willing to go to the place, if they happen to live near there or work near there, but if they don’t, will people travel to go there? Not really, is my view.” (PH1)

Implementation in Hackney occurred via Primary Care Networks (PCN), which are consortia of general practitioner (GP) surgeries and community health services in specific localities, and 2 hospital hubs (ages 5–9):

“With the polio programme, all general practices do the routine polio vaccines anyway, they were invited to provide the booster. And then the extra provision on top of that were Homerton hospital [...] and additional clinics in a kind of PCN estate at weekends.” (PH6)

However, HCPs in GP surgeries described varying capacities during the campaign period, ‘you need to book about two weeks in advance to get an appointment with me now’ (HCP6). HCPs in general practice described the expectation to deliver the campaign as a major pressure raising implications for service delivery, ‘if you want us to do this, what do you not want us to do [their emphasis]? There’s an opportunity cost for everything’ (HCP1).

Hospital hubs were not considered by HCP to be an effective site for Haredi families, who would have to travel by public transport to access the site. As one HCP commented during a hospital site visit, “Jewish families come here a lot, especially for maternity services, but not for vaccinations.”

#### 3.2.1. Sunday clinics operated by Primary Care Networks

A PCN expanded weekly Sunday vaccine clinics across 2 GP surgeries for eligible children resident in Hackney during the campaign. While the vaccine clinics were not exclusively for Haredi families, Sundays were recognised to be especially practical for Haredi families due to the timetables of Haredi schools (most of which are independent): “that was specifically to cater to the Orthodox Jewish community [...] we tried to put it up to five nurses, so we quadrupled capacity” (PH5).

Sunday clinics involved a combination of booked appointments and walk-in services. Walk-in services (as a general offer) were valued by mothers with busy schedules and who had delayed routine vaccinations and wanted to catch-up, “I can choose a time, whenever it’s best for me” (Mum5). Booked appointments were preferred by others, “they were phoning up and giving the appointments, which is a lot easier” (Mum6). However, parents registered at one GP surgery were not always aware why they were being directed to different GP surgeries in the PCN:

“I do prefer to go to my GP but it was interesting, because I called my GP and they gave me appointment in a different surgery [...] I didn’t want to go when I saw the name [of the GP surgery] but I thought ‘you know what, I’ve got my appointment, I’m just going.’ I do prefer to go to my own [GP] but it’s not so easy to get appointments [...] but it’s just like, ‘better that you come to the walk in.’ But I prefer proper appointments” (Mum4).

The option to choose the most appropriate service was an enabler to accessing vaccine delivery points during the campaign (and in general), though such operational flexibility is resource-intensive. PH participants

responsible for commissioning immunisation services were concerned by missed appointments and the need for comprehensive health systems to support flexible delivery models as an enabler to access, “*We know that for our Orthodox Jewish clinics that actually we have a really high DNA [Did Not Attend] rate on the day. So, call and recall is really important*” (PH8).

Rather than expecting parents to attend different sites to vaccinate children aged 1–4 and 5–9, this PCN sought to increase enablers to access by inviting all eligible children to Sunday clinics:

*“When you have large families of all these ages, it doesn’t make sense for them to come with one child and take two somewhere else. You’re losing that opportunity already to vaccinate, so we wouldn’t want to create this barrier, we would want to make it easy [...] And if you think of people’s life and how busy they are having 5 children under the age of 10. You think of how to make it easy for them”* (HCP2).

GP surgeries in the PCN broadened the age band of target families in invitations to address widespread issues of delayed uptake of primary immunisations and make engagement relevant to local families:

*“This whole thing with the polio campaign, 1 to 9 years, it doesn’t work for our cohort, because we’re talking about 0 to 9 [...] The schedule of immunizations within that first year, from 0 to 1, you’ve got three doses. They haven’t even had that. So, if we start talking about 1-9, it doesn’t work for our cohort we’ve got to talk about from 0 because we want them to bring in the babies as well”* (HCP5).

