Food Standards Scotland

For safe food and healthy eating

# CAMPYLOBACTER

## Estimating the healthcare cost of gastrointestinal infection in Scotland

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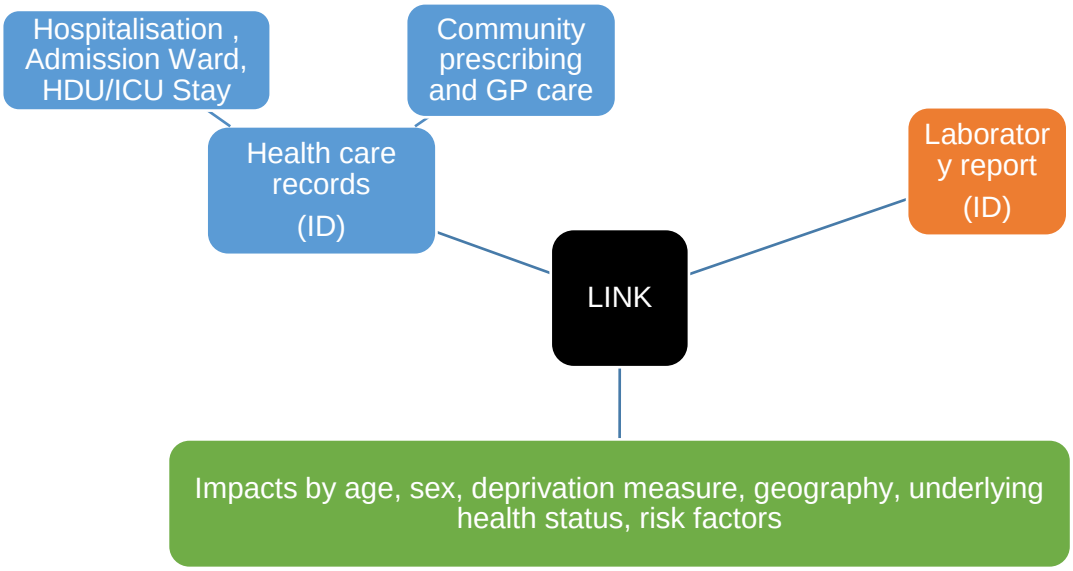
## Introduction

*Campylobacter* is recognised as being responsible for a significant disease burden in the Scottish population with around 6,000 laboratory confirmed cases per year. Previous studies have suggested that laboratory reports underestimate the true incidence by a factor of around nine (https://www.food.gov.uk/sites/default/files/media/document/711-1-1393_IID2_FINAL_REPORT.pdf), however only laboratory confirmed cases are within the scope of these cost estimates.

While laboratory data is available for all confirmed cases of *Campylobacter* in Scotland, little is known about how the demographic characteristics of confirmed cases relate to their clinical outcomes. The availability of individual-level hospitalisation, GP care, mortality and prescribing datasets in Scotland enables linkage with laboratory data, thus providing information on relevant health events before and after the episode of infection for each individual. Through analysis of this linked data, the data linkage project sought to estimate the disease burden of *Campylobacter* in Scotland, identify risk factors associated with hospitalisation, and gather information on the proportion of cases developing complications and sequelae.

### Figure 1: Data Linkage Project Flow Chart




This work has been completed describing the proportion of *Campylobacter* in Scotland hospitalised, duration of hospitalisation, risk factors of hospitalisation and poor outcome for the years 2013-2017 and the final report is available on the FSS website.

This methodology will be replicated for other gastrointestinal pathogens including *Salmonella* and Shiga toxin-producing *E. coli* (STEC) in Scotland in order to better

describe the overall burden of disease and compare the risk factors, severity of illness and possible complications of each pathogen.

*Campylobacter*, *Salmonella*, STEC and other gastrointestinal pathogens have multiple modes of transmission including foodborne, waterborne, animal and environmental contact as well as person to person transmission. In this work it wasn't possible to assign the proportion of cases that are likely to have acquired their infection via foodborne transmission or other routes of transmission.

As there is no published comprehensive assessment of the cost of gastrointestinal illness in Scotland this was an opportunity to calculate robust estimates of healthcare costs for these reported cases based on the data linkage project outputs.

