SCOTTISH HOSPITALS INQUIRY

Bundle of documents for Oral hearings commencing from 19 August 2025 in relation to the Queen Elizabeth University Hospital and the Royal Hospital for Children, Glasgow

Bundle 44 Volume 7
Responses from Experts, (Mr Mookerjee & Dr Drumright) and Associated Documents

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Scottish Hospitals Inquiry

Opening Note by Counsel to the Inquiry prior to the Glasgow IV, Part 2 Hearing: 19 to 29 August 2025

Introduction

1. This opening note has been produced to assist the Chair and CPs to prepare for the Glasgow IV Part 2 hearing which will run from 19th to 29th August 2025. No Closing Statements will be produced at the end of this hearing.

2. The primary purpose of Glasgow IV, Part 2 is to consider the report of Professor Hawkey, Dr Agrawal and Dr Drumright in respect of the evidence of risk of infection from the water and ventilation systems at the QEUH/RHC ("the HAD Report")[1]. The primary issue that requires to be resolved in this hearing is whether there was in fact an exceedance of infections in QEUH/RHC in the period 2016 to 2019. The authors of the HAD Report advance a number of propositions, and those who responded to that report have also raised a number of issues. The HAD authors have changed their position in certain respects[2]. A detailed note of the key themes and topics are set out in Appendix 1 to this note.

3. The hearing will also hear further evidence on the assessment and management of the issue of risk by considering a report prepared by Dr Mumford as a consequence of representations made in the closing statements on behalf of the Scottish Ministers and NHS NSS after the Glasgow 3 hearing. The opportunity will also be taken to address with Dr Mumford an issue about her joint report with Ms Dempster raised by Dr Chaput of NHS GGC after the Glasgow 3 hearing[3].

4. All the witnesses who will be called to give evidence in Glasgow 4, Part 2 are persons of skill and expertise and can (within the scope of their expertise) be asked to give opinion evidence. The list of themes and topics in Appendix 1 will

[1] Bundle 44, Volume 1, Document 1, Page 5.
[2] Bundle 44, Volume 5, Document 2, Page 20.
[3] Bundle 44, Volume 4, Documents 1 and 2, Pages 3 & 9.

be supplied to those witnesses so that they can appreciate the issues which require to be addressed and thus aid their preparation.

The HAD Report

5. The HAD Report was originally instructed by NHS GGC and the letters of instruction to its authors are produced in Bundle 44, Volume 1[4]. The data supplied by NHS GGC to the authors of the HAD Report was supplied to the Inquiry at the end of March 2025. What was supplied to them by NHS GGC and where it can be found it set out in an inventory[5]. Data sets containing patient identifiable information are not included in the hearing bundles. That data was separately supplied to the CLO for NSS, Lindsays for the Cuddihy/Mackay patients and families group and MDDUS for Dr Peters and Dr Inkster at their request and all under Restriction Order 1.

6. The HAD Report is divided into an Executive Summary and eight substantive chapters.

   a) Chapter 1 introduces the report and ends with a specific reference to the work of the Case Notes Review Expert Panel ("the CNR").

   b) Chapter 2 is a description of what micro-organisms are, under reference to how they are named, what is meant by an outbreak and the potential for Blood Stream Infection (BSI) to have its source in the patient's gut.

   c) Chapter 3 is entitled "Clinical significance and epidemiology of the most common groups of presumed environmental bacteria selected for inclusion by the CNR". The chapter describes what are presented as the characteristics of bacteria considered in the CNR Overview Report listed by order and genus, particularly under reference to their potential as endogenous rather than exogenous sources of infection or alternatively having a source in another colonised patient or staff member, thus, as it would appear, questioning the appropriateness of the criteria used to define the cohort which was subject to the CNR. This section appears to argue that some of the bacteria infections

[4] Bundle 44, Volume 1, Documents 3, 4 and 5, Pages 234 to 245.
[5] Bundle 44, Volume 1, Document 2, Page 224.

considered by the CNR (including Klebsiella spp., Serratia marcescens, Citrobacter Stenotrophomonas and Pseudomonas) are not properly environmental infections but tend to come from other colonised patients.

d) Chapter 4 is a methodological critique of the work of the CNR.

e) Chapter 5 focuses on the question of whether it is correct to say that there was “widespread contamination” of the water system and its consequences. It does not address the actual observed condition of the water system of the QEUH/RHC at any stage. It explains that where there is an increased risk of infection due to water contamination one does not usually see an increase in infection rates across the whole of a hospital population, rather, when there is an occurrence of nosocomial infection invariably one sees local rises in particular physical locations or among particular groups of patients.

f) Chapter 6 addresses the issue of the potential for infection risk from an “inadequate or insufficient” ventilation system in generality. It does not address the specific features of the ventilation system of the different parts of the QEUH/RHC. At section 6.1.3 the authors observe that the risk of infection arising from an inadequate or insufficient ventilation system would not be equal across all patient populations. Within a large hospital serving many types of patients, the impact would be greatest in patients with the greatest degree of immunocompromise, either because of their underlying medical condition, the treatment they are receiving or both. Therefore, any increase in infection rates due to airborne transmissible diseases would be most visible in these patients and one of the highest-risk populations is the group of patients with haematological, and other, cancers undergoing intensive chemotherapy and/or haematopoietic stem cell transplants (HSCT). The principles of ventilation systems were extensively covered by the Inquiry in its hearing in respect of Edinburgh in May 2022 the Chair has reached conclusions on this subject in Chapter 5 of the Interim Report.

g) Chapter 7 is the largest part of the report and describes itself as an analysis of infection rates and data from QEUH & RHC. It has three parts:

7.1 Whether water testing results are consistent with there being 'widespread contamination' by reference to *P. aerugionsa*.

7.2 A detailed epidemiological review of bacteraemia from supplied NHS GGC data for both adults and children.

7.3 Focuses solely on Whole Genome Sequencing ("WGS").

Section 7.2 is further subdivided into four sections albeit that the numbering sequences for subsections has broken down. There are, for example two sections 7.2.3[6], two sections 7.2.6[7] and no section 7.2.4. The four sections appear to cover:

- The incidence of 'environmentally relevant' species from available NHS GGC BSI data; adults 2013 to 2023 and paediatric 2005 to 2022,
- Methods for analysing NHS GGC bacteraemia data.
- Bloodstream infections in adult patients in NHS GGC January 2013-2023.
- Bacteraemia in paediatric patients in NHS GGC 2003 to 2022.

In response to a request by the Inquiry Team, Dr Drumright[8] later provided several tables and data sets that relate to calculations and figures in Chapter 7[9]. That response[10] and the tables and data that did not contain patient information[11] have been included in Bundle 44, Volume 2[12]. All that data was separately supplied to the CLO for NSS, Lindsays for the Cuddihy/Mackay patients and families group and MDDUS for Dr Peters and Dr Inkster at their request and all under Restriction Order 1.

h) Chapter 8 is a study of the numbers of Aspergillus infections in the haemato-

[6] Bundle 44, Volume 1, Document 1, Pages 69, 73.
[7] Bundle 44, Volume 1, Document 1, Pages 84, 92.
[8] Bundle 44, Volume 2, Document 46, Page 705.
[9] Further details about this data can be found in Bundle 44, Volume 5, Document 2, Page 34, para 2.E.2.
[10] Bundle 44, Volume 2, Document 3, Page 51.
[11] The destination of each table or set of data is set out in Bundle 44, Volume 2, Documents 4 to 12, Pages 78 to 106.
[12] Bundle 44, Volume 2, Document 2, Page 49.

oncology population of the QUEH/RCH and in predecessor units in Glasgow back to 2013 for adult patients and 2005 for paediatric patients. In response to a request by the Inquiry Team, Dr Agrawal provided his calculations for this Chapter that had not previously been included in the HAD Report[13].

i) The balance of the HAD Report is a list of tables and figures (Chapter 9), References (Chapter 10), a declaration by the authors (Chapter 11) and details of the authors (Chapter 12).

7. Once the decision was made to receive the HAD Report, the instruction of its authors by NHS GGC was novated to the Scottish Hospitals Inquiry and HAD Questionnaire 1 was sent to the HAD authors. Their response is produced[14].

8. In their application for receipt of the report in March 2025 NHS GGC submitted that the report directly addresses TOR 1 and whether "the built environment of the QEUH/RHC expose[s] patients to an increased risk of infection". This effectively amounts to a submission that the report addresses Key Question 4 which is:

> [4] Is there a link, and if so in what way and to what extent, between patient infections and identified unsafe features of the water and ventilation systems?

9. In that submission NHS GGC also submitted that:

> "2.3. The Report concludes, following detailed data analysis, that there were no excess infections at the QEUH/RHC when compared with other hospitals."

The HAD Report and the Case Notes Review

10. Whilst the Case Notes Review is not mentioned in the Executive Summary of the HAD Report the final paragraph of the Introduction ends in the following terms:

> "A significant reliance appears to have been placed on the Queen Elizabeth University Hospital and Royal Hospital for Children Case Note Review Overview Report (Stevens, Evans and Wilcox, 2021) (CNR) in relation to whether the built environment at the QEUH and RHC posed an increased risk

[13] Bundle 44, Volume 2, Document 13, Page 107.
[14] Bundle 44, Volume 2, Document 1, Page 12.

of infection. However, we do not consider that the CNR is of assistance in determining this for the reasons set out below."

11. Note should be taken of the position taken in the Closing Statement of Counsel to the Inquiry in Chapter 3.9[15] which addresses the use the Inquiry should make of the conclusions of the CNR in circumstances where patient specific records, the tableau timeline and the individual assessments and conclusions for each infection were not available to the Inquiry. It was submitted that the Chair should:

    (i) Take full account of the expert opinions and assessments of the members of CNR Expert Panel expressed collectively in the Overview Report and individually in their statements and oral evidence on all matters, except in respect of their core conclusions on infection link.

    (ii) Not use the CNR Expert Panel's core conclusions on infection link as an initial factor in reaching an initial conclusion on Key Question 4. The Chair should first reach his own reasoned conclusion on that question, using all the other evidence before him, and then, once he has reached a provisional conclusion, compare his answer and his reasons for it with those of the CNR Expert Panel as, in essence, a cross check as to his conclusions reached without taking account of those core conclusions on infection link.

