Infectious diseases

Contents

Executive summary

- Infectious diseases are still prevalent within Hackney and the City, and represent a significant cause of morbidity and mortality. This chapter focuses on six broad categories of infection: vaccine preventable childhood infections; vaccine preventable respiratory infections; blood-borne viruses; food-borne diseases; travel-related gastrointestinal infections; and healthcare-associated infections.
- There is variation in the reported incidence of infectious disease related to age, gender, ethnicity, socio-economic disadvantage, and in different parts of the area.
- National vaccination programmes exist to prevent the spread of certain childhood and respiratory infections. However, vaccination rates in Hackney and the City are below target levels and, as a consequence, local outbreaks are not uncommon, most notably in measles
- The data available as described in this chapter are based on the number of *reported* cases of different infections. However, this represents only a proportion of the overall burden of disease, particularly with regards to food-borne illness and blood-borne viruses
- Each of the main sections in this chapter covers a number of the main infections within each of the six categories, and is structured according to a consistent format, using the following headings.
    - Introduction
    - Causes and risk factors
    - Local data numbers and rates
    - Health inequalities
    - Comparisons with other areas
    - Evidence and good practice
    - Service and support available locally
    - Service gaps and opportunities (where identified)

1. Introduction

Infectious diseases are microorganisms such as bacteria, viruses, parasites or fungi that cause disease and can be spread, directly or indirectly, from one person to another. [1] Infectious disease is a commonly used descriptor to describe an infection caused by a microorganism and is the descriptor that will be used in this chapter.

Many, but not all, infectious diseases are 'notifiable' – that is, they are required by law to be reported to government authorities via a local health protection team (HPT). The local HPT for Hackney and the City is the North East and North Central London (NENCL) HPT. For further definitions used throughout this chapter, see Box 1.

Box 1: Definitions used in this chapter

Blood-borne infection – an infectious disease spread through contamination by blood and other body fluids. This is often not directly by blood contact but by an insect or other 'vector' (see below), or by inanimate objects, notably medical devices such as needles.

Childhood infection – an infectious disease more likely to be contracted by a person under the age of 18.

Food-borne infection – an infectious disease spread through contamination of food.

Healthcare-associated infection (HCAI) – an infectious disease that patients acquire during the course of receiving treatment for other conditions within a healthcare setting.

Notifiable disease – an infectious disease that is required by law to be reported to government authorities at a local HPT.

Pathogen – a bacterium, virus or other microorganism that can cause disease.

Respiratory infection – an infectious disease spread via droplets in the air causing an infection in the respiratory tract.

Transmission – the passing of a pathogen causing infectious disease from one person (or a group) to another person (or group).

Travel-related infection – an infectious disease that is not found in the UK but is common in other parts of the world.

Vaccine-preventable disease (VPD) – an infectious disease for which an effective preventative vaccine exists.

Vector – an organism, typically a biting insect or tick, which transmits a disease or parasite from one person to another.

Over the last century, the burden of disease in the UK (like much of the world) has shifted from infectious disease to non-infectious disease. This is due to advances in our understanding of infectious diseases, how they are spread and how they can be treated. However, they remain a significant cause of morbidity and mortality globally, and also within certain communities and at-risk populations in the UK. [2]

To put it in perspective, diarrhoea and lower respiratory and other common infectious diseases are estimated to contribute to 651.84 per 100,000 disability-adjusted life years (or DALYs)[1] in London. This compares to 312.83 per 100,000 for breast cancer and 327.33 per 100,000 for diabetes mellitus. [3] This reveals that infectious disease still represents a significant cause of morbidity and mortality.

This chapter will help to unpick some of these statistics through an investigation into local evidence on some of the most important infectious diseases still prevalent within the local populations of Hackney and the City – focusing on: vaccine-preventable childhood infections and respiratory infections; blood-borne viruses; food-borne diseases; travel-related gastrointestinal infections; and healthcare-associated infections.

A note on the data

Throughout this chapter, data are presented by rates per 100,000 people in the population. Incidence refers to the number of cases being diagnosed within a specific period of time; prevalence refers to a snapshot of the number of cases at any given point in time. Where there are small numbers of diagnoses, it may be difficult to ascertain significant differences between groups. To capture the uncertainty surrounding the use of data from small samples, confidence intervals are shown on the charts (if available). Confidence intervals are an indicator of how accurately the data shown reflect the 'true' or underlying population data.

Throughout this chapter, reference is made to 'statistical peers' when making comparisons with other areas. Statistical peers are local authorities with a similar demographic make-up to the local population. Hackney's statistical peers are Tower Hamlets, Islington, Southwark, Wandsworth, Camden, Hammersmith and Fulham, and Lambeth.

2. Vaccine-preventable childhood infections

2.1. Introduction: focusing on measles, mumps and pertussis

The success of the national childhood routine immunisation programme has led to vaccine-preventable diseases (VPDs) such as measles, mumps and pertussis (whooping cough) becoming less common in the UK. However, outbreaks of these infections have recently occurred, including in Hackney.

Outbreaks of childhood infections can place a great strain on health services, and are the cause of approximately half of all children's GP consultations. [4] As Hackney

[1] DALYs are a measure of overall disease burden expressed as the number of years lost due to ill health, disability or early death.

and the City of London are home to mobile populations, maintaining high vaccination coverage for 'herd immunity' (Box 2) is vital to prevent the reintroduction of VPDs into the local community.

Box 2: *Herd immunity*

Herd immunity refers to the situation when a large enough proportion of the population is immune to an infection to provide protection for individuals who are not immune. The extent of vaccination coverage required to achieve herd immunity varies by disease. For example, 95% of the population must be vaccinated against measles for this to be achieved.

Vaccine-preventable childhood infections are the source of significant health inequalities, with outbreaks in the past 10 years predominantly having occurred in areas in Hackney that have a high concentration of minority groups (such as the Orthodox Jewish Charedi community). It is also known that vulnerable children, such as those moving in from high-risk areas of the world, are more likely not to have complete vaccination schedules. For more details, see the 'Children and young people' chapter of the JSNA.

This section focuses on measles, mumps and pertussis as there has been a relatively high number of cases of these three infections in recent years in Hackney and the City of London. All three infections are notifiable to Public Health England (PHE) local health protection teams under the Health Protection (Notification) Regulations 2010, in order to monitor and contain potential outbreaks.

2.2. Causes and risk factors

2.2.1. Measles

Measles is caused by a highly contagious virus, which is spread by droplet transmission. This occurs when oral or nasal secretions infected with the virus enter the eyes, nose or mouth of another person, most commonly during coughing or sneezing. [5] Measles mainly causes a mild illness, but it can lead to serious and potentially life-threatening complications, such as: otitis media (middle-ear infection) in 7-9% of cases; secondary bacterial pneumonia in up to 6% of cases; and, rarely, encephalitis, meningitis and subacute sclerosing pan-encephalitis. [6]

Measles mainly affects children. The highest risk is among infants, children under the age of five, those who have a weakened immune system or malnutrition, and during pregnancy. [7] In pregnancy, contracting measles can lead to miscarriage, stillbirth and preterm delivery. [8]

Those who are unvaccinated remain the largest at-risk group, with recent outbreaks occurring in communities where vaccination coverage is low. This includes the Orthodox Jewish Charedi community, where there are a large number of children under the age of five. [7]

2.2.2. Mumps

Mumps is caused by a highly contagious virus that mainly affects the salivary glands, but can sometimes affect other organs. It is spread through infected droplets of saliva that can be inhaled or picked up from surfaces and transferred into the mouth or nose. The common symptoms are fever, headache and swelling of salivary glands, but can (rarely) lead to more serious complications such as viral meningitis, swelling of ovaries and testicles, deafness, and infertility in males. [9]

Mumps tends to occur in young adults who did not receive the full course of MMR (measles, mumps, rubella) vaccine as part of the routine childhood vaccination schedule or did not have mumps as a child, tending to most commonly affect those over the age of 15. [10]

2.2.3. Pertussis (whooping cough)

Pertussis, otherwise known as 'whooping cough', is a respiratory infection caused by bacteria. The disease is spread via droplet transmission and infants are most at risk of the disease, in whom bouts of coughing can be followed by periods of apnoea[2] and seizures. The highest mortality rates from pertussis are in those under six months of age. [11] Pneumonia is a known complication, and, rarely, seizures and encephalopathy can also occur. [11]

Again, as pertussis is a vaccine-preventable disease, those who are unvaccinated remain at highest risk of developing the disease.

For all vaccine-preventable childhood infections, travel and migration are significant risk factors. Vaccination programmes vary from country to country, and children entering the UK may not have completed the immunisation schedule according to UK standards.

2.3. Local data – numbers and rates

Table 1 presents the numbers and incidence rates of measles, mumps and pertussis in Hackney and the City of London between 2012 and 2016. Please see Section 2.5 for further information on rates over time.

[2] Apnoea is the temporary stopping of breathing.

Table 1: Number and incidence rate of measles, mumps and pertussis cases in Hackney and the City of London (all ages, per 100,000 population, 2012–16)

	Hackney		City of London	
	Number	**Rate per 100,000**	**Number**	**Rate per 100,000**
Measles	227	80	0	0
Mumps	108	39	<5	Not available
Pertussis	216	77	<5	Not available

Source: Public Health England NENCL Health Protection Team.
Note: Numbers are based on notifications to the NENCL Health Protection Team. [12] The NENCL Health Protection Team reports cases that are confirmed and probable.

2.4. Health inequalities

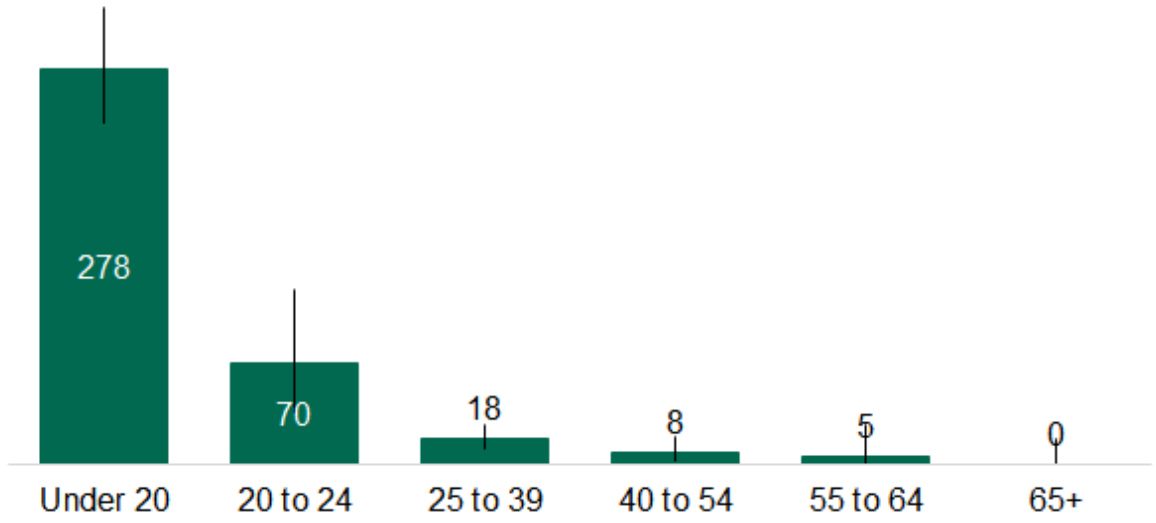
2.4.1. Age

The incidence of measles is more common in children and young people (aged under 20) than all other age groups (Figure 1). Over two in five cases of measles in Hackney were in residents under four years of age.

Incidence of mumps is highest among those aged 20–24 years (Figure 2).

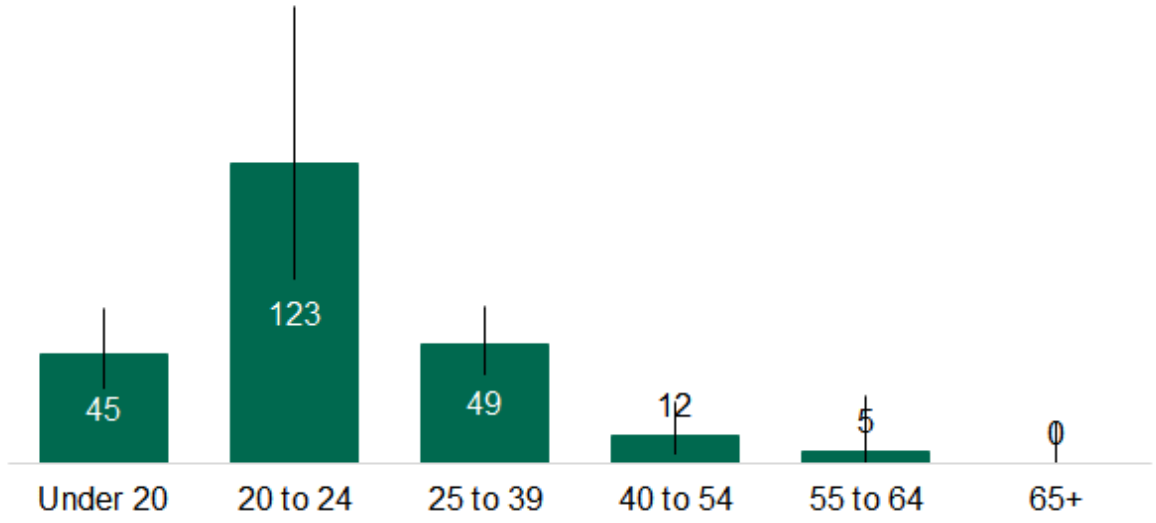
As with measles, the highest rates of pertussis are found in those under the age of 20 (Figure 3). Unlike measles, pertussis is not uncommon among working-age adults.

Figure 1: Incidence of reported cases of measles in Hackney and the City of London, by age (all ages, per 100,000 population, 2012–16)



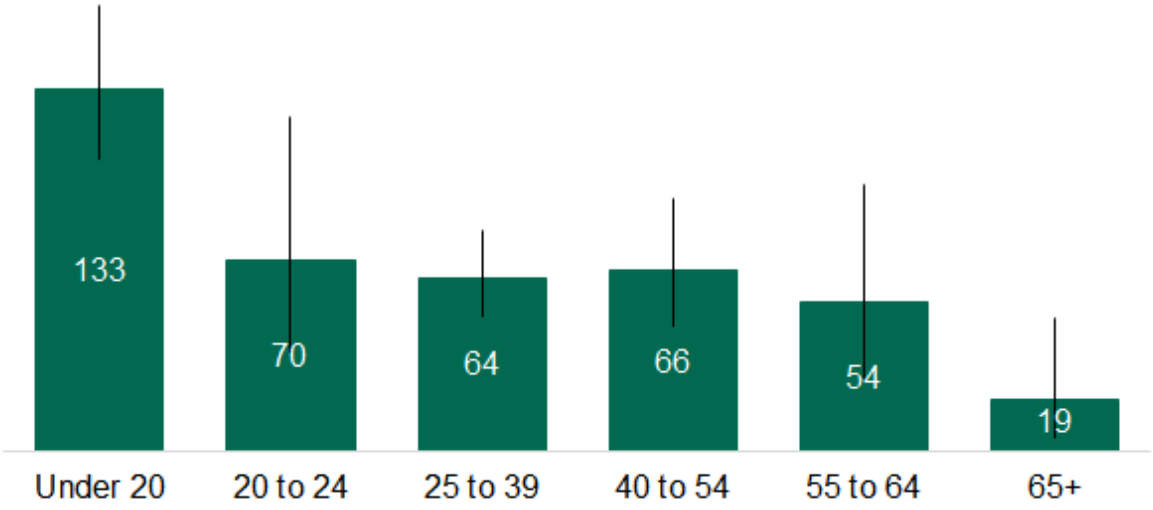
Source: Public Health England NENCL Health Protection Team. [12]

Figure 2: Incidence of reported cases of mumps in Hackney and the City of London, by age (per 100,000 population, 2012–16)



Source: Public Health England NENCL Health Protection Team. [12]

Figure 3: Incidence of reported cases of pertussis in Hackney and the City of London, by age (per 100,000 population, 2012–16)

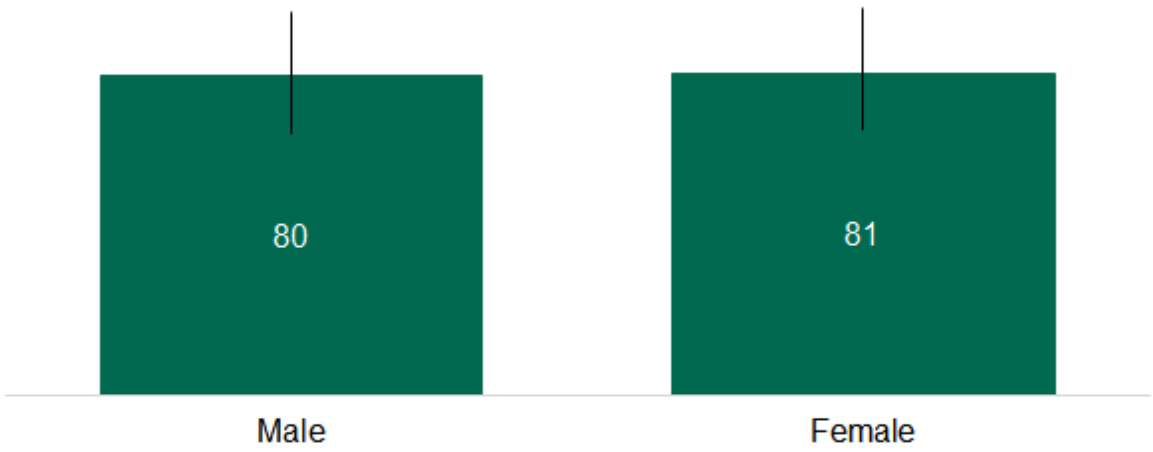


Source: Public Health England NENCL Health Protection Team. [12]

2.4.2. Gender

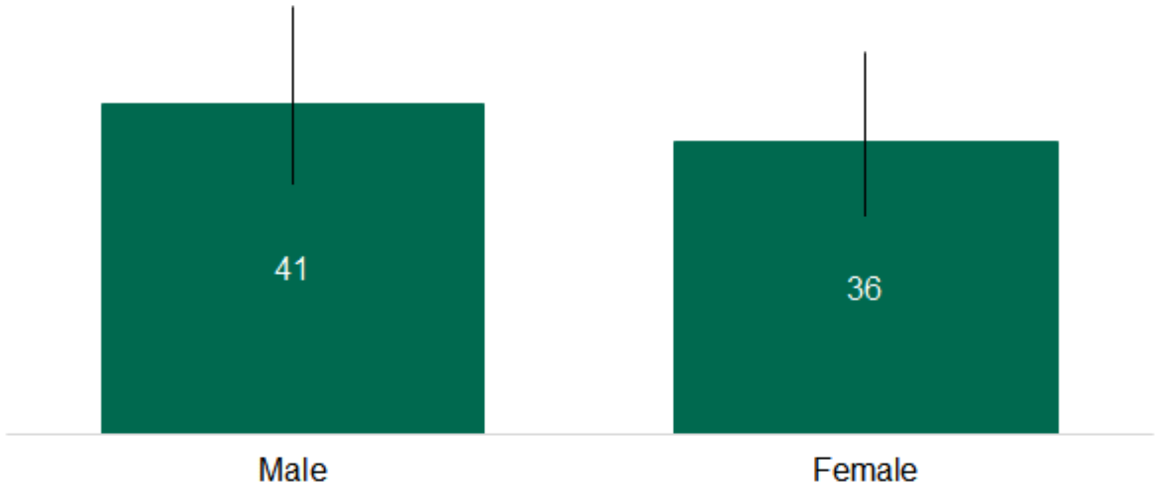
There is no significant difference in the rate of measles or mumps between men and women (Figure 4 and Figure 5). However, women are significantly more likely to be diagnosed with pertussis compared to men, but the reasons for this are not fully understood (Figure 6).