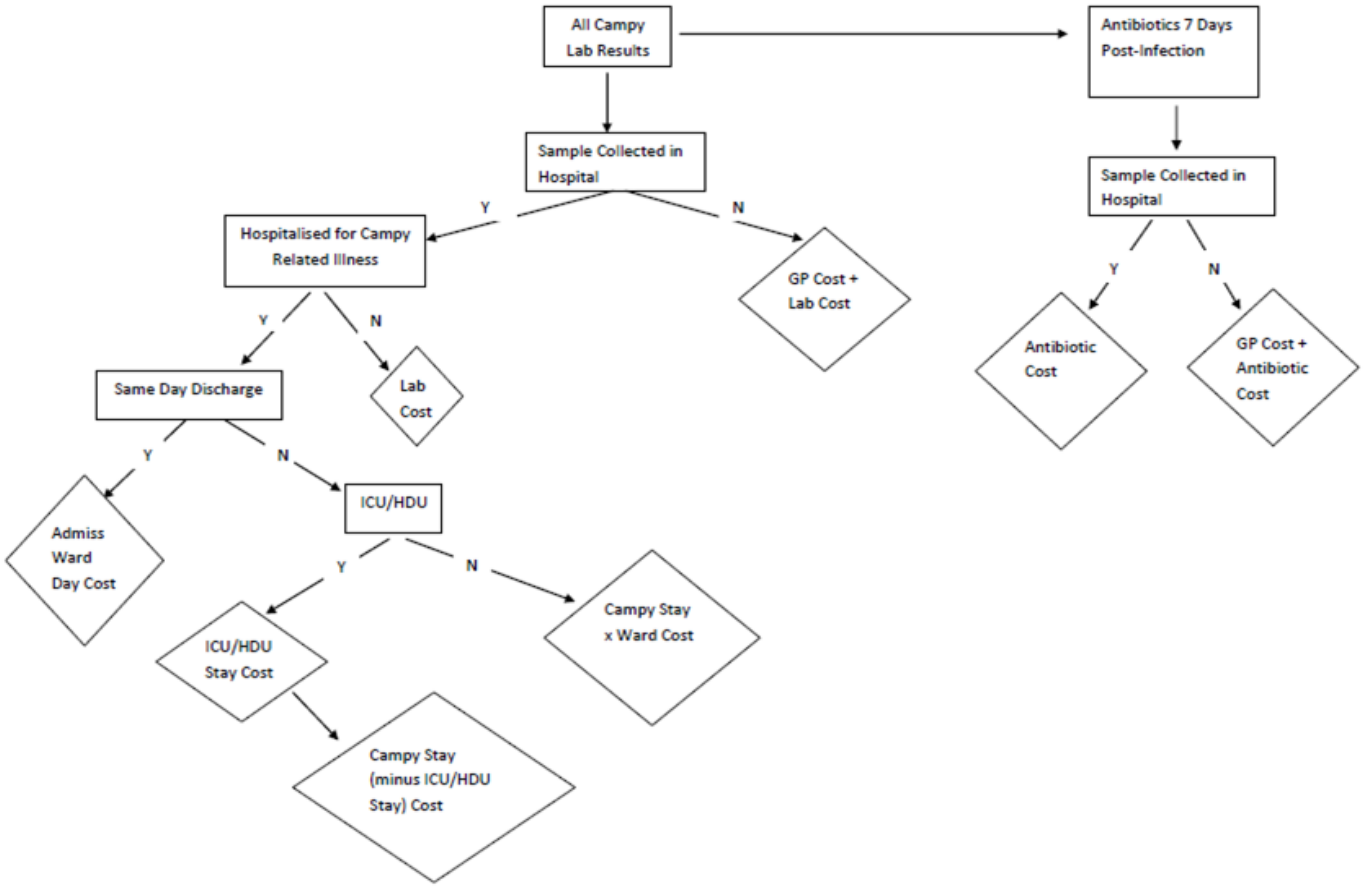
The aims of this component of the study were:

