

Polio, public health memories and temporal dissonance of re-emerging infectious diseases in the global north

1. Introduction

Eradicating wild poliovirus through mass vaccination remains a global public health ambition and has attracted an unparalleled investment of \$18 billion between 1988-2020. Incidents of polio have decreased by 99% since the Global Polio Eradication Initiative (GPEI) was launched in 1988. There are just two countries where attempts to prevent transmission of wild poliovirus have failed and which remain endemic – Afghanistan and Pakistan. The production of ethnographic knowledge around polio has subsequently been situated in lower- and middle-income countries that are endemic or vulnerable to outbreaks (Closser 2010; Jeffery and Jeffery 2011; Renne 2010), where the legacies of disease events remain imprinted on the ‘polio-disabled’ bodies of survivors (Szántó 2020; Vargha 2018).

The quest to eradicate polio worldwide is inextricably linked to the haunting memories of twentieth-century epidemics – and the profound impact of polio vaccination – in higher income countries such as the United Kingdom (UK) and United States (US) (Oshinsky 2006; Wilson 2005; Millward 2009). Paralysed children, iron lungs, mobility aids, sanatoria, sugar cubes and the race to develop polio vaccines materialise the social and political history of infectious disease control in the global north (Oshinsky 2006; Linder and Blume 2006; Vargha 2018). Anthropologist Ann Kelly (2018) has examined how disease control programmes can be driven by ‘evidentiary charisma,’ where global public health challenges are prioritised or neglected based on epidemiological narratives. Through that lens, the ability to prevent disability in childhood underlies the global public health salience and moral imperative of continued investment in polio eradication through top-down mass vaccination delivery.

Routine use of polio vaccines in childhood immunisation schedules since the 1950s led the US to be polio-free in 1979, and the World Health Organization (WHO) European Region in 2002. Yet, closely-related strains of vaccine-derived poliovirus (VDPV) were detected in the sewage systems

of several New York State counties and London boroughs in 2022. The detections signaled the first evidence of polio transmission in the UK since 1984 and just the second case in the US since 1979 (Klapsa et al. 2022; Link-Gelles et al. 2022), and hence constituted the first encounter with polio in a generation – for public health agencies and publics alike. In this paper we take these events as a point of departure to critique the role of temporality in disease control programmes. How were memories of polio deployed in public health responses? How was the ‘re-emergence’ of a disease perceived by stakeholders tasked with implementing and delivering public health responses – and by the intended beneficiaries of protection? And what role should public health memory of disease events perform in vaccination campaigns? Addressing these questions places analytical attention on the relevance of social and historical narratives for contemporary public health action.

In what follows we integrate data from ethnographic investigations conducted in London and New York in the immediate period of public health responses to the transnational spread of poliovirus in 2022. This approach directs critical attention towards the diverse ways that social and historical narratives were evoked in contemporary public health action amidst transnational disease events. Our analytical course develops the framing of *public health memory* to conceive how historical and epidemiological narratives of progress are evoked in ways that diverge with present concerns, and how memories may not translate into the evidence sought by intended beneficiaries of public health engagement.

1.1 The return of polio? Temporality, disease events and public health memories

Social science attention to the ‘lifetimes of epidemics’ illustrate how social, political and temporal dynamics shape ideas of disease events beyond the framing of ‘unexpected eruptions’ (Lynteris 2014; Roth 2020; Samimian-Darash 2009; Wigen et al. 2022). Analyses of epidemic temporalities index institutional and peopled experiences of time that disrupt categories of ‘before,’ ‘during’ and ‘after’ (Roth 2020). Articulations of memory expose the dissonance inherent within temporalities, particularly when recollections of the past diverge from present realities or futures – and rupture visions of anticipated progress (Tousignant 2013; MacPhail, 2014; also Caduff

2014). Linked to temporality and memory of disease events is how interventions to preserve life are viewed against the backdrop of historical injustices – inspiring distrust of public health and state motives that become mobilized through conspiracies (Fassin 2013; Kasstan 2022). The spread of infectious disease has historically created and reinforced the targets of public health through ‘outbreak narratives’ (Wald 2008; Briggs and Mantini-Briggs 2004), reminding us how the ‘publics’ (or ‘communities’) in public health can be historically, politically and socially cultivated (Holloway 2006; Marsland 2014; Kasstan 2019; Kelly et al. 2017).

We build on these contours of temporality in disease events by offering *public health memory* as a conceptual framing to problematise how historical public health threats and success stories are evoked in responses to contemporary challenges and (re)emerging pathogens. Memory captures how institutional (public health agencies) and peopled (publics) engagement with the past are aligned – or if not, how they are negotiated or juxtaposed. The eradication of smallpox, for example, underscores how public health memories of success continue to be mobilised in the GPEI (Hardon and Blume 2006; also Closser 2010). Yet, the celebratory narratives of smallpox eradication sideline the collective memories of coercive and heavy-handed methods of vaccination teams in post-colonial settings (Greenough 1995). Hence, public health memories can be revived selectively, and diverge from the historical realities of publics.

The spread of polio in 2022 offers a steppingstone to interrogate the revival of social history narratives in public health responses in the US and UK, specifically as a method to engage practitioners and vulnerable families in vaccine campaigns. We followed how detections of poliovirus in sewage across London boroughs and New York counties in 2022-23 provoked media and clinical commentaries centred on the narrative of the ‘return’ and ‘comeback’ of a feared disease (Rai et al. 2022; Uwishema et al. 2022). Clinicians in the National Health Service (NHS) in England were considered unlikely to have encountered polio, and attempts were made to remind medical professionals about pathogenesis and protocols (Cohen 2022). Experts projected waning public ‘memory of polio’ and twentieth-century epidemics as a cause of low vaccine acceptance among post-eradication generations of parents in the US (Forman in Backman 2022). Interviews with polio survivors were produced to narrate experiences of walking aids and biomedical

procedures as an attempt to sway parents to accept polio vaccines to prevent this epidemiological past from returning (Jewish Orthodox Women's Medical Association 2022). The spread of polio in 2022 then brought the subject of memory to the centre of clinical practice and local moral worlds, as public health memories revived lived experiences of disease events as much as historical references to epidemiological pasts.

Unlike the transmission of wildtype poliovirus that plagued early twentieth century childhoods in the global north, vaccine-derived poliovirus type 2 (VDPV2) isolates were found in the sewage networks of London, New York, Montreal and Israel (Klapsa et al. 2022; Link-Gelles et al. 2022; Pan American Health Organization 2022; Zuckerman 2022). The isolates were found to have close genetic links to each other, as long-distance air travel had caused the transnational spread (World Health Organization 2022a). The spread of VDPV2 in the global north is likely to have emerged following viral shedding by an individual vaccinated elsewhere with live-attenuated oral poliovirus vaccines (OPV) (Hill et al. 2022). The OPV has formed the bread and butter of the GPEI in the global south, primarily due to logistics, cost, ease of administration in mass vaccine programmes and the ability to provide passive immunity to unvaccinated people ('herd immunity'). However, if overall polio vaccination rates in a population remain low, OPV presents a rare risk of mutation and infecting unvaccinated individuals (Kew and Pallansch 2018). OPV was replaced with inactivated polio vaccines (IPV) in the routine immunisation schedules of polio-free countries – as occurred in the US in 2000 and UK in 2004. Transmission of VDPV2 in the UK, US and Israel in 2022 was likely sustained in separate social networks with lower-level vaccination coverage (Hill et al. 2022).