HCP and PH participants agreed with the suitability of this approach for addressing disparities in Hackney, “*it’s never too late to catch up. And we want to be as open, as inclusive as possible*” (PH8).

Haredi patients registered in Haringey were typically referred to the dedicated Sunday clinics in Hackney. PH considered operational flexibility across ICS, as a tailored form of delivery to Haredi families, to be important learning about enablers to access during the polio campaign:

*“And there will be definitely opportunities and ways in which we work now moving forward jointly with northeast London, north central London, to look at those nuances that exist between Hackney and Haringey”* (PH3).

### 3.2.2. Complementary delivery pathways

PH participants acknowledged that complementary delivery pathways (Jewish community POD) in local authority-maintained children’s centres were convenient and familiar, and had the potential to promote access for Haredi and non-Haredi parents in Haringey and Hackney:

*“Feedback from the community was they wanted familiarity with the site so we’re actually mobilizing the clinics in a children’s center in Haringey that the community are very in touch with already”* (PH3)

A children’s centre located in the Seven Sisters ward of Haringey (an area of higher deprivation) was considered strategic for enabling access for a range of underserved populations. While 2 clinics were advertised in December 2022, barriers to access remained due to limitations in implementation. A primary advert was produced to detail the clinic location and times and noted that appointments had to be reserved via a booking link or QR code. A supplementary poster, intended to sit alongside the primary advert, clarified that ‘walk-in appointments will be available as well as appointments booked via the QR code.’ PH professionals acknowledged that the advertising and method of delivery was not suited to the limited use of internet and social media in Haredi families, “[...] because of the community they were aimed at, a QR code isn’t the best thing but it’s the best way to do some booking” (PH9). However, PH anticipated that Haredi parents “*Would mainly do more walk-ins*” (PH9). This approach led to misunderstandings, and was considered a barrier to access by community partners:

*“You had to scan a barcode on your smartphone and book an appointment online. So that immediately cut off most of the Haredi community [...] It [vaccine clinic] was for anyone, but ultimately, you’re cutting off, if you don’t give people a phone line to call or an option to walk in, you’ve immediately cut off all those people who can’t scan a barcode”* (CO2).

The Hackney PCN had reinstated a weekly vaccine POD in a local children’s centre, which has a long-running history of providing a

childhood immunisations that has been interrupted by commissioning arrangements. The vaccine POD is embedded in a community setting and offers support to families with children under 5 via a range of activities. Appointments are available by telephone, and parents felt confident that help and support may be available when attending appointments with multiple children, “*I need an extra pair of hands, I wouldn’t get that at the GP surgery, that’s why I came here*” (Rapid22). Mothers perceived the weekly clinic as a familiar service, and easier to obtain appointments compared to the GP surgeries they were registered at, “*I came here before and saw this nurse, and feel more comfortable. It’s easy to get an appointment, I just called up and they even gave me a reminder*” (Rapid23). Convenience was crucial to engage Haredi families with the campaign, with primary care and community-delivery pathways the most practical vaccination sites.

### 3.3. How parents engaged with the campaign

Parents interviewed as part of the evaluation were aware of the polio incident but did not consider their children to be at risk of transmission:

*“A lot of people weren’t concerned. I just thought maybe I didn’t need to be. I didn’t really hear anyone actually [being infected with poliovirus], and I kept asking like round, “are you doing it? Are you doing it?” And so everyone looked at me, as if like, ‘no’ [...] So many people out there are saying “just don’t do anything to your kids if you don’t know”* (Mum4).

Mothers who were unsure about the campaign turned to their social networks to deliberate, which tended to reinforce the perception that the IPV booster was not necessary, “*I did speak to my sister actually. And she was like ‘no, we give them enough immunisations. We don’t need it.’ So, I just left it”* (Mum3).