- A framework for estimating the healthcare costs of other gastrointestinal illness in Scotland
- A robust estimate for the total public sector healthcare spend on laboratory confirmed gastrointestinal illness in Scotland
- Understanding of the burden and costs across the population by: demographics, index of deprivation

## Methodology

Using the pathway detailed in Figure 2, outputs from the linkage dataset were then assigned costs from Scottish Health Service Costs published by ISD Scotland (https://www.isdscotland.org/Health-Topics/Finance/Costs/). The costs used are national averages per treatment and are based on 2017 costs. Although data exists for the average cost per visit for General Practice by health board and hospital, the Scottish figures used in this analysis are a weighted average of the disaggregated estimates. National average costs were used to analyse the burden on a consistent basis avoiding any differences due to regional economies of scale. This approach allows for the calculation of the overall healthcare cost burden of confirmed *Campylobacter* in Scotland. A comprehensive list of data sources is included in Appendix 1.

## Figure 2: Costs Pathway




A number of assumptions, inclusions and exclusions apply to the cost analysis:

| Includes | Excludes |
|---|---|
| ▪ Average national GP cost (where applicable, assumes one visit).<br>▪ Average national laboratory cost<br>▪ Hospital ward costs (national average ward type cost for overnight and day cases)<br>▪ ICU/HDU nightly cost<br>▪ Antibiotic prescribing (within 7 days of lab result) | ▪ Emergency admission cost<br>▪ Ambulance transport costs<br>▪ Cost of calls to NHS 24<br>▪ Quality of life burden (QALYs)<br>▪ Lost working days, either for those caring for others or patients themselves<br>▪ Sequelae costs<br>▪ Hospital stays of more than 20 days (unlikely to be for *Campylobacter*)<br>▪ Personal health care costs<br>▪ Costs to carers<br>▪ Costs to NHS Board Health Protection Teams for monitoring trends of cases locally and case investigation.<br>▪ Costs associated with deaths (number of *Campylobacter* related deaths were small) |

**Assumptions**

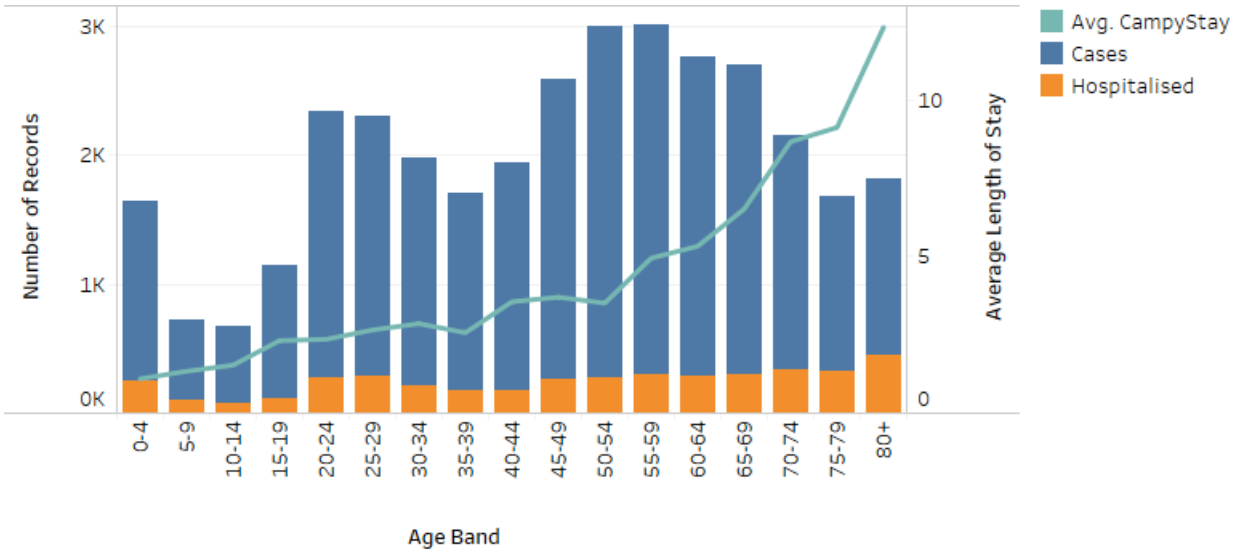
- For cases admitted to hospital, laboratory testing costs are included in the hospital day costs as these capture all laboratory testing.
- For cases not admitted to hospital, assumes one laboratory test per case.
- Assumes no GP costs for cases admitted to hospital, it is recognised that some of the hospitalised cases will have presented to primary care, but from the available data it is not possible to determine this proportion, so it is recognised this will underestimate GP costs.
- The cost of hospitalised patients with a positive test for *Campylobacter* are assumed to be due to *Campylobacter* however it is acknowledged that a patient may have other conditions alongside this.