Figure 4: Incidence of reported cases of measles in Hackney and the City of London, by gender (all ages, per 100,000 population, 2012–16)



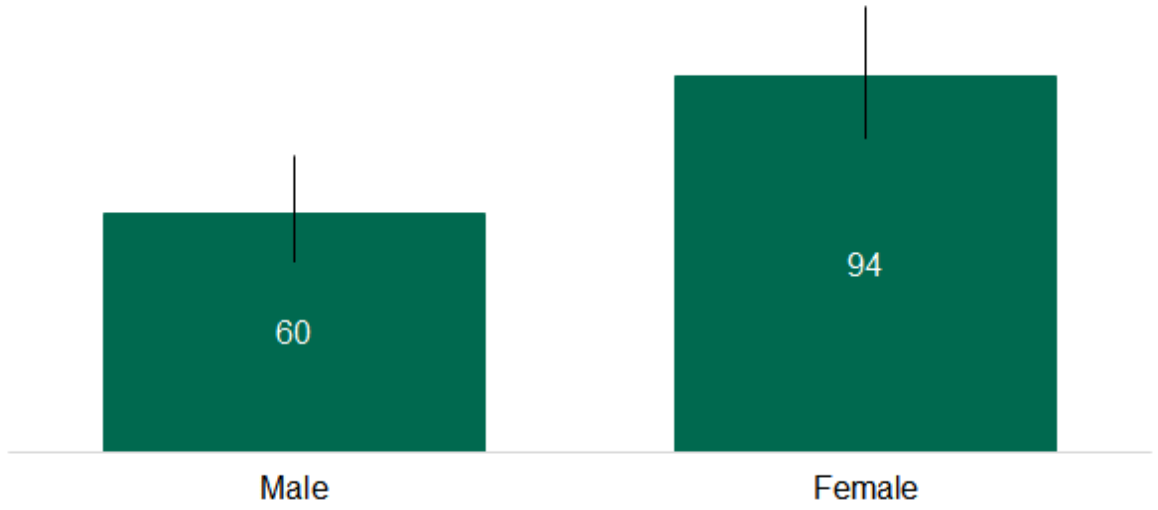
Source: Public Health England NENCL Health Protection Team. [12]

Figure 5: Incidence of reported cases of mumps in Hackney and the City of London, by gender (all ages, per 100,000 population, 2012–16)



Source: Public Health England NENCL Health Protection Team. [12]

Figure 6: *Incidence of reported cases of pertussis in Hackney and the City of London, by gender (all ages, per 100,000 population, 2012–16)*



Source: Public Health England NENCL Health Protection Team. [12]

2.4.3. Ethnicity

Due to ethnicity being poorly recorded in the available data, it is not possible to compare measles, mumps or pertussis across different ethnic groups.

2.4.4. Socio-economic disadvantage

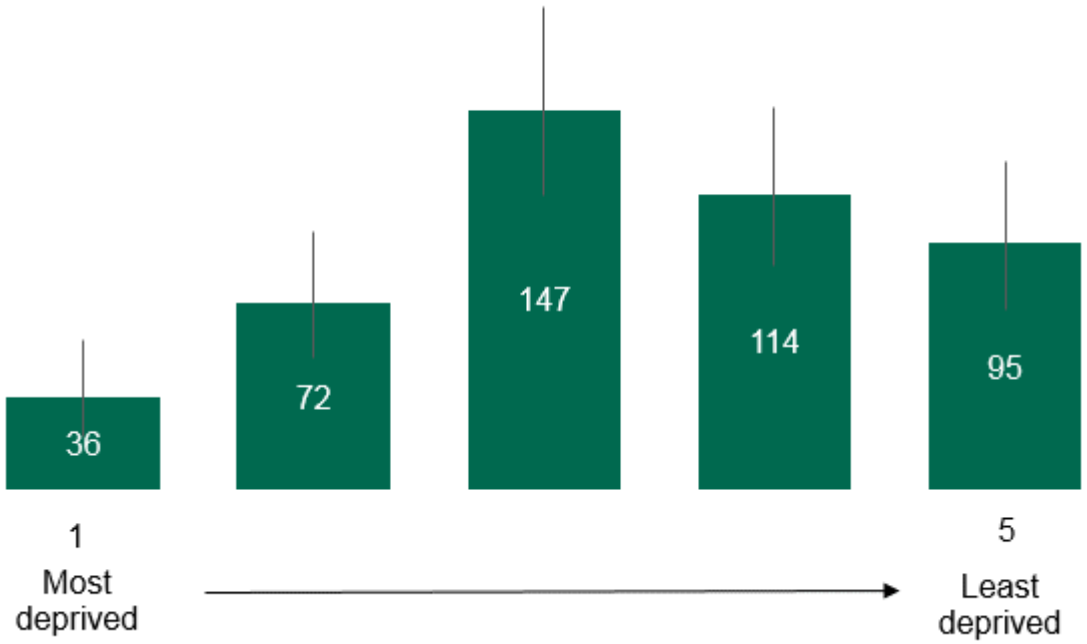
There does not appear to be a clear pattern in the rate of measles by local area deprivation (Figure 7).

There are no statistically significant differences in the rate of mumps by deprivation quintiles (Figure 8).

Similarly, there does not appear to be a clear association between the rate of diagnosis of pertussis and local area deprivation (Figure 9).

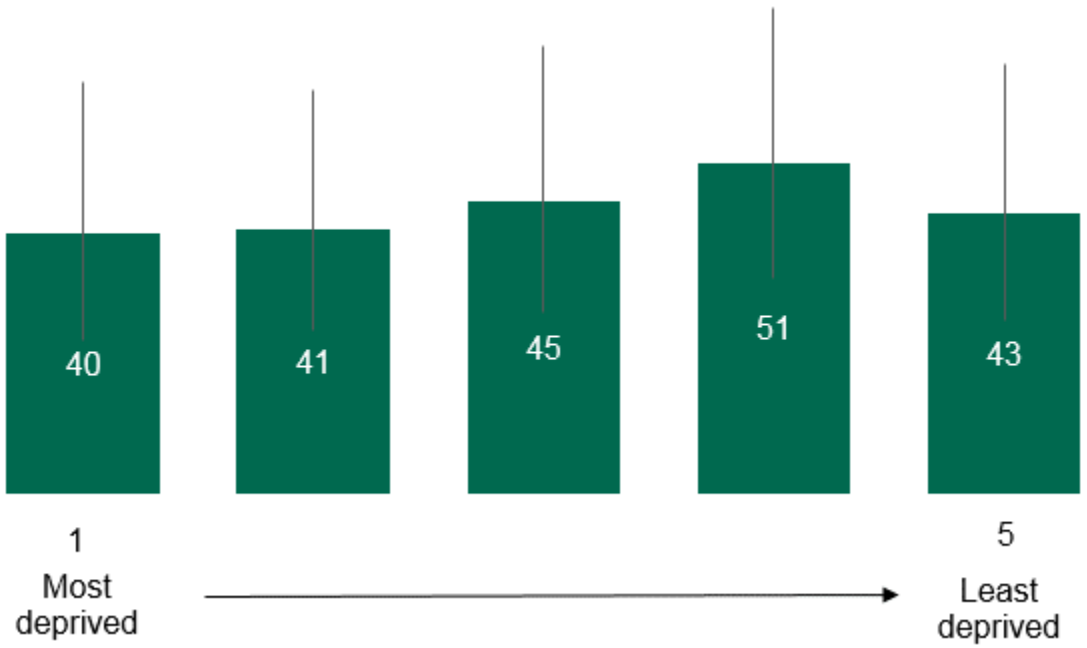
Due to small numbers, the City of London was not included in this analysis.

Figure 7: *Incidence of reported cases of measles in Hackney, by deprivation quintile (all ages, per 100,000 population, 2012–16)*



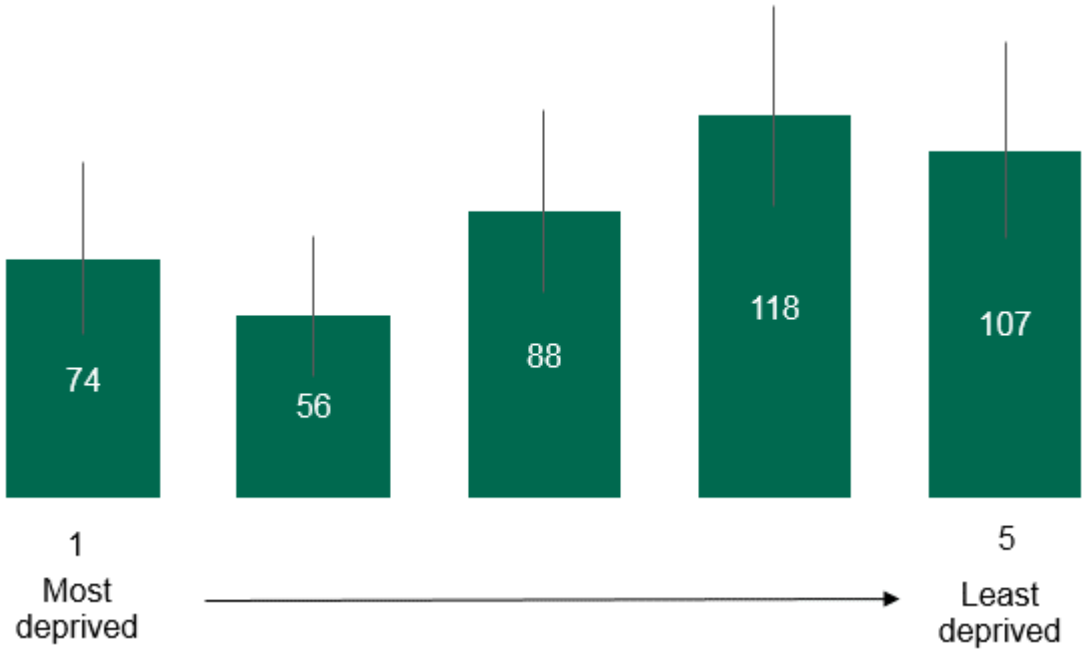
Source: Public Health England NENCL Health Protection Team. [12]
Note: The Index of Multiple Deprivation (IMD) uses many indicators across seven domains (income; Employment; health and disability; education, skills and training; barriers to housing; crime; and living environment) to provide an overall measure of deprivation for each area, relative to other areas within England. Areas have been ranked according to their IMD score and split into five groups – from the 20% most deprived areas (1) to the 20% least deprived (5).

Figure 8: Incidence of reported cases of mumps in Hackney, by deprivation quintile (all ages, per 100,000 population, 2012–16)



Source: Public Health England NENCL Health Protection Team. [12]
Note: The Index of Multiple Deprivation (IMD) uses many indicators across seven domains (income; employment;, health and disability; education, skills and training; barriers to housing; crime; and living environment) to provide an overall measure of deprivation for each area, relative to other areas within England. Areas have been ranked according to their IMD score and split into five groups – from the 20% most deprived areas (1) to the 20% least deprived (5).

Figure 9: *Incidence of reported cases of pertussis in Hackney, by deprivation quintile (all ages, per 100,000 population, 2012–16)*



Source: Public Health England NENCL Health Protection Team. [12]
Note: The Index of Multiple Deprivation (IMD) uses many indicators across seven domains (income; employment; health and disability; education, skills and training; barriers to housing; crime; and living environment) to provide an overall measure of deprivation for each area, relative to other areas within England. Areas have been ranked according to their IMD score and split into five groups – from the 20% most deprived areas (1) to the 20% least deprived (5).

2.4.5. Locations within Hackney and the City

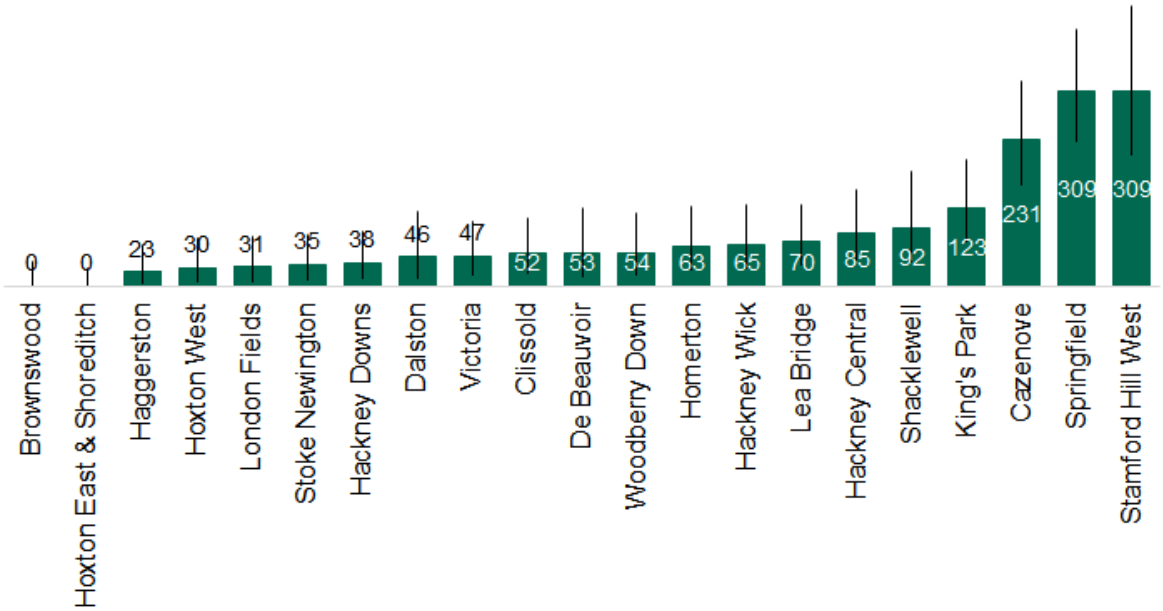
Data are presented below by ward for Hackney. Ward-level data for the City are not currently available.

Between 2012 and 2016, the wards with the highest rates of measles diagnosis were in the north of the borough – in Cazenove, Springfield and Stamford Hill West (Figure 10). These are areas with the largest concentration of Hackney's Orthodox Jewish Charedi community.

The rate of diagnosis of mumps does not vary significantly across most of Hackney (Figure 11). Woodberry Down has the lowest rate and Homerton the highest.

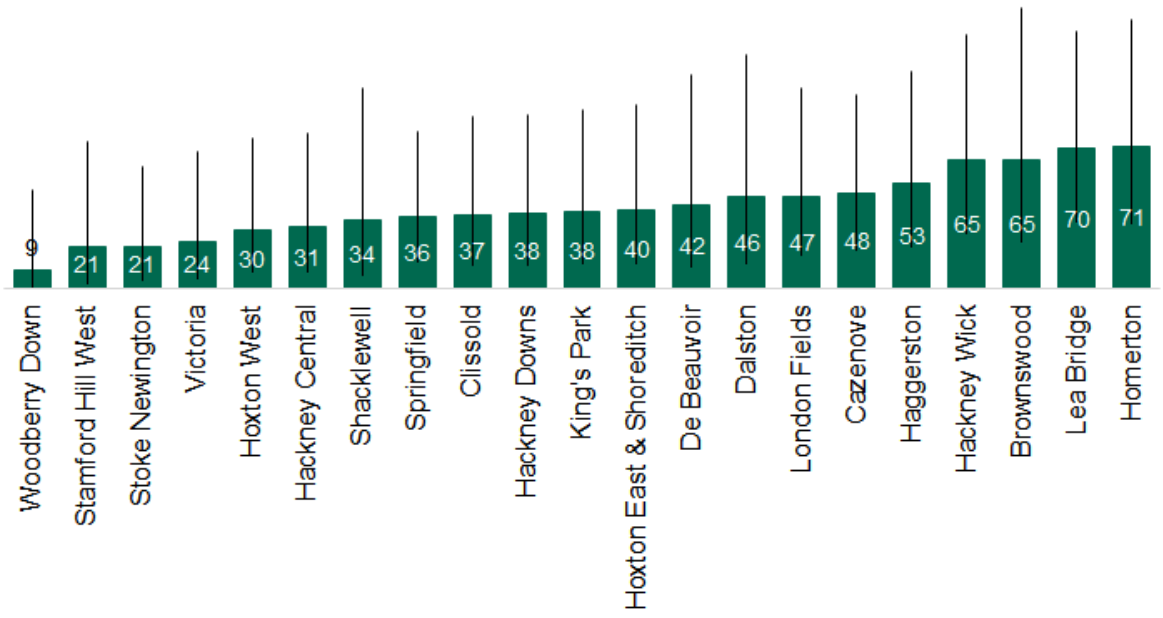
The highest rates of pertussis are found in Victoria ward and the lowest in De Beauvoir, as can be seen in Figure 12.

Figure 10: *Incidence of reported cases of measles in Hackney, by ward (all ages, per 100,000 population, 2012–16)*



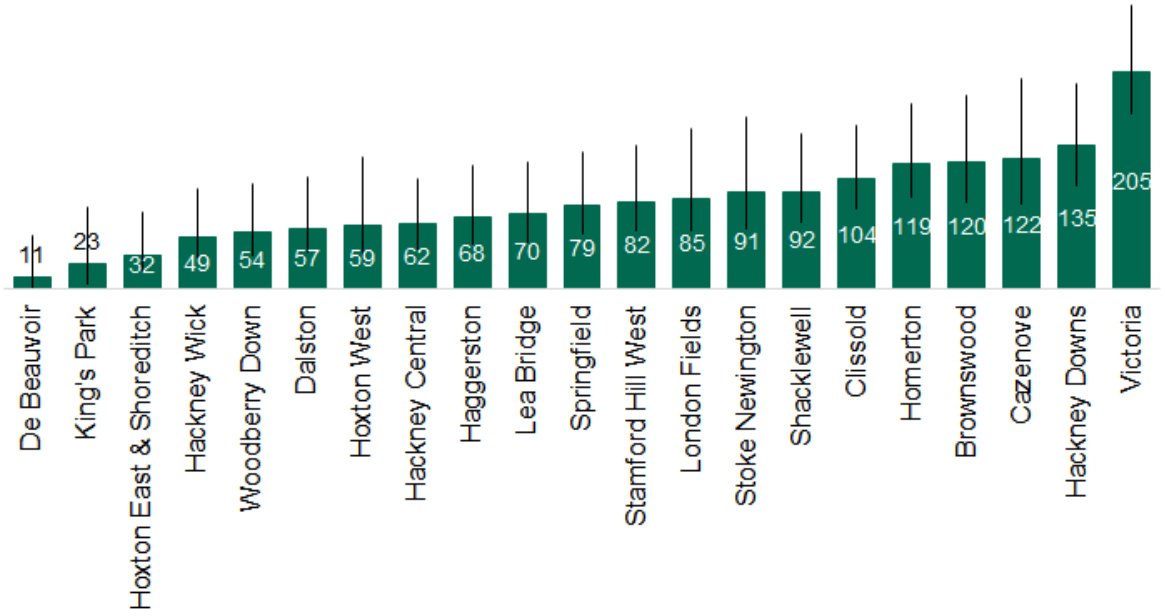
Source: Public Health England NENCL Health Protection Team, [12]
Note: Ward population estimates are based on Greater London Authority (GLA) ward population projections 2014.

Figure 11: *Incidence of reported cases of mumps in Hackney, by ward (all ages, per 100,000 population, 2012–16)*



Source: Public Health England NENCL Health Protection Team. [12]
Note: Ward population estimates are based on GLA ward population projections 2014.

Figure 12: Incidence of reported cases of pertussis in Hackney, by ward (all ages, per 100,000 population, 2012–16)



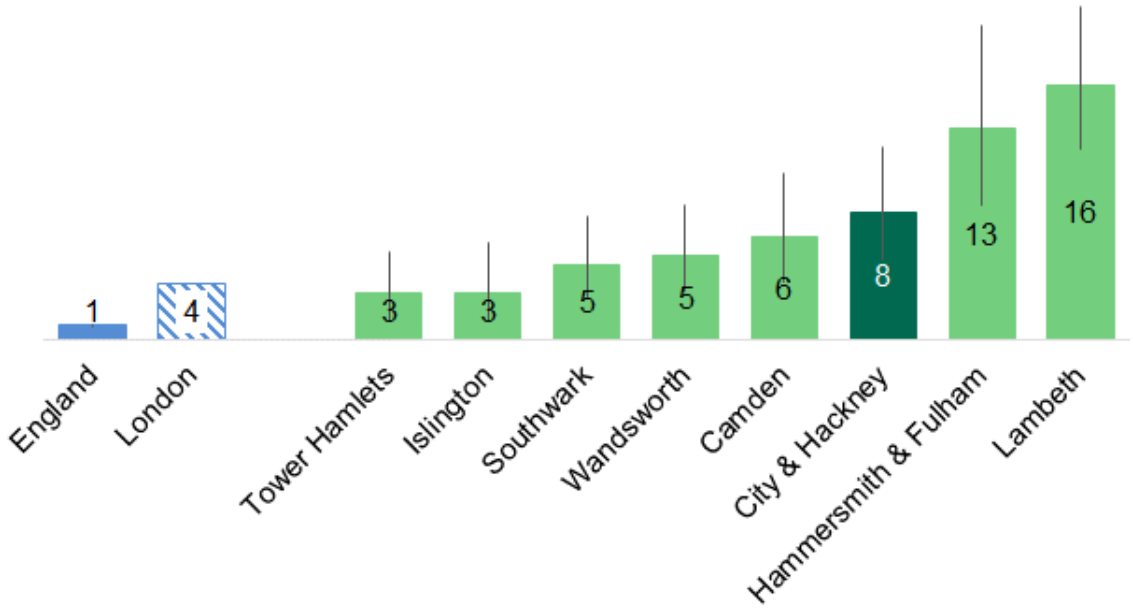
Source: Public Health England NENCL Health Protection Team. [12]
Note: Ward population estimates are based on GLA ward population projections 2014.

2.5. Comparisons with other areas and over time

Based on the latest available data, the incidence rate of measles in Hackney and the City of London is significantly higher than England, but similar to most of Hackney's statistical peers (Figure 13).