An outbreak response was launched in New York State in July 2022 following a confirmed case of paralysis (New York State Department of Health 2022), which indicated that 1,000 or more people may be infected with polio asymptotically (Lopez et al. 2024). A public health emergency was then declared in New York State on 9th September 2022, as the continued detection of VDPV2 isolates in sewage signaled community transmission (see Link-Gelles et al. 2022). The UK Health Security Agency (UKHSA) instead declared a *national enhanced incident* as poliovirus isolates had been detected in sewage, despite an absence of two or more confirmed

cases ‘linked in time, place and/or person association’ (Public Health England 2019 [2012]: 6). This designation nonetheless provokes action.

The semantics of global public health – the what and how of disease risk classification – is significant because infectious disease events prompt technical and administrative relationships and reporting to national and international agencies (Lakoff 2017). The WHO (2022) listed the UK, US and Israel as ‘infected’ with circulating VDPV2 in November 2022, with twelve months of zero detections required for these countries to no longer be considered ‘infected’ by VDPV2. The spread of poliovirus, including VDPV2, has remained a public health emergency of international concern (PHEIC) since 2014, where a disease event is ‘serious, sudden, unusual or unexpected,’ presenting risks beyond national borders. Moreover, states have legal responsibilities to detect, assess, report, and respond to disease events to prevent transmission (Centers for Disease Control and Prevention, 2022). Scholars have argued that the decision to declare polio a PHEIC was more political than epidemiological, as ‘the goal of polio eradication may not be achieved, unless more international coordinated efforts occur’ (Wilder-Smith and Osman 2020: 7). Polio eradication then emerges as an anticipatory agenda in global public health due to the ‘palpable effect of the speculative future on the present’ (Adams et al. 2009: 247).

While thresholds of risk dictate global public health semantics and scrutiny, it is important to note that ‘regardless of size, any outbreak will be considered a serious disease event’ (Kelly 2018: 136). Disease events, regardless of scale, raise practical and urgent dilemmas of how to protect those most vulnerable to disease, which form the moral underpinning of public health (Hahn and Inhorn 2009). The transnational spread of poliovirus in 2022 was largely described as ‘silent’ due to continued detection in wastewater without further cases of paralysis. Public health responses in New York and London were then concerned with *anticipatory* risks, and the potential for paralysis among under or unvaccinated children and adults.

1.2 Viral vulnerabilities

While public health agencies in London and New York noted that the overall risk at the national level was low, 'communities' with lower-level childhood vaccination coverage rates were noted to be at increased risk of infection (United Kingdom Health Security Agency 2022). The 'communities' affected by the spread of poliovirus were not explicitly disclosed in public health communications geared towards universal audiences in the US or UK, though implicit references indicated which publics were considered priorities for engagement and vulnerable to paralysis (see 3.1). There were strong indications that Haredi Jewish children (who are often referred to as 'ultra-Orthodox') were vulnerable to the spread of polio, and their positionality serves as a case study to understand issues affecting underserved collectives in the global north.

There was considerable overlap between areas where poliovirus was detected and neighbourhoods with low vaccination coverage that are home to Haredi families. The adult paralysed by polio in New York was a resident of Rockland County, which has the largest Jewish population per capita of any county in the United States (numbering approximately 31.4% of the county population) (New York State, no date). Polio vaccination coverage (3 doses) by 24 months in August 2022 was profoundly low in the Rockland County ZIP codes of Monsey (37.3%) and Spring Valley (57.1%), which are home to a significant Haredi Jewish population (New York State Department of Health 2022). The New York-state level IPV coverage at the time was 79%, compared with 93.4% national coverage (among children born during 2018–2019) (see Kidd et al, 2023). Detections of VDPV2 were concentrated in north central and north east London boroughs, which includes Hackney – where one in four children are Haredi (City & Hackney 2018). Compared with a 91.8% national average in 2021–22, hexavalent vaccination (polio-containing) coverage at 12 months of age in Hackney was 64% (National Health Service Digital 2022). A case of paralysis in an unvaccinated child was confirmed in February 2023 in Tzfat, a largely Haredi locality in northern Israel, and was linked to VDPV2 isolates previously detected via environmental surveillance (European Centre for Disease Prevention and Control 2023). Low routine immunisation coverage rates have resulted in frequent outbreaks of preventable disease affecting Haredi children in the UK, US, and Israel, some of which became associated with larger regional, national and international spread (Stein-Zamir et al. 2020; McDonald et al. 2019).

Haredi Jews (Haredim) are constituents of Jewish orthodoxies, which involve multiple groups who field multiple claims to ‘authoritative correctness’ (Fader and Naumescu, 2022; Fader and Avishai 2022). Haredim may practice the most stringent interpretations of Jewish law (*halachah*) and individuals may seek out rabbinic consultation over a range of daily decisions and dilemmas. Health technologies that enable the fulfilment of religious imperatives tend to be sanctioned by rabbinic authorities – such as new reproductive technologies (Khan 2006). Yet, health technologies are also a site to understand internal critiques of rabbinic authority and where women carve out their own ‘spheres of authority’ (see Fader 2017) or agency concerning the body and autonomous decisions over interventions (Kasstan 2019; Taragin-Zeller 2023; Raucher 2020). Embedded in this domain are technologies of prevention, especially vaccination, where women navigate decision-making amidst the globalised discourse of vaccine safety doubt (Kasstan 2022) but also practical dilemmas of access to services due to larger family sizes (Letley et al. 2018). Jewish orthodoxies have their own channels of non-vaccination advocacy, circulating mis/information between Israel and North America, and which diverge from the vaccine advocacy messages of Jewish institutions, physicians and authoritative figures.

The links between the spread of poliovirus and Haredi Jewish groups raises additional implications for the conception of memory in public health. Jews have long been positioned as a figure of alterity in Europe and North America, and have historically been blamed for causing plagues, outbreaks and more recently, the COVID-19 pandemic (Markal 1999; Xun and Gilman 2022). Public health memory then emerges as being a particularly salient template for critiquing how the historically and socially situated dynamics of health protection are navigated during disease events. Public health memory, as an analytical framework, raises theoretical and practical implications for social scientists as they grapple with the temporality, legacy of disease events and the mobilization of the past scapegoating for affect when protecting publics.

2 Methods

To address the questions of how memories of polio emerged and were deployed in public health responses, we integrate data collected in London and New York as part of academic engagement

with health protection responses. By conducting fieldwork on linked disease events, this study was an exercise in multi-situated ethnography to examine the 'circulation of cultural meanings, objects and identities in diffuse time-space' (Marcus 1995: 96).

Methods in both settings involved participant observation in neighbourhoods, site visits to clinics, a total of 59 in-depth semi-structured interviews, and text analysis of community-specific health information and public health agency alerts. Interview topic guides were designed and based around vaccine responses in London and New York. The research particulars are outlined below in each country-context (see 2.1–2.4).