## Results and Discussion

The study data for the five years 2013-2017 included a total of 30,032 cases of *Campylobacter*, of whom 14% were hospitalised. Of those hospitalised 3783 (90%) had at least one overnight stay and 410 (10%) were admitted and discharged on the same day.

Among those cases that were hospitalised, the mean length of stay increased with age (Figure 3).

### Figure 3: *Campylobacter* Laboratory Results and Hospitalisation by Age Band and Mean Length of Stay, 2013-2017




## Total Costs

The total calculated healthcare cost for the five years was £14,798,526 (Table 1), resulting in approximately £2.96 million per year (Table 2). The variation in annual costs is driven by differences in the number of cases reported and the healthcare pathways of those cases and is based on 2017 costs and prices.

### Table 1: All Costs by Category, 2013-2017

| | |
|---|---|
| HospStayAllCost | £10,521,241 |
| DayCaseCost | £304,279 |
| GPCost | £3,550,560 |
| LabCost | £392,188 |
| TotalCost | £14,798,526 |

### Table 2: Total Cost by Year

| Year | |
|---|---|
| 2013 | £2,948,615 |
| 2014 | £3,065,833 |
| 2015 | £2,970,419 |
| 2016 | £2,796,316 |
| 2017 | £3,017,342 |

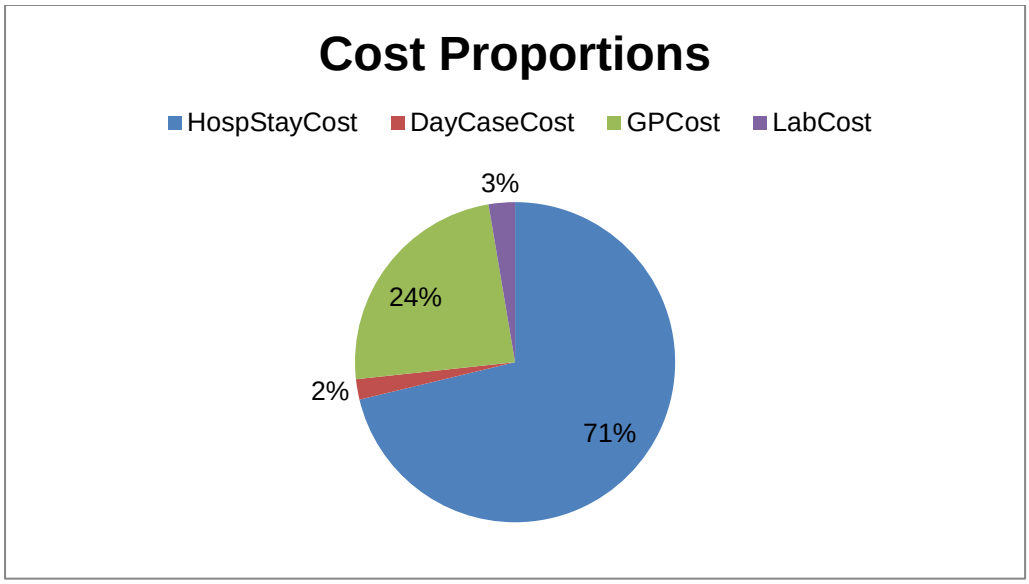
Over 70% of the overall cost was attributable to hospital stays. This does not include same-day discharge cases, which accounted for 2% of the overall cost (Figure 4). The average cost per case was greatly affected by hospitalisation status, with those who were hospitalised costing an average of £2,612 per case, relative to those not hospitalised incurring an average cost of £148 per case (Table 3). Two outstanding questions are whether a) the cases resulting in hospitalisation are inherently more

severe or more likely to require hospitalisation due to the impact of underlying medical conditions or b) whether some of the severity of the case could be mitigated through earlier intervention via GP treatment.