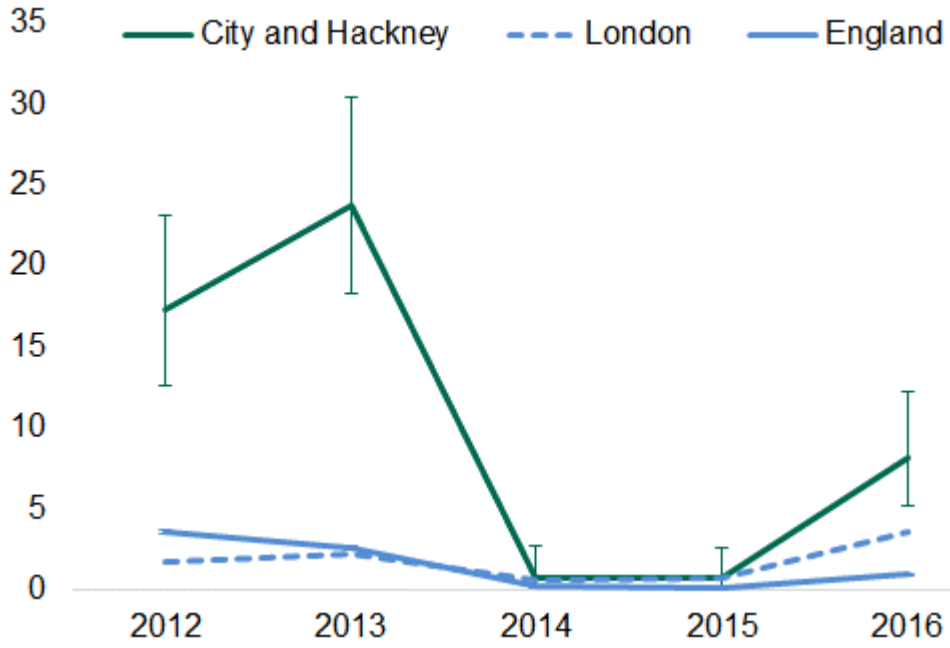
In 2014 and 2015, the measles incidence rate in Hackney and the City was comparable to London and England. However, earlier in 2012 and 2013, the local measles rate was significantly higher than the national average (Figure 14). This was due to an outbreak in the north of the borough. In the most recent data, for 2016, measles incidence is again above the London and national averages.

Figure 13: Incidence rate of measles (all ages, per 100,000 population, 2016)



Source: Public Health England health protection local indicators.
Note: The data for London are an aggregate of incidence in all London boroughs. Confidence intervals are not available for London.

Figure 14: Incidence rate of reported cases of measles over time (all ages, per 100,000 population, 2012 — 2016)



Source: Public Health England health protection local indicators.
Note: The trend for London is an aggregate of incidence in all London boroughs. Confidence intervals are not available for London.

2.6. Evidence and good practice

2.6.1. Prevention

The routine childhood immunisation schedule in England includes two doses of the MMR vaccine, one at 12 months and one at three years and four months. This vaccine provides protection against measles, mumps and rubella. [13] Nationally the target coverage rate for MMR is 95%. This means that to achieve herd immunity, 95% of the population must be vaccinated. Please refer to the 'Children and young people' JSNA chapter for further details of the routine childhood immunisation schedule.

Healthcare workers should provide satisfactory evidence of their immunity to measles prior to taking up a job in the NHS, to protect themselves and patients. [14]

Pertussis vaccination is also part of the routine childhood immunisation schedule, with a target coverage rate of 95%. It is given as part of the '6-in-1' vaccine which is given as a single dose. This replaced the '5-in-1' vaccine in 2017 which required four doses to be given before the age of five. Pertussis vaccination should also be offered to all pregnant women between 16 and 32 weeks of pregnancy as a single vaccine to protect their baby from pertussis from birth. [15].

2.6.2. Identification and early intervention

Clinicians are required to notify all suspected measles and mumps cases as soon as possible to their local HPT for surveillance purposes and so that prompt public health action can take place. Prompt oral fluid testing is available for suspected measles and mumps cases. [7]

Clinical suspicion of pertussis requires notification to the local HPT, which can advise on appropriate tests for confirmation and surveillance. [16]

2.6.3. Treatment

Treatment for measles and mumps is mainly supportive. Those who have been in contact with cases of measles or mumps and are not immunocompromised, aged under one year or pregnant are advised to receive the MMR vaccine. In cases where a pregnant, under one year old or immunocompromised person has had contact with an individual with measles, advice should be sought from the local HPT. [7]

Full details on the treatment of cases and contacts of measles and mumps, as well as how to manage outbreaks, are available in PHE guidelines. [7].

Treatment of pertussis involves the use of antibiotics if onset of the cough is within the previous 21 days. Antibiotic prophylaxis and/or vaccination may also be required for close contacts. [16]

2.7. Services and support available locally

2.7.1. Prevention

The routine childhood immunisation programme is offered at all GP practices in Hackney and the City of London, commissioned by NHS England. Uptake of both the MMR and '5 in 1' vaccinations (now replaced with '6 in 1' vaccinations) were lower than the national target coverage rate of 95%.[3] In 2016/17, only 76% of Hackney and City of London children had received three doses of the '5 in 1' vaccination by their first birthday. [17] During the same time period, only 75% of children had received both MMR vaccinations by the time of their fifth birthday. [17] 'Within borough' variation shows pockets of even lower uptake. Further detail is provided in the 'Children and young people' JSNA chapter.

2.7.2. Identification and early intervention

Support is provided by the NENCL Health Protection Team in all possible cases of measles, mumps or pertussis. This support includes the provision of testing kits and collection of samples where necessary.

2.7.3. Treatment

The NENCL Health Protection Team provides advice to GPs regarding who may need treatment if in close contact with someone with measles, mumps or pertussis. This includes advice on pregnant women, children under one year old, and those who are immunocompromised.

2.8. Service gaps and opportunities

As a consequence of below target vaccine uptake in some areas of Hackney in particular, outbreaks of measles, mumps and pertussis are still being seen locally. This is due to a lack of herd immunity. Targeted work in areas with the lowest uptake could prevent future outbreaks and protect the wider population from infection.

3. Vaccine-preventable respiratory infections

3.1. Introduction: focusing on influenza and tuberculosis

Respiratory infections are a major cause of hospitalisation, morbidity and mortality in the UK, particularly among older and vulnerable people with comorbidities. As such, they are a significant contributor to health inequalities. Minor coughs, colds and influenza (flu) are the most common reasons for sickness absence, representing one fifth of all days lost from work. [18]

[3] The '5 in 1' vaccination is for diphtheria, tetanus, pertussis, polio, and haemophilus (DTaP/IPV/Hib) and children should receive three doses by their first birthday.

Box 3: *Common respiratory infections*

Upper respiratory tract infection – caused by a number of different viruses leading to symptoms of the common cold, such as runny nose, cough, sore throat and sneezing. Represent the majority of the burden of respiratory infection and almost always self-limiting.

Lower respiratory tract infection – caused either by a bacteria or a virus, leading to symptoms such as cough, fever and breathlessness. More severe than an upper respiratory tract infection, but still usually self-limiting.

Pneumonia – a lower respiratory tract infection caused by a bacteria and often leading to more severe symptoms.

The focus of this section is on tuberculosis (TB) and influenza. These are respiratory infections for which vaccines are available, and are therefore preventable, but yet still represent a significant burden of disease.

3.2. Causes and risk factors

3.2.1. Seasonal influenza (flu)

Seasonal influenza (often referred to as flu) is a respiratory viral infection that causes fever, chills, sore throat, cough, muscle ache, headache and fatigue. It is transmitted through droplet infection; by people coughing and sneezing and by touching surfaces where droplets containing the virus have been deposited. [19]

Influenza can be contracted by anyone; those who are otherwise fit and healthy are likely to fully recover within two to seven days without medical attention. However, in the elderly or very young, or otherwise immunocompromised, complications of influenza such as secondary bacterial pneumonia (caused by staphylococcus aureus or streptococcus pneumoniae) can be life threatening. [20]

Those at highest clinical risk of contracting seasonal influenza are also more likely to develop serious complications, or face a more severe illness due to the virus. This includes: those with a respiratory illness or other chronic conditions such as diabetes or heart disease; immunocompromised people; those over the age of 65; and pregnant women. People living in long-stay institutions, such as care homes, are also likely to be at higher risk of infection due to its highly contagious nature, leading to potential outbreaks within these settings. [20]

Frontline healthcare staff are at increased risk of seasonal influenza as their job brings them into regular direct contact with carriers of the virus. [20]

Seasonal influenza typically peaks in winter in the UK, between December and March, and is caused by different strains of the virus each year. [20]

3.2.2. Tuberculosis (TB)

TB is an infectious disease that is caused by bacteria called mycobacterium tuberculosis. It is spread through the inhalation of droplets spread by an infected person coughing and sneezing, and is a disease that mainly affects the lungs (pulmonary TB). However, in rare cases, TB can develop in other organs of the body, such as the abdomen, bones and glands. [21]

When someone is infected with TB, it is usually killed by the body's immune system. However, in some people this fails to happen and, in the case of pulmonary TB, symptoms develop such as weight loss, fever, night sweats, reduced appetite and persistent cough (which may contain blood). This is known as active TB infection. [22] Other people are able to control the infection so that they do not have any symptoms, but the disease remains in the body at low levels. This is known as latent TB. This can go on to become active TB if the immune system is weakened due to causes such as HIV infection, malnutrition, diabetes or taking medication to suppress the immune system. [22]

The biggest risk factor in the UK for developing TB is being born in a country with a high prevalence of the disease, or prolonged travel to such countries. In the UK, almost 75% of cases of TB are in non-UK born residents. [23] The most common countries of origin of TB cases in the UK are Somalia and other sub-Saharan African countries, India, Pakistan and Bangladesh. [23]

TB is strongly associated with deprivation, including poor housing and living conditions, overcrowding and poor nutrition. The risk of TB is also higher in many groups that are socially marginalised – such as people with drug and alcohol addiction, prisoners, sex workers, homeless people and those with mental health illness – making TB a disease related to significant health inequalities. [24] Those with at least one adverse social factor are at increased risk of multi-drug resistant TB and face higher morbidity and mortality. [23]

3.3. Local data – numbers and rates

Seasonal influenza is not a notifiable disease, and as such local incidence data are not available. However, PHE does monitor influenza-like illness recorded by GPs, as well as outbreaks of respiratory illnesses in institutional settings such as schools, care homes and hospitals. [25] In the 2017/18 season, moderate to high levels of influenza activity were observed in the UK with co-circulation of influenza B and influenza A (H3). [26]

In 2016, there were 70 cases of TB in Hackney. The incidence rate in Hackney was 26 per 100,000 population. There were fewer than five cases of TB in the City of London.

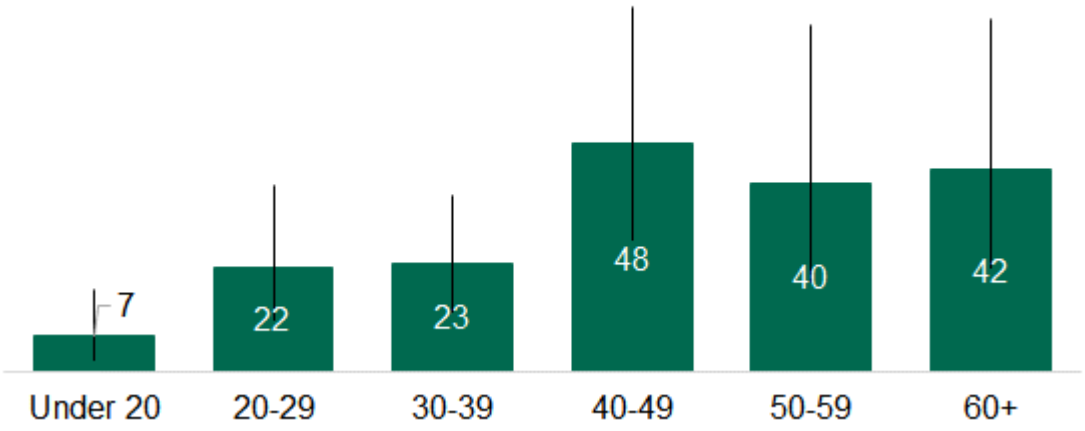
3.4. Health inequalities

3.4.1. Age

In the 2017 to 2018 season, moderate to high levels of influenza activity were observed in the UK, with co-circulation of influenza B and influenza A (H3). The impact of this co-circulation was predominantly seen in older adults, with a consistent pattern of outbreaks in care homes. In addition, high hospital admissions, particularly among older adults, were observed. [26] Local data on influenza are not available.

Figure 15 shows that incidence of TB is higher in older age groups, and least common in the under-20 age group. As discussed earlier, some people are able to control their TB infection so that they do not have any symptoms, but the disease remains in the body at low levels. This is known as latent TB. This can go on to become active TB if the immune system is weakened due to causes such as HIV infection, malnutrition, diabetes or taking medication to suppress the immune system, particularly in older age. [22]

Figure 15: Incidence rate of TB in Hackney residents, by age (per 100,000 population, 2016)



Source: Public Health England field epidemiology service.

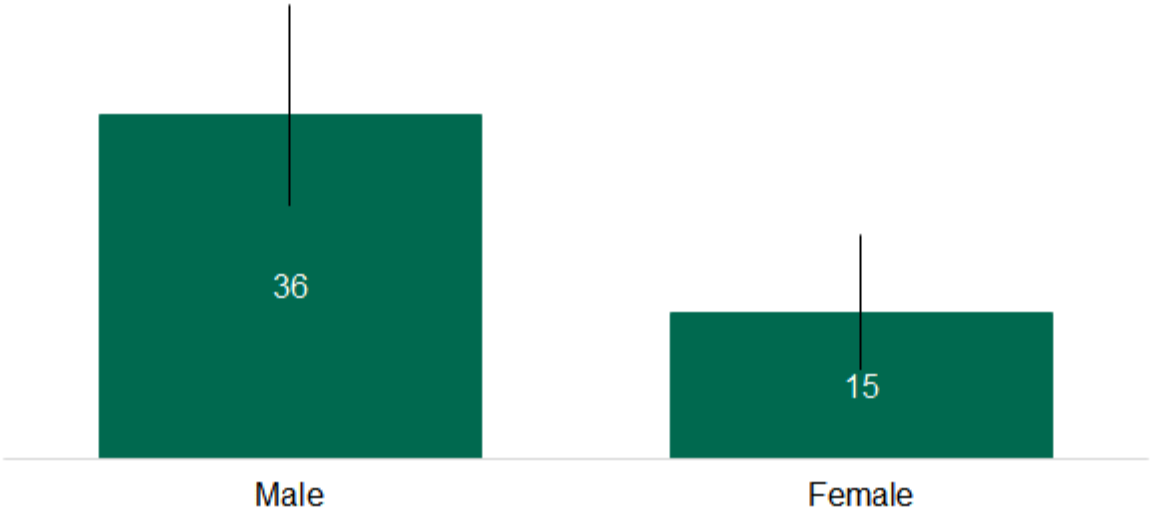
3.4.2. Gender

Women are more likely than men to be caregivers and to work in healthcare occupations, which increases the likelihood of their being exposed to influenza. Pregnancy can also alter the response to influenza, particularly in the second and third trimesters, when the severity of the disease is worse compared to other populations. *[27]*

Men in Hackney are significantly more like to be diagnosed with TB compared with women (

Figure 16). This reflects national data for 2016, when 59% of TB cases were in men. *[23]*

Figure 16: *Incidence rate of TB in Hackney residents, by gender (all ages, per 100,000 population, 2016)*



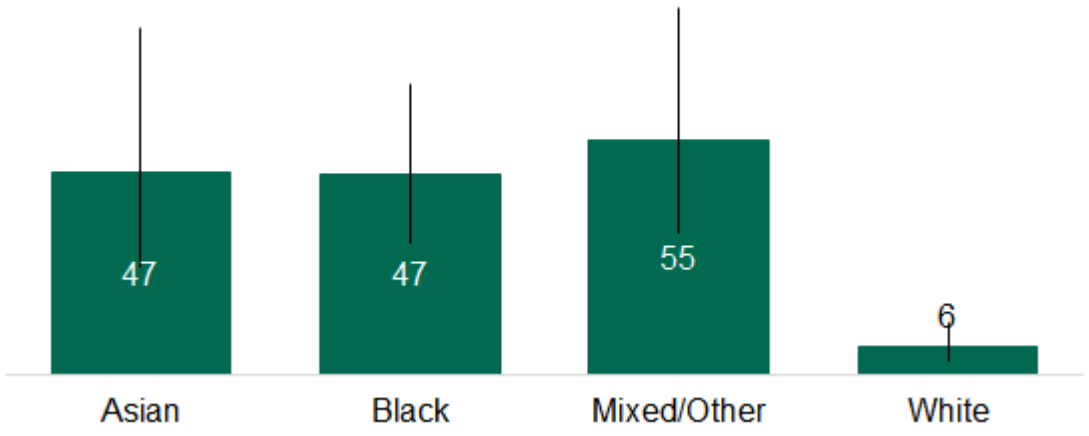
Source: Public Health England field epidemiology service.

3.4.3. Ethnicity

A study in Canada found that White and Black populations were less likely to obtain a seasonal flu vaccination than other ethnic groups, which may put them at higher risk of influenza. [28]

White Hackney residents are significantly less likely to be diagnosed with TB compared with the local Black, Asian and Minority Ethnic (BAME) population (Figure 17). This is at least in part likely to reflect a higher risk of TB in the non-UK born population

Figure 17: Incidence rate of TB in Hackney residents, by ethnicity (all ages, per 100,000 population, 2016)



Source: Public Health England field epidemiology service.

3.4.4. Social-economic disadvantage

There are slightly lower influenza vaccination rates in those living in deprived areas, which may increase the likelihood of developing seasonal influenza. [29]

In 2016, the national rate of TB was 21.5 per 100,000 in the 10% of the population living in the most deprived areas, compared with only 3.4 per 100,000 in the 10% of the population living in the least deprived areas, with a clear trend of an increasing rate of TB with increasing deprivation. [23]

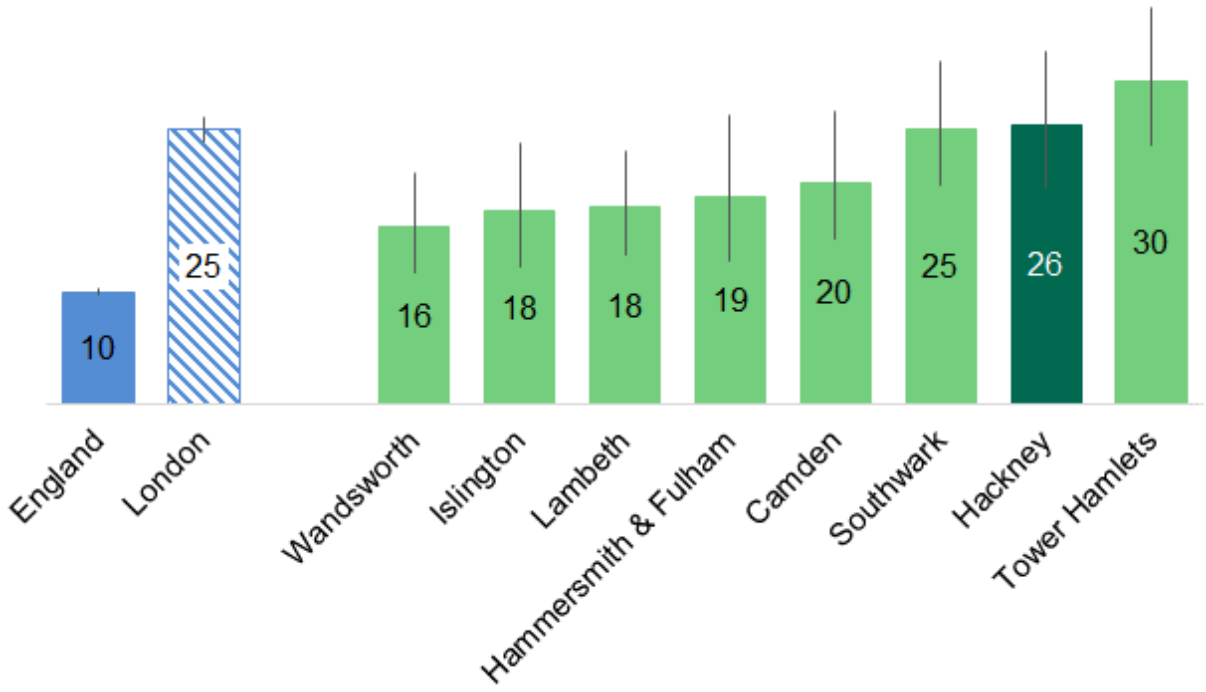
3.5. Comparisons with other areas and over time

In 2016, Hackney had a significantly higher incidence of TB compared with England. Hackney is at the higher end of its statistical peers on this measure, but differences between most similar areas are not significant (Figure 18).

In London and England, TB incidence had been decreasing in recent years, but appeared to have plateaued in 2016 (Figure 19). Due to small numbers, it is not possible to ascertain whether TB incidence in Hackney changed significantly year on year over this period, but the rate in 2015 was significantly lower than in 2012.

