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Linking pathogens, people and places: Using geo-ethnography to understand place-based, socio-economic inequalities in gastrointestinal infections in the UK

Suzanne Rotheram [a,b,*], Jessie Cooper [c], Ben Barr [a,b], Margaret Whitehead [a,b]

[a] National Institute of Health Research Health Protection Research Unit in Gastrointestinal Infections, The University of Liverpool, United Kingdom
[b] Department of Public Health, Policy and Systems, The University of Liverpool, Whelan Building, Liverpool, L68 3GB, United Kingdom
[c] Division of Health Services Research and Management, School of Health Sciences, City, University of London, Myddelton Street Building, London, EC1R 1UW, United Kingdom

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ABSTRACT

This ethnographic study in two socio-economically contrasting areas employed geo-ethnography, underpinned by a relational approach, to understand inequalities in gastrointestinal infections in families with young children. In our 'relatively disadvantaged' area, gastrointestinal infections spread to multiple households within a small radius, whereas in our 'relatively advantaged' area, illness was confined to one household or dispersed long distances. These differences were shaped by historical, social and economic contrasts in: housing; social networks and childcare arrangements; employment and household income. Our findings show how linking places, pathogens and people helps us understand inequalities in gastrointestinal infections and may be pertinent to other infectious diseases such as COVID-19.

1. The public health importance of gastrointestinal infections

Gastrointestinal (GI) infections are a group of infectious diseases associated with viruses, parasites or bacteria transmitted through food, water, the environment, or by person-to-person spread (FSA, 2012). GI infections often cause symptoms of vomiting, and/or diarrhoea and are a public health priority in the United Kingdom (UK) because of the high rates of infection and economic cost to individuals, the economy and the National Health Service (FSA, 2012). In the UK each year approximately 17 million people experience a GI infection and around half of these individuals take time off school/work due to illness (FSA, 2012; Tam et al., 2012). The most common GI infection, norovirus, costs the UK over £80 million each year with patients bearing 80% of costs through lost earnings, and out-of-pocket expenses (Tam and O'Brien, 2016).

Increasingly, epidemiological evidence points to socio-economic and spatial inequalities in GI infections. In high-income countries, 'disadvantaged[1]' children are at greater risk of GI infection compared to more 'advantaged' children (Adams et al., 2018). In the UK, children and adults living in more 'disadvantaged' circumstances experience more severe symptoms and take more time off work/school as a consequence of illness (Rose et al., 2017). Children living in 'disadvantaged' areas have higher hospital admission rates due to GI infection compared to children living in more 'advantaged' areas (Pockett et al., 2011; Rose et al., 2020a).

Despite the increasing epidemiological evidence of spatial and socio-economic inequalities in GI infections, few UK qualitative studies explore the lived experience of GI infections or how inequalities might come about (McGarrol et al., 2020; Rotheram et al., 2020, 2021). This paper aims to address these gaps by drawing on health-geography literature and the innovative application of geo-ethnography to explore the connection between inequality, health and place, as described below.

* Corresponding author. National Institute of Health Research Health Protection Research Unit in Gastrointestinal Infections, The University of Liverpool, United Kingdom.
E-mail addresses: suzanne.rotheram@liverpool.ac.uk (S. Rotheram), Jessie.Cooper@city.ac.uk (J. Cooper), benbarr@liverpool.ac.uk (B. Barr), mmw@liverpool.ac.uk (M. Whitehead).

[1] Our use of the terms advantaged and disadvantaged are explained in our study design.

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2. Applying a relational approach to inequalities in GI infections using geo-ethnography

Health geographers have a long history of using quantitative methods to explore how places, and the people who live in them, contribute to health inequalities (e.g. Jones and Moon, 1993; Macintyre et al., 2002, 1993). Over time this largely quantitative work in medical geography saw a shift towards promoting theoretically informed and qualitative approaches to understand health and place (e.g. Elliott, 2018; Kearns and Joseph, 1993; Popay et al., 2003b). A significant number of qualitative studies in health geography now explore the impact of place on experiences of health (e.g. Bush et al., 2001; Cattell, 2001) and some examine inequalities using data collected from socio-economically contrasting areas (e.g. Dolan, 2011; Garthwaite and Bambra, 2017; Popay et al., 2003b). This body of work has made an important contribution to understanding how contrasting social, economic and historical contexts of places shape health but, to our knowledge, none explore inequalities in GI infections.

Cummins and colleagues' seminal work, which introduces a 'relational' perspective of health and place, is particularly pertinent to GI infections. This relational approach acknowledges that people, and the places in which they live, are not separate, easily disentangled entities, but are 'mutually reinforcing', forming a 'reciprocal relationship' with each other (Cummins et al., 2007). A relational perspective looks to examine the 'processes and interactions occurring between people and places and over time' (Cummins et al., 2007). Bambra and colleagues built on this work by suggesting that a relational perspective could also be 'scaled up' to consider how macro-political forces might shape geographical inequalities in health (Bambra et al., 2019). As GI infections are most commonly spread person-to-person (Tam et al., 2012), we hypothesised that applying a relational approach which examines the processes and interactions between people, in the places they live, over time, may give new insights into the development of inequalities in GI infections.

We gained further methodological insights from the emerging literature on geo-ethnography, used by Cummins as an example of how his relational perspective be applied. This led us to reflect on how we might apply a relational approach to inequalities in GI infections using geo-ethnography. Matthews and colleagues, for example, had coupled geographic information system (GIS) technologies, which plotted geographic locations on maps, with ethnographic data such as observations and interviews, in a method coined 'geo-ethnography' (Matthews et al., 2005). The coupling of spatial and ethnographic data was advantageous to their research because it gave a visual representation of the intense effort and distances families travelled to care for their children alongside the wider cultural, political, economic and social contexts shaping this care (Matthews et al., 2005). Since its inception, geo-ethnography has been used to investigate other questions important to inequalities such as Atlanta 'food deserts' (Tate, 2018) and food shopping behaviours in low-income women (MacNell, 2018) but, to our knowledge, it has not been used to study GI infections. We therefore set out to explore whether the application of geo-ethnography could shed light on inequalities in the management and consequences of GI infections in families with young children in the UK.