12. With that in mind an approach was made to the members of the CNR Expert Panel (Gaynor Evans, Professor Wilcox and Professor Stevens) to invite them to respond to the criticism of their work within the HAD Report. They were given a wide instruction to take the opportunity to respond to any issues within the HAD Report that they felt required a response. A specific instruction was also given to Professor Wilcox, who was asked to include within the response a further discussion on the use of WGS in the HAD Report, particularly at section 7.3. The response of the CNR Expert panel is produced[16] along with papers referred to within it[17].

[15] Closing Statement by Counsel to the Inquiry - Glasgow 3 | Hospitals Inquiry, Section 3.9, Page 119, paras 412 to 424.
[16] Bundle 44, Volume 2, Document 15, Page 120.
[17] Bundle 44, Volume 2, Documents 16 to 44, Pages 207 to 684.

Considering Yorkhill

13. The Inquiry has not previously examined the similarities and differences between infection rates in the QEUH and other hospitals in NHS GGC and in particular at Yorkhill, beyond what is contained in the 2019 HPS Reviews[18]. In light of the significant interest taken by the HAD Report in rates of BSI amongst paediatric haemato-oncology patients at Yorkhill, the Inquiry Team has sought additional evidence from clinicians who might be expected to have direct experience of the incidence of such infections there, but who were not asked about this when they gave evidence in earlier hearings of the Inquiry. These witnesses are referred to by the Inquiry Team as the "Consequential Witnesses" and fall into two groups:

    - Members of the clinical team of the Schiehallion Unit and the wider Yorkhill Hospital who gave evidence in Glasgow 2 in July 2023.

    - IPC and Microbiology clinicians at the QEUH who gave evidence in Glasgow 3 between August and November 2024 and whose statements were largely finished before NHS GGC produced the HAD Report to the Inquiry in July 2024.

14. Questionnaires were sent to these witnesses in April and May 2025, and their statements have now been bundled. As set out in the attached provisional witness list most of these Consequential Witnesses will give evidence in Glasgow 4, Part 2 by written statement only.

Obtaining the views of others

15. The Inquiry has engaged the services of six experts: Dr Mumford, Ms Dempster, Dr Walker, Mr Mookerjee, Mr Bennett and Mr Poplett. Given the scope of the HAD Report, it was decided to ask Dr Mumford as a Microbiologist and IPC Consultant and Mr Mookerjee as an epidemiologist to review aspects of the HAD Report.

16. Dr Mumford was asked to prepare a report for the Inquiry on the whole HAD report, on the validity of its methodology and conclusions from a Microbiology and

[18] Bundle 7, Documents 5, 6 and 7, Pages 194 to 285.

IPC perspective. This report is produced[19]. Counsel to the Inquiry consulted with Dr Mumford and asked her a number of specific questions. She has addressed those questions in her report.

17. Mr Mookerjee was asked to prepare a report for the Inquiry reviewing the methodology and conclusions for Chapter 7 and to also consider if there are any points of comparison or connection between Chapter 7 and other epidemiology studies known to the Inquiry, particularly those carried out by HPS and Dr Kennedy in 2018/2019 and by him for the Inquiry. This report is produced[20]. Counsel to the Inquiry consulted with Mr Mookerjee and asked him a number of specific questions which he has specifically identified in his report.

18. Dr Mumford and Mr Mookerjee were also asked to prepare a Joint Report for the Inquiry reviewing the methodology and conclusions of the HAD Report in respect of Aspergillus infections and to see if there are any points of comparison or connection narrative of Aspergillus infections already analysed by Dr Mumford and Ms Dempster. This report is produced[21]. Counsel to the Inquiry consulted with Dr Mumford and Mr Mookerjee and specifically asked them to consider whether it would be possible to calculate rates of Aspergillus infections based on the data in Chapter 8 and they did so.

19. As parts of Chapter 7 of the HAD Report covers similar ground to the four HPS Reports produced in 2019 the Inquiry Team asked NSS whether the NSS data scientists or epidemiologists involved in the production of those reports could produce a commentary reviewing the methodology and conclusions for Chapter 7. A report (dated 28 May 2025) was prepared by Ms Shona Cairns and is produced[22]. Ms Cairns later saw Dr Agrawal's calculations documents for Chapter 8 and provided a supplementary review on 20 June 2025[23].

Opportunities for the authors of the HAD Report to respond

[19] Bundle 44, Volume 2, Document 48, Page 739.
[20] Bundle 44, Volume 2, Document 79, Page 1255.
[21] Bundle 44, Volume 2, Document 81, Page 1282.
[22] Bundle 44, Volume 2, Document 45, Page 685.
[23] Bundle 44, Volume 3, Document 5, Page 222.

20. The Inquiry Team considered that the authors of the HAD Report should be given the opportunity to respond to the five reports described above and they did so on 20 July 2025 in a response document along with their response to HAD Questionnaire 2[24] ("the HAD Response document"). Both are produced[25].

Directions to Dr Drumright and Mr Mookerjee

21. The Inquiry Team considered that any discussion of the inferences that could be drawn from the analysis in the HAD Report, the various responses and the epidemiological reports and studies already considered in the Glasgow 3 hearing, would be assisted by provision of an agreed set of charts that would set out the rates of infections and the trends of infections over various periods at both Yorkhill and RHC. Counsel to the Inquiry consulted with Mr Mookerjee and Dr Drumright and after the production of the HAD Response document they were directed to jointly consider a series of questions and if possible, to reach an agreed position on those questions. That Direction is produced as Appendix 2 to this opening note. Their response will be produced once it is available.

Other epidemiology reports to be referred to in the hearing

22. Given the important role that epidemiology will play in this hearing it is likely that reference will be made to the following reports already considered by the Inquiry in earlier hearings:

    (i) The *HPS Situational Assessment, Wards 2A/B, Royal Hospital for Children, NHS Greater Glasgow and Clyde* (Bundle 7, Document 5, Page 194) and, in particular, Appendix 4 to that document (Bundle 7, Document 5, Page 205).

    (ii) The *HPS SBAR: To support NHS GGC IMT Mycobacterium chelonae cases and the Incidence of gram-negative bacteraemia in the paediatric haemato-oncology*, September 2019 (Bundle 3, Document 16, Page 127).

[24] Bundle 44, Volume 5, Document 1, Page 4.
[25] Bundle 44, Volume 5, Documents 1 & 2, Pages 4 to 102.

(iii) *Draft HPS Review of NHS GG&C Infection Outbreaks in the Paediatric Haemato-oncology Data* October 2019 (Bundle 7, Document 6, Page 214)

(iv) *HPS Review of NHS GG&C Infection Outbreaks in the Paediatric Haemato-oncology Data* October 2019 - 29 November 2019 (Bundle 7, Document 7, Page 250).

(v) Presentation by Kathleen Harvey-Wood and Dr Christine Peters: *Bacteraemia rates and Resistance Paediatric Haemato-oncology 2014-2018*, 30 August 2018 (Bundle 27 Volume 6, Document 9, page 107).

(vi) Report by Dr Iain Kennedy: *Descriptive Analysis of Trends in Bacteraemia Rates for Selected Gram-Negative Organisms*, 1 October 2018 (Bundle 6, Document 27, page 95).

(vii) Draft report by C Peters and K Harvey-Wood: *Bacteraemia rates and resistance patterns in paediatric haematology/oncology patients 2014-2018,* 10 October 2018 (Bundle 19, Document 19, Page 143).

(viii) Report by Dr Iain Kennedy: *Descriptive analysis of trends in bacteraemia rates for selected gram-negative organisms*, July 2019 (Bundle 6, Document 28, page 104)

(ix) Presentation by Dr Iain Kennedy and Jennifer Rodgers: *Paediatric Haemato-oncology RHC – Summary of Data, September 2019* - Presented at IMT meeting of 20 September 2019 (Bundle 27, Volume 13, Document 13, Page 77)

(x) Mr Mookerjee's *Quantitative Infection Link Report* - 9 May 2024 (Bundle 21, Volume 1, Document 1, Page 3)

(xi) Mr Mookerjee's *Supplementary Report* – 12 August 2024 (Bundle 21, Volume 1, Document 3, Page 71)

(xii) Mr Mookerjee's addendum to that report – 16 October 2024 (Bundle 21, Volume 1, Document 10, Page 767)

(xiii) Mr Mookerjee's Direction 5 response dated 11 July 2024 (:Bundle 21, Volume 5, Document 3, Page 104)

(xiv) The updated chart used by Mr Mookerjee in his oral evidence on 5 November 2024 to present his calculation of the overall Schiehallion rate per 1000 admissions (Bundle 27, Volume 18, Document 1, Page 3) and final chart of RHC Haematology and Oncology Admissions June 2015 to end 2022 supplied by NHS GGC (Bundle 27, Volume 17, Document 45, Page 539).

Other reports to be referred to in the hearing

23. It appears that a decision was made by those who instructed the HAD Report not to ask Professor Hawkey, Dr Agrawal and Dr Drumright to consider investigations and interventions into the water and ventilation systems of the QUEH/RHC, the design features of those systems or the work of the IPC team at the hospital. When asked about a range of key documents considered in evidence by the Inquiry in earlier hearings and the preparation of Provisional Position Papers[26] the HAD authors explained:

> "Investigating interventions and infection control activities was not part of our remit. We were asked to use the data made available to us from the NHS on bed days and microbiology results to determine if there was evidence that the QEUH put people at additional risk of HCAI, specifically BSI and Aspergillus infections" OBJ

24. The implications of this decision do require to be considered, but it is possible that the documents referred to in Question 10 of HAD Questionnaire 1 and Questions 49 and 50 of HAD Questionnaire 2 will be referred to in the hearing.

Structure of the hearing

25. The hearing will run over eight sitting days in August – Tuesday 19th to Friday 22nd and Tuesday 26th to Friday 29th. All witnesses will be called alone.

[26] HAD Questionnaire 1, Question 10, Bundle 44, Volume 2, Document 1, Pages 24 to 26.

26. Consideration was given whether to use concurrent expert evidence to hear the views of the authors of the HAD Report or the members of the CNR Expert Panel. It has been decided not to take that approach because:

    (i) In the case of the CNR Expert Panel the three members of the panel have been able to produce a single joint document that responds to the criticisms of their work and the efficient achievement of the Inquiry's remit and terms of reference can be achieved by calling Professor Stevens to speak to that.