### Table 3: Average Cost for Hospitalised and Non-Hospitalised Cases

| Hospitalisation | |
|---|---|
| Not Hospitalised | £148 |
| Hospitalised | £2,612 |

### Figure 4: Proportion of total Costs by Category




The average cost per case of *Campylobacter* over the five-year period was £490, with a low of £459 in 2014 and a high of £524 in 2016. As these are based on 2017 ISD costs the difference in costs over the years presented therefore represents variation in the number of cases across different treatment pathways rather than changes in per treatment costs over the years.

### Table 4: Average Cost per Case by Year

| 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| £477 | £459 | £480 | £524 | £520 |

### Costs by Age Band and Healthcare Pathway

When stratified by age band, the highest total costs were incurred in the older groups, with an appreciable increase from age 70 years upward (Table 5).

These higher costs in the over 70 years were largely comprised of hospital costs, due to both higher rates of hospitalisation among the older age groups and longer duration of hospital stay.

With the exception of the over-80 years age group, the costs for non-hospitalised cases are fairly consistent across the age-bands, ranging from £145 to £150 (Figure 5).

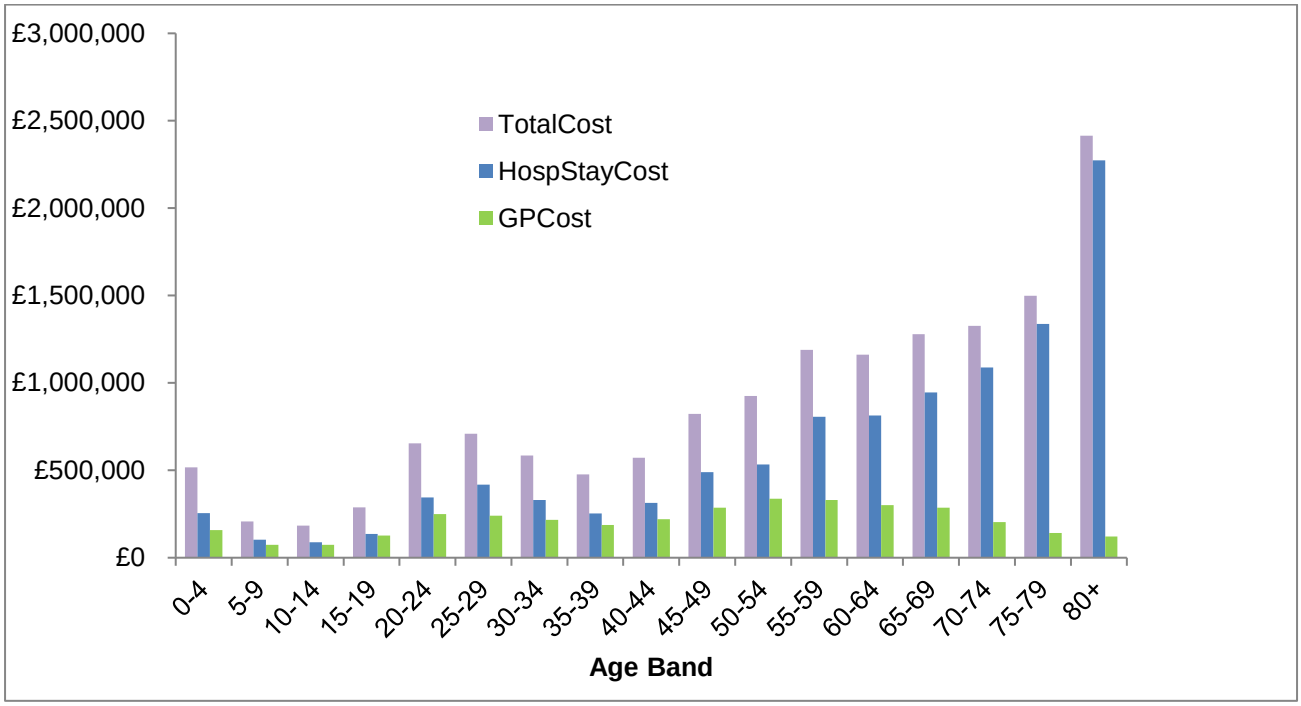
The variation in average cost for cases not hospitalised is due to differences in prescribing across the age bands.