3. Study design

The broader study from which the data in this paper is taken took a place-based, ethnographic approach to examine how the management and consequences of GI infections are shaped in the context of families with young children in socio-economically contrasting areas (Rotheram, 2019). We use the term 'place-based' to mean that we thought about place as encompassing three elements: location, locale and sense of place (Agnew, 1987 in (Lee et al., 2013)). The study drew on the work of Singer, (2016) which conceptualises the patterning and impact of infectious diseases as being mediated by social and cultural factors in their environmental context, rather than as random or a consequence only of biology or individual behaviours (Singer, 2016). In this paper we focus on data collected using geo-ethnography from our two socio-economically contrasting study areas. We defined one area as 'relatively advantaged' and called it Seaview. The second, 'relatively disadvantaged' area we called Rockport. We use inverted commas around these categorisations to reflect our recognition that these labels were imposed by the research team, may not be recognised by people living in those places, and are problematic because of their potential to stigmatise those places and the people that live there (Garthwaite and Bambra, 2018; Popay et al., 2003a).

4. Choosing socio-economically contrasting study areas

Our choice of study areas was informed by considerations employed when choosing socio-economically contrasting places in previous place-based studies (Maciver and Macintyre, 1987; Popay et al., 2003b) and used the following criteria. Firstly, the areas were from one local authority with socio-economically contrasting wards. Secondly, the study areas followed 'ward' boundaries. Wards were small enough geographical units to allow a detailed understanding of the local social and physical environments and had small-scale data available, but were large enough to contain multiple organisations through which recruitment could take place. Thirdly the areas were not contiguous and did not share services in case differences in access to services was important to our research question. Fourthly the areas had a similar population size, ethnic mix and a demographic profile which allowed us to recruit households with young children. Finally, the wards were classified as 'urban with major conurbation' (Bibby and Brindley, 2014) to avoid the effect that rurality has been suggested to have on GI infection rates (Nichols et al., 2012). Ward-level data from the census, Office for National Statistics (ONS, 2016) and Oxford Consultants for Social Inclusion (OCSI, 2016), as well as local knowledge and expertise from local-authority health protection teams, all informed our choice of the two socio-economically contrasting study areas.

The study areas were in the North West of England and their socio-economic contrasts can be seen in Table 1. In 2017, when fieldwork took place, Rockport had the lowest average life expectancy in its local authority and 95% of its population lived in the most 'deprived' 20% of areas by Index of Multiple Deprivation (IMD) in the UK. In contrast, Seaview's life expectancy was five years greater than Rockport and none of its population lived in areas classified as the most 'deprived' 20% of areas by IMD in the UK. The pooled rate of hospital attendances for GI infections in Rockport was almost twice that of Seaview (Table 1).

5. Methodology

Ethical approvals were given by the University of Liverpool (ref 0915) and data were collected by SR over ten months between March–December 2017. Ethnographic data included observations (around 150h), ethnographic interviews (13) and narrative interviews (23). The significant time spent in the study areas allowed the researcher to 'embed' in Rockport and Seaview and to observe residents within their everyday contexts (Hammersley and Atkinson, 2007). Participant observations were conducted while volunteering in four playgroups for pre-school children and their parents/carers – two in Seaview and two in Rockport. Non-participant observations took place while: spending time with participants in their homes and local area; attending community groups; and 'hanging out' (Hobbs and May 1993) in Seaview and Rockport. Observations were directed towards understanding the physical, social, economic, political and environmental context of these areas (Singer, 2016). Observations were written up as fieldnotes alongside non-verbatim notes from informal (ethnographic) conversations. Narrative interviews were conducted with 23 parents (four male, nineteen female) from 19 households (ten from Seaview, nine from Rockport) who had cared for a child under five with a GI infection in the

Table 1
Socio-economic contrasts between the two study areas.

	Seaview	Rockport
Rural-urban classification	Urban with major conurbation	Urban with major conurbation
Total population	13,500	15,000
Size of area	Ward-sized	Ward-sized
Ethnicity – White British %	95	95
Population 0–9 years %	9	18
Male	9	14
Female		
Life expectancy (years)	80	75
Men	78	71
Women	82	77
IMD[a] Score	11	55
Children living in poverty[b]%	7	47
% of people living in most deprived 20% of areas by IMD[a]	0	95
Average household income (£)	38,000	22,000
Hospital attendance for a GI infection (pooled 2013–2016) (rate per 1000)	31	55
Housing: Tenure %	81	35
Owner occupied	3	34
Social rented	16	31
Other		
Economy: Job type %	13	6
Managerial	44	17
Professional	12	10
Administrative	9	11
Skilled trade	6	18
Elementary occupations		
Largest employment sector	Education	Health & Social work

Note: Historical, economic and social contrasts for Rockport and Seaview are described in the fieldnote descriptions at the beginning of the Results section for each area.

[a] IMD = Index of Multiple Deprivation. A small area measurement based on 7 different domains of 'deprivation'. A higher score indicates higher deprivation (Smith et al., 2015).

[b] Poverty defined as household income less than 60% of current median income.

previous 12 months (Table 2). Interviews took place between April–November 2017 and the majority of participants had experienced managing GI infections within the few months prior to interview. Narrative-style interviews allowed participants to tell their remembered account of illness (Riessman, 2008; Wengraf, 2001). These narratives gave insights into participants' experience of having a GI infection and how they made sense out of what happened (Riessman, 2008). Interviews were digitally recorded and transcribed verbatim.

Importantly, these various ethnographic data contained within them not only rich insights into the experiences of dealing with a GI infection from households in the study areas, but also information on the locations of other people who had become infected in and beyond Seaview and Rockport. During narrative interviews, therefore, these locations were also recorded, entered into ArcGIS software (ESRI, 2021) as point features and used to create 'maps' (n = 19). The maps provided an easily accessible, visual, spatial representation (Matthews et al., 2005) of the remembered onwards transmission of GI infections which could be compared and contrasted within and between our socio-economically contrasting research areas. Taken together, the maps and narratives represented accounts of GI infections which privileged the understandings and interpretations of participants (Riessman, 2008).