    (ii) Whilst the authors of the HAD Report prepared a joint report it has become clear at consultation that there is considerable division of labour between the three authors in preparing responses to HAD Questionnaires 1 and 2 and therefore each of Professor Hawkey, Dr Agrawal and Dr Drumright can give evidence separately about the aspects of the joint report which they respectively took a lead on.

Fred Mackintosh KC
Craig Connal KC
Graham Maciver, Advocate
Neil Morrison, Advocate

31 July 2025

Appendix 1: Themes and Issues

1. The key issues and propositions that require to be considered in the hearing can be grouped under six headings

    a) Higher level propositions.

    b) Analysis of the incidence of BSI.

    c) Analysis of the incidence of Aspergillus infections.

    d) The value of whole genome sequencing.

    e) The criticisms made of the CNR by the HAD Authors.

    f) Challenges to the work of the HAD Authors,

2. It is not intended to conduct a detailed review of the whole of Chapter 3 of the HAD Report for the simple reason that its authors had, when they wrote it, no knowledge of and did not take account of the investigations, interventions and infection control activities carried out at the QEUH/RHC[27]. However, the issue of the extent to which biofilms containing the bacteria discussed in Chapter 3 in parts of a hospital water system such as pipe, tanks, TMVs and drains might form a reservoir of different or distantly related microorganisms does appear relevant to the issue of the value of WGS and will be discussed at the hearing.

<u>Higher level propositions</u>

A. When considering types of bacteria that are common in the environment as a whole and in patients' own flora, does establishing a link between infections and the environment require consideration of alternative sources of infection, such as the patient themselves.

B. What inferences can be drawn about whether there was extensive contamination of the hospital water system from inspection of water testing

[27] Answer to HAD Questionnaire 1, Question 10: Bundle 44, Volume 2, Document 1, Pages 24 to 26 and HAD Questionnaire 2, Questions 49 and 50: Bundle 44, Volume 5, Document 1, Page 18.

results for *Pseudomonas aeruginosa*[28]?

C. Is it correct to proceed on the basis that the impact of any risk of infection due to widespread contamination of the water system and/or inadequate ventilation system would fall on **both** adult and paediatric patients with haematological, and other, cancers undergoing intensive chemotherapy and/or haematopoietic stem cell transplants (HSCT)? OBJ

D. Given that infection risk is multifactorial, is it correct to conclude that (a) an increase in infection rates is not necessarily attributable to the built environment and (b) that to assess whether there is an increased risk of infection a normal level of risk must be established[29]

E. Is it correct to proceed on the basis that attributing the source of a BSI pathogen to the built environment of the hospital can only be done if: the strains identified are indistinguishable, a source is present, and a route of transmission and a portal of entry are identified? OBJ

F. Should the Inquiry require confirmation that samples are genetically identical or closely related before determining that there is a link between them for the purpose of answering Key Question 4?

G. What is the effect of the apparent difference between the definition of an "outbreak" in section 2.2 of the HAD Report[30] and Chapter 3 of the Scottish NIPCM[31]?

H. What is the value of the proposition advanced by the CNR Expert Panel[32] that *"Basic infection control analysis clearly showed clustering of some types of infections in time and place. The occurrence of repeated, unrelated infections with the same microorganism is very unlikely. What is the chance that clusters, occurring in time, of children managed in the same wards all*

[28] Bundle 44, Volume 1, Document 1, Page 62, para 7.1, and CNR Rebuttal, Chapter 8, Bundle 44, Volume 2, Document 16, Page 171.
[29] Bundle 44, Volume 1, Document 1, Page 6, paras 3, 4.
[30] Bundle 44, Volume 1, Document 1, Page 20.
[31] Bundle 27, Volume 4, Document 16, Page 176 and discussed in the CNR Rebuttal, Bundle 44, Volume 2, Document 15, Page 129-130; by Dr Mumford at paras 3.3-3.12 in her M1 Report at Bundle 44, Volume 2, Document 48, Page 743.
[32] Bundle 44, Volume 1, Document 14, Page 127.

developed BSIs caused by bacteria of the same species that had no common source(s)? It is implausible that, on repeated occasions, patients who developed a BSI were the source of BSIs in other patients. It is more likely that there were common sources of the bacteria involved that either colonised (and then infected) or directly infected the children"?

Analysis of the incidence of Blood Stream Infections ('BSI')

I. How did the numbers and rate of environmentally relevant BSI in paediatric haemato-oncology patients change over the period for which infection and activity data were available from 2008 onwards (a) at Yorkhill (b) at the time of the move from Yorkhill to the RHC and (c) after the decant to Wards 4B and 6A on 26 September 2018 and what, in any, inferences can be drawn from that data?[33]

J. Does any issue arise from the differences between the groupings of potentially environmentally transmitted micro-organisms considered by the HAD Report and the groups considered by HPS in 2019[34] and Dr Kennedy in 2018 and 2019? OBJ

K. Para 7.2.2 of the HAD report considers methods for analysing GGC bacteraemia data and considers potential epidemiological clusters. Three issues arise to be considered:

1. Is there any validity in the critique[35] of the clustering methodology adopted by the HAD Authors that it does not align with the definitions in Chapter 3 of the Scottish NIPCM[36] and does not reflect the often polymicrobial and/or poly-strain epidemiology of outbreaks with an environmental source?

[33] Views are expressed in (1) HAD Report, Chapter 8 (Bundle 44, Volume 1, Document 1, Page 123), (2) NSS Commentary paras, 1.4 (Bundle 44, Volume 2, Document 45, Page 686), (3) Mr Mookerjee from para 2.21 and Table 6 of his M2 Report (Bundle 44, Volume 2, Document 79 from page 1274), and by the HAD Authors in the HAD Response document (Bundle 44, Volume 5, Document 2, Page 44) in respect of trend methodology 2.F.1 and 2F.2 and Chapter 6 (particularly para 6.8) where they conclude that for the period 2012 to 2018 "On further inspection of additional data sources, with slightly different denominators and case definitions from ours, it appears that overall trends are similar".
[34] Bundle 7, Documents 5, 6 and 7, Pages 194 to 285.
[35] Bundle 44, Volume 2, Document 45, Page 696, paras 3.4.1 – 3.4.2.
[36] Bundle 27, Volume 4, Document 16, Page 176 and discussed in the CNR Rebuttal, Bundle 44,

2. Does the HAD Report actually consider *"all available data"* [OBJ] to identify clusters, as the authors were not given access to available contemporaneous material such as the material considered by the CNR and described in Section 11 of the CNR Overview Report[37].

3. How should the Inquiry rationalise the HAD Authors' critique of the CNR attempt at understanding clusters on the grounds that "*The CNR panel's method of "defining" outbreaks/clusters in our experience is an unusual, suboptimal and a limited method of investigation"* because it did not consider WGS[38] with its own attempt at clustering in Chapter 7.2, when they had access to substantially less data than the CNR[39]?

L. What is the relevance of the conclusion of the HAD Report that following the move of the BMT service (Adults) from the Beaston to Ward 4B QEUH on 30 June 2018, the incidence of bacteraemia attributable to environmental organisms decreased with the move to QEUH[40], in light of the evidence that by the time that move had taken place Ward 4B had been refitted, POUFs were fitted and interventions following the start of the Water Incident had been underway for some time?[41]

M. In light of the issues raised with Mr Mookerjee about his methodology in the Glasgow 3 hearing and the submissions of NHS GGC and NHS NSS about that methodology, seven issues arise in respect of data sources used by the HAD Authors for the analysis of BSI rates for paediatric haemato-oncology patients in in both Yorkhill and RHC [42]:

1. How and by whom were the paediatric BSI identified and extracted from GGC records, placed in the BSI data set provided by GGC "GGC Paeds

Volume 2, Document 15, Page 129 to 130.
[37] Bundle 6, Document 38, Page 1095. A similar point is made in the NSS Commentary, paras 3.4.3-3.4.6: Bundle 44, Volume 2, Document 45, Page 697.
[38] Bundle 44, Volume 1, Document 1, Page 42.
[39] As discussed in the CNR Rebuttal, Chapter 5, Bundle 44, Volume 2, Document 15 , Page 155 and the list of material available to the CNR in the CNR Overview Report, Chapter 11, Bundle 6, Document 38, Page 1095.
[40] Executive Summary and Section 7.2.3 to 7.2.6, Bundle 44, Volume 1, Document 1, Pages 8 and 92.
[41] Bundle 10, Documents 1 to 19, Pages 5 to 77.
[42] Bundle 44, Volume 1, Document 1, Pages 95 to 118, paras 7.2.7 to 7.2.10, and Bundle 44, Volume 5, Document 2, para 2B.2.

Onc CHI only 01.01.05 - 31.12.22.xlsx" [OBJ] and then extracted by the HAD Authors[43]?

2. Were the paediatric BSI identified and extracted from GGC records on the basis of named consultant rather than on the basis of whether the patients were located in the Schiehallion Unit[44] and what is the impact of that decision[45]?

3. Given that the contemporaneous descriptive epidemiological studies (Kennedy 2018[46] and 2019[47] and HPS 2018[48] and 2019[49]) had sought to identify BSI amongst patients located in the Schiehallion Unit, why did the HAD authors not seek to adopt that approach?[50]

4. Does any issue arise from the differences in de-duplication between the HAD report as produced and the data sets produced by Dr Drumright and reviewed by NSS?

5. Why did the HAD Report not contain a table similar to Table 4 setting out occupied bed days for paediatric haemato-oncology patients in both Yorkhill and RHC?