2.1 New York

Rapid ethnographic and qualitative research was conducted in Rockland County ancillary to a Centers for Disease Control & Prevention epidemiologic investigation that was launched to support immediate poliovirus response efforts. The study sought to assess the priorities for improving vaccination coverage in Rockland County (Kasstan et al., 2023). Fieldwork was conducted in August 2022, after the positive case detection on 21 July 2022 and prior to the declaration of a public health emergency on 9 September 2022. Methods consisted of participant observation and 23 semi-structured in-depth interviews. Interview participants formed part of the following research clusters: I) public health professionals based in county and federal agencies (n=5); II) healthcare providers (physicians, nurse practitioners) based in private paediatric clinics and county health departments (n=9); and III) Jewish community organizations, partners and rabbinic authorities (n=9).

Site visits took place in private-sector paediatric clinics (n=4) and a county health department POD (point of dispensing), where we met with healthcare providers, and explored the availability of health information and guidance pertaining to the spread of poliovirus. Broader sites of engagement included public spaces where health stands were set up to offer information and updates on the polio outbreak (and childhood immunisations). Informal ethnographic

conversations were held with Haredi Jewish residents to explore their perceptions of the polio outbreak.

2.2 London

Fieldwork in London was conducted as part of a responsive study in the Health Protection Research Unit in Vaccines and Immunisation at the London School of Hygiene & Tropical Medicine. Ethnographic research in London was conducted over a longer timeframe (October 2022 to March 2023), which allowed an evaluation of the period of polio booster availability (10 August 2022 to 23 December 2022). The London fieldwork built on long-term, extensive research into public health relations with Jewish orthodoxies in Hackney and England more broadly (Kasstan 2019; Kasstan et al., 2023), and hence relationships were in place to conduct this study.

Methods primarily consisted of 37 semi-structured in-depth interviews with: I) public health professionals, including consultants, immunisation programme managers, commissioners, who were based in UKHSA, regional public health bodies ('Integrated Care Boards') and local authorities (n=10); II) healthcare providers, including general practitioners (GPs), nurses and practice managers or facility managers (n=12); III) Jewish community partners and representative groups (n=3), IV) linked professionals who provide services to Haredi neighbourhoods outside of London (n=4); V) Haredi Jewish mothers who had at least one child eligible for the polio booster campaign (n=7); and VI) Jewish survivors of polio (n=1).

Site visits were conducted in five vaccination delivery points across Hackney (and the neighbouring borough of Haringey) that were involved in the polio booster campaign, including primary care (GP surgeries) clinics (n=2), a designated vaccine centre (n=1), hospital-based delivery hub (n=1), and Jewish community POD (n=1). We held 26 rapid 'exit' interviews with parents during clinic visits to discuss when and how parents had heard about the spread of polio, whether they were concerned by the incident, and their decision to accept the polio booster vaccines. Most rapid 'exit' interviews (n=20) with Haredi mothers were conducted in primary care centres and the Jewish community POD. The remaining rapid 'exit' interviews (n=6) were held

with non-Jewish parents attending an NHS vaccine centre or NHS hospital. No Haredi parents were observed accessing these sites during the visits, in contrast to primary care and POD site visits.

2.3 Methodological context: Immunisation delivery in New York and London

We elaborate on the political economy of healthcare in the US and UK to more fully convey what was shared and situated in health protection responses. Childhood immunisations in New York State are typically delivered via private-sector paediatrician clinics, and less commonly, in county health departments as part of targeted campaigns to serve under-vaccinated migrant and mobile families. Un- and undervaccinated New York State children who might not otherwise be vaccinated may be entitled to receive all Advisory Committee on Immunization Practices (ACIP)-recommended vaccines at no cost via the federally funded Vaccines for Children (VFC) programme (Centers for Disease Control, 2022). Children must receive all required doses of vaccines on the recommended schedule to attend day care and pre-kindergarten (under the age of 5) through to 12th grade (ages 17–18) or provide proof of immunity via titres (when permitted), or have a medical exemption. In England, routine childhood vaccinations are provided free of charge by the NHS and are typically delivered via primary care teams or school immunization services. There is no legal requirement for children to be vaccinated for school entry in England. Hence, drivers to vaccination vary between linked populations in New York and London and will be influenced by health systems in situated ways.

Diverging public health responses were implemented in New York and London, which informed our methodological approach and analysis. The approach in New York was 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. Children in London who had not completed the routine immunisation schedule were invited to catch-up on missed polio-containing vaccinations, and all children aged 1–9 years who were vaccinated to schedule were offered an IPV-containing booster vaccine due to concerns of waning immunity (Joint Committee on Vaccines & Immunisation 2022). Approximately 950,000 children in London were eligible for an

IPV-containing vaccine (catch-up and booster). The booster campaign ran from 10 August to 23 December 2022, and underlies parental responses to the London research phase.

2.4 Research practicalities and ethical considerations

Participants across both settings were recruited via past research projects, professional networks, and snowball sampling. Participants provided written or verbal consent, and all names and particulars have been replaced with pseudonyms to protect their identities. Interviews were recorded using a digital audio recording device, when permission was granted, and detailed notes taken. Interview data was transcribed, and analysis was developed using grounded theory (Corbin and Strauss, 1990), whereby theoretical insights emerge from the data rather than being pre-conceived. Key analytical themes included history and memory, vaccine confidence and trust, and service delivery in Haredi neighbourhoods. Analysis was based on a separate and comparative basis, raising common as well as situated issues across the two contexts.

BK-D has conducted ethnographic research into child health and immunization among Haredi families in the UK and internationally over the past decade (Kasstan 2019, 2022), which led to his involvement in evaluations of the 2022 London and New York polio responses as an academic researcher. SF, DE, VS and AB are public health professionals, and supported the integration of qualitative evaluation into the outbreak responses they were leading. TC initials was involved in the London data collection as an academic researcher. Ethical approval was obtained from the Institutional Review Boards of the University of Bristol Law School, the Centers for Disease Control and Prevention (NCIRD-PPLB-8/1/22-99107), and UKHSA Research Ethics and Governance of Public Health Practice Group (NR0348).

3 Results

Abie worked as an attendant in a local health centre, and formed part of the fabric of Jewish orthodoxies in Rockland County. Well into his 70s, he recalled receiving the OPV in a sugar cube during childhood and asked, 'is it coming back? You're playing with fire by not vaccinating.' By

referencing a historical technique of dispensing the OPV in sugar cubes to balance the bitter taste of the pharmaceutical, Abie materialised the fear documented in historical photographs of parents queuing to vaccinate their children with the newly developed polio vaccines in the mid-twentieth century (Oshinsky 2006). We take Abie's reflections as a point of departure into the various ways that memories of polio were raised in the summer of 2022, which are organised according to: I) the revival of polio in the public health present through messaging; II) how polio was viewed as an exceptional public health risk; III) parents tasked with making decisions about how to protect their children amidst a disease event that few parents had lived through in the past; and IV) the role of the media in shaping memories and risk.