One mother accepted the polio booster for her eligible children to strengthen their immunity amidst the incident, “*I knew that they were already protected against it. Just, I did it [...] to give better protection*” (Mum5). Not all parents felt fully informed about the purpose of the polio booster campaign, wanting “*clarification why the extra booster was needed when they were considered fully vaccinated before*” (Rapid24). Concerns surrounding past outbreak vaccination campaigns had also influenced perceptions of the polio incident response:

*“We just went through the whole ho-ha with the COVID vaccinations. And it turned out that wasn’t so straightforward. I think what’s in the back of my mind. To be honest, I didn’t take it very serious, the outbreak of polio [...] I didn’t take much note”* (Mum7).

Not all mums shared this view and drew distinctions between the COVID-19 vaccination programme, which was rapidly developed and implemented in the first year of the pandemic, and the long-established use of the IPV in the routine programme and booster campaign:

*“They were thinking about giving it [COVID-19 vaccines] to children. And my kids were invited, my older children, and I had more anxiety, I wasn’t going to let my growing daughter take the COVID vaccine. But over here [polio vaccine] no, it didn’t worry me at all”* (Mum6).

Haredi children attending vaccine clinics during site visits typically required catching-up on routine childhood vaccinations due to vaccine delay. However, mothers were not always aware of what they were delaying and what risk their child remained at risk of, “*I won’t do more than 2. What’s the most important?”* (Rapid22). Hence, vaccine delay was not always due to access barriers.

### 3.4. How the campaign impacted documented disparities

Health partners (1.2) were involved in a range of incident management groups to monitor campaign delivery at regional, borough and local-levels, which was facilitated by exchange of data on vaccination uptake. Some of the HCP interviewed raised concerns of delays in targeted engagement with underserved populations during the campaign, which were linked to coordination of tasks across health partners:

*“The targeting should have happened much earlier on in the campaign. It kind of happened towards mid to the end of October, whereas it should have*

happened way before. I think there was an assumption on our part as NHS England that the ICBs are doing this, and that they didn't need as much hand holding, as we then ended up doing with them [...] when there's an urgent campaign, you really do need to look at your underserved communities to make sure that they are very much at the forefront, that they're your targets, not your low hanging fruit." (HCP10)

While Haredi families were considered a priority in the campaign response, PH participants were uncertain whether tailored activities initiated in Hackney were translating into measurable percentage increases in vaccine uptake:

"I started to feel a little bit more and more uneasy about the question of whether those relationships and those discussions, those forum settings and events, were they actually resulting in us making meaningful efforts to vaccinate that community." (HCP12)

A PH participants raised concerns that higher uptake of polio boosters occurred in areas of less deprivation, hence compounding disparities between populations most and least at risk of VPD outbreaks:

"All that's happened is that it just increases the health inequality because we have these people, and we've seen from looking at some data on deprivation, that the areas where more people went to have the booster, the supplementary dose were in areas of less deprivation." (PH9)

Concerns of widening disparities were felt to be more acute in Hackney, "we obviously had a much higher mountain to climb, compared to other boroughs" (PH5).

HCPs in the Hackney-based PCN were concerned that offering an additional IPV booster to fully-vaccinated children, as directed by JCVI (2022) due to concerns of waning immunity, required resources that could have been more effectively invested in a strategy to reach un and underimmunised children in areas of NEL who remained most at risk of paralysis and VPD more broadly:

"My fear in the first place [was] that actually we're potentially worsening health inequalities by having a very focused campaign just on polio, because actually, what you'll find is, those parents that come will be those that are engaged, that want the kid vaccinated for polio [...] and probably at very low risk to get an additional booster." (HCP1)

However, other local HCPs felt the polio booster campaign offered an opportunity to promote catch-up of IPV-containing multi-antigen vaccines and opportunistically offer vaccinations for a range of VPD following parental decisions to delay:

"We were very, very good in maximizing the uptake of other things as well. That was a great opportunity to catch up on many different things, especially on MMR. So, I think, yes, there was an outbreak [incident] and a great risk, but at the same time, it was a good opportunity to, to vaccinate anybody who were missing something else, you know, polio wasn't a single vaccine, single ingredient vaccine." (HCP2)