Written consent was taken from participants taking part in narrative interviews and from staff in community groups where participant observations took place. Participants were provided with written information about the research, given time to consider if they wanted to take part, assured of anonymity and confidentiality, and given the right to withdraw at any stage. Verbal consent was taken for ethnographic interviews. Separate consent was taken for observations in homes and for recording location data. All participants were given a pseudonym and identifiable information including road networks were removed before maps were created (Matthews et al., 2005).

6. Analysis

As is common practice in ethnography the analysis of interviews, observations and maps started during fieldwork and continued as data collection progressed (Hammersley and Atkinson, 2007). Once fieldwork was completed a more formal, thematic analysis of data took place (Braun and Clarke, 2006). Data were organised in NVIVO 11 and sections of interviews and fieldnotes were assigned codes or 'units of meaning' (Miles and Huberman, 1994). Codes were then organised into larger themes, which captured an important element of the management or consequences of GI infections or were relevant to their place-based contexts. Themes were developed alongside the data represented in participant maps, were discussed among the research team and triangulated across the dataset (Kwan and Ding, 2008).

To illustrate our findings, we present narrative interview data and associated maps from six households - three from Rockport and three from Seaview - which were chosen as exemplars because they demonstrate characteristics of the experiences and practices of managing GI infections across the dataset as a whole. In order to contextualise these accounts, we present these data alongside ethnographic fieldnotes collected across the whole dataset. By organising the data in this way, we situate the management and consequences of GI infections in our socio-economically contrasting research areas and show how they are shaped by their particular historical, social and economic contexts.

7. Results

7.1. Gastrointestinal infections in Rockport: three households' accounts

Lydia (R4), Mia (R7), Talia (R6) and Scott (R6) all lived in Rockport and were parents of children under five who had experienced a GI infection in the previous 12 months. Lydia and Talia worked full-time caring for their children, Mia was a care-worker and Scott was in receipt of disability payments. All three households were categorised as having a low-income which qualified them for a free government-funded nursery place.

7.2. Gastrointestinal infections next door: the historical context of friends and family living nearby

Rockport, the home of Lydia, Mia, Talia and Scott, started life as a fishing settlement. During the industrial revolution Rockport received substantial investment and became an important, industrial dock system. The work generated by these docks brought an influx of people into the area and dock houses were built to accommodate them. Rockport became a close-knit, largely working-class community. During the last half of the 20th century, however, the drop in UK manufacturing led to work in Rockport's ports drying up, investment stopping and the area went into rapid decline. Dock houses were knocked down and replaced by council estates. This historical loss of industry and physical deterioration continues to have repercussions to the current day. At the time of fieldwork Rockport had the lowest average life expectancy in its local authority, the highest percentage of children living in low income families and over one third of its population lived in social rented housing.

Many residents of Rockport and their families had grown up in Rockport and stayed, often living within a few streets of where they'd lived as a child. This geographical proximity of family was evident in interviews with Lydia, Mia, Talia and Scott. Lydia explained that she lived around the corner from her mum, dad, brother and his family. Talia described Scott's family as living *'all around'* meaning that they lived close by and Mia said that multiple members of her family lived nearby:

Table 2
Participant details from households in Rockport and Seaview recruited for narrative interviews.

Rockport (relatively 'disadvantaged' area)					
Household	Participant Pseudonym	Male/Female	Age of child(ren)	Employment	Engagement with Healthcare[a]
R1	Zoe	F	1	p/t Care assistant	None
R2	Jo	F	2 & 6	Full-time mum	Doctor
R3	Naomi	F	2	p/t Cleaner	Emergency Department
R4	Lydia	F	1 & 2	Full-time mum	None
R5	Georgia	F	2	Full-time mum	Doctor
R6	Talia[b]	F	2	Full-time mum	NHS 111
	Scott[b]	M		In receipt of disability benefit	
R7	Mia	F	2	Care-assistant	Doctor & Chemist
R8	Freya	F	3	Full-time mum	Emergency Department
R9	Caren	F	1 & 2	p/t shop assistant	Doctor
Seaview (relatively 'advantaged' area)					
Household	**Participant Pseudonym**	**Male/Female**	**Age of child(ren)**	**Employment**	**Engagement with Healthcare[a]**
S1	Sarah	F	2 & 5	p/t Manager	None
S2	Linzi	F	1 & 1	Full-time mum	None
S3	Holly	F	2	p/t civil servant	Doctor
S4	Esme[b]	F	1	p/t Academic	None
	Neil[b]	M		Academic	
S5	Annabelle	F	2 & 4	p/t Call centre worker	None
S6	Penny	M	<1, 2 & 4	p/t Doctor	None
S7	Stephanie[b]	F	<1, 2 & 4	Full-time mum	Online advice
	Ed[b]	M		Engineer	
S8	Harriett	F	1, 4 & 7	Full-time mum	None
S9	Jess	F	3	p/t self-employed	Online advice
S10	Jack[b]	M	<1 & 3	Doctor	None
	Lucy[b]	F		Doctor	

NHS 111 = NHS telephone advice service.
[a] Engagement with health care for child's most recent episode of a GI infection.
[b] Denotes two parents in a relationship who jointly parent a child who had a recent GI infection.