3.1 Reviving the past in public health messaging

A range of notifications were produced during the polio disease events in New York and London, but those drawing on social history and memory in public engagement are most relevant to this paper. In August 2022 a marketing agency was commissioned to produce infographics in English, Yiddish, Spanish and Creole as an attempt to engage Rockland County (RC) residents from a range of backgrounds who were vulnerable to transmission due to low vaccination coverage (Figure 1). Naavah, a content-producer closely involved with the design of the infographic, evoked public health memories of the first generation to be offered polio vaccines as an emotional driver for parents today:

‘And one of the biggest things with polio is the ability to look to the older generation, where there's so much of an understanding. There was terror, and an abject fear of parents, and then relief of being in line for vaccines and the extreme gratitude’ (RC Community Partner 3).

Further illustrating how public health memory was mobilized as a method of engagement, Naavah described the strategy taken to emphasise the impact of immunization in poliovirus prevention and control: ‘to show the timeline of cases, immunization, cases drop’ (RC Community

Partner 3). Susannah, a nurse practitioner, agreed with the importance of this message for separating the established efficacy and acceptance of polio vaccine from perceptions of the more recent COVID-19 pandemic and vaccination campaign, which was embedded in bipartisan politics and interpretations of state authority vis-a-vis individual autonomy in the US (see Kenworthy et al. 2021):

‘The timeline was helpful because it shows how the vaccine works. It’s been around for a while, unlike COVID. But people don’t understand that in 1979, we didn’t see polio anymore, like with smallpox’ (RC Healthcare Provider 2).

The use of the timeline then indicated waning memory and recognition of the US being declared polio-free due to high vaccination coverage, as per smallpox eradication. However, the infographic was not without criticism, not least for failing to balance public health memory and historical context with relevant and clear information about pathogenesis. Clinicians questioned how the central image of a spinal cord would be interpreted by parents: ‘they won’t understand the link’ (RC Healthcare Provider 2). References to transmission such as ‘polio spreads through contact with the fecal matter of an infected person’ were not considered to be relatable themes about household hygiene for parents: ‘it needs to be more explicit, babies, diapers and handwashing – not just faecal matter’ (RC Healthcare Provider 2).

[Author1] shared the infographics produced in RC with health agencies in London to enable an exchange of learning in linked disease events. National and regional UKHSA and NHS teams subsequently developed an infographic, which implicitly targeted Jewish audiences vulnerable to transmission. The infographic included a timeline punctuated by key milestones, such as the development of polio immunisations by Jonas Salk (a Jewish virologist) in 1955, the introduction of the polio vaccine in the UK in 1956 and subsequent decline in reported polio cases (Figure 2). Moreover, the infographic noted that further information about the vaccines used in the response were available in Yiddish, and cited a comparable campaign in Israel, which would not be relevant context for a universal audience. A key difference was that the London infographic

was produced by UKHSA rather than a marketing agency. Hence, public health professionals were cautious to balance the historical context alongside clear messaging:

‘We made a decision to utilize some of the principles and to augment it and bring it into what we call our style, the UKHSA style guide. The language in that Rockland infographic was quite emotive and sensationalist. The imagery also felt, from a design perspective, like a very dated sort of approach, which was potentially inflammatory, disturbing, concerning, worrying. And we tend to find that parents who are frightened and worried, will defer to not doing anything rather than making a poor decision.’ (London Public Health Professional 4)

Aside from the stylistic divergence, there were clear differences about public health responses to convey due to the recommendation to offer all children aged 1-9 years resident in London an IPV-containing booster: ‘It was important to refer to it as a booster campaign because that’s exactly what it was [...] And if you call it an outbreak vaccine, that tends to frame it in a very different way in parents’ minds.’ (London Public Health Professional 4)

Public health memory was then deployed across both settings but subject to institutional approaches to the linked disease events.

Figure 1: Infographic, Rockland County

Figure 2: Infographic, London

3.2 Memory, exceptional risks and urgency to vaccinate

Healthcare professionals drew on public health memories to describe polio as an exceptional disease risk for Londoners and New Yorkers to be confronted with, which underscored the

urgency to vaccinate. Leticia, a public health professional in New York, reflected on the unprecedented and unexpected challenge presented by the spread of polio – precisely because of how the threat of disability is materialised for a generation for whom epidemics form living memory:

‘I remember when I was studying it [at university], seeing the iron lungs, people I had met through my life that had polio as a child, that were older than I, it had left them with deformed lower limbs. Unable to walk to for the rest of their lives. We had never seen that. I remember getting the polio vaccine as a child at school, we’d get a little sugar cube, we used to get the oral then. I remember clearly getting that. Those that remember polio, from my perspective, it is a little daunting, that if we do get more cases, that do become paralytic polio, we are in trouble. Second of all, there are so many people, the worried well, that remember polio as children and they are now in their 70s and 80s, and are calling us, and the community at large in the county is very worried.’ (RC Public Health Professional 1).

The potential for further cases, as a speculative threat of return to a past, was of concern to public health professionals and the ‘worried well,’ which we can assume to mean vaccinated people who were not at-risk of polio. Leticia suggested that memories of polio care in the mid-twentieth century might diverge from current approaches to care, but the potential to cause permanent disability remained:

‘The only difference now is that [...] we will be able to treat them faster with things that we didn’t necessarily have in the 50s. When you had all those cases. So that might help. But if you have paralytic polio, it’s not going to get better. There’s no stopping it from causing damage to your nerve endings.’ (Leticia, RC Public Health Professional)

For these reasons, polio was typically considered by public health professionals to not be ‘anything that we should accept in the 21st century.’ Healthcare providers similarly alluded to the

notion of returning to an epidemiological past. Dr Black, who was a physician and a constituent of Jewish orthodoxies, lambasted the Haredi ‘community’ for the low-levels of vaccination coverage which led to the “return” of polio – implying a collective responsibility and glossing over the diversity of Haredi Judaism:

‘This is an embarrassment to the United States and it’s an embarrassment to the community. What is it, the first case of polio in the United States in how long? It should not even be on the table in Rockland County. It’s an embarrassment. (RC Healthcare Provider 1)

Unlike the private-sector approach to immunisation delivery in New York, delivery pathways serving the needs of Jewish orthodoxies in London were vulnerable to persistent changes to health commissioning and funding arrangements (cf. Chantler et al. 2016). Diane, a healthcare provider in London, discussed a vaccination clinic embedded in a Jewish children’s and family centre, which was designed to complement primary care delivery and support mothers with larger-than-average-family sizes, but had experienced interrupted provision since inception in 2010-11:

‘It’s disruptive for the community. And of course, when there’s an outbreak, the community gets blamed. They become the scapegoat. It’s like history, isn’t it? “But you know, it’s the Jewish problem.” And, yes, we know that part of it is correct, because immunization is not a priority. However, if you are there constantly, and you make the focus a priority, it changes the mindset. But if you suddenly you have the service there, and then, six months or two years down the line, you take the service away, you can’t blame the community, you can’t blame them if there’s an outbreak.’ (London Healthcare Provider 9)

What is striking is how Diane situates the transmission of polio in 2022 in a historical record of Jewish minorities being blamed for plagues as part of ‘outbreak narratives’ in Europe and North America (Wald 2008; Markal 1999). Yet, Diane felt that it was wrong to collectively blame Haredi

residents for under-vaccination, when limited resource allocation had hampered the ability of healthcare providers to emphasize childhood immunisations as a priority.