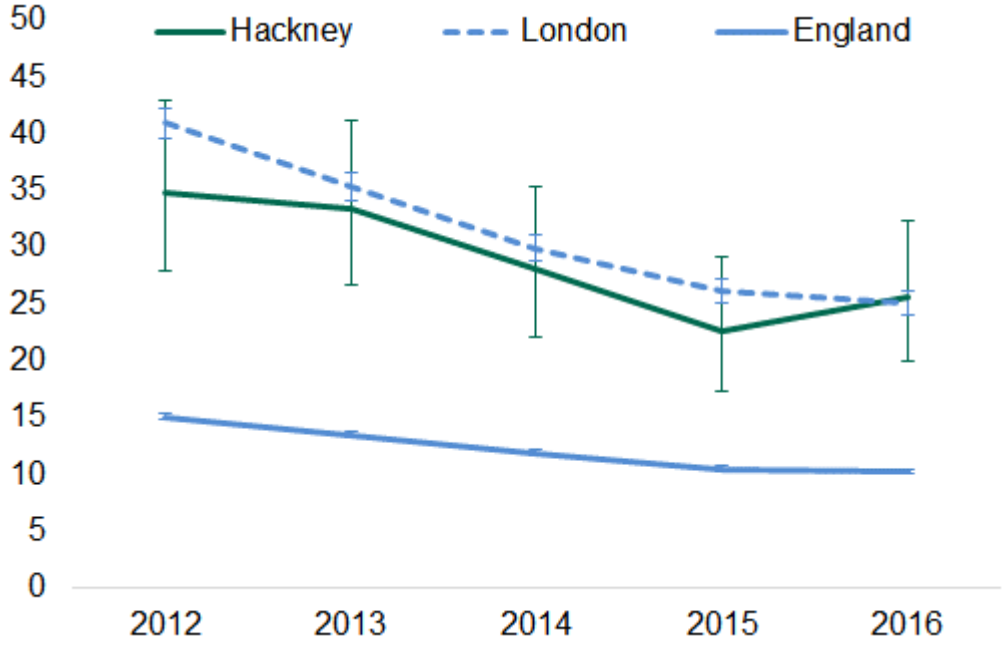
Comparable data for the City of London are not available.

Figure 18: Incidence rate of TB (all ages, per 100,000 population, 2016)



Source: Public Health England field epidemiology service.

Figure 19: *Incidence rate of TB over time (all ages, per 100,000 population, 2016)*



Source: Public Health England field epidemiology service.

3.6. Evidence and good practice

Public Health England (PHE) and NHS England have published a collaborative TB strategy for England that sets out evidence-based interventions for the prevention, early identification and treatment of TB. [30]

3.6.1. Prevention

The national seasonal influenza vaccination programme is launched each year, based on the advice of the Joint Committee on Vaccination and Immunisation. The programme aims to provide protection to those who are at higher risk of influenza-associated morbidity and mortality. [31] Box 4 shows the groups eligible for seasonal influenza immunisation for 2017/18.

Box 4: Seasonal influenza vaccination eligibility, 2017/18

- All children aged between two and eight on 31 August 2017
- All primary school children in previously piloted areas[4]
- All those aged six months to 65 years in clinical risk groups
- Pregnant women
- All aged 65 years and over
- Those in long-stay residential homes
- Carers
- Frontline health, care and social workers – supplied by their employers

Source: Public Health England, 2017. [31]

[4] The national seasonal influenza vaccination programme started to be extended to include children in 2013/14. Implementation for all children began in selected pilot primary schools.

Usually the live attenuated influenza vaccine is given. However, in some cases it is medically contraindicated, and so an inactivated influenza vaccine is given. Full guidance can be found in the influenza chapter of 'The Green Book' (the government's regularly updated information on immunisation against infectious diseases). [32] Vaccinations are available through GP practices and also the NHS Community Pharmacy Seasonal Influenza Vaccination Advanced Service for those aged 18 years and over.

In the UK, the BCG[5] vaccination is offered to those who are considered to be at highest risk of developing TB. [30] BCG vaccination increases a person's immunity to TB and protects against severe disease such as TB meningitis and disseminated TB. It does not, however, prevent primary infection or reactivation of latent pulmonary TB. [33] Box 5 summarises the main groups of people for whom BCG vaccine is recommended.

Box 5: Groups who should be offered BCG vaccination [34]

- All infants (aged 0 to 12 months) living in areas of the UK where the annual incidence of TB is 40 per 100,000 population or greater
- All infants with a parent or grandparent who was born in a country with a high incidence of TB
- Previously unvaccinated children with a parent or grandparent who was born in a country with a high incidence of TB
- Healthcare workers under the age of 35 years

Multi-disciplinary TB teams should identify and support TB education programmes for local professionals in contact with the general public and high-risk groups. This includes emergency department staff, GPs, and people working in housing support services, hostels, prisons and substance misuse projects. [35]

3.6.2. Identification and early intervention

Influenza is not a notifiable disease. However, PHE monitors influenza-like illness reported by GP practices to understand influenza activity and compare it to activity in previous years and to activity in other countries in order to aid early identification of epidemics. PHE also monitors outbreaks of respiratory illnesses in institutional settings such as schools, care homes and hospitals. [25] In the event of an outbreak in such settings, influenza is identified by sending viral swabs for PCR (polymerase chain reaction) testing.

'Active case finding' is a strategy to identify and treat people with TB who would not seek prompt medical attention otherwise, targeting groups at high risk of TB. This is carried out by performing chest X-rays. Screening tests for latent TB infection using the tuberculin skin test (Mantoux test) and interferon gamma release assays (IGRAs) are recommended for high-risk groups, such as close contacts of patients with TB, healthcare workers, immunosuppressed patients (such as those with HIV infection), and new entrants from countries with high incidence of TB. [30]

[5] BCG stands for Bacillus Calmette-Guérin, named after the scientists who discovered the vaccine.

3.6.3. Treatment

The management of influenza in primary care is mainly supportive. However, in institutional settings (such as hospitals, care homes and schools) antiviral medication for treatment and prophylaxis[6] can be used in certain circumstances for at-risk groups, according to National Institute for Health and Care Excellence (NICE) guidelines [36] [37] .

Treatment for TB is usually under the care of a specialist TB team, and consists of up to four antibiotics for a duration of at least six months. 'Directly observed therapy' (DOT) is recommended for those who may not be likely to adhere to treatment or have multidrug-resistant TB, or have previously been treated for TB. [35] Treatment of multidrug-resistant TB involves testing for antibiotics that are not resistant and using several of these as part of treatment concurrently. Multidrug-resistant TB is increasing worldwide and is a priority for the World Health Organization. [35]

NICE Guideline 33 provides full details of the recommended treatment of TB. [35]

3.7. Services and support available locally

3.7.1. Prevention

In 2017/18, uptake of flu vaccination in the eligible local population was below the national standards.

- Under half (44.2%) of those at risk between the age of six months and 65 years received a flu vaccination. This was short of the standard of 55%.
- 32% of pregnant women received a flu vaccination, again short of the standard of 55%.
- Among school-age children, vaccination coverage was 35.6% (the standard is 65%).
- In those 65 and over, vaccination coverage was 66.1% (compared with a standard of 75%). [38]
- Among healthcare workers at Homerton University Hospital NHS Foundation Trust the vaccination coverage was 70.7%, which is below the national target of 75%.

BCG vaccination against TB is currently recommended for all babies born in London, as incidence of TB is over 40 per 100,000. It is usually done immediately after birth at Homerton Hospital, but can also be given at a later date in the community.

3.7.2. Identification and early intervention

The NENCL Health Protection Team offers guidance and assistance in the event of influenza outbreaks in schools, hospitals and care settings. Guidance is provided with regards to isolation of affected individuals and good personal hygiene to prevent further transmission.

[6] Prophylaxis is the use of treatment to protect or defend against disease.

The NENCL Health Protection Team also offers guidance and assistance in all individual cases of TB and in outbreaks. In addition, a mobile X-ray unit, commissioned by NHS England, provides rapid screening in London for TB in high-risk groups such as those living in hostels and in areas where there are high numbers of immigrants working or residing. A nurse-led service exists for screening those who have been in contact with people with TB using the Mantoux or IGRA screening tests. Community screening for TB contacts in educational settings and the workplace occurs following identification of cases of TB. This is overseen by the NENCL Health Protection Team and delivered by local TB teams.

3.7.3. Treatment

Homerton University Hospital NHS Foundation Trust's TB service manages adult and paediatric cases of TB. It offers on-site and community treatment, adherence support and case workers for patients with complex needs.

City and Hackney Clinical Commissioning Group (CCG) funds accommodation for homeless people diagnosed with active TB who have no recourse to public funds. The CCG is now meeting this need. [35]

3.8. Service gaps and opportunities

Uptake of influenza vaccination needs to be increased across all groups that require vaccination.

4. Blood-borne viruses

4.1. Introduction: focusing on Hepatitis B and C

Blood-borne viruses (BBVs) are carried within the blood and are spread via blood-to-blood transmission. The most common BBVs in the UK are HIV (human immunodeficiency virus), hepatitis B and hepatitis C. This section will focus on hepatitis B and C; HIV is discussed in further detail in the forthcoming 'Sexual health' chapter of JSNA.

Hepatitis B and C are highly infectious and pose a significant public health concern. They disproportionately affect some of the most marginalised groups in society, such as intravenous drug users, migrants and men who have sex with men. It is estimated that 180,000 people are affected by chronic hepatitis B in the UK and 216,000 affected with chronic hepatitis C [39]. When left untreated they can lead to serious ill health such as scarring of the liver (known as cirrhosis), liver failure or reduced function, liver cancer and death. [40] [41] Treatment is often delayed as symptoms are often absent during acute infection, which leads to poorer outcomes and increases the ongoing transmission risk.

4.2. Causes and risk factors

Both hepatitis B and C are viral infections that are transmitted through contact with infected blood or other bodily fluids from one person to another. This can be through

use of an infected needle (such as intravenous drug use, tattooing or piercing), transmission through unprotected anal or vaginal sex, or during pregnancy or childbirth when an infected mother passes on the virus to her child. Risk factors for hepatitis B and C are presented in Box 6 and ; many are shared by both viruses.

Hepatitis B and C cause an acute infection when the virus attacks the liver to cause acute inflammation. For others it can cause fatigue, loss of appetite, muscle and joint pains, and jaundice (yellowing of skin and eyes).

Both hepatitis B and C can become chronic infections, which occurs when the acute virus is not cleared by the immune system. Hepatitis C is much more likely to develop into a chronic infection than hepatitis B – an estimated 20–80% of cases. [42] Chronic hepatitis B is far more likely to occur in people infected at a younger age – 90% of babies with acute hepatitis B go on to develop chronic infection, in comparison to 5–10% of adults. [40] Chronic hepatitis B and C can cause scarring of the liver (cirrhosis), and can lead to liver failure, which manifests with symptoms such as jaundice, accumulation of fluid in the abdomen and legs, confusion, and blood in stools and vomit. Chronic hepatitis can also lead to development of liver cancer (hepatocellular carcinoma).

There is no current vaccination against hepatitis C. Hepatitis B, however, is a vaccine-preventable disease, meaning that those at highest risk of infection can be protected. Furthermore, the earlier the treatment of chronic hepatitis B and C begins, the quicker the infection can be cleared from the body, leading to less liver damage.

As HIV and hepatitis B and C share the same routes of transmission, there is a risk of co-infection, with an estimated up to 15% of those with hepatitis C infection also having HIV, and co-infection with HIV in up to 20% of those with chronic hepatitis B. [43]

Box 6: Risk factors for acute hepatitis B infection. [44] [45]

- Born or raised in a country with intermediate or high prevalence of chronic hepatitis B: Africa, Asia, the Caribbean, Central and South America, Eastern and Southern Europe, the Middle East and the Pacific islands
- Babies born to mothers infected with hepatitis B
- People who have injected intravenous drugs
- Men who have sex with men
- Unprotected sex; in particular, commercial sex workers, people with multiple sexual partners, previous unprotected sex with contact in a high prevalence area
- Looked-after children and young people, including those living in care homes
- Prisoners, including young offenders
- Immigration detainees
- Close contacts of someone known to be chronically infected with hepatitis B

Box 7: *Risk factors for acute hepatitis C infection. [44]*

- People who have ever injected drugs
- People who received a blood transfusion before 1991 or blood products before 1986, when screening of blood donors for hepatitis C infection and heat treatment for inactivation of viruses were, respectively, introduced
- People born or brought up in a country with an intermediate or high prevalence (2% or greater) of chronic hepatitis C: Africa, Asia, the Caribbean, Central and South America, Eastern and Southern Europe, the Middle East and the Pacific islands
- Babies born to mothers infected with hepatitis C
- Prisoners, including young offenders
- Looked-after children and young people, including those living in care homes
- People living in hostels for the homeless or sleeping on the streets
- HIV-positive men who have sex with men
- Close contacts of someone known to be chronically infected with hepatitis C

4.3. Local data – numbers and rates

Between 2012 and 2016, there were 16 cases of acute hepatitis B identified in Hackney residents and fewer than five cases of acute hepatitis C. In the City of London, there were zero cases of acute hepatitis B and fewer than five cases of acute hepatitis C during the same time period. [12]

As of April 2017, 1,416 Hackney residents registered with a GP had been diagnosed with chronic hepatitis B, and 887 had been diagnosed with chronic hepatitis C. [7] In the City of London, 26 residents registered with a GP had been diagnosed with hepatitis B and 16 had been diagnosed with hepatitis C. [46]

It should be noted, however, that due to the asymptomatic nature of the infection, these numbers are likely an under-representation of the overall local disease burden.

4.4. Health inequalities

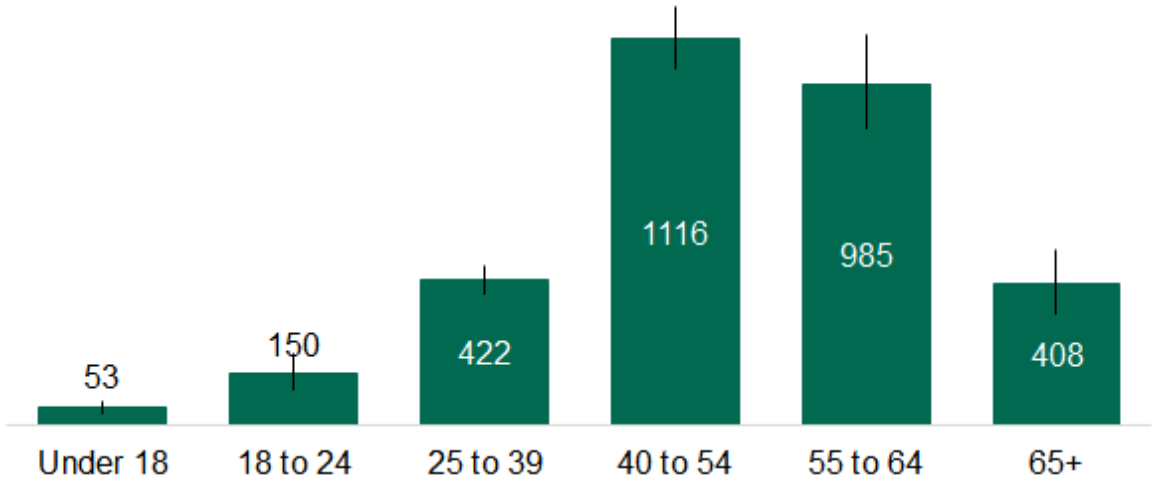
The inequalities in hepatitis C and B prevalence reported in this section are correlated to the risk factors for infection described in Box 6 and above.

[7] Extracted from the local GP register by Clinical Effectiveness Group (CEG), Blizard Institute, April 2017. Data cover residents of Hackney and the City registered with a GP in Hackney, the City of London, Tower Hamlets and Newham.

4.4.1. Age

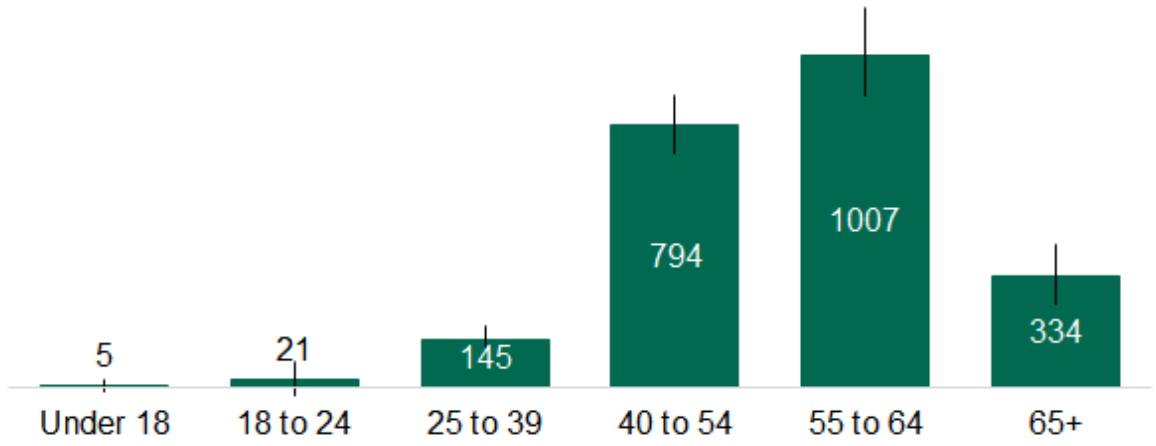
Older working-age adults (age 40–64) are more likely to be diagnosed with chronic hepatitis B and C than other age groups. Chronic hepatitis B and C are uncommon in people under the age of 24 (Figure 20 and Figure 21).

Figure 20: *Rate of GP patients recorded with chronic hepatitis B in Hackney and the City of London, by age (per 100,000 population, 2017)*



Source: Extracted from the local GP register by CEG, Blizard Institute, April 2017. Data cover residents of Hackney and the City registered with a GP in Hackney, the City of London, Tower Hamlets and Newham.

Figure 21: Rate of GP patients recorded with chronic hepatitis C in Hackney and the City of London, by age (per 100,000 population, 2017)

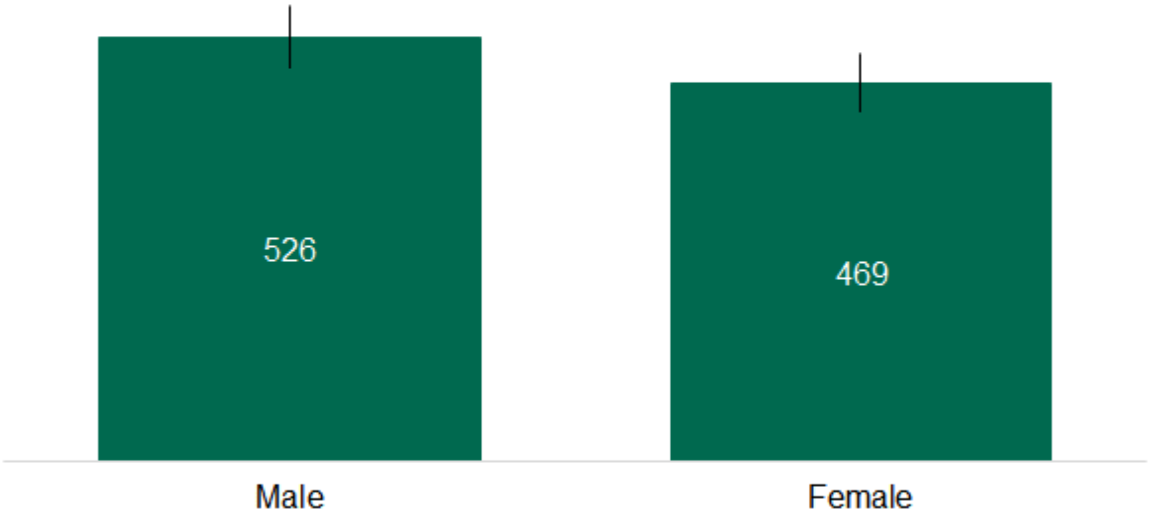


Source: Extracted from the local GP register by CEG, Blizard Institute, April 2017. Data cover residents of Hackney and the City registered with a GP in Hackney, the City of London, Tower Hamlets and Newham.

4.4.2. Gender

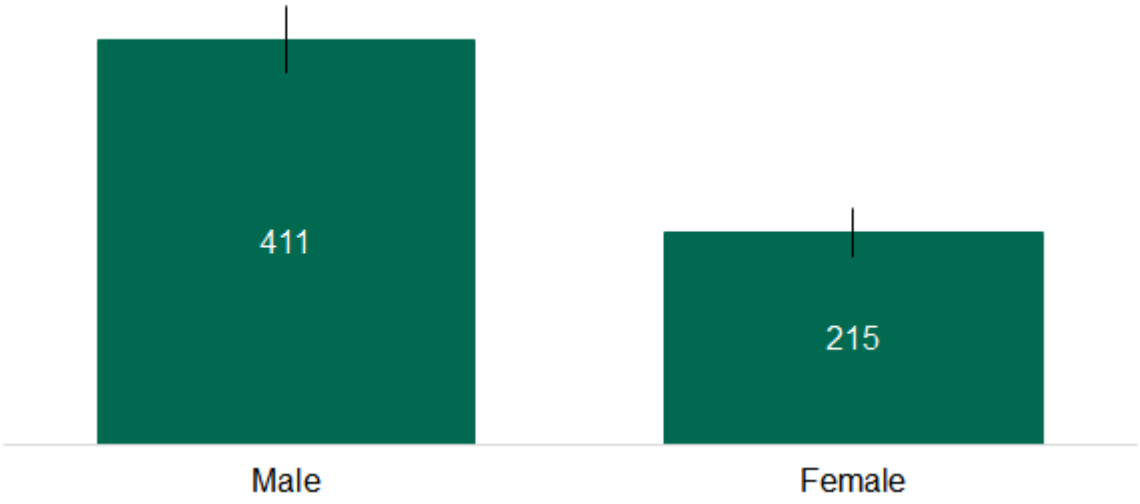
There is a small but significant difference between male and female residents with GP-recorded chronic hepatitis B, with men being more likely to be diagnosed (Figure 22). This gender disparity is much wider for patients diagnosed with chronic hepatitis C (Figure 23).