> … my mum lives about 10 minutes away from me and my partners mum and dad live just in the street in front of us. (Mia, Rockport, R7)

This proximity of family shaped participants' experiences of GI infections. The spatial representation of Lydia's narrative of illness is represented in Fig. 1 and she described her household's GI infection transmission:

> Well I think [younger daughter] got it first then [older daughter] got it, then I got it, and then my mum came to help me, while [partner] is up work, so then she [Lydia's mother] ended up with it, and then my other half got it, and then my mum passed it to my dad, and they had gone to see my nieces, my nieces caught it, and my sister and brother-in-law, (…) we all just caught it. And I have got a brother who lives over the road from me, with a little boy and a partner, and I think they all ended up with it, but I don't think my sister-in-law caught it (…). She [sister in law] works full time so I think she had managed to stay away from them. (Lydia, Rockport, R4) (Fig. 1)

Lydia's narrative and map show how her experience of having a GI infection was one which spread to four further households within a small geographical radius. The number of households who were part of

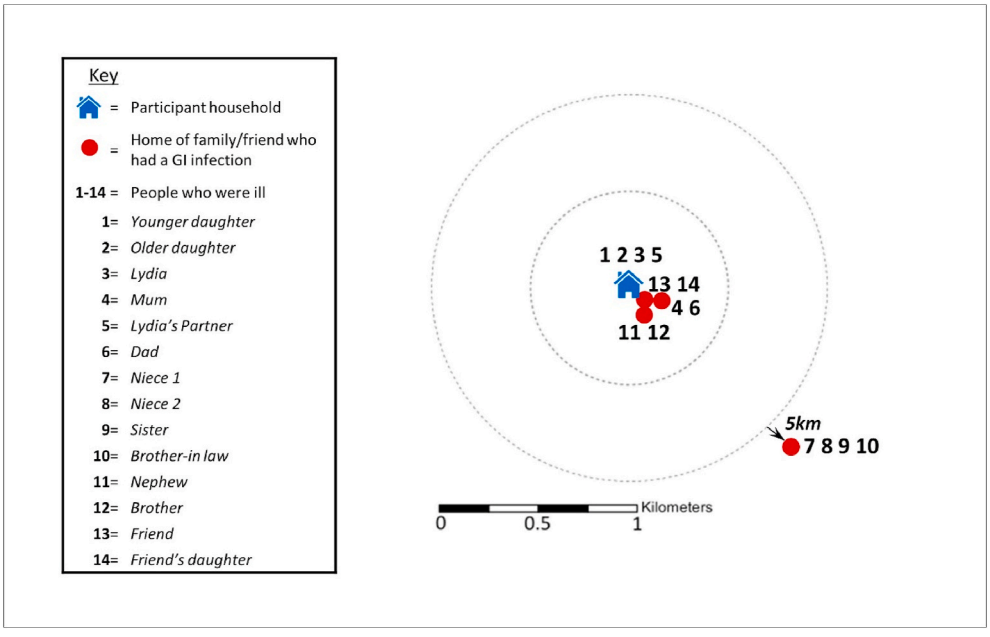

Fig. 1. Representation of the spread of GI infection from Lydia's household (Rockport, R4).

Lydia's story was underpinned by the history of Rockport and having many family and friends living nearby. The nature of the social ties between family and friends also played an important role in shaping experiences of infection and is explored below.

7.3. Close relationships between family and friends shape gastrointestinal infections

Spending time in Rockport gave insights into the close relationships that existed between local residents. One resident, Georgia, stated that because of the high numbers of council houses this was why *'everyone knew everyone else'* (Georgia, Rockport).

Lydia, Mia, Talia and Scott's narratives revealed that living in and among people they had known their whole lives brought a relational closeness. Talia explained that her partner's family often had their daughter to stay and Lydia described her mum as being '*always at mine*'. Mia said she saw her mum every day and her partner's parents once a week:

> *I go and see my mum every day that I am not in work and if I am in work I will call in afterwards if I am on a daytime shift and have a cup of tea (…). With [partner's] mum living in front of us you would think we would see her a lot but we don't, we see her once a week but the baby sees them a lot …. They will have her for 2 days, so overnight and then they will take her away to the caravan and stuff all the time so they are all really close.* (Mia, Rockport, R7)

Mia's family's frequent contact and support shaped her experience of having a GI infection which not only affected her daughter and her partner, but also family and friends living nearby (Fig. 2):

> *Well it [the stomach bug] just came out of nowhere (…) [we] kept her [daughter] in for a few days but it didn't get no better and then her nan was like, 'oh we'll look after her for a night, if you want'. So I took her there and stayed out and then about two days later they thought 'we are really sick'. And I was like 'oh I am sorry' and then my mate came round and she was only in the house for about 20 minutes, and she messaged me the next day saying I am in work and I can't stop going to the toilet (laughs) (…). She [daughter] infected my mum as well, I am saying infected as if she was [doing it deliberately] but no it just spread everywhere and it was horrible.* (Mia, Rockport, R7) (Fig. 2)

Lydia explained that having an illness that spread through multiple members of her relationally close family was, for her, a normal part of family life:

> *…. we are quite close my family so if someone is ill we all catch it, it goes right through the lot of us and then usually comes back round we all get it again.* (Lydia, Rockport, R4)

The frequent contact between family described by households in Rockport continued when children were ill as family stepped in to provide hands-on support. As we show next, this support was particularly important for participants living on a low income.

7.4. Living on a low-income shaped transmission of gastrointestinal infections

The social and economic decline in Rockport in the late 20th century was still evident during fieldwork. Local playgrounds were in disrepair and community centres provided food-banks and social supermarkets to support residents living on a low-income. Families living in challenging economic circumstances with few well-maintained facilities nearby described how they and their children went *'freely'* (Jo, Rockport) between their family's homes. This was inexpensive entertainment for children which gave parents a much-needed break from childcare.

When Lydia, Mia, Talia and Scott described managing GI infections, the importance of support from family members in the context of their low-income households was evident. Lydia said that if her partner took time off work he lost pay and this made budgeting '*harder*' the following month. To avoid this outcome Lydia's mum came to help her when she or her children were ill (Fig. 1).