Public health memories of polio were not always felt by public health professionals to provoke a rush to vaccinate. Public health professionals in London were concerned about the transmission vulnerability among Jewish orthodoxies based on the transnationally-linked disease events, noting that ‘polio seems to represent a disproportionately large threat to Orthodox Jewish communities because of the Israel and New York links’ (London Public Health Professional 1). Public health teams had also hoped that the memories of polio and its disabling potential would lend impetus to the timely acceptance of childhood immunisations, though this was found to be limited:

‘So, I would have said the polio booster vaccine campaign would be a huge success if suddenly everyone was much more aware about polio, then more conscious of it, and therefore more concerned. People who hadn't previously hadn't had their children vaccinated at all, for polio as well as diphtheria and tetanus and other vaccinations, were sort of like “you know what, it's changing the equation. Now, it is worthwhile”’ (London Public Health Professional 1).

Hence, the epidemiological past of polio in the global north was implicitly and explicitly referenced by public health professionals and healthcare providers in New York and London, often to invest hope in public responses and instill an urgency to vaccinate among intended beneficiaries. Interviews with parents, however, raised diverging reflections around memory.

3.3 Public and parental perceptions of polio

Mr Fletcher, an adult survivor of polio who lived among Jewish orthodoxies in London, maintained that Jewish parents were taking a risk by not vaccinating their children. As a grandfather in his 70s, he argued that such parents were contravening religious legal obligations:

‘Don't risk it. You have no authority from God to decide yourself whether to care for yourself or not. You have got absolute duty to do the very best by your children, and that includes vaccination. Your children are entitled to have a healthy life. Make sure you give it to them.’

Interviews with parents, however, indicated the importance of not over-determining religion at the expense of broader influences on parental vaccine decision-making within Jewish orthodoxies. Mrs. Liebowitz, a Haredi mother of seven in London, described how the polio disease event was not high on her agenda – but not because of religion:

‘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 haven't heard any cases locally. I haven't heard any, I haven't been acquainted with any incidences of polio outbreaks. I didn't take much note.’ (London Mother 7)

Her reason for dis-engaging with the London polio booster campaign reflected doubt about the need and importance of immunization guidance, and underlying concerns about generalised and globalised discourse of vaccine safety. More recent public health histories surrounding the COVID-19 pandemic and questions of trust in health guidance had left an imprint on parents. Mrs. Birenbaum, also a Haredi mother of seven, instead drew clear distinctions between polio and COVID-19 vaccines, and implied a familiarity with the former but nonetheless did not feel concerned by the incident:

‘I didn't look at it as a big enough deal to start, do you know what I mean? Like to do some major research, “is this or isn't this safe?” I mean the COVID vaccine was much more worrying to me back in the day. At one point, they were giving it [COVID-19] to children. And my kids were invited, my older children. I had more anxiety, I wasn't going to let my growing daughter take the COVID vaccine. But over here [polio] no there wasn't. It didn't worry me at all.’ (London Mum 6)

Parents who held a more cautious stance on vaccination were less willing to accept the polio boosters. Mrs Goldblatt, a Haredi mother of four, considered the polio incident to hold a lesser state of urgency compared with past measles outbreaks in Hackney. Yet, she also conveyed an uncertainty around transmission vis-a-vis surveillance of poliovirus, and perceived the silent spread of polio to be less virulent due to the absence of reported cases:

‘Meaning to say, did we hear it on people? No, we didn't. It was just like “it's in the sewage.” And now what? Why are we looking in sewages? Do you get what I'm saying? When there was a measles outbreak, do you remember in New York not so long ago? Probably about three or four years ago [...] So what we did was, we just gave that vaccination. Do you get what I'm saying? That was going around seriously. People were catching it and being isolated. It was vibrant shall we say. Whereas polio, it's so not tactile.’ (London Mum 1)

Parents attending vaccine delivery points were approached as part of rapid interviews and were clear that there were competing influences on their decisions:

‘there's information, but all kinds,’ but the perceived severity of polio ultimately swayed their decision towards acceptance “Then with polio, makes you think” (Rapid interview, mother 1).

When attending delivery points, mothers generally had presented for catch-up on delayed routine vaccinations but were unsure about accepting the additional IPV booster for eligible children and ‘giving more than what's necessary’ (Haredi mother presenting with 2 children to primary care). Hence, the drive for vaccinations among Haredi parents was subdued, despite the lower-level vaccination coverage in Rockland County and Hackney.

3.4 Role of the media in shaping memories and risk

The unprecedented nature of the polio disease events in London and New York provoked media interest on the ground, though the press sector serving Jewish orthodoxies responded in ways that were consistent with the disengagement found in parents (see #3.2). An ‘Eyewitness News

ABC 7' report van was parked outside two of clinics as we arrived to meet Rockland physicians, indexing the media and public interest in the New York polio outbreak. More orchestrated scenes were occurring in London. During a site visit, we encountered BBC News (2022) crews recording inside a clinic and celebrating how take-up rates had risen to 1 in 4 eligible children by November 2022. Editors of newspapers that serve Jewish orthodoxies, however, maintained a more cautious standpoint and cited the legacy and politicisation of the COVID-19 pandemic for public health relations in the US. When [author initials] contacted editors of Haredi press to share updates about the polio response, the following response was received, showcasing the role of public health memories of COVID-19 in responses:

‘I am sure you have realized by now that due to what has transpired over the past three years trust in government health agencies has dropped precipitously and anything they say is viewed as suspect by many in the community’ (Editor, newspaper serving Jewish orthodoxies in the US).

Contrary to the perception of urgency cultivated through public health communications, editors noted that there had ‘only’ been 1 confirmed case and hence ‘we can’t speculate’ and it was prudent ‘not to cause panic’ (Editor, Jewish Community Partner in the US). Disengagement from the polio response was evidently clear among the press sector serving Jewish orthodoxies in the US, but in London circulars printed advertisements funded by health agencies to raise awareness of the vaccine response which had been identified and flagged by parents: ‘it’s been well advertised’ (Rapid interview, Haredi mother 23). Hence, there were differences in the social responses to linked and transnational polio disease events due to the legacy of COVID-19.

4. Discussion

The ‘return’ of polio provoked concern in the UK and US, particularly among generations who survived twentieth-century epidemics or who trained as medical professionals amidst the afterlives of disease events – and recalled seeing iron lungs or polio-disabled bodies. Narratives of the epidemiological past were revived in oral histories and official communications to

encourage current generations of parents to vaccinate, for example, by illustrating timelines of the public health progress offered by routine childhood immunisations. Hence, the provocation of affective and emotive responses to the past were framed in a more tangible context of significant public health dates that marked the disappearance of epidemics and cases of polio due to the availability of vaccination. Public health memory was therefore evoked as a method of public engagement in the context of re-emerging infectious diseases in the global north.