Figure 22: Rate of GP patients recorded with chronic hepatitis B in Hackney and the City of London, by gender (all ages, per 100,000 population, 2017)



Source: Extracted from the local GP register by CEG, Blizard Institute, April 2017. Data cover residents of Hackney and the City registered with a GP in Hackney, the City of London, Tower Hamlets and Newham.

Figure 23: Rate of GP patients recorded with chronic hepatitis C in Hackney and the City of London, by gender (all ages, per 100,000 population, 2017)



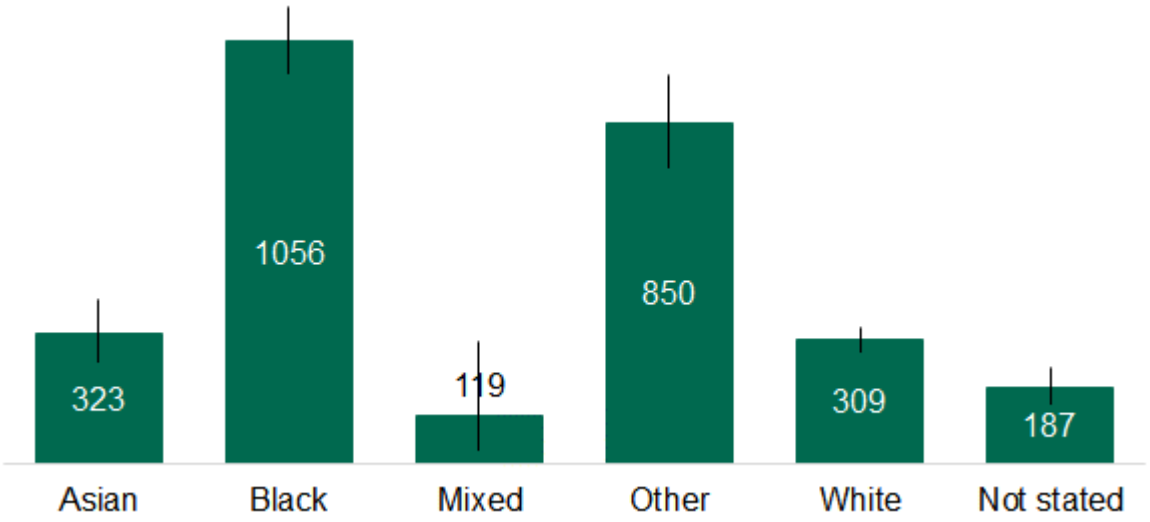
Source: Extracted from the local GP register by CEG, Blizard Institute, April 2017. Data cover residents of Hackney and the City registered with a GP in Hackney, the City of London, Tower Hamlets and Newham.

4.4.3. Ethnicity

There is a significantly higher rate of Black and 'Other' ethnicity residents with GP-recorded chronic hepatitis B (Figure 24).

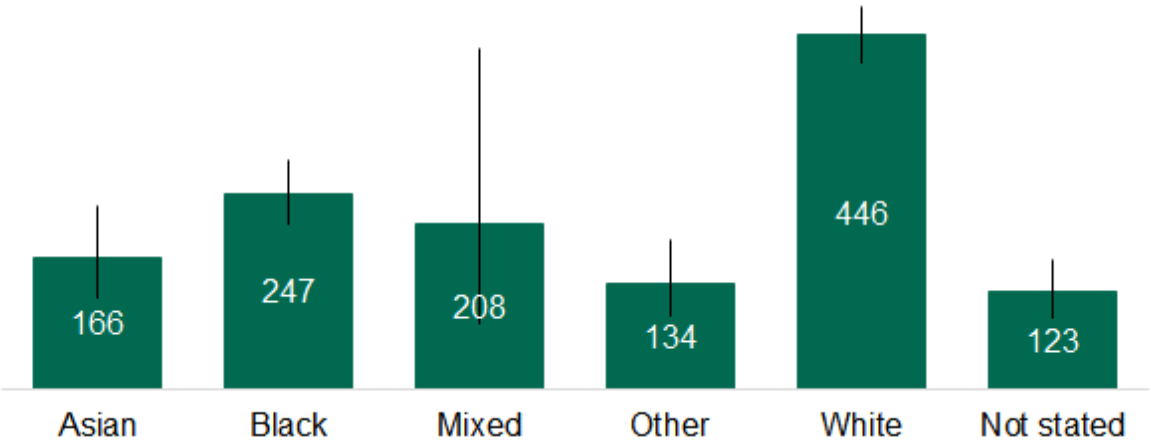
White residents are significantly more likely to be diagnosed with chronic hepatitis C compared to all other ethnic groups (Figure 25).

Figure 24: Rate of GP patients recorded with chronic hepatitis B in Hackney and the City of London, by ethnicity (all ages, per 100,000 population, 2017)



Source: Extracted from the local GP register by CEG, Blizard Institute, April 2017. Data cover residents of Hackney and the City registered with a GP in Hackney, the City of London, Tower Hamlets and Newham.

Figure 25: Rate of GP patients recorded with chronic hepatitis C in Hackney and the City of London, by ethnicity (all ages, per 100,000 population, 2017)

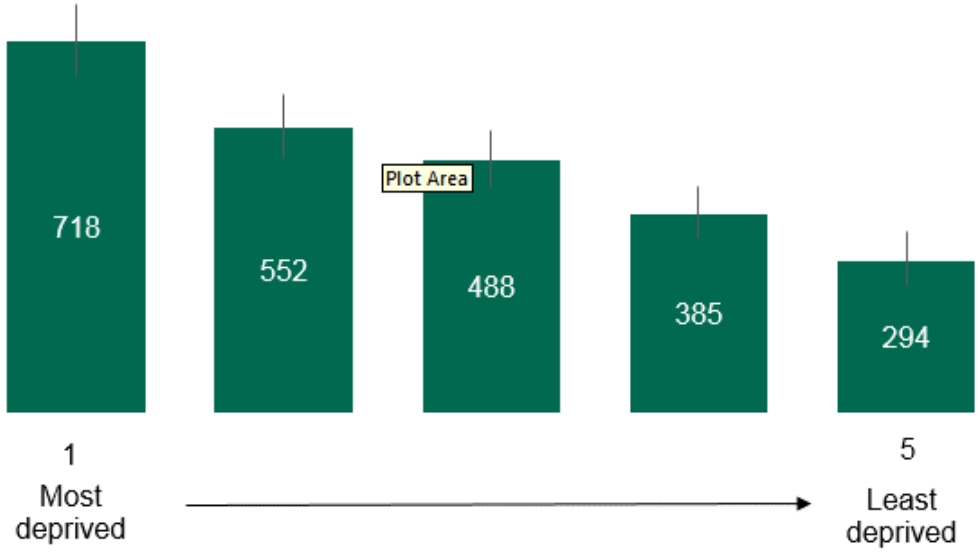


Source: Extracted from the local GP register by CEG, Blizard Institute, April 2017. Data cover residents of Hackney and the City registered with a GP in Hackney, the City of London, Tower Hamlets and Newham.

4.4.4. Socio-economic disadvantage

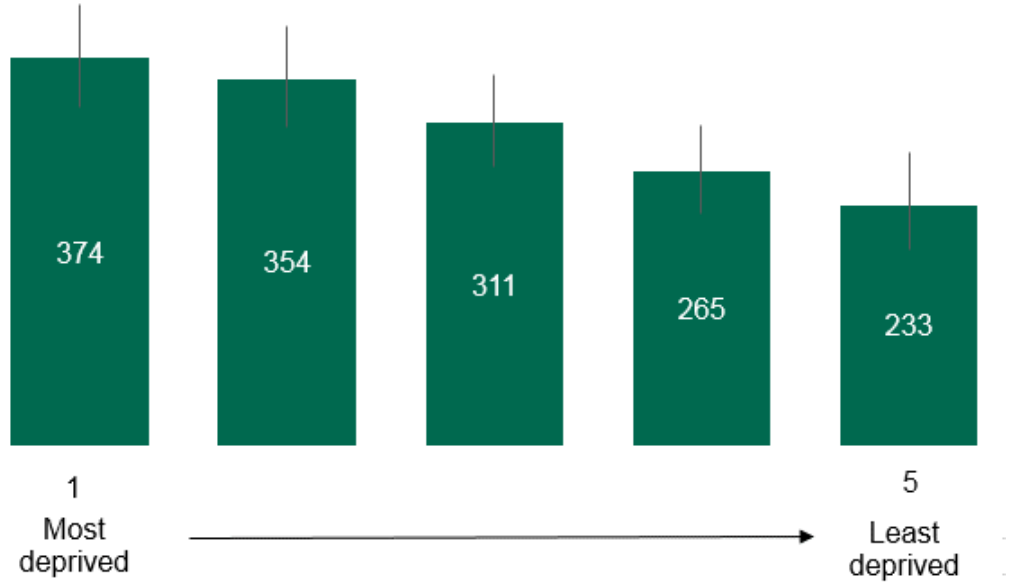
There is a clear social gradient in chronic hepatitis B and C diagnoses, with patients who live in the most deprived areas in Hackney and the City of London being significantly more likely to be diagnosed compared to those who live in the least deprived areas (Figure 26 and Figure 27).

Figure 26: Rate of GP patients recorded with chronic hepatitis B in Hackney, by deprivation quintile (all ages, per 100,000 population, 2017)



Source: Extracted from the local GP register by CEG, Blizard Institute, April 2017. Data cover residents of Hackney and the City registered with a GP in Hackney, the City of London, Tower Hamlets and Newham.
Note: The Index of Multiple Deprivation (IMD) uses many indicators across seven domains (income; employment; health and disability; education, skills and training; barriers to housing; crime; and living environment) to provide an overall measure of deprivation for each area, relative to other areas within England. Areas have been ranked according to their IMD score and split into five groups – from the 20% most deprived areas (1) to the 20% least deprived (5).

Figure 27: Rate of GP patients recorded with chronic hepatitis C in Hackney by deprivation quintile all ages, (per 100,000, 2017)



Source: Extracted from the local GP register by CEG, Blizard Institute, April 2017. Data cover residents of Hackney and the City registered with a GP in Hackney, the City of London, Tower Hamlets and Newham.
Note: The Index of Multiple Deprivation (IMD) uses many indicators across seven domains (income; employment; health and disability; education, skills and training; barriers to housing; crime; and living environment) to provide an overall measure of deprivation for each area, relative to other areas within England. Areas have been ranked according to their IMD score and split into five groups – from the 20% most deprived areas (1) to the 20% least deprived (5).

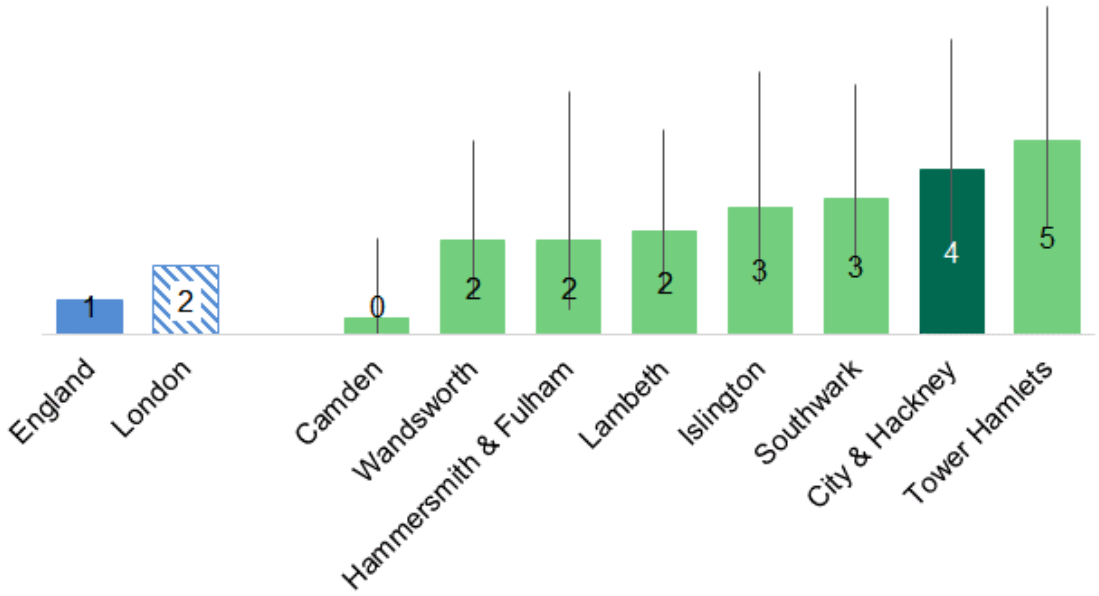
4.5. Comparisons with other areas and over time

Figure 28 and Figure 29 show the rate of acute hepatitis B and C in Hackney and the City of London compared to other areas. Data for previous years are not available, therefore it is not possible to ascertain a trend.

Figure 29 shows that the acute hepatitis C detection rate in Hackney and the City is low compared to Hackney's statistical peers.

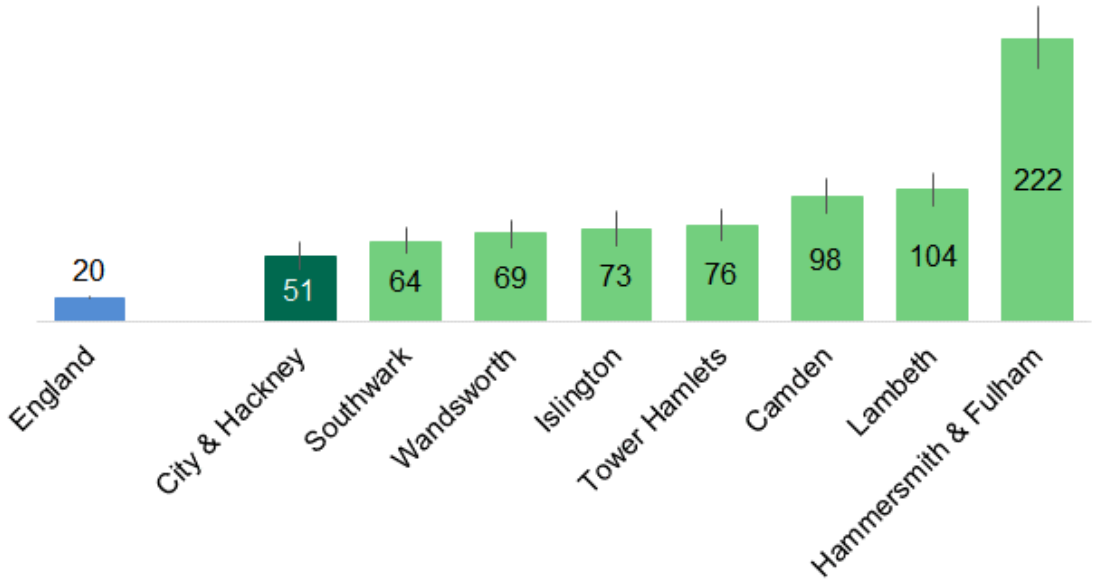
There are no data available on chronic hepatitis B and C to allow for comparison over time or with similar areas.

Figure 28: Acute hepatitis B incidence rate in Hackney and the City of London (per 100,000 population, 2016)



Source: Public Health England health protection profile.

Figure 29: Chronic hepatitis C detection rate in Hackney and the City of London (age 1+, per 100,000 population, 2016)



Source: Public Health England health protection profile.

4.6. Evidence and good practice

4.6.1. Prevention

The Department of Health recommends hepatitis B vaccination for those at increased risk of contracting the virus (see Box 6). The routine childhood immunisation schedule now includes hepatitis B vaccination as part of routine immunisations for all babies born after 1 August 2017.

In addition, in those babies born to hepatitis B positive mothers the first vaccination should be given immediately after birth, followed by all other recommended doses and a blood test to check for infection and, where appropriate, hepatitis B immunoglobulin, in line with 'The Green Book'. [45]

To prevent sexual transmission of the hepatitis B and C viruses, safer sex should be promoted in the general population, including proper use of condoms. Further information can be found in the forthcoming 'Sexual health' JSNA chapter. Provision of needle-exchange and harm-reduction programmes in drug services, accident and emergency services, and some pharmacies is recommended. Local skin piercing and tattoo businesses should be required to adhere to health and safety measures and national regulations while offering their services. [44] [47]

Regular updates should be communicated to healthcare workers to follow standard hepatitis B and C infection-control precautions at all times. [44]

4.6.2. Identification and early intervention

Access to confidential testing for hepatitis B and C should be made available in primary care, mental health and learning disability units, prisons, youth offender

institutions, immigration removal centres, drug treatment services and sexual health clinics. [44]

The general public, in particular those in high-risk groups (Box 6 and), should be educated about the importance of early diagnosis and management of hepatitis B and C. Equally it should be made clear to these high-risk groups where confidential testing is available. [44]

All cases of acute hepatitis B and C require notification to local HPTs upon their detection.

4.6.3. Treatment

The treatment of acute and chronic hepatitis B and C is clearly laid out within the British Association for Sexual Health and HIV (BASHH) guidelines. [48]

In acute hepatitis B, usually treatment would just be given to control the symptoms of the infection. However, in severe acute hepatitis B infection, antiviral agents may sometimes be used. In acute hepatitis C, patients should be referred to a specialist centre for assessment, monitoring and treatment with antiviral agents.

In both chronic hepatitis B and C (if the virus is present for over six months), patients should be referred to a hepatologist for disease monitoring, liver cancer screening, and possible treatment with antiviral agents. [48]

4.7. Services and support available locally

4.7.1. Prevention

Hackney and the City follow Department of Health and Social Care guidelines in offering hepatitis B vaccination to at-risk groups, as summarised in Section 4.6.1. However, there is a national and international shortage of hepatitis B vaccine that is affecting vaccine availability in Hackney and the City.

The City of London Corporation and Hackney Council have each produced a code of practice for those who provide services such as acupuncture, massage, skin piercing and tattooing, which includes infection control advice. [49] [50]

Hackney Recovery Service provides on-site hepatitis B vaccination to at-risk groups, and includes a needle-exchange service that operates from a number of pharmacies in the borough. Harm-reduction advice is also a standard part of the service offer.

City of London treatment services similarly offer vaccination, and commission two pharmacies to offer needle-exchange services.

4.7.2. Identification and early intervention

Hackney and the City residents can request testing for hepatitis B and C at three Homerton University Hospital NHS Foundation Trust sexual health service sites

(Clifden Centre, Ivy Centre and John Scott Health Centre) and also at their GP practice.

Hackney Recovery Service offers on-site hepatitis B and C testing for those affected by drug and alcohol misuse. The City of London similarly offers blood-borne virus services.

4.7.3. Treatment

Homerton Hospital runs a specialist consultant-led hepatitis clinic. There is also a nurse-led clinic for hepatitis, which receives direct referral for assessment, monitoring and treatment of hepatitis B and C from primary care and various departments within the hospital (including antenatal, fertility, and sexual health departments).

Work is currently underway to establish a satellite for hepatitis services run by Homerton Hospital from Hackney Recovery Service, including fibroscans (to check for liver inflammation) and treatment.

5. Food-borne diseases

5.1. Introduction: focusing on campylobacter and salmonella

Food-borne infections, often referred to as 'food poisoning' are those caused by ingestion of a food or drink that is contaminated by a virus, bacteria or parasite [51]. The majority of food-borne infections are preventable through improved hygiene and adherence to food safety standards.

This section focuses on campylobacter and salmonella as they are notifiable diseases and have been identified as local priorities for prevention and control. They are both bacterial infections that cause gastroenteritis, frequently with bloody diarrhoea. Shigellosis is another important food-borne disease, covered in the travel-related infections section of this JSNA chapter.

Nationally, campylobacter causes most recorded cases of food poisoning. For most people, campylobacter and salmonella are relatively mild illnesses, but they can cause serious disease and/or be fatal in vulnerable groups – including immunosuppressed individuals, infants and the elderly. [52]

5.2. Causes and risk factors

5.2.1. Campylobacter

Campylobacter infection is caused by ingestion of undercooked meat and unpasteurised milk. It can affect anyone, but in the UK there tends to be a slightly higher rate in males. It is also a travel-associated infection. Campylobacter is common worldwide, and travel-related cases tend to reflect the travel patterns of UK residents – the highest number of cases over recent years have been associated with travel to Spain and Turkey. [53]

5.2.2. Salmonella

Salmonella bacteria can be found in the gut of many animals, poultry in particular. It is contracted by the ingestion of infected meat, eggs, milk and other dairy products that have been undercooked or are raw. Salmonella can also be transmitted via contact with: faeces of animals such as cats or dogs that have contracted the bacteria; or fruit and vegetables grown in manure from contaminated animals. [54]

It mostly causes a mild disease resulting in gastroenteritis. Disease can be severe in the young, the elderly and those with weakened immunity. In England, salmonella often affects children, and peak season tends to be around September, at the beginning of the school year. [55]

5.3. Local data – numbers and rates

It is important to note that a significant number of people do not seek medical attention for gastroenteritis, often just staying at home to recover from what is usually a time-limiting and relatively mild illness. There is a high level of under-reporting of diarrhoeal illnesses, as well as under-diagnosis as a result of many stool samples not being sent for laboratory testing.