### Table 5: Average Cost per Case by Age Band and Hospitalisation Status

| AgeBand | Ave Cost | Ave Cost Not Hosp | Ave Cost Hosp |
|---|---|---|---|
| 0-4 | £369 | £147 | £1,386 |
| 5-9 | £329 | £147 | £1,371 |
| 10-14 | £306 | £150 | £1,471 |
| 15-19 | £275 | £149 | £1,318 |
| 20-24 | £310 | £148 | £1,375 |
| 25-29 | £347 | £150 | £1,542 |
| 30-34 | £328 | £150 | £1,627 |
| 35-39 | £310 | £149 | £1,555 |
| 40-44 | £321 | £150 | £1,971 |
| 45-49 | £353 | £150 | £1,923 |
| 50-54 | £339 | £150 | £2,030 |
| 55-59 | £437 | £149 | £2,778 |
| 60-64 | £467 | £149 | £2,895 |
| 65-69 | £531 | £148 | £3,191 |
| 70-74 | £724 | £147 | £3,295 |
| 75-79 | £1,097 | £145 | £4,210 |
| 80+ | £1,747 | £137 | £5,085 |

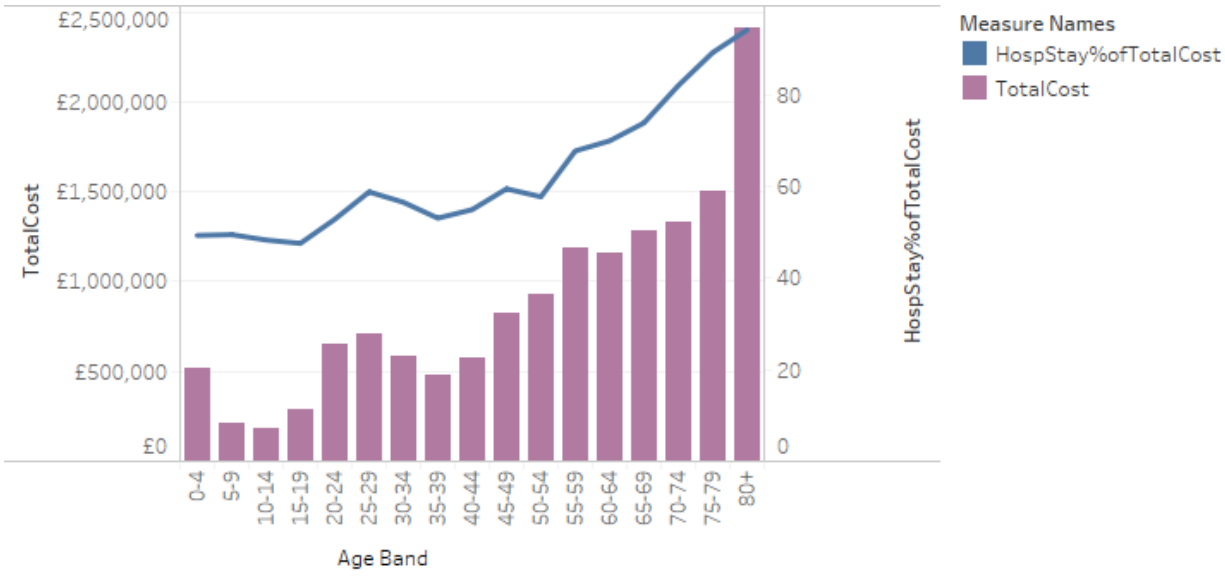
Figure 5 shows the total cost and hospitalisation and GP cost by age band.