Deploying memories of polio in the 2022 public health responses, however, was complicated by the more recent legacy of the COVID-19 pandemic and the situated ways in which its management was politicised in both settings. Jewish parents (a primary target of public health engagement) and editors of newspapers serving Jewish orthodoxies had mixed responses to these efforts. There were notable contextual differences across the two settings under study. Parents in London were tasked with practical decisions of whether to accept an additional IPV booster for their children, or for many parents in this study, to bring their children up-to-date on the routine schedule. The risk of paralysis from polio occasionally made parents ‘think’ about their decisions to delay immunisations, indexing public health memories of a severe but now preventable disease. While for others, memories of the COVID-19 vaccination programme had displaced their trust in public health recommendations. Against the backdrop of limitations in COVID-19 pandemic management raised by participants, maintaining public confidence in the recommendations and communications of public health agencies is critical. Results therefore indicate that public health communications, which emphasize vaccines as instrumental to relegating diseases to the ‘past,’ do not always have the intended effect on parents concerned with their children’s welfare. To paraphrase a London-based public health professional interviewed as part of this study (#3.1), parents will prefer to wait rather than make a hasty decision. And as parents in London told us repeatedly, they remained ambivalent in the absence of more relatable evidence than results from testing sewage. In other words, public health memories of polio were not enough. Parents waited for cases of paralysis and disability before deciding how to act, yet this was precisely the evidence that public health agencies were trying to avoid.

This study focused on the relevance of public health responses for Jewish orthodoxies as networked populations that were vulnerable to transnational spread in the 2022 polio disease events. However, the issues of undervaccination that have led to persistent outbreaks of preventable disease in London were linked by interlocutors to the political economy of health. The pattern of collectivizing (and at times, blaming) ‘the community’ for low-level vaccination coverage was contrasted by the perceived inability of health services to sustain tailored delivery pathways that meet parents’ needs. Such concerns should be understood in an era of changes to commissioning frameworks, but also public health austerity and broader concerns of deteriorating standards of child health in England (Marmot et al 2020; Morton 2024). Broader conceptualisations of public health memory then intersected within this research context, capturing how more recent outbreaks, such as measles in 2018-19, and past plagues coalesce in ‘outbreak narratives’ (Wald 2008).

The conceptual framing of public health memory offers an intervention in debates about temporality and disease events, particularly by drawing attention to how epidemiological pasts are deployed in contemporary health protection responses. Medical historian Dora Vargha (2018) recalled how adult survivors of polio in Hungary described themselves as ‘dinosaurs,’ and a ‘breed that is about to become extinct,’ capturing how the attainment of polio eradication in Europe pushed living memory of epidemics into the realm of public health pasts. The ‘return’ of polio, or the *possibility* of its return as a public health threat in 2022-23 in the US and UK, mobilised memories of devastating twentieth century epidemics as a technique of anticipation. Through public health memory, we see how the past is literally dragged into the present through an anticipated return to past traumas, demonstrating how anticipation forms a ‘politics of temporality’ and ‘mode of prediction’ (Adams et al. 2009: 246-247).

Anthropologists emphasize how disease events are not book-ended neatly by beginnings and endings but are experienced according to diverse timeframes by differently positioned actors (Roth 2020). Emmanuelle Roth (2020: 13) beautifully argues how ‘epidemics enact particular temporal dynamics, which both order and disturb the *individual* and *collective* experience of infectious diseases’ [emphasis added]. While outbreaks may be felt as disease ‘events’ and

sudden ruptures of normality on the ground, they are typically the result of long-term and interdependent social, political and economic processes (Lynteris 2014). The HIV/AIDS crisis in post-Apartheid South Africa exemplifies how the past is traced to the present in experiences of outbreaks and disease, as epidemic temporalities are profoundly shaped by histories of inequality (Fassin 2007). Epidemics constitute ‘total social phenomena’ as they ‘exercise a transformational impact on social life’ (Kelly et al. 2019), which become contained in memories with the passing of time. When those memories are revived in the context of re-emerging infectious diseases, the legacy of past ‘transformational impacts’ can be felt differently by public health institutions than publics.

We take debates forward by drawing attention to the ‘temporal dissonance’ caused by re-emerging infectious diseases, as memory of disease events can hold different value for public health institutions and publics. Social scientists have conceived ‘temporal dissonance’ in diverse ways, but broadly to capture the disjunctures that occur between past or present realities and anticipations about the future (Zivkovic 2018; McGonigle 2022; see also Caduff 2014). Temporal dissonance in the context of re-emerging infectious diseases indicates how the global public health challenge of under-vaccination disrupts epidemiological narratives of progress. On the other hand, engaging parents with re-emerging diseases requires care to avoid a temporal dissonance where public health memory does not align with the contexts in which people make decisions today. The 2022 disease events experienced by Londoners and New Yorkers, and more acutely by public health and healthcare professionals, underscores the temporal and indeed spatial dissonance inherent in the framing of ‘re-emerging’ infectious diseases. It is not lost on us that VDPV remains a reality rather than a memory in low-middle income countries – where the burden of transmission and risk of paralysis is geographically located. Portraying polio as a ‘re-emerging’ disease threat in higher income countries classed as polio-free then obscures the fact that on a global level, transmission of polio and VDPV has not ceased, despite temporal narratives of what is expected to be or remain in the past.

We invite social scientists to consider how public health memory is situated in such debates of temporality due to the dis/locations that occur when constructions of the epidemiological past

are deployed in present campaigns. Drawing on survivors of past epidemics to champion vaccination may, in fact, lead to a temporal dissonance in time and space due to technological advancements, shifts in political economy of healthcare, and lingering questions of trust in public health recommendations following crisis. Hence, attention to memory places analysis on how institutional (public health agencies) and peopled (publics) responses to disease events become mis/aligned, and raises questions about what is sought, by whom, and for what affect.

5. Conclusion

Memories of past polio epidemics and eradication were revived in public health responses to the spread of polio in London and New York in 2022, specifically as a method of engaging vulnerable publics with vaccination campaigns. Yet, a temporal dissonance becomes apparent through the misalignment of public health memories and the current context in which people make decisions. Selectively deploying public health memories in contemporary vaccination campaigns can be ineffective and assumes that people's decisions can be influenced by narratives of epidemiological progress from an era characterised by diverging social, political and clinical challenges. Institutional memories may not translate into the evidence sought by intended beneficiaries of public health engagement. The work of public health services is to now understand whether local – rather than institutional – experiences and memories of outbreaks can inform future engagement strategies. The framing of public health memory raises practical and theoretical implications for social scientists as they grapple with how to learn from past outbreaks as part of the anticipation of preparedness and the 'politics of temporality.'

References

Adams, V., Murphy, M., Clarke, A. 2009. Anticipation: Technoscience, life, affect, temporality. *Subjectivity*, 28: 246-265. <https://doi.org/10.1057/sub.2009.18>

Backman, I. 2022. Is polio making a comeback? Yale School of Medicine, 26 August. Accessed 19 September 2023: <https://medicine.yale.edu/news-article/is-polio-making-a-comeback/>

BBC News. 2022. London polio vaccine take up rate reaches 23%, figures show, 15 November. Accessed 18 September 2023: <https://www.bbc.co.uk/news/uk-england-london-63642669.amp>

Briggs, C.L., Mantini-Briggs, C. 2004. Stories in the Time of Cholera: Racial Profiling during a Medical Nightmare. Berkeley, CA: University of California Press.