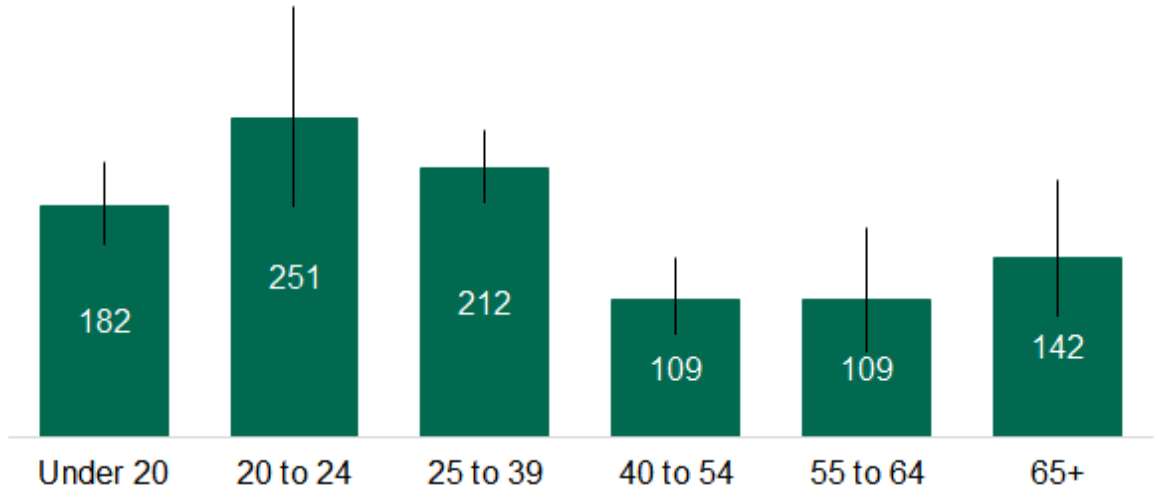
In 2016, there were 137 cases of campylobacter (50 per 100,000) identified in Hackney residents, and fewer than five cases identified in the City of London. During the same year, 38 cases of salmonella (14 per 100,000) were identified in Hackney residents and zero in the City of London. [12]

5.4. Health inequalities

5.4.1. Age

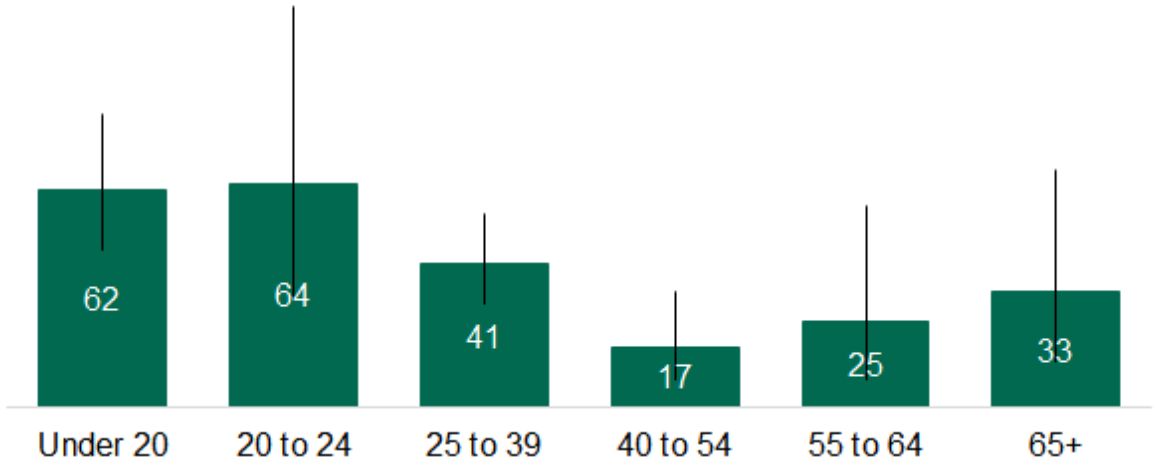
There are higher recorded rates of campylobacter in children and young adults (aged under 20) and among the younger working-age population (those aged between 20 and 39) compared to older age groups (see Figure 30). The pattern is similar for salmonella, but due to small numbers the differences are generally not statistically significant (Figure 31).

Figure 30: *Incidence rate of identified campylobacter in Hackney and the City, by age (per 100,000 population, 2012–16)*



Source: Public Health England NENCL Health Protection Team. [12]

Figure 31: Incidence rate of salmonella in Hackney and the City, by age (per 100,000 population, 2012–16)



Source: Public Health England NENCL Health Protection Team. [12]

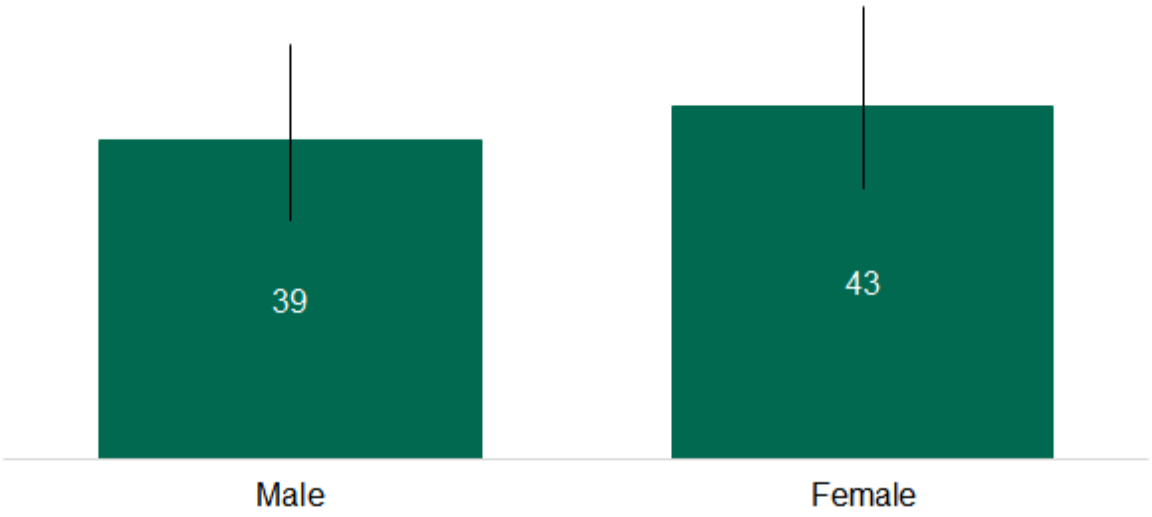
5.4.2. Gender

There is no significant difference in the rate of campylobacter or salmonella between men and women (Figure 312 and Figure 323).

Figure 31: *Rate of campylobacter in Hackney and the City of London, by gender (all ages, per 100,000 population, 2012–16)*

Source: Public Health England NENCL Health Protection Team. [12]

Figure 323: *Rate of salmonella in Hackney and the City of London, by gender (all ages, per 100,000 population, 2012–16)*



Source: Public Health England NENCL Health Protection Team. [12]

5.4.3. Ethnicity

A study in the United States found higher rates of salmonella in BAME populations compared with White populations. The same study found the lowest rates of campylobacter in Black populations compared with all other BAME and White populations. [56]

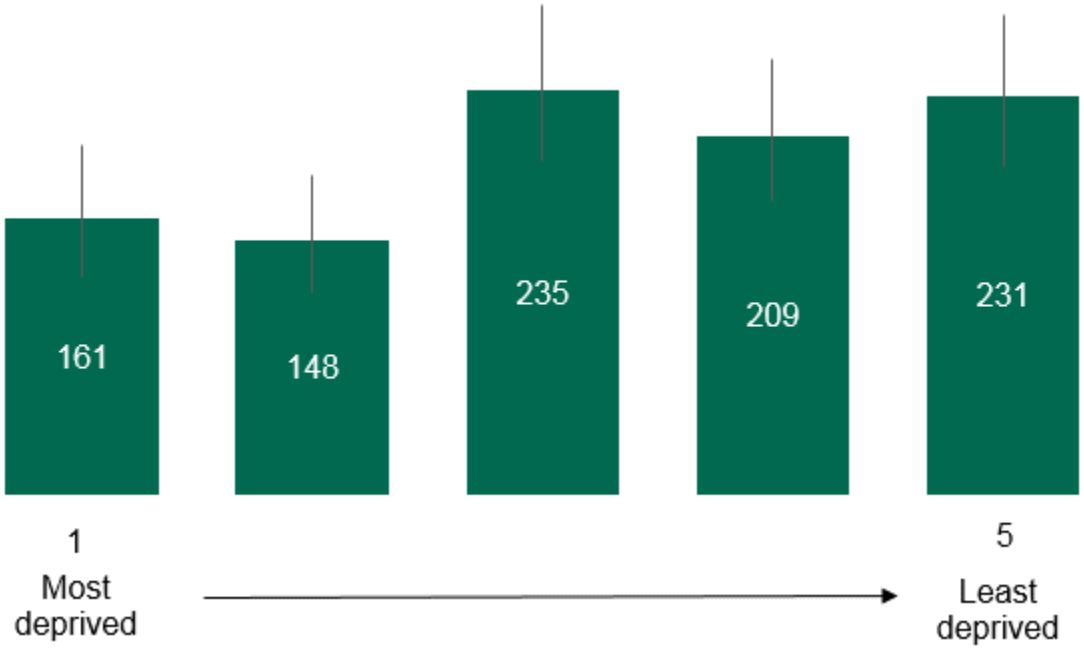
Local data are not available on food-borne illness by ethnic group.

5.4.4. Socio-economic disadvantage

There is a higher rate of identified campylobacter in the least deprived areas of Hackney compared with the most deprived (Figure 33). This may be due to residents living in more deprived areas being less likely to seek treatment for food-borne illness.

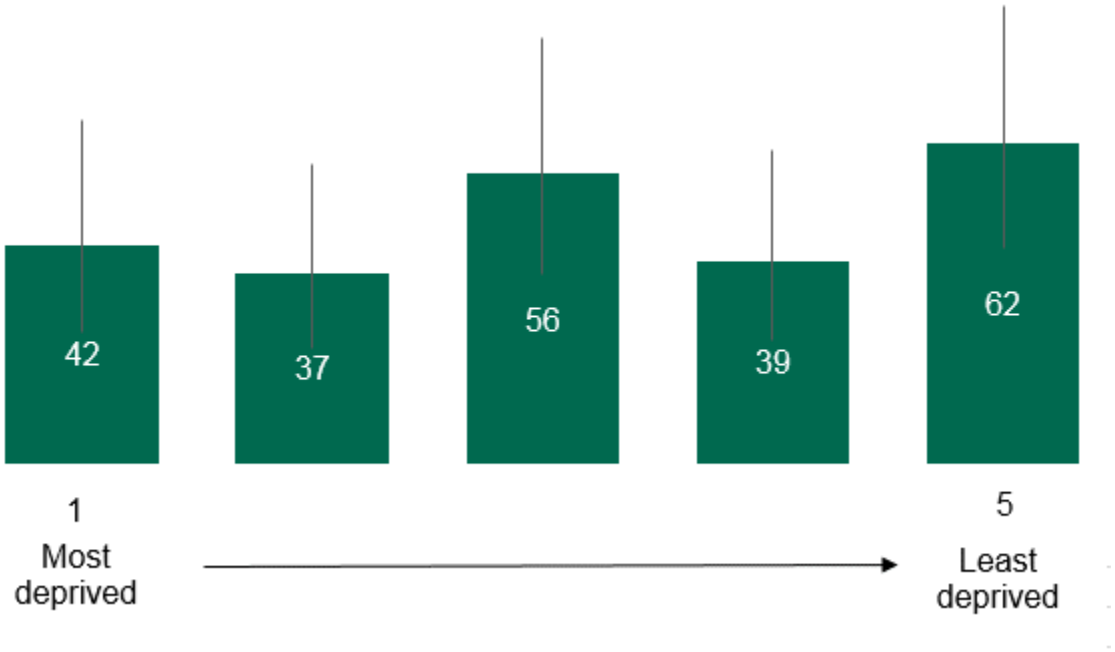
There are no statistically significant differences in the rate of salmonella by deprivation quintiles (Figure 34).

Figure 33: Incidence rate of campylobacter in Hackney, by deprivation quintile (all ages, per 100,000 population, 2012–16)



Source: Public Health England NENCL Health Protection Team. [12]
Note: The Index of Multiple Deprivation (IMD) uses many indicators across seven domains (income; employment; health and disability; education, skills and training; barriers to housing; crime; and living environment) to provide an overall measure of deprivation for each area, relative to other areas within England. Areas have been ranked according to their IMD score and split into five groups – from the 20% most deprived areas (1) to the 20% least deprived (5).

Figure 34: *Incidence rate of salmonella in Hackney, by deprivation quintile (all ages, per 100,000 population, 2012–16)*



Source: Public Health England NENCL Health Protection Team.
Note: The Index of Multiple Deprivation (IMD) uses many indicators across seven domains (income; Employment; health and disability; education, skills and training; barriers to housing; crime; and living environment) to provide an overall measure of deprivation for each area, relative to other areas within England. Areas have been ranked according to their IMD score and split into five groups – from the 20% most deprived areas (1) to the 20% least deprived (5).

5.5. Comparisons with other areas and over time

In England, the incidence of food-borne illness being reported has increased by 43% in 2008/09 compared with 1995/96. However, the number of people visiting their GP with this type of illness had decreased by 50% in the same time period, indicating that more people may be self-managing rather than accessing healthcare services. [57]

Local data on food-borne illness are not available over time or by comparison group.

5.6. Evidence and good practice

5.6.1. Prevention

Food-borne infections can be prevented by adherence to food hygiene standards published by the Food Standards Agency (FSA) for all those involved in the food production chain – from rearing animals to slaughtering, supplying, cooking and serving. Further details can be found on the FSA website. [58]

Employees handling food are required to complete food hygiene training courses, on which infection control and hand hygiene are also covered. The food handling guide published by the FSA has further information. [59]

5.6.2. Identification and early intervention

Campylobacter and salmonella are both identified through stool sample culture. NICE guidelines provide advice to healthcare workers on when to send stool samples for laboratory testing. [60]

Campylobacter and salmonella are both notifiable diseases. Local HPTs usually receive notifications from local laboratories, which forward the samples to reference labs for diagnostic confirmation. Notifying HPTs allows timely identification of outbreaks, identification of the source of infection, and for advice to be provided on how to limit further spread within the community.

If a link is found to a food establishment being the source of infection, environmental health officers may investigate and, if necessary, ensure that the business involved improves its standards of hygiene to prevent reoccurrence. [61]

5.6.3. Treatment

Campylobacter and salmonella infections are usually self-limiting. Treatment involves increasing oral fluid intake to replace loss through diarrhoea. Antibiotics are recommended in cases of severe infection or in immunocompromised patients. [62]

Patients are advised to remain off work or school until they have been symptom-free for 48 hours. Hand-hygiene advice should be provided, and the recommendation is not to prepare food until 48 hours after resolution of symptoms. [61]

5.7. Services and support available locally

5.7.1. Prevention

Food safety advice is provided for both Hackney and the City businesses and members of the public on the Hackney Council and City of London Corporation websites. [63] [64]

5.7.2. Identification and early intervention

All cases of campylobacter and salmonella detected by local laboratories are reported to the NENCL Health Protection Team. Risk assessments are then undertaken to identify the source and prevent further transmission. Environmental health officers are also informed and can assist in collecting further samples, as well as conducting assessments of food premises in the case of an outbreak.

5.7.3. Treatment

There are guidelines for the management of infectious gastroenteritis within the ‘North East London management of infection guidance for primary care’, adapted

from Public Health England guidance. [65] The advice within these guidelines is that antibiotic therapy is usually not indicated unless the patient is systemically unwell.[8]

An antimicrobial pharmacist and a microbiologist provide an on-call service at Homerton Hospital to provide advice and assistance to healthcare staff dealing with cases of campylobacter and salmonella (as well as other bacterial infections).

6. Travel-related gastrointestinal infections

6.1. Introduction: focusing on typhoid, paratyphoid and shigella infection (shigellosis)

Travel-related gastrointestinal (GI) infections are the most common illnesses reported by those who have recently travelled outside of the UK. [66] Reflecting the ease of international travel in modern times, the UK has seen a rise in the number and type of travel-related infections over recent years. Between 2004 and 2008, over 24,000 laboratory-confirmed GI infections were reported in those who had recently travelled abroad from the UK. [67] This number is just the tip of the iceberg, however: most illnesses are self-limiting and symptoms have often resolved before formal testing is carried out; and travel history information is often incomplete for confirmed cases.

Reflecting local population health needs, this section will focus on travel-associated cases of salmonella typhi, salmonella paratyphi (which cause typhoid fever and paratyphoid fever respectively), as well as shigellosis. Typhoid fever can be potentially life-threatening and requires prompt identification and treatment. Paratyphoid fever tends to be a milder disease. Both require notification to a local HPT upon suspicion and confirmation.

In the UK, there are about 500 cases of travel-related typhoid and paratyphoid fever each year, and almost half of these cases are in London. Shigellosis refers to infection caused by the shigella group of bacteria, which causes a diarrhoeal illness and is often related to travel. There are about 450 cases of travel-related shigellosis each year, and about 40% of the cases are in London. [68]

6.2. Causes and risk factors

6.2.1. Typhoid and paratyphoid

In the UK, typhoid and paratyphoid are mainly acquired abroad through the ingestion of contaminated food and water. [69] These diseases are prevalent in areas of the world with poor sanitation. In the UK, most cases of typhoid and paratyphoid fever are linked to recent travel to India, Pakistan, Bangladesh or parts of Africa. [70] Types of foods more commonly associated with outbreaks include salads, raw vegetables and sandwiches, as they are not cooked and involve a lot of hand contact in preparation. [71]

[8] Systemically unwell means the whole body is involved with the infection. This would show with a high temperature or a fast heart rate.

6.2.2. Shigella infection

Shigella infection, also known as shigellosis, is caused by four species of bacteria:

- shigella dysenteriae
- shigella flexneri
- shigella boydii
- shigella sonnei.

Shigella dysenteriae and boydii occur as travel-associated cases and are not indigenous to the UK. They are most commonly linked to recent travel in India, Egypt and Pakistan. [72] Cases of travel-related shigellosis commonly occur in young children. Shigella flexneri and sonnei may also be associated with travel, but are also endemic in the UK in men who have sex with men (covered further in the forthcoming 'Sexual health' JSNA chapter).

Like typhoid and paratyphoid, shigella is spread from infected faeces contaminating water or food. As such, outbreaks of shigella are similarly common in uncooked foods and those that involve a lot of hand contact in their preparation. [73]

6.3. Local data – numbers and rates

Between 2012 and 2017, there were 31 cases of travel-related shigellosis identified in Hackney residents and fewer than five cases identified in the City of London. [12]

During the same period, there were 12 cases of typhoid fever in Hackney and fewer than five in the City of London. There were nine cases of paratyphoid fever[9] in Hackney and fewer than five in the City of London. [12]

6.4. Health inequalities

6.4.1. Age

Since 2012, almost all cases of travel-related shigellosis in Hackney and the City of London have been in adults of working age. Fewer than five cases were in children under 18 and fewer than five cases were in older adults over 65 years of age.

Similarly, across England, Wales and Northern Ireland, the majority of cases occurred in adults; only 15% of cases occurred in those aged 16 years and under. National data also show that cases of travel-related shigellosis commonly occur in young children.

In 2016, age and sex were known for 313 cases of typhoid fever and paratyphoid fever in England, Wales, and Northern Ireland; 42% were adults aged between 20 and 39 years. Those aged 16 years and under accounted for 28% of cases, with 2% (N=6) of the total in children under two years (and thus ineligible for vaccination – see Section 6.6.1). [74]

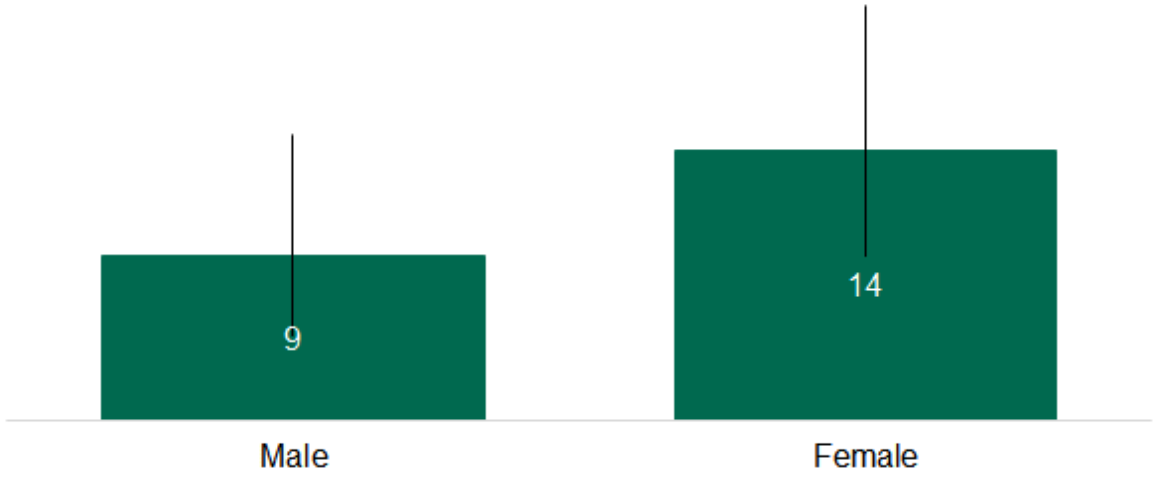
[9] This includes paratyphoid fever A.

