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Original Research

Variation in incidence and notification of *Campylobacter* and *Salmonella* by general practice in the Thames Valley area

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ABSTRACT

Objectives: To test whether there is unexplained variation in a) incidence of diagnosed bacterial food poisoning; and b) notification of bacterial food poisoning between general practices.

Study design: Observational study using routine surveillance data collected between 1 January 2008 and 31 December 2009.

Methods: Poisson regression, and the pseudo-R^2 statistic, was used to test for the unexplained (i.e. after adjustment for measured confounders) variation in incidence between practices. A generalized linear model, and the pseudo-R^2 statistic, was used to test for variation in notifications between practices. Both models were adjusted for demographic factors and organisational factors (Primary Care Trust and Quality and Outcomes Framework score).

Results: A total of 5766 incident cases (811 *Salmonella* and 4955 *Campylobacter*) were included. The adjusted incidence of *Salmonella* and *Campylobacter* was 128.3 cases per 100,000 persons per year. The adjusted incidence by general practice ranged from 9.8 to 281 per 100,000 (IQR: 90.2–151) persons per year. The median practice notification rate for *Salmonella* was 25% (range: 0%–100%), and 14.3% (range: 0%–87.5%) for *Campylobacter*.

The Poisson regression model had a pseudo-R^2 of 0.080 for the total number of *Salmonella* and *Campylobacter* cases, after adjustment for Primary Care Trust and practice deprivation, suggesting substantial variation. The Generalized Linear regression model (predicting notification by general practice) had a pseudo-R^2 of 0.040 for *Salmonella* and *Campylobacter*, after adjustment for Primary Care Trust and practice deprivation, suggesting substantial unexplained variation.

Conclusion: Substantial variation in the diagnosed incidence and notification of *Salmonella* and *Campylobacter* by general practice in the Thames Valley area exists. Practice-level factors are likely to account for some of the difference in testing and under-notification. This is important for interpreting data from surveillance systems. Further research is needed to inform interventions designed to increase notifications or improve testing.

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Introduction

Each year around one in five people experience food poisoning.[1] While the majority of cases are self-limiting, food poisoning accounts for significant morbidity and economic loss.[1] A small proportion of cases are fatal, 830 deaths were attributed to diarrhoea and infectious gastroenteritis in England & Wales in 2011.[2]

Good food hygiene can prevent most cases. Enforcement of standards, as well as monitoring of trends, is informed by surveillance.[3,4] While there are several components to any surveillance system, one part is the systematic collection of cases. This requires both identification (testing to confirm the diagnosis and identify the causative agent) and notification (or reporting) of cases to the relevant authorities.

In the UK most cases of food poisoning are self-managed and do not present to health service. Of the cases that present to the health service, the majority present to primary care.[1,5] Besides having an important role in terms of diagnosis, management and testing of food poisoning cases, general practitioners can have an important role in the early detection (and reporting) of food poisoning.[1,5,6] Early and timely notification of food poisoning can be critical for early detection of outbreak to prevent further cases. When a new case of food poisoning (clinically diagnosed) presents, general practitioners should notify the case as 'food poisoning' rather than awaiting definitive laboratory confirmation. Notification in this way may result in the public health authorities being informed several days earlier than if the notification is made once laboratory confirmation has occurred. Notification of food poisoning is a statutory duty in the UK.[7]

The present surveillance systems significantly underestimate the burden of disease.[1,5,8] This may occur because cases do not present for medical care, because cases are not tested, or because cases are not notified. Approximately for every 147 cases of food poisoning that occur in the community one case is reported to national surveillance.[5]

Under-testing and under-reporting have been described, but very limited work has looked at variation in testing or notification.[6,9] Identifying unwarranted (or excess) variation and understanding the causes of the variation may guide efforts to improve surveillance systems.

This work sets out to explore the variation between practices in: a) incidence of food poisoning (considered an indicator of the extent of testing); and b) notification of food poisoning by practice. In doing so, it focuses on the two most common causes of food poisoning in the UK, Campylobacter and Salmonella.[4]

Methods

Setting

The Thames Valley Health Protection Unit (HPU), part of the former Health Protection Agency, was responsible for a population of approximately 2.2 million. It covered the counties of Oxfordshire, Buckinghamshire and Berkshire as well as the town of Milton Keynes, and sits to the north east of London. The region has several major urban areas with populations greater than 100,000 (Reading, Oxford, Slough, High Wycombe and Milton Keynes). The balance of urban and rural populations is likely similar to the national average (England: 81.5% urban vs 18.5% rural; South East within which the Thames Valley resides is 79% vs 21%).[10]

The age distribution of the population in the Thames Valley (0–14 years: 19%; 15–24 years: 13%; 25–44 years: 29%; 45–64 years: 25%, 65 years and over: 14%) is similar but slightly younger in comparison to England (from the 2011 census: 0–14 years: 18%; 15–24 years: 13%; 25–44 years: 28%; 45–64 years: 25%, 65 years and over: 16%).[11] The population has a relatively high proportion of ethnic minority groups (less than 80% of the population identify as White British compared to 86% in England).[12,13] While there are significant areas of deprivation within the region, the average household income is relatively high compared to the English average.[13,14] The area had five primary care trusts: Berkshire East, Berkshire West, Buckinghamshire, Milton Keynes and Oxfordshire.

Data – Salmonella and Campylobacter notifications

Data on all notifiable cases of *Campylobacter* and *Salmonella* infection were taken from the local HPU database of notifiable diseases. *Campylobacter* and *Salmonella* were chosen because they are the most common form of diagnosed (i.e. laboratory confirmed) gastroenteritis presenting to general practice in the UK, and are largely acquired in the UK. *Cryptosporidium* was excluded because of variation in testing across the region.

The HPU maintained an electronic database of all notified diseases. This included both cases directly notified by a doctor and those notified directly from a laboratory. Each local hospital laboratory sent a weekly download of all new laboratory confirmed notifiable diseases. A standard protocol was followed to prevent duplication of entries onto the database. Positive results identified elsewhere in England for patients residing in the area are also notified, so the database should capture all laboratory confirmed cases for residents.

From the HPU database a spreadsheet of the number of notified cases with a confirmed laboratory diagnosis of either *Salmonella* or *Campylobacter* was compiled. This included the patient's age, date of notification, the patient's GP and whether the case was notified by the GP for the years 2008 and 2009 (i.e. cases notified between 1 January 2008 and 31 December 2010, inclusive). Cases were included based on the date of first notification.

Cases of *Salmonella Typhi* and *Salmonella Paratyphi* were excluded as their patterns of acquisition (and likely patient and GP behaviour would be different). The analysis was restricted to those patients both living in the Thames Valley area, and with a registered GP based within the Thames Valley area. All GP practices classified as walk-in-centres were excluded because the denominator population for these practices was unclear.

Data – population estimates and practice information

Estimates of the general practice population, by age (0–4 years; 5–14 years; 15–64 years; 65 years and over), for the year 2009 produced by the South East Public Health Observatory