6. Now that Dr Drumright has explained that the occupied bed days can be found in the table "Paeds Bed Days", how was that table created and by whom? Does it relate to the monthly occupied bed days for the Schiehallion Unit[51] or other wards?[52] How do they compare[53] to the data

[43] Bundle 44, Volume 2, Document 45, Page 689, paras 3.1.1 and 3.2.7.1.
[44] Defined as Schiehallion and Ward 7a at Yorkhill, Wards 2A and 2B in RHC and Ward 4B and 6A in QEUH in the Appendix 4: Health Protection Scotland – Epidemiology Report, December 2018 (Bundle 7, Document 5 at page 205)
[45] See the discussion by Mr Mookerjee from para 2.20 of his M2 Report (Bundle 44, Volume 2, Document 79 from page 1268).
[46] Bundle 6, Document 27, Page 95.
[47] Bundle 6, Document 28, Page 104.
[48] Bundle 7, Document 5, Page 205.
[49] Bundle 7, Document 6, Page 214.
[50] Bundle 44, Volume 5, Document 2, para 2B.7 and Chapter 6.
[51] Source of this definition is Appendix 4 to The HPS Situational Assessment, Wards 2A/B, Royal Hospital for Children, NHS Greater Glasgow and Clyde (Bundle 7, Document 5, Page 205).
[52] See the questions raised by Mr Mookerjee from para 2.20(4) and Table 2 of his M2 Report (Bundle 44, Volume 2, Document 79, Page 1269).
[53] Bundle 44, Document 2, Page 32 - See explanation at para 2B.3.

supplied by NHS GGC to the Inquiry for use by Mr Mookerjee[54] and to HPS in 2019[55].Does it take account of day cases?[56] What is the impact of the fact that the bed days for 2005 to 2007 were calculated by Dr Drumright from the average from 2008 to 2014[57] and what impact does this have on the weight than can placed on the calculated monthly BSI rates for 2005, 2006 and 2007?

7. Does any issue arise about the value of the calculated BSI incidence rates if there is an inconsistency between the geographical scope of the numerator and the denominator in the calculation?

N. Was there an immediate decrease in the rate of environmentally relevant BSI amongst paediatric haemato-oncology patients after the move to the RHC and what, if any, inferences can be drawn from that?

O. Was there a period of increased incidence of environmentally relevant BSI amongst paediatric haemato-oncology patients in approximately June 2016 to November 2019, which was preceded and followed by periods when rates fluctuated with multiple months with a rate of zero, and what, if any, inferences can be drawn from that?[58]

P. Can any inference be drawn from the decline in the rate of environmentally relevant BSI amongst paediatric haemato-oncology patients from 2018 in light of the introduction of environmental controls including fitting of POUFs and the decant of patients?

Q. What evidence is there in the occupied bed days and other activity data supplied by NHS GGC to HAD[59], HPS in 2019[60] and the Inquiry for Mr

[54] A45186514 - Response from NHS GGC to Section 21 Notice No. 12 dated 25 August 2023 - RHC Haematology and Oncology Inpatient Admissions and Occupied Bed Days 10 June 2015 to 31 December 2022 - 11 September 2023 details – to be bundled.
[55] Bundle 7, Document 6, Page 224 - Figure 2.
[56] Bundle 44, Volume 2, Document 45, Page 692, para 3.2.3.
[57] Bundle 44, Volume 5, Document 2, Page 32, paras 2B.5 and 2B.7 and Chapter 6.
[58] As proposed in NSS Commentary para 3.5.2: Bundle 44, Volume 2, Document 45 at page 700 and see Bundle 44, Volume 5, Document 2, Page 50 - para 2F.12, Figures 2.F.3. 2.F.4, 2F.5 and 2F.6.
[59] Bundle 44, Volume 2, Document 8, Page 94.
[60] Bundle 7, Document 6, Page 224, Figure 2.

Mookerjee[61] for the proposition[62] that "When Yorkhill moved to RHC there was an intended reduction in activity"?

Aspergillus

R. How did the numbers and rate of Aspergillus infections in paediatric haemato-oncology patients change (a) over the period for which numbers and activity data were available, (b) at the time of the move from Yorkhill to the RHC and (c) during the period between 2016 and 2020[63] and what, if any, inferences can be drawn from that data?[64]

S. Is the utility of the analysis of infection rates for aspergillus in Chapter 8 of the HAD Report and then further presented in Chapter 5 of the HAD Response[65] affected by the criticisms of the methodology advanced by NSS? OBJ

T. What was the impact of the move from Yorkhill to RHC on 10 June 2015 on the rate of Aspergillus infections in paediatric haemato-oncology patients[66]?

U. What was the impact of the move of patients from Wards 2A and 2B to 6A and 4B on 26 September 2018 on the rate of Aspergillus infections in paediatric haemato-oncology patients[67]?

The value of whole genome sequencing

The Inquiry has already heard a considerable amount of evidence on value of whole genome sequencing and whether it can be used to exclude a link between BSI and the environment[68]. It is not proposed to put all this material to Professor Hawkey, but

[61] A45186514 - Response from NHS GGC to Section 21 Notice No. 12 dated 25 August 2023 - RHC Haematology and Oncology Inpatient Admissions and Occupied Bed Days 10 June 2015 to 31 December 2022 - 11 September 2023 details – to be bundled.
[62] Bundle 44, Volume 3, Document 1, Page 5.
[63] As proposed by the NSS Commentary para 4.7.1; Bundle 44, Volume 2, Document 45 at page 702-703.
[64] Views are expressed in (1) HAD Report Chapter 8 (Bundle 44, Volume 1, Document 1, Page 123), (2) NSS Commentary paras, 1.4 (Bundle 44, Volume 2, Document 45, Page 686) and (3) HAD Response paras. 5.C.1 to 5.C.4 (Bundle 44. Volume 5, Document 2, Pages 75 to 80).
[65] Bundle 44, Volume 5, Document 2, Page 63.
[66] Bundle 44, Volume 2, Document 81, Page 1289, para 2.19.
[67] Bundle 44, Volume 2, Document 81 at page 1289, para 2.19.
[68] Including in the Glasgow 3 hearing Professor Stevens, Professor Wilcox, Professor Leonord, Professor Dancer, Dr Inkster, Dr Peters, Dr Mumford and Ms Dempster.

rather to hear and interrogate his opinion evidence. The issue is addressed in Chapter 8 of the CNR Rebuttal[69].

V. Is it correct to proceed, as HAD Authors do at Para 5.3.2. on the premise that *"when clusters of infection occur caused by potentially environmentally sourced bacteria in immune supressed patients, investigation with detailed typing very often reveals a homogeneous cluster of strains and helps tremendously in identifying the source and introducing control measure"*[70]. The Inquiry Team asked for a justification for this statement in HAD Questionnaire 1[71] and HAD Authors promised a response in the HAD Response document. It does not appear to have been produced within Chapter 1 of the HAD Response[72]. The issue is also addressed in the CNR Rebuttal[73].

W. Can WGS be used to refute an environmental connection by the absence of close connections between BSI samples as proposed by the HAD Authors[74]. In particular the hearing will need to consider:

X. What support is there in the literature referred to by the various witnesses for the proposition that the absence of close connections between BSI samples can refute a potential environmental connection. OBJ

Y. Is the proposition[75] that *"Although there may be a number of strains of the same bacterial species in the environmental site and the key infecting strain may not have been selected when that site was cultured, studies of outbreaks using WGS will show some matches thus identifying the sources involved"* by

[69] Bundle 44, Volume 2, Document 15, Pages 196 to 204.
[70] Bundle 44, Volume 1, Document 1, Page 50.
[71] Bundle 44, Volume 2, Document 2, Page 30, Question 17.
[72] Consideration of this issue will include looking more closely at the reference study Nurjadi D et al., (2021) (Bundle 44, Volume 5, Document 16, Page 222) and the numbers of environmental samples taken in that study.
[73] Chapter 6, Bundle 44, Volume 2, Document 15, Page 166 with reference to the Halstead et al 2021 paper, Bundle 44, Volume 2, Document 77, Page 1227.
[74] See for example Para 5.4.3 (specifically with reference to the paper *by Kampmeier et al 2017* at Bundle 44, Volume 2, Document 27, Page 508) and Chapter 4 (Bundle 44, Volume 1, Document 1. Pages 42 to 43).
[75] Bundle 44, Volume 1, Document 1, Page 42, Chapter 4.

reference to Kampmeier et al. 2017[76] and Halstead et al. 2021[77], valid and applicable to the QEUH[78]?

Z. What support is there in the literature for the proposition that a large hospital water system like the QEUH will contain only a single strain or a very limited number of strains of each micro-organism that caused BSI in the Schiehallion Unit, or is there academic research that supports the view that water systems like that at the QEUH will be polyclonal or polymicrobial?[79]

AA. Is it fair to say that *"a reasonable sample"* of clinical and environmental isolates have been sampled at the QEUH/RHC from 2015 to 2020 and does the WGS Data for Cupriavidus, Enterobacter and Stenotrophomonas[80] considered in Section 7.3 of the HAD Report[81] support the conclusion of the authors that the environment was not a significant source of infection[82].

The criticisms made of the CNR by the HAD authors

The Inquiry does not have access to the patient specific records considered by the CNR, their tableau timeline or the individual assessments and conclusions for each infection. The HAD Authors did not have access to this material, although as Professor Stevens observed in Glasgow 3[83] NHS GGC could have attempted to duplicate the work of the CNR using the raw data they had access to. The HAD Report contains a criticism of the methodology of the CNR in Chapter 4[84] and the Inquiry now has a rebuttal from CNR[85]. The HAD Authors appear to criticize the

[76] Bundle 44, Volume 2, Document 27, Page 508.
[77] Bundle 44, Volume 2, Document 77, Page 1228.
[78] See the discussion of the number of outlets tested in Halstead by Dr Mumford at para 8.25 of her M1 Report (Bundle 44, Volume 2, Document 48 at page 765).
[79] As discussed in Chapter 4 of the CNR Rebuttal, Bundle 44, Volume 2, Document 15, Page 135 (in respect of Klebsiella), Page 139 (in respect of Enterobacter); by Dr Mumford in the context of biofilms her M1 Report at para 2.2 and 5.13 (Bundle 44, Volume 2, Document 48 at page 741); HAD Response (Bundle 44, Volume 5, Document 2, Page 26, 28, para 1C.4, 1C.5 and 1E.1 by reference to Verweiji et al. 1998 and Moretti et al. 2024 (Bundle 44, Volume 5, Documents 4 & 6, Pages).
[80] Discussed in detail for Stenotrophomonas in the HAD Report, Chapter 4, Page 43 and also HAD Response para 1C.3
[81] Bundle 44, Volume 1, Document 1, Page 119.
[82] Bundle 44, Volume 1, Document 1, Page 121. Alternatively Dr Mumford describes "environmental specimen collection being inconsistent and mostly non-contemporaneous to the clinical infections" M1 Report, para 5.13 and also discussed at 8.23-8.24 (Bundle 44, Volume 2, Document 48, Page 753).
[83] Professor Mike Stevens, Transcript, 30 October 2024, Cols 79-80.
[84] Bundle 44, Volume 1, Document 1, Page 40.
[85] Bundle 44, Volume 2, Document 15, Page 144, Chapter 5.

choice of bacteraemia considered by the CNR, but the evidence is that was not a decision made by the CNR, but by those who instructed them. Given the way that it is proposed to use the evidence of the CNR in this Inquiry one principal and seven subordinate issues might be usefully addressed.