Caduff, C. 2014. Pandemic prophecy, or how to have faith in reason. Cultural Anthropology, 55(3): 296-315. <https://doi.org/10.1086/676124>

Centers for Disease Control and Prevention. 2022. International Health Regulations, 26 April. <https://www.cdc.gov/globalhealth/healthprotection/ghs/ihr/index.html>

Centers for Disease Control and Prevention. 2023. What is polio? 9 January. <https://www.cdc.gov/polio/what-is-polio/index.htm#:~:text=Paralysis%20is%20the%20most%20severe,muscles%20that%20help%20them%20breathe.>

City and Hackney. 2018. Health needs assessment: Orthodox Jewish community in Stamford Hill, north Hackney. Accessed 21 April 2023: <https://www.cityhackneyhealth.org.uk/wp-content/uploads/2019/08/Orthodox-Jewish-Health-Needs-Assessment-2018.pdf>

Closser, Svea. 2010. Chasing Polio in Pakistan: Why the Largest Public Health Initiative may Fail. Nashville: Vanderbilt University Press

Cohen, J. 2022. Polio: Clinical features. Jewish Medical Association. Accessed 18 September 2023: <https://jewishmedicalassociationuk.org/wp-content/uploads/2022/09/Dr-Cohen-JMA-Sept-2022-Polio-presentation.pdf>

European Centre for Disease Prevention and Control. 2023. Poliomyelitis situation update, 24 April. Accessed 22 May 2024:

<https://www.ecdc.europa.eu/sites/default/files/documents/Poliomyelitis-situation-update-2023.pdf>

Fader, A. 2017. J(ewish) Blogosphere: gendered language and the mediation of religious doubt among ultra-Orthodox Jews in New York. J.R. Anthropol. Inst. 23: 727-747.

Fader, A., Avishai, O. 2022. Introduction to the theme. AJS Review 46, 1-11.

Fader, A., Naumescu, V. 2022. Religious Orthodoxies: Provocations from the Jewish and Christian margins. Annu. Rev. Anthropol. 51: 325-43.

Fassin, D. 2007. When bodies remember: experiences and politics of AIDS in South Africa. Berkeley: University of California Press.

Global Polio Eradication Initiative. 2022. Short report on type 2 polioviruses detected in the USA, Israel and UK, 28 July. Accessed 23 May 2024: <https://polioeradication.org/wp-content/uploads/2022/07/VP1-narrative-ISR-NY-UK-29072022..pdf>

Greenough, P. 1995. Intimidation, coercion and resistance in the final stages of the South Asian smallpox eradication campaign, 1973-1975. *Soc. Sci. Med.* 41(5): 633-645.

Hahn, R.A., Inhorn, M.C. 2009. *Anthropology and Public Health: Bridging Differences in Culture and Society*. New York: Oxford University Press.

Hardon, A., Blume, S. 2006. Shifts in global immunisation goals (1984-2004): Unfinished agendas and mixed results. *Soc. Sci. Med.* 60(2): 345-356.

Hill, M., Bandyopadhyay, S., Pollard A.J. 2022. Emergence of vaccine-derived poliovirus in high-income settings in the absence of oral polio vaccine use. *Lancet* 400, 713–715. [https://doi.org/10.1016/S0140-6736\(22\)01582-3](https://doi.org/10.1016/S0140-6736(22)01582-3)

Holloway, K.F.C. 2006. Accidental communities: Race, emergency medicine and the problem of polyheme®. *AJOB* 6(3): 7-17.

Jeffery, P., Jeffery, R. 2011. Underserved and underdosed? Muslims and the Pulse Polio Initiative in rural North India. *Contemp. South Asia* 19(2): 117-135 <https://doi.org/10.1080/09584935.2010.537744>

Jewish Orthodox Women’s Medical Association. 2023. Welcome to my world – Chava Willig Levy’s story, 17 December. <https://www.youtube.com/watch?v=9urJ-QbLJ00>

Joint Committee on Vaccination and Immunisation. 2022. Extraordinary JCVI meeting to discuss polio and meningococcal B. Minute of the meeting held on 25 July 2022. Retrieved 21 April 2023 from: <https://app.box.com/s/iddfb4ppwkmjtjusir2tc/file/1054119657802>

Kahn, S.M. 2006. Making technology familiar: Orthodox Jews and infertility SUPPORT, advice, and inspiration. *Cult. Med. Psychiatry* 30: 467-480.

Kasstan, B. 2019. *Making bodies kosher: The politics of reproduction among Haredi Jews in England*. Oxford: Berghahn Books.

Kasstan, B. 2022. Viral entanglements: Bodies, belonging and truth-claims in health borderlands. *Medical Anthropology Quarterly*, 36(1): <https://doi.org/10.1111/maq.12677>

Kasstan, B., Mounier-Jack, S., Chantler, T., Masters, N., Flores, S.A., Stokley, S., Meek, H., Easton, D., De Luna-Evans, T., Souto, M., Ruppert, P.S., Rosenberg, E., Routh, J. 2023. Poliovirus outbreak in New York State, August 2022: Qualitative assessment of immediate public health responses and priorities for improving vaccine coverage. *Epidemiology & Infection*, 151:e120. doi:10.1017/S0950268823001127

Kasstan, B., Mounier-Jack, S., Zuriaga-Alvaro, A., Weil, L.G., Chantler, T. 2023. “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. *Social Science & Medicine Qualitative Health* 4(100365): <https://doi.org/10.1016/j.ssmqr.2023.100365>

Kelly, A.H. 2018. Ebola vaccines, evidentiary charisma and the rise of global health emergency research. *Economy and Society*, 47(1): 135-161. <https://doi.org/10.1080/03085147.2018.1448557>

Kelly, A.H., MacGregor, H., Montgomery, C.M. 2017. The publics of public health in Africa. *Crit. Public Health*, 27:1, 1-5, DOI: 10.1080/09581596.2016.1254178

Kelly, A.H., Keck, F., Lynteris, C. 2019. *The Anthropology of Epidemics*. Oxon: Routledge.

Kenworthy, N., Koon, A.D., Mendenhall, E. 2021. On symbols and scripts: The politics of the American COVID-19 response. *Glob. Public Health*, 16(8-9): 1424-1438.

Kew, O., Pallansch, M. 2018. Breaking the last chains of poliovirus transmission: Progress and challenges in global polio eradication. *Ann. Rev. Virol.* 5: 427-451.

Klapsa D, et al. 2022. Sustained detection of type 2 poliovirus in London sewage between February and July, 2022, by enhanced environmental surveillance. *Lancet* 400, 1531–1538. DOI: [https://doi.org/10.1016/S0140-6736\(22\)01804-9](https://doi.org/10.1016/S0140-6736(22)01804-9)

Lakoff, A. 2017. *Unprepared: Global Health in a Time of Emergency*. Berkeley: University of California Press.

Letley L, et al. 2018. Tailoring immunisation programmes: using behavioural insights to identify barriers and enablers to childhood immunisations in a Jewish community in London, UK. *Vaccine* 36(31), 4687–4692. DOI: [10.1016/j.vaccine.2018.06.028](https://doi.org/10.1016/j.vaccine.2018.06.028)

Lindner, U., Blume, S.S. 2006. Vaccine innovation and adoption: Polio vaccines in the UK, the Netherlands and West Germany, 1955-1965. *Medical History* 50: 425-446.