Scott and Talia were unemployed and did not own a car. Scott was in receipt of disability benefits. Talia described the 'support *network*' that Scott's family provided as being vital when they had a GI infection and Scott explained that this support included driving to buy extra nappies and looking after their daughter:

> *… my stepdad would sometimes go to the shop for us in the car or, if we needed a bit of rest he would take [daughter].* (Scott, Rockport, R6)

This contact and hands-on help shaped Scott and Talia's experience of multiple members of their family being ill with a GI infection (Fig. 3):

Scott: *I think my mum had it didn't she?*

Talia: *Yes, your mum and [stepdad].*

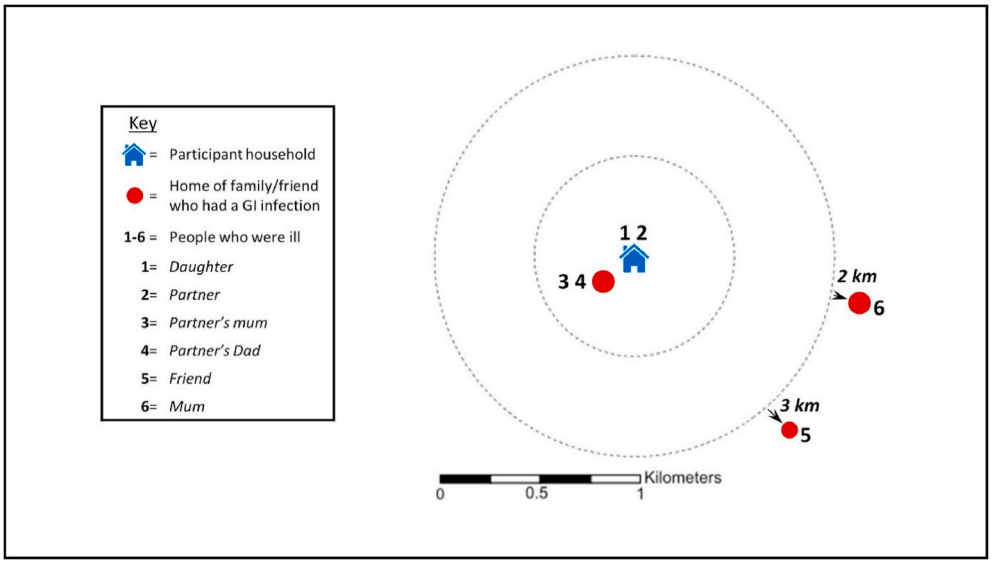

Fig. 2. Representation of the spread of GI infection from Mia's household (Rockport, R7).

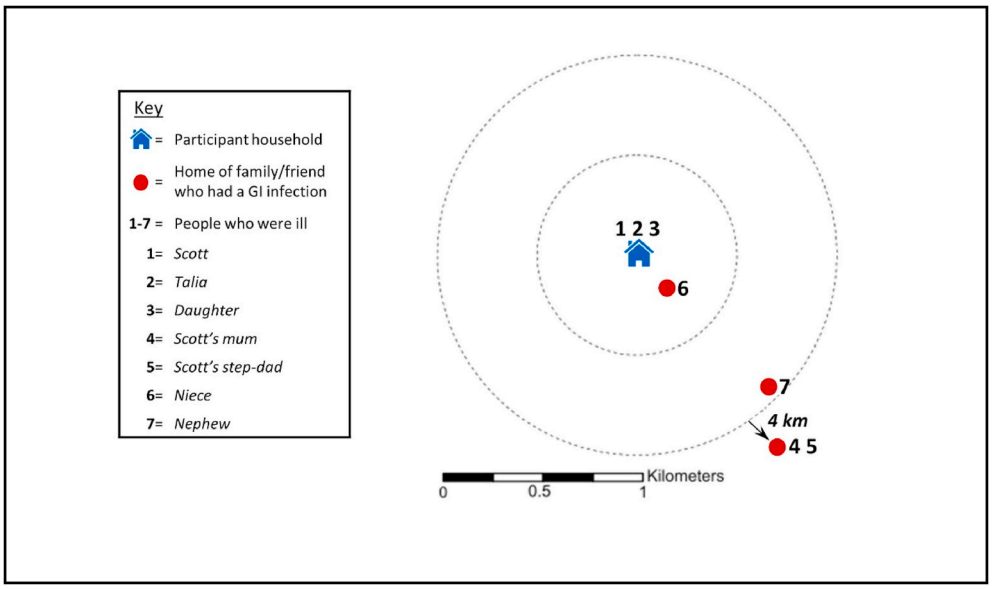

Fig. 3. Representation of the spread of GI infection from Scott and Talia's household (Rockport, R6).

Scott: *And my stepdad got it as well. Basically, near enough the whole family.*

Talia: *Just* pass *around.* (Scott and Talia, Rockport, R6) (Fig. 3).

These experiences in Rockport of having GI infections which spread to multiple households of family and friends living nearby could therefore be seen to be constructed by: the industrial history of Rockport, its housing and geographical proximity of family and friends; the close social relationships with family and friends living nearby; and the strong social support when children were ill underpinned by households' economic and employment contexts.

7.5. Gastrointestinal infections in Seaview: three household accounts

Jess (S9), Stephanie (S7) and Ed (S7), Jack (S10) and Lucy (S10) all lived in Seaview and were parents of children under five who had experienced a GI infection in the previous 12 months. Ed, Jack and Lucy worked in professional employment, Jess was self-employed and Stephanie worked full-time caring for her children.

7.6. Gastrointestinal infections spread over large distances: the historical context of large distances between family and friends

Seaview, like Rockport, also started life as a small fishing port. In contrast to Rockport, however, Seaview's development in the late 19th century was not driven by industrialisation but first by the arrival of wealthy landowners and later by the development of transport links to local towns and cities which attracted wealthy business owners. In contrast to Rockport, therefore, whose population expansion was driven by low paid workers and industry, Seaview's population grew due to an influx of wealthy residents wanting to live by the coast while working in nearby towns and cities. This history continues to shape it to the present day. Compared to the national average, fewer residents claim social benefits, fewer children live in poverty, and more residents own their own home. Present day Seaview still attracts professionals who relocate to Seaview to commute to work. Being a 'commuter' town meant that, in comparison to Rockport, where multiple generations of the same family lived nearby, much of the population of Seaview was characterised by people who lived a long way from family and friends.