BB. To what extent is the disagreement between the CNR and the HAD Authors about the BSI considered by the CNR to have a connection to the hospital environment one of quantum not principle?

CC. In respect of *Stenotrophomonas maltophilia,* is there any inconsistency between the findings of the CNR that 66% of infections with *Stenotrophomonas spp*. were most likely to have been associated with the environment[86], and the view of the HAD Authors that "not all clusters of *S. maltophilia* infections in immunocompromised patients are necessarily spread from an environmental source[87]?

DD. In respect of *Klebsiella spp.* is there any inconsistency between the findings of the CNR that 35% of infections with *Klebsiella spp.* were most likely to have been associated with the environment[88], and the position of the HAD Authors that the most common sources of *Klebsiella* are colonised patients and that "on occasions" wet sources such as sink traps, drains, medical equipment and cleaning cloths can act as primary sources for infection having been contaminated by material from colonised patients[89]?

EE. In respect of *Enterobacter spp.* is there any inconsistency between the findings of the CNR that 28% of infections with *Enterobacter spp.* were most likely to have been associated with the environment[90], and the position of the HAD Authors that the colonised patient is the most common source[91]?

FF. In respect of *Pseudomonas aeruginosa* is there any inconsistency between the findings of the CNR that 28% of infections with *Pseudomonas spp.* were

[86] Bundle 6, Document 38, Page 1044, Table 5.4.
[87] Bundle 44, Volume 1, Document 1, Page 53, para 5.4.3.
[88] Bundle 6, Document 38, Page 1044, Table 5.4.
[89] Bundle 44, Volume 1, Document 1, Page 26, para 3.1.1, and Bundle 44, Volume 5, Document 2, Page 29, para 1F.2.
[90] Bundle 6, Document 38, Page 1044, Table 5.4.
[91] Bundle 44, Volume 1, Document 1, Page 26, Para 3.1.2.

most likely to have been associated with the environment[92], and the papers discussed by the HAD Reports in paragraph 5.4.3[93] and the position of the HAD Authors as described at some length in para 3.2.1[94]?

GG. In respect of *Acineobacter spp.* is there any inconsistency between the findings of the CNR that 30% of infections with *Acineobacter spp.* were most likely to have been associated with the environment[95], and the position of the HAD Authors that, although there are reports of contamination of wet medical equipment together with isolates from sink traps as outbreak sources, surface contamination and resistance to drying is the most important source[96]?

HH. In respect of *Cupriavidus spp.* is there any inconsistency between the findings of the CNR that both infections with *Cupriavidus spp.* were most likely to have been associated with the environment[97], and the position of the HAD Authors that a common source was unlikely[98].

II. In respect of *Serratia marcescens* is there any inconsistency between the findings of the CNR that 14% of infections with *Serratia spp.* were most likely to have been associated with the environment[99], and the position of the HAD authors that *S. marcescens* should not be viewed as an environmental bacterium in the way non-fermenters such as Stenotrophomonas, Cupriavidus, Rhizobium etc. are, as the colonised patient is the common source of outbreaks[100]?

<u>Challenges to the work of the HAD Authors</u>

The HAD authors have explained that they did not take account of the investigations, interventions and infection control activities carried out at the QEUH/RHC from when the hospital water system was filled in 2013[101]. Their only detailed sources of

[92] Bundle 6, Document 38, Page 1044, Table 5.4.
[93] Bundle 44, Volume 1, Document 1, Page 53.
[94] Bundle 44, Volume 1, Document 1, Pages 28 to 30.
[95] Bundle 6, Document 38, Page 1044, Table 5.4.
[96] Bundle 44, Volume 1, Document 1, Page 30, Para 3.2.2.
[97] Bundle 6, Document 38, Page 1044, Table 5.4.
[98] Bundle 44, Volume 1, Document 1, Page 37, para 3.4.3.
[99] Bundle 6, Document 38, Page 1044, Table 5.4.
[100] Bundle 44, Volume 1, Document 1, Page 28, para 3.1.4.
[101] Answer to HAD Questionnaire 1, Question 10, Bundle 44, Volume 2, Document 1, Pages 24 to 26, and HAD Questionnaire 2, Questions 49 and 50, Bundle 44, Volume 5, Document 1, Page 18; and

information about these events are the water testing summary reports prepared by Dr Chaput[102] and the BSI test result data supplied to them by NHS GGC.

JJ. What is the relevance to the weight to be given to the conclusions of the HAD Report of the observation by the CNR that none of the HAD Authors had experience in paediatric haematology oncology?

KK. As the HAD Authors did not consider evidence beyond Dr Chaput's report about the state of water system at the QEUH/RHC from 2015 to 2020, does that give rise to an issue for their conclusion that "*the available data does not support an opinion that the water system at QEUH had widespread contamination"*.[103]

LL. To what extent might it be a reasonable criticism of the HAD Report that its authors have approached the question of what evidence there was of risk of infection from the water systems on the assumption that when a water system is a source of environmental contamination and there is spread to vulnerable patients it is not the whole system that has a high bacterial load, but specific outlets that represent a potential source of spread to patients[104]?

MM. Is it a reasonable criticism that the HAD Report proceeds on the basis that clusters of infections are frequently observed to be linked through a particular fitting such as a drain or sink as opposed to widespread contamination of the whole water system[105], and to what extent is that assumption impacted by

NN. the contemporary conclusions of the NHS GGC Water Technical Group of 13 April 2018 and 20 April 2018 that there was "widespread water infection" and "every floor is showing contamination" [106] and

OO. the widespread use of Horne Optitherm Taps across the hospital in light of the

further explanation of their views on this issue in HAD Response, Bundle 44 Volume 5, Document 2, Page 24, para 1B.1.
[102] Response to Question D(d), Bundle 44, Volume 2, Document 1, Page 20. Dr Chaput's work is at Bundle 18, Volume 1, Document 2, Page 13.
[103] Bundle 44, Volume 1, Document 1, Page 7, para 15.
[104] Bundle 44, Volume 1, Document 1, Page 49, Section 5.3.2 as discussed by Dr Mumford in her M1 Report, Bundle 44, Volume 2, Document 48, Page 755, paras 6.11 to 6.25 and 6.27.
[105] Bundle 44, Volume 1, Document 1, Page 49, para 5.3.2.
[106] Bundle 10, Document 2, Page 9; Bundle 10, Document 3, Page 14.

investigations into P. aeruginosa in flow straighteners and tap bodies of that sort of tap following the deaths of four neonates in Northern Ireland in 2011 and 2012[107]?

PP. How is the value of the discussion of the role of exposure to antibiotics in *Stenotrophomonas maltophilia* cases in the HAD Report[108] impacted by lack of knowledge by the HAD authors of the prescribing patterns in the Schiehallion Unit from 2005 to 2022?

QQ. How is the value of Chapter 6 of the HAD Report as summarised in paragraphs 16 and 17 of the Executive Summary[109], impacted by the limited knowledge of the HAD authors of the potentially deficient features of the ventilation systems of Ward 2A RHC as occupied by the Schiehallion Unit prior to 28 September 2018?

RR. As the HAD Report does not take account of the views of the clinical teams on the Schiehallion Unit at RHC and Yorkhill[110] as recorded in the investigations, interventions and infection control activities carried out at the QEUH/RHC from 2015, does anything arise from the evidence of the consequential witnesses that is relevant to the conclusions of the HAD Report?

SS. The HAD authors accept that they did not include in the HAD Report the full details of the underlying arithmetic/working for Chapters 7.2 and 8. These were provided later after requests from the Inquiry Team[111]. Does the absence of this material from the HAD Report impact on the value of the report to the Inquiry?

TT. Why did the HAD Report not consider the numbers and locations of Mycobacterium chelonae within the paediatric haemato-oncology population?[112]

[107] As discussed in the CNR Rebuttal: Bundle 44, Volume 2, Document 14 at page 138 and in Walker et al 2013: Bundle 44, Volume 2, Document 76, Page 1219.
[108] Bundle 44, Volume 1, Document 1, Page 52, Chapter 4, Para 5.4.3 (qv. Page 45).
[109] Bundle 44, Volume 1, Document 1, Page 8, paras 16, 17.
[110] As more fully described by Dr Mumford in her M1 report at Bundle 44, Volume 2, Document 48, Page 747, paras 3.18 to 3.20 and 5.2.
[111] Bundle 44, Volume 5, Document 1, Pages 5 to 8, Questions 39 and 40.
[112] See Bundle 44, Volume 2, Document 45, Page 690, para 3.1.3.

Appendix 2

Scottish Hospitals Inquiry

Direction in respect of discussion
between Experts – Mr Sid Mookerjee & Dr Lydia Drumright
22 July 2025

Introduction

1. The Inquiry needs to understand the scale and significance of infection events within the paediatric haemato-oncology patient cohort within the Schiehallion Unit arising from micro-organisms that have the potential to be connected in some way to changes to the water and ventilation systems of that hospital and whether there was in fact an exceedance of infections in QEUH/RHC in the period 2016 to 2019.

2. The Inquiry has already considered a number of reports which consider that question in respect of the QEUH/RHC after June 2015 and heard a considerable amount of expert evidence on these issues. These reports are listed in the annex to this Direction. Chapters 7 and 8 of HAD Report provides new material on this issue. Mr Mookerjee, Dr Mumford and Ms Cairns have reviewed those parts of the HAD Report[113]. The Response document produced by the HAD authors on 20 July 2025 along with their response to HAD Questionnaire 2[114] ("the HAD Response document") contains in sections 2 and 5 additional and supplementary tables and figures that revisit tables and figures that were contained in the HAD Report.

3. The Inquiry has heard competing evidence from clinicians, microbiologists, data scientists, members of the IPC team and others of the perceived importance of (i) the move from Yorkhill to the RHC on 10 June 2015, (ii) the 'decant' of patients from Wards 2A and 2B to Wards 4B and 6A on 26

[113] See Bundle 44, Volume 2, Documents 48, 79, 81 and 45.
[114] Bundle 44, Volume 5, Document 1, Page 4.