## Figure 5: Total Costs, Hospital Stay and GP Cost by Age Band (2013-2017)



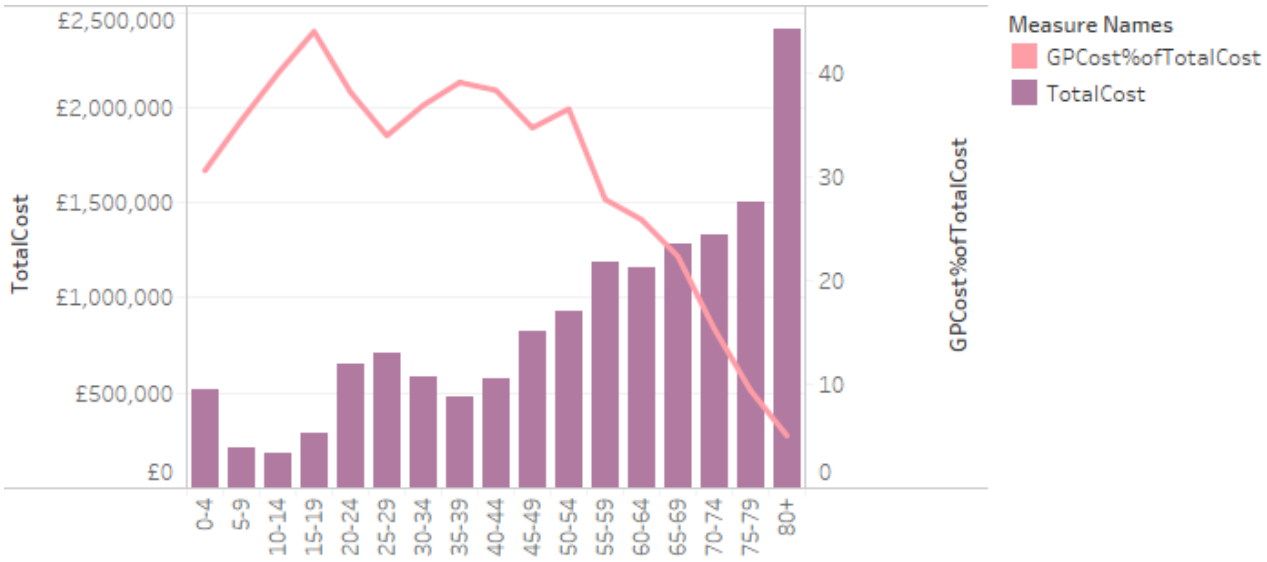

Disaggregating the costs by age band and by healthcare pathway provides a better understanding of the differences across the population. As illustrated in Figure 6, the cost burden on hospitals from confirmed *Campylobacter* cases increases with age from around 50% of total costs for the youngest age group up to almost 100% of total costs for the oldest; a major factor in this being the higher rate of hospitalisation among the older cases and a longer hospital stay.

## Figure 6: Total Cost and Hospital Stay Cost as % of Total Cost by Age Band



In contrast, GP costs typically follow an inverse relationship with age, as can be seen in Figure 7. This is partly caused by the fixed nature of these costs, if incurred. Therefore as total costs increase, the proportion due to GP costs decreases. This is well illustrated in the 15-19 age group, one of the lowest total cost brackets but with the highest proportion of GP costs at 44%. However, as described above, hospitalised cases were assumed not to have a GP consultation as it wasn't possible from the data to determine the proportion who did attend primary care before their hospital admission; therefore it is likely that the GP costs are underestimated, especially among the older age groups.

### Figure 7: Total Cost and GP Cost as % of Total Cost by Age Band




## Deprivation

There is variation in the average cost per case for those living in the most deprived area compared to those living in the least deprived area, based on Scottish Index of Multiple Deprivation (SIMD) category[1] (Table 6). This difference highlights variation in the severity and treatment pathways of cases in different areas. The average cost per case in the most deprived area is over 50% greater than in the least deprived area. This analysis does not include differences due to variation in the cost of providing healthcare in different areas around Scotland as national average costs are used in place of local costs.