The large distances that many residents of Seaview lived from family and friends was evident in interviews with Jess, Jack and Lucy. Jess's parents lived in Scotland and Lucy and Jack's family and friends lived hundreds of miles away in different parts of the UK. These large distances between family and close friends shaped participants' experience of having a GI infection. Lucy and Jack explained that their daughter started vomiting while Lucy's mum was staying and shortly after they hosted a Christening party for family and friends from all over the country (Fig. 4):

Jack: *Lucy's mum lives in [town around 100 km away].*

Lucy: *Yes, but she comes up to look after the girls a couple of days a week so she's the one who got exposed more than anyone because she was there for the initial contact of the sickness and she went home and by the …*

Jack: *Gave it to your dad that weekend.*

Lucy: *Yes, she went home and within a couple of days she became unwell with vomiting and diarrhoea and then passed it to my dad who also was unwell and then obviously we had the party […]*

Lucy: *[…] 6 people …*

Jack: We got the blame. (Lucy and Jack, Seaview, S10) (Fig. 4)

For Lucy and Jack, therefore, their experience of a GI infection as one which spread to people living a long way away was underpinned by the large geographical distance between their family and friends (Fig. 4).

As in Rockport, it was not only the geographical distance, but also the nature of social ties between family and friends which shaped GI infections, examined below.

7.7. GI infections confined to the home through planned social interactions and support

Local facilities and community groups in Seaview contrasted greatly with those seen in Rockport. Whereas Rockport's community centres focused on supporting low-income residents and the area had poorly maintained, under-funded facilities, Seaview had multiple tennis courts, golf clubs, well-maintained playgrounds, bowling greens, libraries and eight different playgroups. These facilities, alongside the professional, salaried jobs of Seaview's population, meant that families described participating in a variety of activities including: playgroups; singing sessions; reading sessions; walking to the beach; going to the shops, visiting cafes and taking children to local parks and playgrounds. These activities, alongside the large distances that often existed between

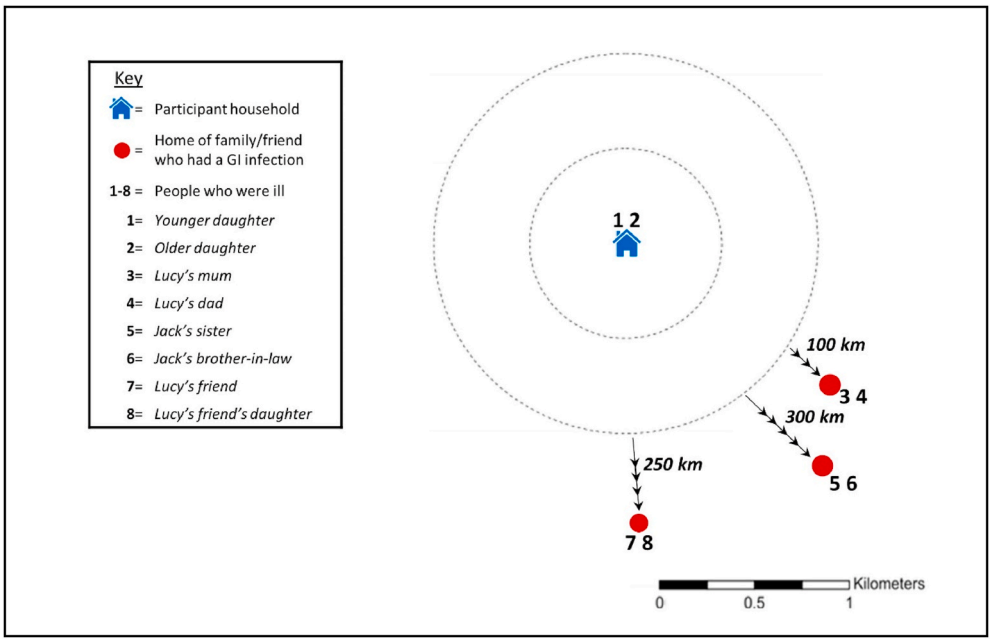

Fig. 4. Representation of GI infection transmission from Lucy and Jack's household (Seaview, S10).

family and friends, created a different kind of social interaction locally to that seen in Rockport where people went *'freely'* in and out of each other's homes – interactions between family and friends in Seaview were organised and planned rather than spontaneous.

These 'planned' social interactions were evident in interviews with Jess, Stephanie, Ed, Jack and Lucy. Lucy said her mum travelled to Seaview on specific days to provide childcare while Lucy and Jack worked. Jess said that even if she lived near her parents her partner would still want visits to be arranged in advance through the use of a:

> *(…) 30 minute 'buffer' zone to make sure the in-laws would need to ring before coming round and wouldn't just turn up.* (fieldnotes, Jess, Seaview, S9)

This relational distance underpinned by the nature of pre-arranged social interactions was particularly evident when participants in Seaview were ill. Jess explained that when her household had a GI infection they postponed a friend's visit until after her family were well. Similarly, although Stephanie said her mum and sister lived '*round the corner*', when her household had a GI infection their only interaction with family was for them to drop off supplies:

> *I have got parents round the corner and a sister, round the corner but again, can't really palm kids off on them, to go and get stuff done. It is quite lucky because they can always drop things off for us, but otherwise, we are just housebound (…) because obviously you don't want to risk bumping into friends and passing bugs on that way …* (Stephanie, Seaview, S7)

As 'dropping off' supplies didn't involve physical contact with anyone who was ill, Stephanie's narrative of illness and map only included her own household (Fig. 5):