September 2018 and (iii) the opening of the refurbished Wards 2A and 2B in March 2022. Witnesses have given opinion evidence of the impact of these three events on the rates of infections amongst paediatric haemato-oncology patients. It is now necessary to for the Inquiry to have the tools to discuss the significance of these events and whether any effect of them can be seen in the data.

4. In the HAD Report separate linear fitted lines were provided for BSI rates for each of the two hospitals[115], but in the HAD Response document Dr Drumright has provided both GAM fit[116] Linear and Linear+Smooth components for BSI[117] and Aspergillus[118] rates only for the two hospitals combined. In order to provide material to discuss with skilled and expert witnesses in the Glasgow 4, Part 2 hearing the Inquiry needs to see if there is common ground between Dr Drumright and Mr Mookerjee on rates and trends of infections in the two hospitals and between these events.

5. In order to make efficient use of the time of the Glasgow 4, Part 2 hearing Dr Drumright and Mr Mookerjee are directed to jointly consider the questions set out in this Direction and if possible, to reach an agreed position on those questions. That joint consideration may take the form of a video call or calls between them, or an exchange of emails or a combination of both.

6. Following that joint consideration Dr Drumright and Mr Mookerjee are directed to prepare a statement for the Inquiry that sets out the answers to those questions on which they agree. Where they disagree, they should provide a summary of their reasons for disagreeing.

7. Dr Drumright and Mr Mookerjee should produce their response to this Direction by Monday 11 August 2019 at 09:00 BST.

8. What inferences can be properly drawn from their agreed answers will be subject of questions to them and other witnesses during the Glasgow 4, Part 2

[115] Figures 21 and 22 (Bundle 44, Volume 1, Document 1, Pages 117 and 118).
[116] Bundle 44, Volume 5, Document 2, Page 44, para 2F.2 (albeit that her code is not provided).
[117] Bundle 44, Volume 5, Document 2, Pages 50,51, see Figures 2.F.3 and 2.F.4.
[118] Bundle 44, Volume 5, Document 2, Pages 77,80, see Figures 5C.3 and 5C.4.

hearing and therefore Dr Drumright and Mr Mookerjee should not express any view on the significance of their answers at this stage. Both Dr Drumright and Mr Mookerjee should expect to be asked about the use of generalised additive models (GAMs) and the software package used to answer these questions in the hearing.

Issue 1 - Aspergillus infections amongst paediatric haemato-oncology patients

9. The Inquiry has heard evidence that the ventilation system at the RHC was different from the ventilation system at Yorkhill, that patients moved into the RHC from Yorkhill on 10 June 2015 and that no changes were made to the ventilation system at the RHC outside of isolation rooms until the new Ward 2A and 2B opened in March 2022.

10. Two attempts have been made to calculate rates of Aspergillus infection amongst paediatric haemato-oncology patients at Yorkhill and RHC. These have resulted in in Table 3 and Figure 1 in Dr Mumford and Mr Mookerjee's review of Chapter 8[119] and Table 5C.1 of the HAD Response document[120]. Both attempts use whole months, and both rely on occupied bed day data that includes three years of data in 2005, 2006 and 2007 that has been imputed by Dr Drumright[121].

11. Notwithstanding the criticisms made of Dr Agrawal's approach by Ms Cairns in her Supplementary Report[122] the following questions should be answered using the rates of infection set out in Table 5C.1 of the HAD Response document.

Question 1

1(a) What was the overall rate of Aspergillus infection amongst paediatric haemato-oncology patients at Yorkhill over the whole period from January 2008 to May 2015?

[119] Bundle 44, Volume 2, Document 81, Pages 1295,1296.
[120] Bundle 44, Volume 5, Document 2, Page 76.
[121] Bundle 44, Volume 5, Document 2, Page 32, para 2B.5.
[122] Bundle 44, Volume 3, Document 5, Page 222.

1(b) During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

Question 2

2(a) What was the overall rate of Aspergillus infection amongst paediatric haemato-oncology patients at the RHC over the whole period from June 2015 to February 2022?

2(b) During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

Issue 2 – Potentially environmentally connected infections amongst paediatric haemato-oncology patients

12. The evidence before the Inquiry is that the domestic water system at the RHC was different from the domestic water system at Yorkhill, that patients moved into the RHC at Yorkhill on 10 June 2015, that by 13 March 2018 point of use filters (POUFs) had been fitted in Ward 2A and that on 26 September 2018 the paediatric haemato-oncology patient cohort within the Schiehallion Unit were moved from Wards 2A and 2B to Wards 4B and 6A. This cohort of patients was accommodated in Wards 4B and 6A until the new Ward 2A and 2B opened in March 2022.

13. As explained in the HAD Response document Dr Drumright has updated the tables of monthly incidence rates of BSI attributed to environmental organisms[123] and used that to produce Figure 2E.3. Figure 2E.3 appears to be a replacement for Figure 22[124] of the HAD Report. Figure 2.F.3[125] contains GAM fit linear and smooth components against incidence rates for BSI incidence rates attributed to environmental microorganisms among paediatric haematology-oncology patients in Yorkhill (Jan 2005-April 2015) and RHC at QEUH (May 2015-Dec 2025). A similar exercise was also carried out for non-

[123] Bundle 44, Volume 5, Document 2, Page 44, Table 2E.6.
[124] Bundle 44, Volume 1, Document 1, Page 118.
[125] Bundle 44, Volume 5, Document 2, Pages 48, 50 - Along with associated explanation at paras. 2F.11 to 2F.13.

environmental BSI in Figure 2.F.4 [126] albeit that no equivalent data table has been included. This latter exercise is addressed in Issue 3. These calculations use whole months and rely on occupied bed day data that includes three years of data in 2005, 2006 and 2007 that has been imputed by Dr Drumright[127].

14. There is clearly a discussion to have with witnesses at Glasgow 4, Part 2 about whether anything significant arises (a) from differences in definition used by HAD to define environmental BSI and those used by HPS, Dr Kennedy and Dr Mumford and Mr Mookerjee and (b) the choice of numerator and denominator data and (c) whether it is legitimate to impute occupied bed days for 2005 to 2007, but in recognition that Dr Drumright is the only person to attempt to calculate BSI rates at Yorkhill from before 2013 the following questions should be answered using the rates of infection set out in Table 2E.6.

Question 3

3(a) What was overall BSI incidence rate attributed to environmental microorganisms among paediatric haematology-oncology patients in Yorkhill for the whole period from January 2008 to May 2015?

3(b) During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

Question 4

4(a) What was overall BSI incidence rate attributed to environmental microorganisms among paediatric haematology-oncology patients in the RHC for the whole period from June 2015 to the September 2018?

4(b) During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

[126] Bundle 44, Volume 5, Document 2, Pages 50, 51 - Associated explanation at paras. 2F.14 to 2F.16.
[127] Bundle 44, Volume 5, Document 2, Page 32, para 2B.5.

Question 5

5(a) What was overall BSI incidence rate attributed to environmental microorganisms among paediatric haematology-oncology patients in the RHC for the whole period from October 2018 to February 2022?

4(b) During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

Question 6

6(a) What was overall BSI incidence rate attributed to environmental microorganisms among paediatric haematology-oncology patients in the RHC for the whole period from June 2015 to February 2022?

6(b) During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

Issue 3 - Potentially non-environmentally connected infections amongst paediatric haemato-oncology patients

15. For completeness a similar exercise should also be carried out for the underlying data for non-environmental BSI shown in Figure 2.F.4 [128] albeit that no equivalent data table has been included in the HAD Response document.

Question 7

7(a) What was overall BSI incidence rate attributed to non-environmental microorganisms among paediatric haematology-oncology patients in Yorkhill for the whole period from January 2008 to May 2015?

7(b) During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

[128] Bundle 44, Volume 5, Document 2, Pages 50, 51 - Associated explanation at paras. 2F.14 to 2F.16.

Question 8

8(a) What was overall BSI incidence rate attributed to non-environmental microorganisms among paediatric haematology-oncology patients in the RHC over the whole period from June 2015 to February 2022.

8(b) During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

Annex

1. The HPS Situational Assessment, Wards 2A/B, Royal Hospital for Children, NHS Greater Glasgow and Clyde (Bundle 7, Document 5, Page 194) and, in particular, Appendix 4 to that document (Bundle 7, Document 5, Page 205).

2. The HPS SBAR: To support NHS GGC IMT Mycobacterium chelonae cases and the Incidence of gram-negative bacteraemia in the paediatric haemato-oncology, September 2019 (Bundle 3, Document 16, Page 127).

3. Draft HPS Review of NHS GG&C Infection Outbreaks in the Paediatric Haemato-oncology Data October 2019 (Bundle 7, Document 6, Page 214)

4. HPS Review of NHS GG&C Infection Outbreaks in the Paediatric Haemato-oncology Data October 2019 - 29 November 2019 (Bundle 7, Document 7, Page 250).

5. Presentation by Kathleen Harvey-Wood and Dr Christine Peters: Bacteraemia rates and Resistance Paediatric Haemato-oncology 2014- 2018, 30 August 2018 (Bundle 27 Volume 6, Document 9, page 107).

6. Report by Dr Iain Kennedy: Descriptive Analysis of Trends in Bacteraemia Rates for Selected Gram-Negative Organisms, 1 October 2018 (Bundle 6, Document 27, page 95).

7. Draft report by C Peters and K Harvey-Wood: Bacteraemia rates and resistance patterns in paediatric haematology/oncology patients 2014- 2018, 10 October 2018 (Bundle 19, Document 19, Page 143).