[1] The Scottish Index of Multiple Deprivation (SIMD) identifies small area concentrations of multiple deprivation across all of Scotland in a consistent way. It allows effective targeting of policies and funding where the aim is to wholly or partly tackle or take account of area concentrations of multiple deprivation.
SIMD ranks small areas (called data zones) from most deprived (ranked 1) to least deprived (ranked 6,976).
Further information is available here: https://www2.gov.scot/Topics/Statistics/SIMD

### Table 6: Average Cost per Case by Deprivation Category

| SIMD | Avg. TotalCost | TotalCost |
|---|---|---|
| 1 | £624 | £3,172,899 |
| 2 | £589 | £3,433,666 |
| 3 | £446 | £2,691,528 |
| 4 | £423 | £2,773,174 |
| 5 | £408 | £2,640,567 |

Overall, *Campylobacter* incidence is highest in the least deprived areas but hospitalisation is higher in the most deprived areas, however, the mean length of stay is similar across SIMD category.

There are a number of factors that could be influencing the higher average cost per case in the more deprived areas, in particular the higher rate of hospitalisation among cases in the more deprived areas which may in part be due to the higher incidence of underlying health conditions in this group. Other factors that may contribute to the overall differences in rates of *Campylobacter* by SIMD and impact on treatment pathway and hence costs may include differences in healthcare seeking behaviour, access to health services, opportunity cost for the cases of accessing health services (e.g. taking time from work) so in theory could be less likely to attend GP early in disease, stool sample requesting by GPs, stool sample submission by cases. Understanding the reasons behind this is beyond the scope of this study.

## Limitations

The costings used were national averages rather than board/hospital specific costs so do not account for difference in costs for rural or island locations. The decision to use national averages was based on the objective of identifying health care costs of *Campylobacter* for the whole of Scotland, rather than assessing the difference within Scotland of the cost of healthcare provision in general.

This work took a health service perspective and did not account for:

- emergency admission costs
- sequelae associated with *Campylobacter*
- costs to NHS Board Health Protection Teams for monitoring trends of cases locally and case investigation
- costs associated with deaths (number of *Campylobacter* related deaths were small)

As a health service perspective was taken the work did not seek to capture the wider societal, individual or economic costs, such as those associated with time absent

from work (for case or caring for dependent), lost productivity due to staff absence, pain, grief and suffering associated with *Campylobacter* or longer term sequelae.

The work was based on laboratory confirmed cases of *Campylobacter* infection and therefore will not have captured costs associated with cases who sought medical attention and did not have a positive laboratory report, it could be hypothesised that such cases may be milder and would be less likely to require a hospital admission, however from a wider societal or economic perspective there are likely to have been costs associated with such unconfirmed cases.

## Conclusion

This project assessed the direct healthcare costs associated with *Campylobacter* in Scotland and due to the limitations detailed above is likely to be an underestimation of the true total cost as unconfirmed cases are not captured and some healthcare costs such as NHS 24 calls and public health surveillance are not included. Costs associated with personal healthcare, welfare burden (QALYs) and wider impacts such as lost earnings are not included.

The average costs estimated through this piece of analysis, however, are likely to be a fair representation of the cases resulting in hospitalisation and GP care. Exploring the differences across age and SIMD category this analysis identifies potential key population groups facing the highest burden from *Campylobacter* based on healthcare pathways. It has identified the groups where reductions in the incidence of *Campylobacter* would potentially have the greatest impact on the costs incurred by the health service.

## Appendix 1

### Data sources:

https://www.isdscotland.org/Health-Topics/Finance/Costs/

https://www.isdscotland.org/Health-Topics/Finance/Costs/File-Listings-2018.asp

https://www.isdscotland.org/Health-Topics/Finance/Costs/Detailed-Tables/Speciality-Costs/Acute-Surgical.asp

Source: Scottish Health Service Costs, Report R300, R380, R391 ISD Scotland

Source: Scottish Health Service Costs, Report R130, ISD Scotland

Source: Scottish Health Service Costs, Report R130X, ISD Scotland

IR2019 - 111XX GP

R040 inpatient specialty costs and activity - inpatients in all specialties (exc long stay), by hospital

R042 daycase specialty costs and activity - daycases, by specialty, by hospital