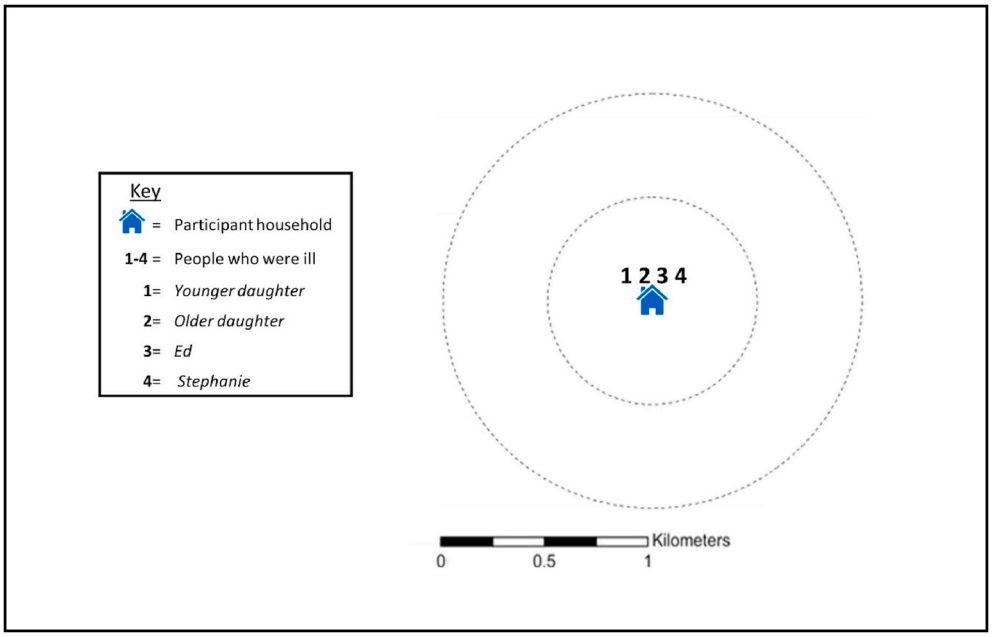

Fig. 5. Representation of GI infection transmission from Stephanie and Ed's household (Seaview, S7).

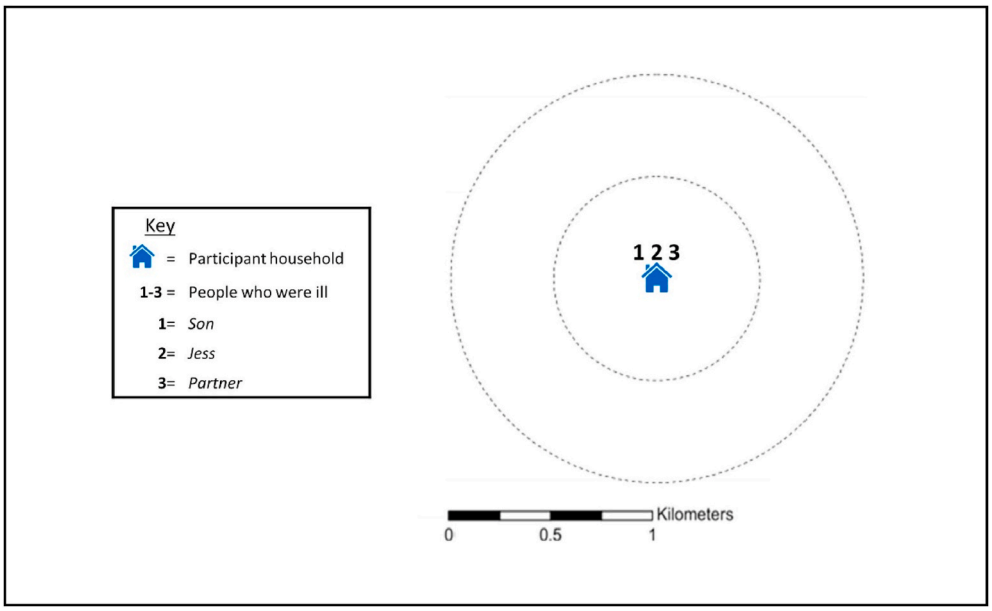

Fig. 6. Representation of Gi infection transmission from Jess's household (Seaview, S9).

I think [younger daughter] got it first, (…) and then [older daughter] got it, (…) and then Ed [her partner] and I just [got] ill, sort of one night, overnight both of us … (Stephanie, Seaview, S7) (Fig. 5).

This example from Stephanie and Ed illustrates how, within Seaview, symptoms of GI infections were often managed within one household, with minimal interactions outside that household. The type of social-relational distance (i.e. the day to day interaction and inter-dependence) between family and friends in Seaview meant contact with other people was often pre-arranged and therefore easily post-poned when households were ill. This compared to families in Rockport who were geographically *and* relationally close, even in the midst of illness.

These minimal interactions when managing a GI infection were also shaped by the economic and working conditions in Seaview, explored next.

7.8. Flexible, salaried employment in Seaview shaped gastrointestinal infections

As Jess, Stephanie, Ed, Jack and Lucy described their household's GI infections it became clear that their professional, salaried jobs and comfortable household incomes shaped their experiences of managing illness in a different way to participants in Rockport. When Lucy and her daughter were ill, her partner, Jack, stayed at home to help. This was facilitated by Jack's understanding employers, salaried employment as a doctor and paid parental leave. When asked how Jack's work had reacted to his leave they replied:

Jack: *Oh fine, I have not had much time off sick to be honest. And, that kind of thing is … they don't criticise you for a day off for—*

Lucy: *It was kind of carer's leave as opposed to—*

Jack: *Yes.*

Lucy: *Well you didn't feel great either but I don't think I would have coped with both of them …* (Jack and Lucy, Seaview, S10)

Jack and Lucy therefore managed their household's GI infection without relying on family to help. Similarly, Jess explained that she and her partner had flexible employment which allowed them to work from home so they managed their GI infection alone even though her partner's sister lived nearby. Jess described how a couple of days after her son had been ill with a GI infection she and her partner also developed symptoms:

… I was having sickness and diarrhoea quite violent (…) and so I am back and forth to the toilet, (…) Carried on until about probably 1.30 in the morning, at which point I hear [partner] sprinting down the hall, down-stairs. And so that was me just coming out of it just as he was going into it (Jess, Seaview, S9, Fig. 6).

For participants in Seaview, therefore, the limited interaction between family and friends when managing GI infections meant that symptoms often stayed within participants' households (Figs. 5 and 6). On the occasion when social contact coincided with having a GI infection, through a pre-arranged event, transmission of infection spread over a long distance (Fig. 4). This compared with Rockport where transmission was within a small geographical radius (Figs. 1–3). These experiences in Seaview were shaped by: the area's historical development into a commuter town and large geographical distances that often existed between family and close friends; the social distance between family and friends living nearby; and by social support from family and friends when children were ill not being required due to the flexible employment circumstances and salaries of households.