8. Report by Dr Iain Kennedy: Descriptive analysis of trends in bacteraemia rates for selected gram-negative organisms, July 2019 (Bundle 6, Document 28, page 104)

9. Presentation by Dr Iain Kennedy and Jennifer Rodgers: Paediatric Haemato-oncology RHC – Summary of Data, September 2019 - Presented at IMT meeting of 20 September 2019 (Bundle 27, Volume 13, Document 13, Page 77)

10. Reports by Mr Mookerjee for the Glasgow 3 hearing:

    a. Quantitative Infection Link Report - 9 May 2024 (Bundle 21, Volume 1, Document 1, Page 3)

    b. Supplementary Report – 12 August 2024 (Bundle 21, Volume 1, Document 3, Page 71)

    c. An addendum to that report – 16 October 2024 (Bundle 21, Volume 1, Document 10, Page 767)

    d. Direction 5 response dated 11 July 20242852 (Bundle 21, Volume 5, Document 3, Page 104)

    e. A chart produced for the hearing day upon which he gave evidence (Bundle 27, Volume 18, Document 1)

Scottish Hospitals Inquiry
Glasgow 4 Part 2

Cover Note in relation to Mr Sid Mookerjee's and Dr Lydia Drumright's Responses to Direction Note dated 22 July 2025[1]

The Inquiry Team asked Dr Drumright and Mr Mookerjee to meet to see if they could produce a joint answer to a series of questions. Those questions are set out in a Note by Counsel to the Inquiry (Appendix 2 of Counsel's Opening Note for Glasgow 4 Part 2). They met and whilst it seems that they do agree about some matters, they don't agree about others. Mr Mookerjee produced a response on Monday 11 August 2025, and then Dr Drumright produced a response on Tuesday 12 August 2025. Both are produced and both witnesses will be asked about the two responses and their views when they give evidence in the Glasgow 4, Part 2 hearing commencing 19 August 2025.

[1] Appendix 2, Opening Note by Counsel to Inquiry for Glasgow 4 Part 2.

SCOTTISH HOSPITALS INQUIRY

Expert report.

Response to - Direction Note on Discussion between Experts (Dr Drumright and Mr Mookerjee) - 21 July 2025

Expert Report prepared for the Scottish Hospitals Inquiry

Mr. Sid Mookerjee, BSc, MSc, MPH, FRSPH

1. Introduction

1.1. This response report has been prepared at the request of the Scottish Hospitals Inquiry and answers questions posed in the 'Direction Note on Discussion between Experts (Dr Drumright and Mr Mookerjee) - 21 July 2025'.

2. Response to questions

2.1. Question 1(a) Using the *Aspergillus spp* incidence and bed days in Table 1 and 2 in Dr Mumford and Mr Mookerjee's review of Chapter 8[1], a point estimate for the period 2008 – 2015 by dividing the total number of *Aspergillus* by the total bed days was calculated at 0.31 per 1000 bed days. This figure is very similar to the one noted by Dr. Drumright in her response – 0.34 per 1000 bed days[2].

2.2. Table 1 below compares the rate per 1000 bed days - Dr Mumford and Mr Mookerjee's review of Chapter 8[3] and Table 5C.1 of the HAD Response document[4].

Table 1: Comparison of *Aspergillus* rates per 1000 bed days, 2008 - 2015

Year	Dr Mumford and Mr Mookerjee HAD review paper	HAD Response report
2008	0.41	0.39
2009	0.29	0.27
2010	0.15	0.28
2011	0.38	0.37
2012	0.15	0.14
2013	0.77	0.91
2014	0.33	0.33

[1] Bundle 44, Volume 2, Document 81, Pages 1294
[2] Dr. Drumright, Response document
[3] Bundle 44, Volume 2, Document 81, Pages 1295,1296.
[4] Bundle 44, Volume 5, Document 2, Page 76.

2015	0.00	0.16

2.3. Question 2(a). In line with the methodology outlined in paragraph 2.1, the rate for the period June 2015 – Feb 2022 was calculated as 0.78 per 1000 bed days, compared to Dr. Drumright's 0.71 [5]. Table 2 below is a comparison of rates by year.

Table 2: Comparison of *Aspergillus* rates per 1000 bed days, 2015 - 2022

Year	Dr Mumford and Mr Mookerjee HAD review paper	HAD Response report
2015	0.16	0.16
2016	0.60	0.57
2017	0.83	0.82
2018	0.45	0.72
2019	1.33	1.22
2020	0.72	0.91
2021	0.40	0.39
2022	1.71	0.56

2.4. Questions 1(b), 2(b). I am not in agreement with Dr. Drumright's use of GAM models to understand the trend in rate of *Aspergillus* infections over the period 2008 – 2022.

[5] Dr. Drumright, Response document

2.5. Using Dr. Drumright's *Aspergillus* dataset [6], I utilised a linear regression model, providing a trend, initially for each of the two periods January 2008 – May 2015 and June 2015 to February 2022, which is suitable for infection rates based on low infection incidence numbers, and unlike GAMs which typically require more data points to reliably estimate smooth curves, linear regression works well even with fewer monthly data points. I summarise my methods and results, including the Python 3.10 code and accompanying figures below.

Analysis of *Aspergillus* Infection Rate Trends (2008–2022)

Objective

To assess whether there was a statistically significant change in infection rates (per 1,000 bed-days) over the period 2008–2022, focusing on two time periods:

1. January 2008 – May 2015
2. June 2015 – February 2022

Methods

Monthly infection rates from January 2008 to February 2022 were analysed. The dataset was split into two segments based on an observed shift in mid-2015.

For each segment:

- The mean infection rate was calculated.
- A linear regression was used to assess within-period trends.
- An independent two-sample Welch's t-test was used to compare mean rates between periods.

Results

Segment statistics:

- Jan 2008 – May 2015: Mean rate = 0.39 per 1,000 bed-days
- Jun 2015 – Feb 2022: Mean rate = 0.745 per 1,000 bed-days

Change in mean rate: +0.355 per 1,000 bed-days.

[6] Bundle 44, Volume 5, Document 2, Page 76.

Statistical test: Welch’s t-test showed the difference to be statistically significant (t = −2.04, p = 0.043).

Interpretation

- Pre-2015: Low and stable infection rates.
- Post-mid-2015: Stable rates but at a significantly higher baseline level.
- The primary change appears to be a step-change rather than a gradual increase, suggesting a discrete shift in infection control environment or exposure risk starting mid-2015. This finding is in line with the move from Yorkhill to RHC in June of 2015.

Python code

```
plt.figure(figsize=(12,6))

colors = ["tab:blue", "tab:orange"]

for (name, data), color in zip(sections_new.items(), colors):

    plt.scatter(data["DecimalYear"], data["Rate_per_1000"], label=name, color=color, alpha=0.6)

    X = sm.add_constant(data["DecimalYear"])

    y_pred = sm.OLS(data["Rate_per_1000"], X).fit().predict(X)

    plt.plot(data["DecimalYear"], y_pred, color=color, linewidth=2)

    mean_rate = stats_new[name]["mean_rate"]

    mid_x = (data["DecimalYear"].min() + data["DecimalYear"].max()) / 2

    plt.text(mid_x, mean_rate + 0.05, f"{mean_rate:.2f}", color=color, ha="center", fontsize=10, fontweight="bold")


plt.axvline(2015 + 5.5/12, color="black", linestyle="--", linewidth=1)

plt.xlabel("Year")

plt.ylabel("Rate per 1,000 bed-days")
```

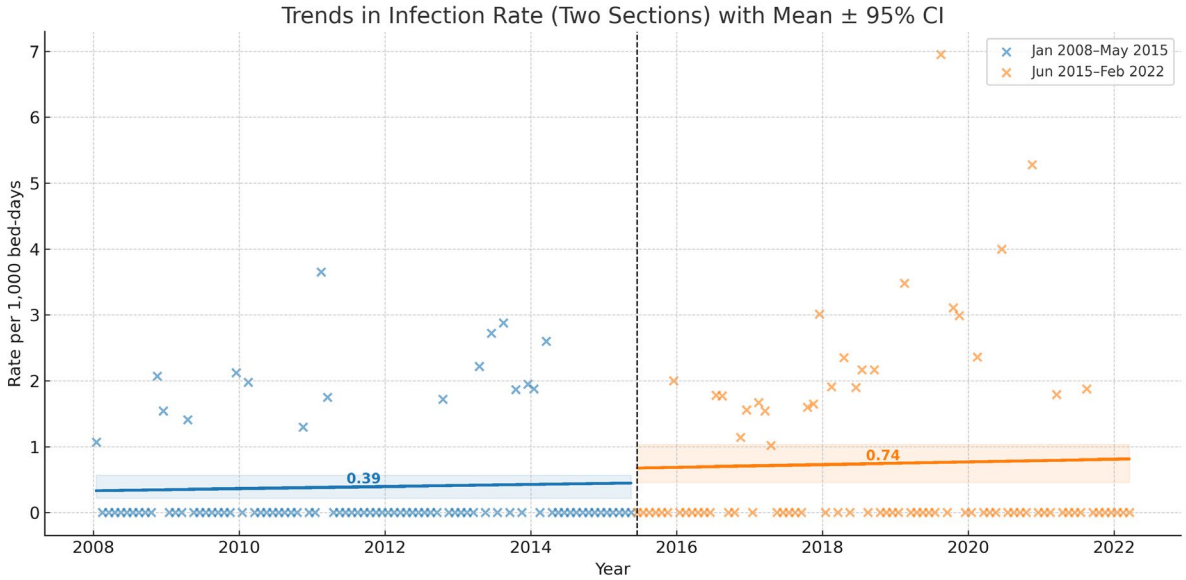
```
plt.title("Infection Rate Trends by Period (2008–2022)")

plt.legend()

plt.show()
```

Figure 1: *Aspergillus* Infection Rate Trends (2008–2022)

The scatter points show monthly infection rates; solid lines indicate fitted linear trends for each period; dashed vertical line marks the 2015 mid-year breakpoint. Numbers above each section represent mean infection rate.

The shading shows there's minimal overlap between pre-2015 and post-2015 confidence intervals, which visually supports the statistically significant difference detected in the t-test.

Figure 1: *Aspergillus* rates per 1000 bed days, 2008 - 2022



2.6. The outputs of the linear regression analysis are in contrast to Dr. Drumright's GAM analysis [7]. In Wood, S.N. book on Generalised Additive Models [8], the author notes three points, namely, "*GAM smoothers involve a trade-off between capturing local fluctuations and avoiding overfitting*" ; "*If the*

[7] Dr. Drumright, Response document
[8] Wood, S. N. (2017). Generalized Additive Models: An Introduction with R (2nd ed.). Chapman & Hall/CRC.

smoothing parameter is too large (common when data are sparse, noisy, or have many zeros), the model will over-smooth, effectively flattening or averaging out short-term changes" and "*In low-count infection data with few events per time step, this smoothing can hide meaningful short-lived increases or decreases*". Given the characteristics of the Aspergillus dataset – low counts, lots of zeros, small sample size, it is clear that GAM models are not suited to elucidate the trend in these infections, negating the resulting outputs. The outputs from the simpler, more suited linear model, as evidenced above using Dr. Drumright's *Aspergillus* dataset, is in keeping with the evidenced clinical picture presented to the inquiry relating to environmental issues at the RHC and its reasoned impact on patient bacterial and fungal infection risk [9],[10],[11].