6.4.2. Gender

There is no significant difference in the rate of travel-related shigellosis between men and women (Figure 356). In England, Wales, and Northern Ireland, 55% of shigella infections were in women.

In 2016, in England, Wales, and Northern Ireland 51% of cases of typhoid fever and paratyphoid fever were in men. [74]

Figure 356: Rate of travel-related shigellosis in Hackney and the City of London, by gender (all ages, per 100,000 population, 2012–17)



Source: Public Health England NENCL Health Protection Team. [12]

6.4.3. Ethnicity

A study in the United States found higher rates of severe shigella infection among Black people compared with White people. [75]

Shigella dysenteriae and boydii occur as travel-associated cases and are not indigenous to the UK. They are most commonly linked to recent travel in India, Egypt and Pakistan, and therefore may be more likely to occur in South Asian and North African communities who travel more frequently to these three countries. [72]

In the UK, most cases of typhoid and paratyphoid fever are linked to recent travel to India, Pakistan, Bangladesh or parts of Africa. [70] In England, Wales, and Northern Ireland, the majority of those with typhoid and paratyphoid fever are those of Pakistani, Indian, and Bangladeshi ethnicity. [74]

Local data on cases of travel-related shigella, typhoid fever, and paratyphoid fever were not available by ethnicity.

6.4.4. Socio-economic disadvantage

There is a lack of evidence of an association between travel-related infection and deprivation in the UK. However, travel-related shigellosis, typhoid fever, and paratyphoid fever are more likely to occur in low-income countries with poor sanitation.

Local data on cases of travel-related shigellosis, typhoid fever, and paratyphoid fever were not available by socio-economic disadvantage.

6.5. Comparisons with other areas and over time

In 2012, 2,327 cases of shigellosis (both travel-related and not related to travel) were reported in England, Wales and Northern Ireland. The proportion of shigella infections that are travel-related has been decreasing since 2005. [72] Local data on travel-related shigellosis over time and for similar areas are not available for comparison.

In 2016, 313 laboratory-confirmed symptomatic cases of typhoid fever and paratyphoid fever were reported in England, Wales and Northern Ireland. A third of cases were in residents of London. Typhoid fever and paratyphoid fever have decreased by an average of 7% year on year since 2011 in England, Wales and Northern Ireland. [74] Local data on typhoid fever and paratyphoid fever over time and for similar areas are not available for comparison.

6.6. Evidence and good practice

6.6.1. Prevention

Travellers to endemic countries are advised to receive vaccination against typhoid infection. [76] Further information on this can be found in ‘The Green Book’. [77]

Travellers should also check the NHS fitfortravel website, which has country-specific advice on health risks and recommended immunisations. [78]

Following food hygiene advice when travelling abroad can help to prevent infection. Avoiding raw fruit and vegetables, unless they are peeled and washed in clean water, can help prevent transmission of infection. Travellers should also ensure bottled water is consumed abroad in endemic areas of typhoid, paratyphoid and shigellosis. [70]

Hand hygiene after using the toilet and before eating or preparing food is a preventative measure against all travel-related GI infections. [70]

For cases of shigellosis in men who have sex with men, the forthcoming ‘Sexual health’ JSNA chapter covers advice for safer sex precautions.

6.6.2. Identification and early intervention

Typhoid and paratyphoid fever are definitively diagnosed by culture of the salmonella typhi or salmonella paratyphi organism from blood, urine, or from another sterile site or faeces. The organism can be seen in blood cultures early in the disease, and from urine and faeces after the first week of illness. [69]

Shigellosis is detected by a positive stool culture for any of the four species of shigella. [79]

Close contacts of cases of typhoid, paratyphoid and shigellosis should be assessed for risk and early screening if required.

6.6.3. Treatment

Typhoid and paratyphoid fever requires prompt antibiotic treatment. [80]

Shigellosis treatment involves ensuring adequate hydration to prevent dehydration, as well as rest until symptoms resolve. [79]

Advice on exclusion from work or school for cases and close contacts must be sought from the local HPT. [76]

6.7. Services and support available locally

6.7.1. Prevention

Travel health advice and vaccination appointments are offered in GP practices across Hackney and the City, available at a charge.

Some local pharmacies also offer travel vaccinations at a charge.

6.7.2. Identification and early intervention

Cases of typhoid fever, paratyphoid fever and shigellosis are all notifiable to the NENCL Health Protection Team. Risk assessments are then undertaken to prevent further transmission, and advice and guidance is given where necessary.

6.7.3. Treatment

An antimicrobial pharmacist and a microbiologist provide an on-call service at Homerton Hospital to provide advice and assistance to healthcare staff dealing with cases of typhoid fever, paratyphoid fever and shigellosis (as well as other bacterial infections).

Included within the ‘North East London management of infection guidance for primary care’ is guidance on the management of traveller’s diarrhoea. [65] This provides guidance on stool investigation and indications for starting antibiotics prior to a positive laboratory specimen.

6.8. Service gaps and opportunities

Locally improved reporting of travel history for cases of gastrointestinal illness would significantly improve ascertainment of travel and non-travel associated infections and support improved surveillance and control measures.

7. Healthcare-associated infections

7.1. Introduction: focusing on MRSA and C. difficile

Healthcare-associated infections (HCAIs) are infections that patients acquire while receiving treatment for another condition within a healthcare setting. The setting may include hospitals and/or long-term care facilities such as nursing homes. [81] Every year in England, approximately 300,000 patients are affected by HCAIs, costing the NHS over £1bn. HCAIs are a cause of significant morbidity, prolonged hospital stay and mortality. It is estimated that at least one in five of these infections is preventable through effective infection-control practices. [82]

There are multiple different types of HCAI, but this section will focus specifically on two infections associated with significant disease burden and resource use – methicillin-resistant Staphylococcus aureus (MRSA) and Clostridium difficile (C. difficile). For further information on other HCAIs, please refer to PHE guidance on HCAIs. [83]

7.2. Causes and risk factors

C. difficile is found naturally in the gut of up to 3% of the healthy adult population. However, in patients who live in long-term healthcare facilities, or in patients who have long or frequent stays in hospital, this proportion increases significantly. [84] When the balance of bacteria in the gut has been affected by antibiotics, surgery, chemotherapy or other illnesses, C. difficile bacteria can multiply, producing toxins that can cause symptoms such as diarrhoea, abdominal pain, fever and inflammation of the bowel.

MRSA is a bacteria that is found on the skin of approximately 3% of the healthy population. [85] If the bacteria passes through the protective barrier of skin, it can enter the blood stream and cause bacteraemia. Those who naturally carry the MRSA bacteria on their skin are therefore at risk of infection when they undergo any procedure that breaks the surface of the skin – such as in surgery, or in open wounds, ulcers and sores.

The risk of HCAIs increases with the number of healthcare interventions, including frequent or prolonged stays in hospital or other settings. In long-term care settings, the reason for the increased risk of HCAIs is largely due to greater opportunity for spread of bacteria from person to person in a closed environment. [86]

Older age is associated with declining immune system function and with long-term conditions, leading to an increased risk of acquiring infection. [86] Since many long-

term conditions are linked to deprivation, there is an expected positive relationship between HCAI risk and socio-economic disadvantage. [87]

7.3. Local data – numbers and rates

In 2016/17, there were fewer than five cases of MRSA in Hackney and the City of London – a rate of 1.1 per 100,000 population.

In 2016/17, there were 24 cases of C. difficile in Hackney and the City of London – eight per 100,000 population. [88]

7.4. Health inequalities

7.4.1. Age

As reported earlier, older age is associated with declining immune system function and with long-term conditions, leading to an increased risk of acquiring infection. [86]

7.4.2. Gender

The evidence strongly suggests that males have a higher risk of MRSA carriage. Males comply poorly with hand-hygiene recommendations compared with females, and gender differences in motivation for improvement have been reported. Other issues that might be relevant include occupation and participation in contact sports that may increase susceptibility to MRSA. [89]

7.4.3. Ethnicity

In the United States, MRSA infections are higher among Black people compared with White people; however, much of this variation can be explained by income and deprivation (see Section 7.4.4). [90] In one study, after controlling for socio-economic factors, there was no difference in MRSA infection between ethnic groups. [90]

7.4.4. Socio-economic disadvantage

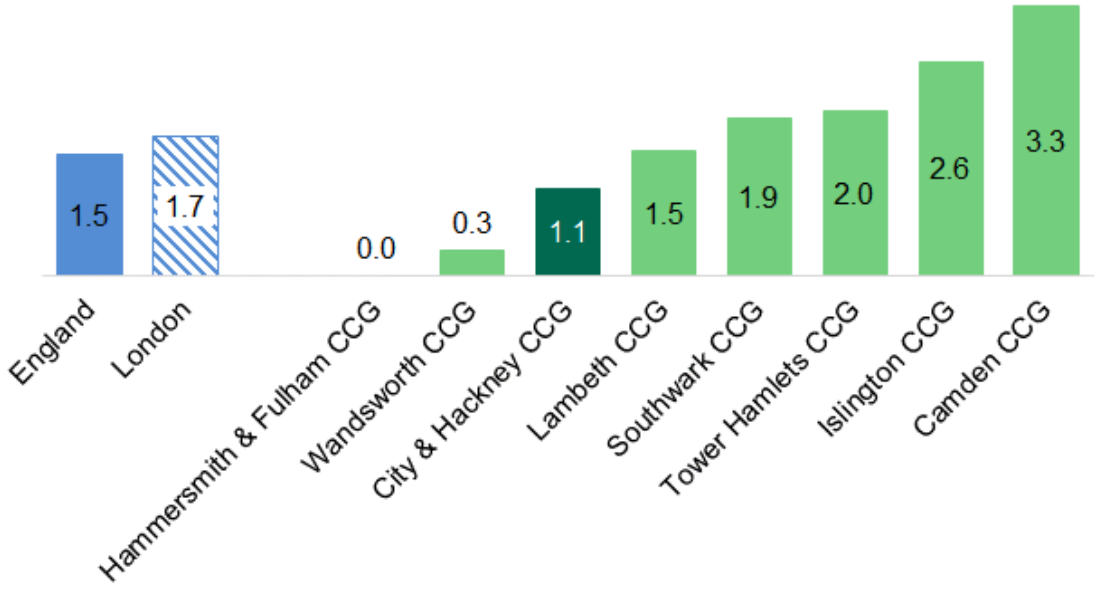
There is a positive relationship between HCAI risk and socio-economic disadvantage. [87] Variation in MRSA infection among ethnic groups can be explained by socio-economic factors. [90]

7.5. Comparisons with other areas and over time

Figure 367, Figure 378,
Figure 389 and Figure 40 present comparative data on incidence rates of MRSA and C. difficile. Due to lack of reporting of confidence intervals, it is not possible to draw any reliable conclusions from these data however.

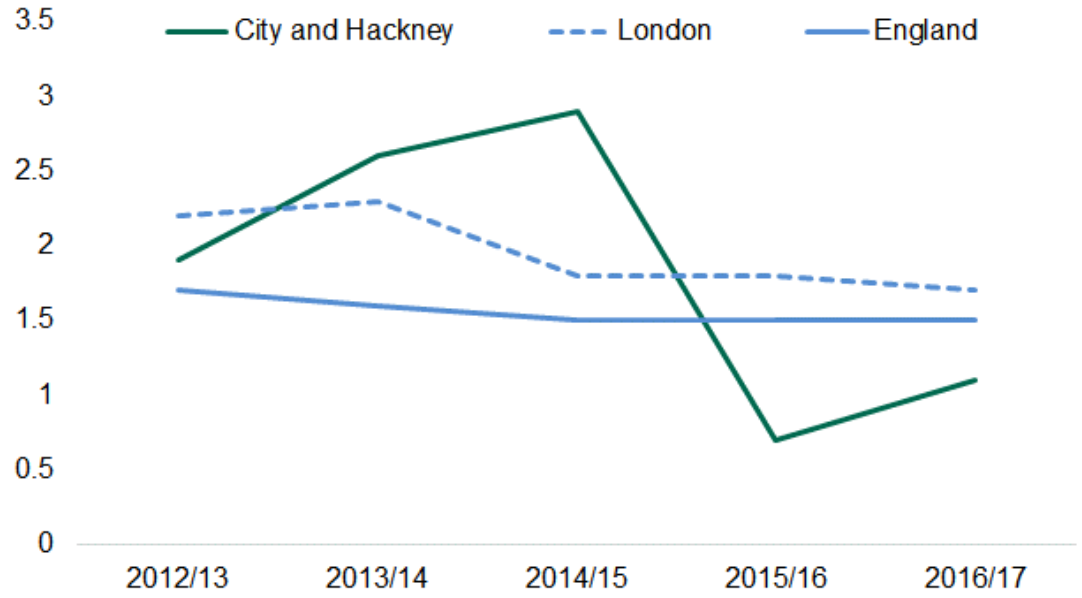
The MRSA threshold for cases at Homerton Hospital is zero. This threshold has been breached every year since 2014/15, but with fewer than five cases being reported each year. [88]

Figure 367: *All MRSA bacteraemia rates, by comparison groups (all ages, per 100,000 population, 2016/17)*



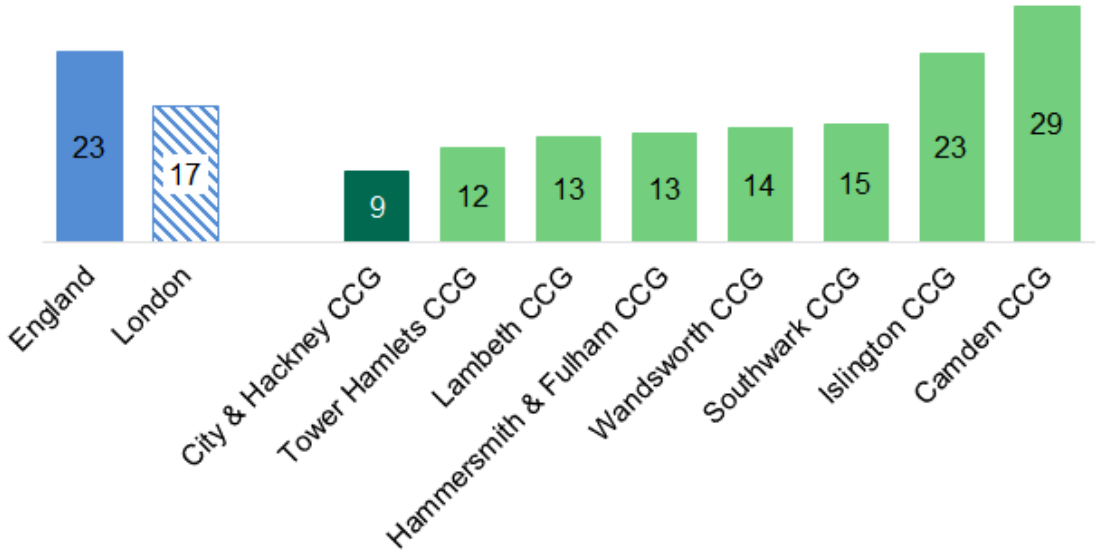
Source: Public Health England (PHE) antimicrobial resistance (AMR) local indicators.
Note: Confidence intervals are not available. PHE has carried out mandatory enhanced surveillance of MRSA bacteraemia since October 2005 and of MSSA (methicillin-susceptible Staphylococcus aureus) bacteraemia since January 2011 for NHS acute trusts; patient-level data of any MRSA and MSSA bacteraemia are reported monthly to PHE. Independent sector healthcare organisations providing regulated activities also undertake surveillance of MRSA and MSSA bacteraemia.

Figure 378: All MRSA bacteraemia rates over time (all ages, per 100,000 population, 2012–17)



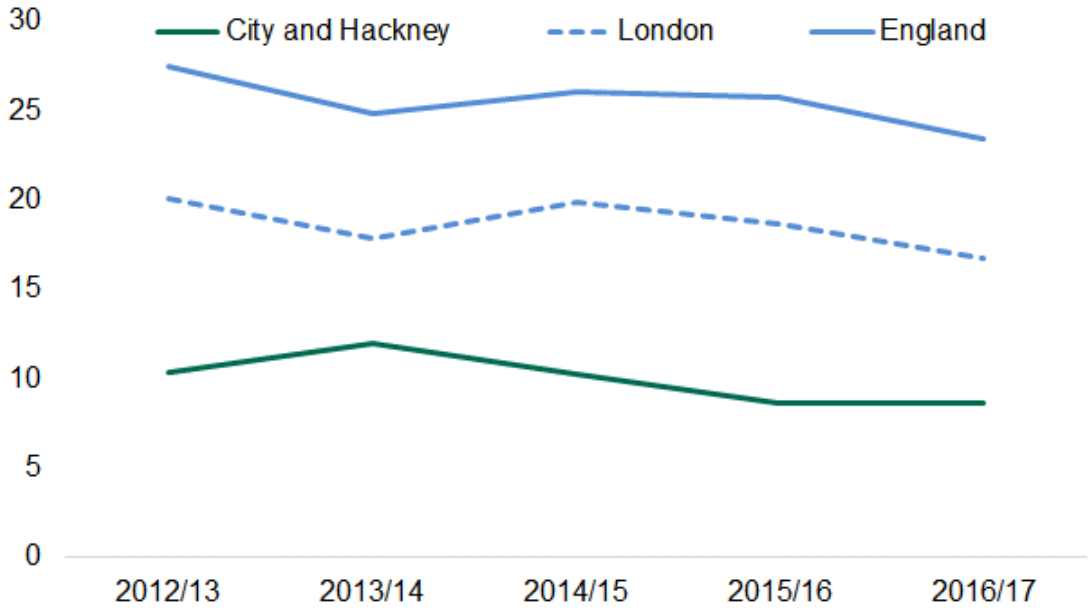
Source: PHE antimicrobial resistance (AMR) local indicators.
Note: Confidence intervals are not available. PHE has carried out mandatory enhanced surveillance of MRSA bacteraemia since October 2005 and of MSSA (methicillin-susceptible Staphylococcus aureus) bacteraemia since January 2011 for NHS acute trusts; patient-level data of any MRSA and MSSA bacteraemia are reported monthly to PHE. Private sector healthcare organisations providing regulated activities also undertake surveillance of MRSA and MSSA bacteraemia.

Figure 389: *All C. difficile rates, by comparison groups (age 2+, per 100,000 population, 2016/17)*



Source: PHE antimicrobial resistance (AMR) local indicators.
Note: Confidence intervals are not available. PHE has carried out mandatory enhanced surveillance of C. difficile infection since April 2007 for NHS acute trusts; patient-level data of any C. difficile infections are reported monthly to PHE. Independent sector healthcare organisations providing regulated activities also undertake surveillance of C. difficile infection.

Figure 40: All C. difficile rates over time (age 2+, per 100,000 population, 2012–17)



Source: PHE antimicrobial resistance (AMR) local indicators.
Note: Confidence intervals are not available. PHE has carried out mandatory enhanced surveillance of C. difficile infection since April 2007 for NHS acute trusts; patient-level data of any C. difficile infections are reported monthly to PHE. Independent sector healthcare organisations providing regulated activities also undertake surveillance of C. difficile infection.

7.6. Evidence and good practice

7.6.1. Prevention

Infection control measures such as good hand hygiene before and after patient contact, and before and after procedures, are effective in preventing HCAIs. Strict infection-control measures such as wearing gloves and aprons, and isolating patients with MRSA or C. difficile in a side room, help to prevent the spread of infection to others. In patients with line access, particular infection-control measures exist such as cleaning the line before and after use to prevent MRSA entering the bloodstream.[10] For further information, please refer to the NICE guidelines, which provide clear guidance on the prevention and control of HCAIs. [91]

Screening for patients colonised with MRSA prior to undergoing elective surgery and on admission to hospital can help prevent invasive MRSA infection.[11] [92]

The use of broad-spectrum antibiotics in those patients who are already colonised with C. difficile can lead to the expansion of the bacteria in the gut and may lead to symptoms of the disease.[12] As such, antibiotics in populations with an increased chance of being colonised should only be prescribed antibiotics when absolutely necessary. [93]

7.6.2. Identification and early intervention

The most recent guidance from the Department of Health and Social Care recommends a focused approach to MRSA screening. [92] The most cost-effective policy is one based on screening admissions to high-risk specialties. It is recommended that mandatory MRSA screening for acute and elective admissions is carried out for the following: [92]

- all patients admitted to high-risk units (i.e. vascular, renal/dialysis, neurosurgery, cardiothoracic surgery, haematology/oncology/bone marrow transplant, orthopaedics/trauma, and all intensive care units)
- all patients previously identified as colonised with, or infected by, MRSA.