#### 4. Discussion

Enablers to participating in the booster campaign for Haredi parents included the production of targeted communications (in print, circulated to households via the *Heimisher* weekly pamphlet), and offering local-level delivery points on Sundays. Parents perceived a complementary delivery pathway, embedded in a community setting, as a more family friendly when attending with multiple children. Haredi Jewish residents in NEL and NCL were considered less likely to use mass or designated vaccine delivery points, which would require travel via public transportation with multiple children (barriers observed during the COVID-19 vaccine programme delivery, see Kasstan et al., 2022). While often described as a 'community,' Haredi parents had diverse requirements as well as expectations of childhood vaccination services.

Barriers included low risk perception during the incident, digital booking systems, and inflexible clinic appointments. Delays in producing and disseminating targeted assets coincided with the extended period of Jewish holidays (September/October 2022), when Haredi parents have competing demands and may be less likely to present for vaccination. Restructuring healthcare delivery via the establishment of

Integrated Care Systems and Boards occurred in the month prior to the announcement of the booster campaign. Coordination of responsibilities required adjustment, but was perceived to cause inefficiencies in the local implementation of the campaign, reflecting the management of past measles outbreak responses among Roma and Romanian families in England (Bell, et al., 2020).

Local-level and tailored communications produced during the poliovirus incident did not appear to drive a sense of urgency among parents to vaccinate children, despite their children being more likely to be un or under-immunised and hence vulnerable to contracting polio. Preferences for delayed vaccination among Haredi parents is consistent with findings documented in the 2014-16 TIP study (Letley et al., 2018), but this evaluation indexed how disengagement from the polio booster campaign was reinforced via social networks. Results indicate a need to conduct sustained public engagement activities and to work closely with community stakeholders to ascertain effective messaging strategies that can engage Haredi residents with accurate evidence of risk and levels of sensitivity, and via suitable dissemination pathways.

The JCVI recommendation to implement a universal polio booster campaign for those fully up to date with their vaccinations required public health resources to be divided between un and under-vaccinated children (numbers varying per borough) and a significantly larger group of fully-vaccinated children eligible for the extra booster dose. Participants in this evaluation flagged the need to prioritise under or unimmunised children in NEL and NCL, as vulnerable communities including Haredi families would be less likely to access vaccinations and were more vulnerable to the transnational spread of VDPV2. The heightened risk of a positive case of paralysis in Hackney due to lower vaccination coverage is a reminder of the need to learn from the deployment of the COVID-19 vaccine programme, particularly concerning the flexibility to operationalise responses to local-level needs and challenges (Mounier-Jack et al., 2023).

Just 79% of children in northeast London received their first measles, mumps and rubella (MMR) vaccine on time prior to the COVID-19 pandemic, with timeliness decreasing most in City & Hackney during the pandemic (Firman, 2022). In October–December 2022, Hackney GP surgeries recorded practice-level hexavalent vaccine coverage rates by 12 months of age as low as 16.7% and 23.4% (United Kingdom Health Security Agency, 2023a). Health protection teams reported cases of broader vaccine preventable disease amidst the poliovirus incident response. Cases of pertussis have occurred among children in Hackney (May 2023), some of which required hospital admission (United Kingdom Health Security Agency, 2023b). London is at risk of a major measles outbreak affecting up to 160,000 children if MMR coverage rates do not improve urgently (United Kingdom Health Security Agency, 2023c). Profoundly low coverage rates may reflect a need to assess the resources required by primary care teams to meet the local-level challenge of under-immunisation in a context of larger child patient cohorts (Letley et al., 2018). Understanding the cost effectiveness of maintaining complementary delivery pathways in Hackney may help commissioners to allocate resources to target under and unimmunised children and attain higher coverage levels. As the Haredi population continues to grow and families settle in Haringey (Flint Ashery, 2020), public health delivery strategies to increase vaccine uptake may need to be explored, opportunities for collaboration across ICS regions to allow for sharing of learning and resources.