Link-Gelles R, et al. 2022. Public health response to a case of paralytic poliomyelitis in an unvaccinated person, and detection of poliovirus in wastewater – New York, June-August 2022. *MMWR. Morb. Mortal Wkly. Rep.*, 71(33), 1065– 1068. <http://dx.doi.org/10.15585/mmwr.mm7133e2>

Lopez, AS, et al. 2024. Chapter 12: poliomyelitis, manual for the surveillance of vaccine-preventable diseases. <https://www.cdc.gov/vaccines/pubs/surv-manual/chpt12-polio.html>

Lynteris, C. 2014. Introduction: The time of epidemics. *Camb. J. Anthropol.* 32(1): 24-31

MacPhail, T. 2014. *The viral network: A pathography of the H1N1 influenza pandemic*. Ithaca: Cornell University Press.

Marcus, G.E. 1995. Ethnography in/of the world system: The emergence of multi-sited ethnography. *Annu. Rev. Anthropol.* 24: 95-117.

Markel, H. 1999. Quarantine! East European Jewish immigrants and the New York City epidemics of 1892. Baltimore: John Hopkins University Press.

Marsland, R. 2014. Who are the “public” in public health? Debating crowds, populations and publics in Tanzania. IN Making and Unmaking public health in Africa: Ethnographic and historical perspectives, edited by R.J Prince and R. Marsland. Athens: Ohio University Press, pp. 75-95

McDonald R, et al. 2019. Notes from the field: Measles outbreaks from imported cases in Orthodox Jewish communities — New York and New Jersey, 2018–2019. MMWR Morb. Mortal Wkly. Rep., 68(19), 444–445. DOI: <http://dx.doi.org/10.15585/mmwr.mm6819a4>

McGonigle I. 2022. “Again you will plant vineyards”: Prophecy, Jewish settlement, and temporal dissonance in the occupied West Bank. HAU: Journal of Ethnographic Theory 12(3): 856-871.

Millward, G. 2019. Vaccinating Britain: Mass Vaccination and the Public since the Second World War. Manchester: Manchester University Press.

New York State Department of Health. 2022. New York State Department of Health and Rockland County Department of Health alert the public to a case of Polio in the County, 21 July. https://www.health.ny.gov/press/releases/2022/2022-07-21_polio_rockland_county.htm

New York State Department of Health. 2022. Polio vaccination rate by ZIP code: Rockland County. Albany: New York State Department of Health, 1 Aug. Available at <https://health.ny.gov/diseases/communic>

able/polio/zip_code_rates/docs/Rockland_polio_vaccination_report.pdf (accessed 1 November 2022).

New York State. No date. Overview. Albany: New York State. Available at <https://www.ny.gov/counties/rockland> (accessed 1 November 2022).

New York State Department of Health. No date. Vaccines for Children. Available at: https://www.health.ny.gov/prevention/immunization/vaccines_for_children/#:~:text=The%20New%20York%20State%20Vaccines,clinics%20enrolled%20as%20VFC%20providers

NHS Digital. 2022. Childhood vaccination coverage statistics – England, 2021-22, 29 September. Available at: <https://digital.nhs.uk/data-and-information/publications/statistical/nhs-immunisation-statistics/2021-22> (accessed 21 April 2023).

Oshinsky, D. 2006. Polio: An American Story. Oxford and New York: Oxford University Press.

Pan American Health Organization. 2022. Epidemiological update: Detection of poliovirus in wastewater, 30 December. <https://www.paho.org/en/documents/epidemiological-update-detection-poliovirus-wastewater>

Public Health England. 2017. Infection prevention and control: An outbreak information pack for care homes - “the care home pack”. <https://www.england.nhs.uk/south/wp-content/uploads/sites/6/2019/10/phe-sw-care-home-pack-oct19.pdf>

Rai, A., et al. 2022. Polio returns to the USA: An epidemiological alert. Ann. Med. Surg. 82: 104563. <https://doi.org/10.1016/j.amsu.2022.104563>

Raucher, M. 2020. *Conceiving Agency: Reproductive Authority among Haredi Women*. Bloomington: Indiana University Press.

Renne, E. 2010. *The Politics of Polio in Northern Nigeria*. Bloomington: Indiana University Press.

Roth, E. 2020. Epidemic temporalities: A concise literature review. *Anthropology Today*, 36(4): 13-16. <https://doi.org/10.1111/1467-8322.12590>

Samimian-Darash, L. 2009. A pre-event configuration for biological threats: preparedness and the constitution of biosecurity events. *Am. Anthropol.* 36(3): 478-491.

Stein-Zamir, C., Abramson, N. Shoob, H. 2020. Notes from the field: Large measles outbreak in Orthodox Jewish communities — Jerusalem District, Israel, 2018–2019. *MMWR Morb Mortal Wkly Rep* v.69(18): 562–563. DOI: [10.15585/mmwr.mm6918a3](https://doi.org/10.15585/mmwr.mm6918a3)

Szántó, D. 2020. *Politicising Polio: Disability, Civil Society and Civic Agency in Sierra Leone*. Singapore: Palgrave Macmillan.

Taragin-Zeller, L. 2023. *The State of Desire: Religion and Reproductive Politics in the Promised Land*. New York: New York University Press.

Tousignant, N. 2013. Broken tempos: Of means and memory in a Senegalese university laboratory. *Social Studies of Science* 43(5): 729-753.

Uwishema, O., et al 2022. Poliovirus returns to the UK after nearly 40 years: Current efforts and future recommendations. *Postgraduate Medical Journal* 98(1165): 816-819.
<https://doi.org/10.1136/pmj-2022-142103>

UK Health Security Agency. 2022. All children aged 1-9 in London to be offered a dose of polio vaccine, 10 August. Retrieved 21 April 2023 from: <https://www.gov.uk/government/news/all-children-aged-1-to-9-in-london-to-be-offered-a-dose-of-polio-vaccine>

Vargha, D. 2018. *Polio across the iron curtain: Hungary's cold war with an epidemic*. Cambridge: Cambridge University Press.

Wald, P. 2008. *Contagious: Cultures, Carriers, and the Outbreak Narrative*. Durham, NC: Duke University Press.

Wigen, E., et al. 2022. Temporal technologies of epidemics. *Medical Humanities*, 48:e17.
doi:10.1136/medhum-2021-012253

Wilder-Smith, A, Osman S. 2020. Public health emergencies of international concern: a historic overview. *Journal of Travel Medicine* 1-13. doi: 10.1093/jtm/taaa227

Wilson, D.J. 2005. *Living with Polio: The Epidemic and its Survivors*. Chicago: The University of Chicago Press.

SSM-D-24-01761

World Health Organization. 2022a. Statement of the thirty-third polio IHR emergency committee, 1 November. Retrieved November 9, 2022, from <https://www.who.int/news/item/01-11-2022-statement-of-the-thirty-third-polio-ihr-emergency-committee>.

Xun, Z., Gilman, S.L. 2021. 'I Know Who Caused Covid-19': Pandemic and Xenophobia. Reaktion Books, London

Zivkovic, T. 2018. Forecasting and foreclosing futures: The temporal dissonance of advance care directives. *Social Science & Medicine* 215: 16-22.

Zuckerman N.S, et al. (2022). Emergence of genetically linked vaccine-originated poliovirus type 2 in the absence of oral polio vaccine, Jerusalem, April to July 2022. *Eurosurveillance* 27(37): pii=2200694.<https://doi.org/10.2807/1560-7917.ES.2022.27.37.2200694>