For patients in high-risk specialties identified as MRSA carriers on screening, decolonisation (treatment to eradicate MRSA carriage) is recommended.

C. difficile is detected upon stool culture and positive C. difficile toxin. If the sample is taken in the community, or within 72 hours of admission, it counts as a community-related case of C. difficile; and if taken 72 hours after admission the case is classified as a hospital-acquired case. This has implications for appropriate infection-control management. If it is classified as a community-related case, it will need to be

[10] Line access is the insertion of a small tube called a catheter into a vein or artery for the purpose of giving treatment or taking measurements. They can be inserted peripherally (in a small vein far away from the heart) or centrally (a larger vein or artery nearer to the heart).
[11] Colonised means a person has the bacteria on their skin but does not have any symptoms of the disease.
[12] Broad-spectrum antibiotics are antibiotics that kill a lot of different types of bacteria. As a result, they kill a lot of the ‘good’ bacteria in the gut as well as the bad.

identified if a care home or long-term community health institution is the source, and the relevant infection-control measures can be implemented. If it is a hospital-acquired case, the infection control team at the hospital will need to investigate and undertake necessary measures to reduce the risk of further spread. Further details can be found within relevant NICE guidance. [93]

7.6.3. Treatment

Treatment of MRSA infection consists of intravenous antibiotic therapy.[13]

C. difficile treatment starts with the removal of any likely causative agent, such as a broad-spectrum antibiotic that is known to increase the risk of developing C. difficile infection. Treatment with specific antibiotics that act on C. difficile is required in moderate and severe disease. PHE has published detailed guidance on the treatment and management of C. difficile. [94] Advice can also be sought from hospital microbiologists.

7.7. Services and support available locally

7.7.1. Prevention

Homerton Hospital has an infection control team in place, with mandatory infection-control training regularly provided for staff.

All patients admitted to Homerton Hospital undergo MRSA screening. Side rooms with contact precautions are used for any patient identified as being MRSA or C. difficile positive.

7.7.2. Identification and early intervention

Local data on HCAIs are collected via national mandatory surveillance programmes. City and Hackney CCG review the number of HCAIs annually and have set thresholds in line with national recommendations for acute trusts. The threshold for confirmed healthcare-associated cases of MRSA is zero and for C. difficile is 31.

7.7.3. Treatment

Treatment for MRSA colonisation is based upon the MRSA protocol followed at Homerton Hospital. This is based on national PHE guidelines. [94]

A C.difficile treatment pathway exists at Homerton Hospital, which again is based on national PHE guidelines. [95] [96]

[13] Intravenous means therapy delivering liquid substances through a vein.

8. References

[1] World Health Organization, “Infectious diseases,” [Online]. Available: http://www.who.int/topics/infectious_diseases/en/. [Accessed 24 May 2018].

[2] "Parliamentary Office of Science and Technology", “UK Trends in Infectious Disease POST Note 545,” January 2017.

[3] Public Health England, “GBD Compare,” 2013. [Online]. Available: https://vizhub.healthdata.org/gbd-compare/england/. [Accessed 08 05 2018].

[4] Brownlie J Peckham C Waage J, “Infectious Diseases: Preparing for the future; Future Threats,” Office Of Science And Innovation, London, 2006.

[5] NHS Choices UK, “Measles,” NHS, 2015. [Online]. Available: https://www.nhs.uk/conditions/measles/. [Accessed 10 November 2017].

[6] patient.co.uk, “Measles- Health Information,” Patient Platform Limited, 2015. [Online]. Available: https://patient.info/health/measles-leaflet. [Accessed 18 September 2017].

[7] Public Health England, “Public Health Guidelines on Measles,” 2017. [Online]. Available: https://www.gov.uk/government/collections/measles-guidance-data-and-analysis. [Accessed 30 05 2018].

[8] Moss WJ Griffin DE, “Measles,” *Lancet,* vol. 379, pp. 153-64, 2012.

[9] NHS Choices, “Mumps,” NHS , August 2015. [Online]. Available: https://www.nhs.uk/conditions/mumps/. [Accessed 09 November 2017].

[10] Public Health England, “Mumps: notifications in England and Wales by age group, 2011 to 2014,” HM Government, London, 2015.

[11] Public Health England, “Pertussis: guidance, data and analysis,” HM Government, London, 2014.

[12] Public Health England, “NENCL Health Protection team,” 2017.

[13] Public Health England, “The complete routine immunisation schedule,” 2017. [Online]. Available: https://www.gov.uk/government/publications/the-complete-routine-immunisation-schedule. [Accessed 11 December 2017].

[14] Department of Health, “Green Book Book Chapter 21- Measles the Disease,” DOH, London, 2013.

[15] Department of Health, “Green Book- Pertussis,” HM Government, London, 2016.

[16] Public Health England, “Guidelines for the Public Health Management of of Pertussis in England,” 2016. [Online]. Available: https://www.gov.uk/government/collections/pertussis-guidance-data-and-analysis.

[17] Public Health England, “Vaccinations and immunisations,” 2016/17. [Online]. Available: https://fingertips.phe.org.uk/profile-group/child-health/profile/child-health-vaccinations/data. [Accessed 21 August 2018].

[18] Department of Health, “Annual Chief Medical Officer's Report 2011- Infections and the rise of antimicrobial resistance,” HM Government, London, 2013.

[19] H. Willacy, “What is flu? Influenza Symptoms and Treatment,” patient.co.uk, September 2017. [Online]. Available: https://patient.info/health/influenza-and-flu-like-illness. [Accessed 31 October 2017].

[20] Public Health England, “Seasonal influenza: guidance, data and analysis,” HM Government, London, 2014.

[21] NHS Choices, “Tuberculosis (TB),” NHS, 11 November 2016. [Online]. Available: https://www.nhs.uk/conditions/tuberculosis-tb/. [Accessed 1 November 2017].

[22] British Lung Foundation, “What is tuberculosis ? (TB),” British Lung Foundation, September 2017. [Online]. Available: https://www.blf.org.uk/support-for-you/tuberculosis/what-is-it. [Accessed 1 November 2017].

[23] Public Health England, “Tuberculosis in England 2017 Report,” HM Government, London, 2017.

[24] Hayward J Murray D Iny I Jarrett J Loergan K Pillas D Seager S, “London TB Service Review and Needs Assessment,” Public Health Action Support Team, London, 2010.

[25] Public Health England, “Sources of UK flu data: influenza surveillance in the UK,” HM Government, London, 2014.

[26] Public Health England, “Surveillance of influenze and other respiratory viruses in the UK: winter 2017 to 2018,” 2018.

[27] World Health Organisation, “Sex, gender, and influenza,” 2010.

[28] S. Quach, J. Hamid and J. Pereira, “Influenza vaccination coverage across ethnic groups in Canada,” *Canadian Medical Association Journal ,* vol. 184, no. 15, pp. 1673-1681, 2012.

[29] C. Coupland, S. Harcourt and Y. Vinogradova, “Inequalities in uptake of influenza vaccine by deprivation and risk group: Time trends analysis,” *Vaccine,* vol. 25, no. 42, 2007.

[30] Public Health England, “Collaborative tuberculosis strategy for England: 2015-2020,” HM Government, London, 2015.

[31] Public Health England, “Annual flu letter 2017 to 2018,” March 2017. [Online]. Available: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/600880/annual_flu__letter_2017to2018.pdf. [Accessed 23 January 2018].

[32] T. G. Book, “Influenza: the green book, chapter 19,” 12 2017. [Online]. Available: https://www.gov.uk/government/publications/influenza-the-green-book-chapter-19. [Accessed 30 05 2018].

[33] Oxford Vaccine Group, “Vaccine Knowledge Project- BCG Vaccine,” University of Oxford, 2015. [Online]. Available: http://vk.ovg.ox.ac.uk/bcg-vaccine. [Accessed 23 January 2018].

[34] Department of Health, “The Green Book Chapter 32- tuberculosis,” HM Government, London, 2013.

[35] National Institute for Health and Care Excellence, “Tuberculosis- NG 33,” NICE, 2016. [Online]. Available: https://www.nice.org.uk/guidance/ng33/chapter/Recommendations. [Accessed 23 January 2018].

[36] National Institue for Health and Care Excellence, “Oseltamivir, amantadine (review) and zanamivir for the prophylaxis of influenza,” NICE, 24 September 2008. [Online]. Available: https://www.nice.org.uk/guidance/ta158. [Accessed 18 Janaury 2018].

[37] National Institute for Health and Care Excellence, “Amantadine, oseltamivir and zanamivir for the treatment of influenza,” NICE, 25 February 2009. [Online]. Available: https://www.nice.org.uk/guidance/ta168. [Accessed 18 January 2018].

[38] NHS England, “Public Health S7A Accountability Report Supplementary DCO Report,” 2017.

[39] NICE, “Hepatitis B and C testing: people at risk of infection,” 03 2013. [Online]. Available: https://www.nice.org.uk/guidance/ph43/chapter/2-public-health-need-and-practice. [Accessed 06 2018].

[40] Hepatitis B Foundation, “Hepatitis B Fast Facts,” Hepatitis B Foundation, 2017. [Online]. Available: http://www.hepb.org/assets/Uploads/hep-b-fast-facts.pdf. [Accessed 22 September 2017].

[41] Centres for Disease Control and Prevention, “World AIDS Day - Coinfection with HIV and Viral Hepatitis,” 2015. [Online]. Available: https://www.cdc.gov/hepatitis/hiv-hepatitis-coinfection.htm. [Accessed 4th January 2018].

[42] NICE Clinical Knowledge Summaries, “Hepatitis C Summary,” NICE, 2017. [Online]. Available: https://cks.nice.org.uk/hepatitis-c#!topicsummary. [Accessed 25 September 2017].

[43] World Health Organisation, “HIV and hepatitis coinfections,” WHO, June 2017. [Online]. Available: http://www.who.int/hiv/topics/hepatitis/en/. [Accessed 31 January 2018].

[44] NICE, “Hepatitis B and C testing: people at risk of infection. Public health guideline [PH43],” NICE, 2012. [Online]. Available: https://www.nice.org.uk/guidance/ph43. [Accessed 9 January 2018].

[45] Department of Health, “Hepatitis B: The green book, chapter 18,” 07 2017. [Online]. Available: https://www.gov.uk/government/publications/hepatitis-b-the-green-book-chapter-18. [Accessed 30 05 2018].

[46] Clinical Effectiveness Group, 2017.

[47] Clinical Effectiveness Group- British Association for Sexual Health and HIV, “United Kingdom National Guideline on the management of viral hepatitides A, B and C,” December 2015. [Online]. Available: https://www.bashhguidelines.org/media/1066/uk-bashh-hepatitis-guidelines-2015.pdf. [Accessed 9 January 2018].

[48] British Association of Sexual Health and HIV, “UK National Guideline on the Management of viral hepatitides A, B and C,” 2015. [Online]. Available: https://www.bashhguidelines.org/media/1066/uk-bashh-hepatitis-guidelines-2015.pdf. [Accessed 2018].

[49] City of London, “City of London MST License Guidance,” [Online]. Available: https://www.cityoflondon.gov.uk/business/licensing/massage-and-special-treatment/Documents/MST-licence-conditions.pdf. [Accessed 29 06 2018].

[50] Hackney Council, “MST Practitioner License Guidance,” 29 06 2018. [Online]. Available: https://www.hackney.gov.uk/mst-practitioner-licence.

[51] Centre for Disease Control and Prevention, “Foodborne Illness and Germs,” 16 02 2018. [Online]. Available: https://www.cdc.gov/foodsafety/foodborne-germs.html. [Accessed 29 06 2018].

[52] WHO, “Campylobacter,” World Health Organisation, December 2016. [Online]. Available: http://www.who.int/mediacentre/factsheets/fs255/en/. [Accessed 19 September 2017].

[53] Public Health England, “Campylobacter: guidance, data and analysis,” HM Government, London, 2014.

[54] Patient UK, “Salmonella,” Patient Platofrm Limited, 03 June 2016. [Online]. Available: https://patient.info/health/salmonella-leaflet. [Accessed 19 September 2017].

[55] Public Health England, “Salmonella data 2006 to 2015,” HM Government, London, 2016.

[56] J. Quinlan, “Foodborne Illness Incidence Rates and Food Safety Risks for Populations of Low Socioeconomic Status and Minority Race/Ethnicity: A Review of the Literature,” *International Journal of Environmental Research and Public Health,* vol. 10, no. 8, 2013.

[57] Tam CC Rodrigues LC Viviani L et al, “Longitudinal study of infectious intestinal disease in the UK (IID2 study): incidence in the community and presenting to general practice,” *Gut,* vol. 61, pp. 69-77, 2012.

[58] Food Standards Agency, “FSA website,” [Online]. Available: food.gov.uk. [Accessed 29 06 2018].

[59] Food Standards Agency, “Food Handlers Guide,” [Online]. Available: https://www.food.gov.uk/business-industry/guidancenotes/hygguid/foodhandlersguide. [Accessed 29 06 2018].

[60] NICE Clinical Knowledge Summaries, “Diarrhoea- adult's assessment,” NICE, March 2013. [Online]. Available: https://cks.nice.org.uk/diarrhoea-adults-assessment#!scenario. [Accessed 9 January 2018].

[61] NHS Choices, “Food poisoning,” 2017. [Online]. Available: https://www.nhs.uk/conditions/food-poisoning/treatment/. [Accessed 09 January 2018].

[62] NICE BNF, “Gastro-intestinal infections, antibacterial therapy,” 2017. [Online]. Available: https://bnf.nice.org.uk/treatment-summary/gastro-intestinal-system-infections-antibacterial-therapy.html. [Accessed 09 January 2018].

[63] City of London, “Food safety and hygiene advice,” [Online]. Available: https://www.cityoflondon.gov.uk/business/environmental-health/food-safety/Pages/prevention.aspx. [Accessed 29 06 2018].

[64] Hackney Council, “Food safety and health and safety advice for businesses,” [Online]. Available: https://hackney.gov.uk/food-safety-advice. [Accessed 29 06 2018].

[65] East London Health & Care Partnership, “North East London (NEL) Management of Infection Guidance for Primary Care,” 01 2018. [Online]. Available: https://www.nelft.nhs.uk/download.cfm?doc=docm93jijm4n2763.pdf&ver=4546. [Accessed 29 06 2018].

[66] NHS Fit for Travel, “Travellers' Diarrhoea,” [Online]. Available: http://www.fitfortravel.nhs.uk/advice/disease-prevention-advice/travellers-diarrhoea. [Accessed 29 06 2018].

[67] Health Protection Agency, “Foreign travel-associated illness: a focus on traveller's diarrhoea,” Health Protection Agency, London, 2010.

[68] Public Health England, “Travel-associated Shigella spp. infection in England, Wales and Northern Ireland: 2014,” 2014. [Online]. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/593642/Travel-associated_Shigella_infections_2014.pdf. [Accessed 29 06 2018].

[69] Public Health England, “Typhoid and paratyphoid: guidance, data and analysis,” HM Government, London, 2014.

[70] Public Health England, “Typhoid- health advice for travellers,” 2014. [Online]. Available: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/361480/PHE_Typhoid_factsheet.pdf. [Accessed 24 January 2018].

[71] Public Health England, “Typhoid - health advice for travellers,” 2014. [Online]. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/361480/PHE_Typhoid_factsheet.pdf. [Accessed 2018].

[72] Public Health England, “Travel-associated Shigella spp. infection in England, Wales and Northern Ireland: 2014,” 2017.

[73] Food Safety, “Shigella,” foodsafety.gov, [Online]. Available: https://www.foodsafety.gov/poisoning/causes/bacteriaviruses/shigella/index.html. [Accessed 23 January 2018].

[74] Public Health England, “Enteric fever (typhoid and paratyphoid) England, Wales, and Northern Ireland 2016,” 2016.

[75] L. McCrickard, S. Crim and S. Kim, “Disparities in severe shigellosis among adults — Foodborne diseases active surveillance network, 2002–2014,” *BMC Public Health ,* vol. 18, no. 221, 2018.

[76] Department of Health, “Typhoid,” HM Government, London, 2015.

[77] Public Health England, “Typhoid. Chapter 33.,” 2015. [Online]. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/457303/Green_Book_Chapter_33_v2_0.pdf. [Accessed 2018].

[78] NHS Scotland, “Fit For Travel,” 2018. [Online]. Available: https://www.fitfortravel.nhs.uk/home. [Accessed 2018].

[79] Public Health England, “Interim Public Health Operational Guidelines for Shigellosis,” HM Government, London, 2017.

[80] NHS Choices, “Typhoid Fever,” NHS, 2015. [Online]. Available: https://www.nhs.uk/conditions/typhoid-fever/treatment/. [Accessed 24 January 2018].

[81] World Health Organisation, “Health care-associated Infections Factsheet,” [Online]. Available: http://www.who.int/gpsc/country_work/gpsc_ccisc_fact_sheet_en.pdf. [Accessed 20 December 2017].

[82] British Medical Association, “Tackling healthcare associated infections through effective policy action,” June 2009. [Online]. Available: http://www.his.org.uk/files/7113/7085/4796/3_BMA_Tackling_healthcare_associated_infections_through_effective_policy_action.pdf. [Accessed 24 January 2018].

[83] Public Health England, “Healthcare associated infections (HCAI): guidance, data and analysis,” 2014. [Online]. Available: https://www.gov.uk/government/collections/healthcare-associated-infections-hcai-guidance-data-and-analysis. [Accessed 2018].

[84] Public Health England, “Clostridium difficile: guidance, data and analysis,” HM Government, London, 2014.

[85] R. Turner, “Health care associated infections: Stemming the rise of the superbug?,” 2008. [Online]. Available: http://www.kingsfund.org.uk/publications/healthcare-associated-infections. [Accessed 24 January 2018].

[86] R. M.-C. Katz MJ, “Healthcare-associated infections in the elderly: What's new,” *Current Opinion in Infectious Diseases,* vol. 29, no. 4, pp. 388-393, 2016.

[87] T. K. Fund, “Long-term conditions and multi-morbidity,” 2013. [Online]. Available: https://www.kingsfund.org.uk/projects/time-think-differently/trends-disease-and-disability-long-term-conditions-multi-morbidity. [Accessed 2018].

[88] NHS City and Hackney CCG, “Quality Report Q1 2017-18 Governing Body Meeting,” 2017.

[89] H. Humpreys, F. Fitzpatrick and B. Harvey, “Gender Differences in Rates of Carriage and Bloodstream Infection caused by Methicillin-resistent Staphylococcus aureus: are they real, do they matter and why?,” *Clinical Infectious Diseases,* vol. 61, no. 11, pp. 1708-1714, 2015.

[90] I. See, P. Wesson and N. Gualandi, “Socioeconomic factors explain racial disparities in invasive community-associated methicillin-resistant Staphylococcus aureus disease rates,” *Clinical Infectious Diseases,* vol. 64, no. 5, pp. 597-604, 2017.

[91] NICE, “Health-care associated infections: prevention and control,” 11 2011. [Online]. Available: https://www.nice.org.uk/guidance/ph36. [Accessed 07 2018].

[92] Department of Health, “Implementation of modified admission MRSA screening guidance for NHS,” HM Government, London, 2014.

[93] NICE, “Clostridium difficile infection: risk with broad-spectrum antibiotics,” 03 2015. [Online]. Available: https://www.nice.org.uk/advice/esmpb1/chapter/full-evidence-summary-medicines-and-prescribing-briefing. [Accessed 07 2018].

[94] Public Health England, “Updated guidance on the management and treatment of Clostridium difficile infection,” HM Government, London, 2013.

[95] Homerton University Hospital, “Management and Prevention C. difficile Associated Diarrhoea,” 2017. [Online]. Available: http://www.homerton.nhs.uk/media/527921/c_difficile_policy-Dec-13.pdf. [Accessed 07 2018].

[96] Homerton University Hospital, “Policy for the Control of Meticillin Resistant Staphylococcus,” 2016. [Online]. Available:

http://www.homerton.nhs.uk/media/527915/mrsa_policy_2013.pdf. [Accessed 07 2018].

[97] Public Health England, “PHE National Measles Guidelines,” HM Government, London, 2017.

[98] “Mumps,” WHO, 2016. [Online]. Available: http://www.who.int/immunization/diseases/mumps/en/. [Accessed 16 09 2017].

[99] Public Health England, “Tuberculosis screening,” HM Government, July 2014. [Online]. Available: https://www.gov.uk/guidance/tuberculosis-screening. [Accessed 23 January 2018].

[100] Public Health England, “PHE National Measles Guideline,” HM Government, London, 2017.

[101] NICE, “Clostridium difficile infection: risk with broad-spectrum antibiotics,” 03 2015. [Online]. Available: https://www.nice.org.uk/advice/esmpb1/chapter/Key-points-from-the-evidence. [Accessed 07 2018].