The last detection of VDPV2 in London sewage occurred in early November 2022, with evidence suggesting that transmission in London had significantly reduced (United Kingdom Health Security Agency, 2023d). By 21 December, prior to the campaign being paused on 23 December 2022, 346,819 IPV-containing vaccines (boosters and catch up) had been administered to children aged 1–9 (National Health Service England, 2022a, 2022b). UKHSA announced on 23 March 2023 that the NHS would deliver a second phase childhood vaccination (IPV and MMR) catch-up campaign in London targeting 'the most vulnerable children' aged 1–11, which includes children who are unvaccinated or

have missed routine vaccinations, through a combination of primary care, primary schools and community clinics (National Health Service England, 2023; United Kingdom Health Security Agency, 2023d). The phase 2 catch-up campaign does not include the polio booster vaccine recommended by the JCVI in 2022, because of the disparities between cohorts of children fully vaccinated according to schedule and those who remain under or un-immunised.

The UK, US and Israel met the WHO definition of circulating VDPV2 (cVDPV2) in September 2022, and were considered by the WHO to be 'infected' by cVDPV2 in November 2022 (World Health Organization, 2022a, 2022b). Twelve months of zero detections are required for these countries to no longer be considered 'infected' by VDPV2. There remains a risk of reintroducing VDPV2 in the UK via international travel. Jewish minorities in London particularly in Hackney, maintain low vaccination coverage and close social networks in Israel, underscoring the need to effectively and efficiently engage parents with the second phase catch-up campaign.

#### 4. Strengths and limitations

A strength of this evaluation is the insights generated for future vaccine delivery in Haredi neighbourhoods of London and more broadly. While rapid exit interviews (n = 26) were conducted to understand the vaccine decision-making of parents during the poliovirus incident, a limitation is the modest number of in-depth interviews conducted with mothers (n = 7) that had accepted the polio booster for their child (n = 1). Most parents approached for in-depth interviews had disengaged from the campaign (n = 6), for a range of reasons, which may continue to affect engagement with the second phase (IPV and MMR) campaign. Evaluations of the second phase should explore these responses in more detail. This evaluation did not aim to quantify uptake of IPV-containing vaccines in NEL and NCL during the polio booster campaign, though findings may contextualise future attempts to disaggregate vaccine data according to location of delivery and phase of the incident response.

#### 5. Conclusion

This evaluation examined how a universal polio booster campaign was tailored to Haredi Jewish children in northeast and north central London boroughs, where uptake of immunisations according to schedule is lower and hence where risk of infection with poliovirus was higher. Printed communications sought to promote dedicated delivery pathways for Haredi parents to access routine childhood vaccinations and IPV-containing booster vaccines. While mothers were aware of the poliovirus incident, they did not perceive their children to be vulnerable to transmission, even if their children were under or un-immunised. Local public health and healthcare provider participants interviewed raised concerns that the resources required to deliver the London region-wide polio booster campaign could have been directed to under and un-immunised child populations to more effectively address disparities in vaccination uptake between populations. Findings demonstrate that health partners require flexibility to efficiently implement catch-up strategies and operationalise responses at local-levels, particularly in areas where women have a large number of children. Priorities emerging from this evaluation include developing messaging strategies with communities that effectively convey transmission risk and urgency to vaccinate while avoiding stigmatisation, and strengthening primary care and valued delivery pathways to improve persistently low coverage rates.

#### Ethical approval

Approval to conduct this service evaluation was granted by the UKHSA Research Ethics and Governance of Public Health Practice Group (NR0348).

#### Author contributions

BK, SM-J and TC conceived of the study. BK and TC planned and conducted the qualitative data collection, and with SM-J, led the data analysis. AZ-A and LW contributed to the design of the study. All authors reviewed the analysis and contributed to writing the manuscript.

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#### Declaration of competing interest

None of the authors declare any conflicts of interest.

#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ssmqr.2023.100365>.

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