8. Discussion

Our use of geo-ethnography (Matthews et al., 2005) underpinned by a relational theoretical perspective of health and place (Cummins et al., 2007) have enabled important, novel insights into how place-based inequalities in GI infections are shaped by contrasting historical, political, economic and social, place-based contexts.

We show how, in Rockport, there was a collective experience in relation to the practical and financial consequences of GI infections within groups of family and friends. Rockport's history as an industrial town, in common with other post-industrial places, has created a social and community structure characterised by strong social networks and local kinship where 'everybody knows everybody' (Degnen, 2005; Evans, 2015). These strong social networks, kinship and support raising children are particularly important in the context of living on a low-income in an area with few facilities. Importantly, these wider contexts relevant to the management and consequences of GI infections have not come about by accident but are underpinned by macro-political forces acting locally (Bambra et al., 2019). Urban planning policies in

the last half of the 20th century drove the development of council estates in post-industrialised areas like Rockport (Power, 2012) and these same areas have experienced greater reductions in public expenditure than more 'affluent' areas as a consequence of national government austerity policies over the last decade (e.g. Hastings et al., 2015). Residents' low-incomes are reinforced by insecure working conditions such as zero hours contracts and hourly paid work which give employees access to a limited set of employment rights and paid leave (Koumenta and Williams, 2019). The collective experience of the consequences of GI infections are therefore underpinned by central government policies acting locally in Rockport.

In contrast, the practical and financial consequences of GI infections in Seaview often remain confined to one household or, in the event of a formal family gathering, were dispersed a long way away. Living further away from friends and family meant that households often did not have the same support networks raising children as families in Rockport. The absence of this support was mitigated by the advantages of Seaview's households' favourable living and working contexts. Again, these advantages have not come about by accident but are underpinned by macro-political forces acting locally (Bambra et al., 2019). Historical local and national investment in Seaview has created a relatively 'affluent' area with good facilities where families working in professional occupations with good incomes can afford to, and choose to, live. These same areas have not experienced the same levels of reductions to public expenditure due to government austerity policies over the last decade (e.g. Hastings et al., 2015). The organisation of professional employment as well as the structure of the labour market provides secure, salaried employment with provision of paid carers' leave and home-working, all of which make it possible for families in Seaview to manage GI infections without calling on outside help. For Seaview, therefore, it could be argued that central government policies, acting locally, were 'shielding' (Nguyen and Peschard, 2003) family and friends living nearby from the practical and financial consequences of GI infections.

The use of geo-ethnography and a relational approach to give insights into inequalities may have applications to other infectious diseases. Emerging research around COVID-19 demonstrates similar social patterning to that reported in GI infections with more 'disadvantaged' areas experiencing higher mortality due to COVID-19 (Rose et al., 2020b; Whitehead et al., 2021). Geo-ethnography and a relational approach to give contextual *and* spatial insights into the practices and interactions between people in contrasting places may therefore be useful to understand inequalities in COVID-19 and other infectious diseases.

9. Strengths, limitations and future research

This study is, to our knowledge, the first to use geo-ethnography to examine inequalities in GI infections and has enabled a rich, contextual understanding of contrasting experiences associated with place. We acknowledge that our findings are not generalizable in the traditional sense and, indeed, we recognise that it would not be appropriate to do so (Popay et al., 1998). Rather, the findings serve the purpose of digging deeper into questions of 'why' and 'how' inequalities in the experience of GI infection in places come about.

One limitation of the study was the restriction of location data to family and friends who became ill. The study originally intended to collect other location data relevant to illness but as the research progressed it became clear that family and friends were more dominant in participants narratives. In keeping with an ethnographic approach which develops its focus as the research progresses (Hammersley and Atkinson, 2007), we therefore decided to focus our location data to represent onwards transmission of infection. Future research would benefit from understanding the use of local services such as health centres, general practitioners and pharmacies when managing GI infections in socio-economically contrasting places. We also acknowledge a limitation due to the small number of male voices in our recruitment which came about because of the relative absence of men in the spaces where the majority of recruitment took place (playgroups). Future research would benefit from men's experiences managing GI infections across socio-economically contrasting places.

10. Conclusion

Geo-ethnography has provided novel insights into how inequalities in the management and consequences of gastrointestinal infections can be embodied in a complex web of contrasting historical, political, social and economic contexts within places. Its findings show the importance of linking pathogens, people and places in order to understand inequalities in GI infections and may have implications for other acute infectious diseases such as COVID-19. Geo-ethnography, and a relational approach could provide an opportunity to look beyond individual local factors to better understand how macro-political and economic, structural factors also shape inequalities in infectious diseases. As such, it extends extant theory on the mechanisms generating health inequalities (Diderichsen et al., 2001) by elucidating the role that differential consequences play in the pathways to inequalities in GI infections. There are further implications for the development of interventions to address infectious diseases. These interventions must be mindful of, and sensitive to, contrasting historical, political, social and economic contexts in different places if they are to be effective at reducing inequalities.

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Appendix 1. Narrative Interview Schedule

A study on stomach bugs in households with young children.

The interview

Brief the participant as to why they are being asked to take part in the research. Check that they have read the information sheet and understood it and ask them if they have any questions.

Explain that I will be doing a narrative interview which aims to find out about their own experiences managing a stomach bug

The interview is to be guided by them and I will only ask additional questions if needed. I might ask for an event to be described in more

detail, or for an example to be given, but otherwise it is completely up to the participant what they describe and how they tell the story.

Question focused on the experience of the household with the child under 5 who experienced a stomach bug.

'I'd like you to tell me about your most recent experience of {child's name inserted here} having a stomach bug with all the events and experiences that were important to you. Start wherever you like, please take the time you need. I'll listen first and won't interrupt, I'll just take some notes for afterwards'

Start wherever you like

Prompts:

If they need more guidance the below prompts can be used:

- Can you tell me what happened when it started?
- Can you tell me what happened next?
- How did you manage the situation?
- Who else was involved and what was their role?
- What did you do then?
- What happened afterwards?
- How did the rest of the household manage the situation?
- Is there anything else you'd like to tell me?

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