2.7. Question 3(a). I have not previously analysed the pre-RHC period bacteraemia rates at Yorkhill. We therefore only have Dr. Drumright's rate.

2.8. Question 4(a). Based off the infection episodes table in my Quantitative Infection Link report [12] and using the corresponding bed days as per Table 2 [13], the rate for the period June 2015 to September 2018 is calculated at 6.14 per 1000 bed days. This is in contrast to Dr. Drumright's rate of 4.76.

2.9. Question 5(a). Based off the infection episodes table in my Quantitative Infection Link report [14] and using the corresponding bed days as per Table 2 [15], the rate for the period October 2018 to February 2022 is calculated at 3.50 per 1000 bed days. This is in contrast to Dr. Drumright's rate of 2.88.

2.10. Question 6(a). Based off the infection episodes table in my Quantitative Infection Link report [16] and using the corresponding bed days as per Table 2 [17], the rate for the period June 2015 to February 2022 is calculated at 4.86 per 1000 bed days. This is in contrast to Dr. Drumright's rate of 3.97.

2.11. The difference in rates is a reflection of differing datasets as noted in 4B.1 and 4B.2 of 'Response to M1 report' [18]

[9] Review of the Link Between Patient Infections and Identified Unsafe Features
of the Water and Ventilation Systems at QEUH/RHC. Bundle 21, volume 1, page 96-179
[10] Professor Hilary Humphreys – Expert Report to SHI. Hearing Commencing 9 May 2022 Bundle 6 – Expert Reports and Statements, page 3
[11] SHI ventilation Report. Independent expert report concerning critical healthcare ventilation systems at the QEUH and RHC. Bundle 21, volume 1, page 468-610
of the Water and Ventilation Systems at QEUH/RHC. Bundle 21, volume 1, page 96-179
[12] Quantitative Infection Link Report - 9 May 2024. Bundle 21, Volume 1, Document 1, Page 24
[13] Bundle 44, Volume 2, Document 81, Pages 1294
[14] Quantitative Infection Link Report - 9 May 2024. Bundle 21, Volume 1, Document 1, Page 24
[15] Bundle 44, Volume 2, Document 81, Pages 1294
[16] Quantitative Infection Link Report - 9 May 2024. Bundle 21, Volume 1, Document 1, Page 24
[17] Bundle 44, Volume 2, Document 81, Pages 1294
[18] Bundle 44, Volume 5, Document 2, page 60.

2.12. Table 3 below details the infection incidence, bed days and rate calculated by me pertaining to my answers to Qs 4(a), 5(a) and 6(a).

Table 3: Infection rates, 2015 – 2022.

Year	Dr. Drumright bed days [19]	Quantitative link report Schiehallion infections [20]	Infection rate per 1000 bed days
2015 – June onwards	3486	7	2.01
2016	6338	27	4.26
2017	7120	66	9.27
2018 - pre decant	4217	38	9.01
2018 - post decant	1721	6	3.49
2019	4743	19	4.01
2020	3140	8	2.55
2021	3556	8	2.25
2022 - Jan and Feb	384	2	5.20

2.13. Questions 3(b), 4(b), 5(b) and 6(b). In answer to these questions, I report on the output from a linear regression model, using Dr. Drumright's environmental bacteraemia rates in paediatric patients' dataset, Table 2E.6 [21].

[19] Bundle 44, Volume 2, Document 81, Pages 1294
[20] Quantitative Infection Link Report - 9 May 2024. Bundle 21, Volume 1, Document 1, Page 24
[21] Bundle 44, Volume 5, Document 2, Page 44, Table 2E.6.

Analysis of Infection Rate Trends (2008–2022)

Objective

Assess monthly infection rates (per 1,000 bed-days) from January 2008 to February 2022, examining three distinct periods:

1. Jan 2008 – May 2015
2. Jun 2015 – Sep 2018
3. Oct 2018 – Feb 2022

Evaluate trends within each timeframe and compare mean rates between successive periods.

Methods

- Reshaped the data into a long format with a continuous Decimal-Year.
- Divided into the three periods with clear time boundaries.
- For each period:
    - Calculated the mean monthly rate.
    - Fitted a simple linear regression (rate ~ decimal year) to estimate trend slope and p-value.
- Compared mean rates using Welch's t-tests for significant differences between adjacent periods.
- Generated a figure illustrating monthly data points, fitted trend lines, vertical section dividers, and shaded bands representing the 95% confidence interval for each period's mean rate.

Results

Table 4: Analysis of trend, Environmental bacteraemia rates, 2015 - 2022

Period	Section	Mean rate (per 1,000)	Trend (per year)	p-value (trend)
1	**Jan 2008–May 2015**	~4.48	−0.27 (slight decline)	0.23
2	**Jun 2015–Sep 2018**	~5.01	+3.15 (significant rise)	< 0.001
3	**Oct 2018–Feb 2022**	~2.98	−0.95 (significant drop)	0.033

- **Period 1 trend**: slight decline in infection rate trend, p value for trend not statistically significant
- **Period 2 trend**: Significant rise in infection rate trend, p value for trend significant
- **Period 3 trend:** Significant drop in infection rate trend, p value for trend significant

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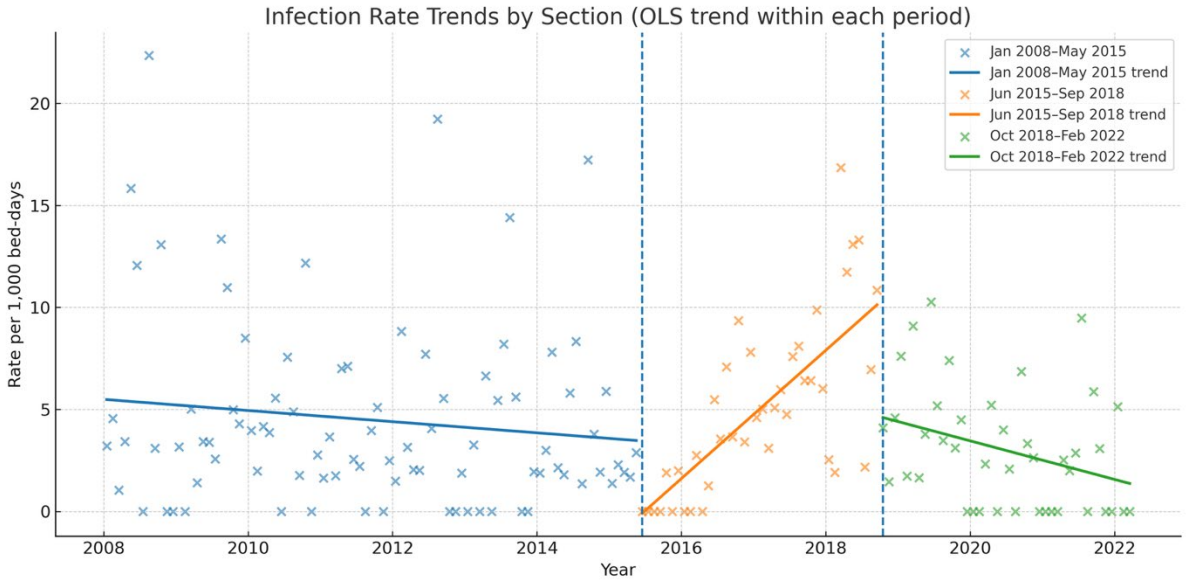
Interpretation

- **2008–mid-2015**: Moderate and stable infection rates.
- **mid-2015–2018**: Marked upward trajectory indicates rising infection risk.
- **post-2018**: Distinct decline and lower baseline suggest effective control interventions or changes in exposure.
- **Figure 2: Environmental bacteraemia in paediatric patients, Infection Rate Trends (2008–2022)**, displays trends for each period, with vertical lines marking section start/end.

Figure 2: Environmental bacteraemia in paediatric patients, Infection Rate Trends 2008–2022.

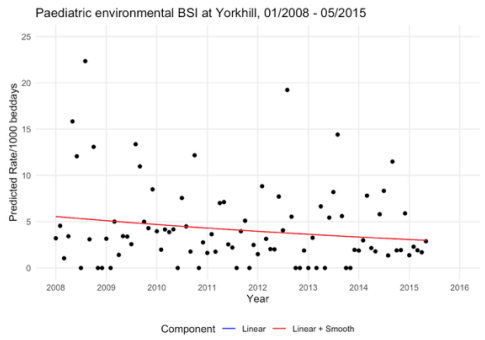


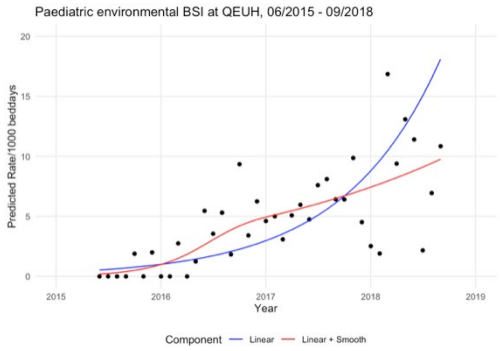
Python Code

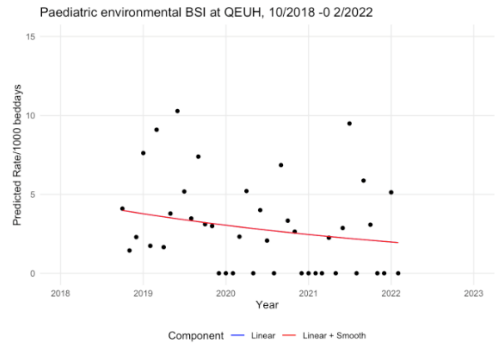
```
# Split dataset into periods using Decimal-Year boundaries
cut1 = 2015 + 5.5/12  # May 2015 → mid-year
cut2 = 2018 + 9.5/12  # Sep 2018 → mid-year

# For each period:
X = sm.add_constant(df_section["DecimalYear"])
model = sm.OLS(df_section["Rate_per_1000"], X).fit()
mean_rate = df_section["Rate_per_1000"].mean()
slope = model.params["DecimalYear"]
p_value = model.pvalues["DecimalYear"]

# Compare means with Welch t-test:
t, p = ttest_ind(secA["Rate_per_1000"], secB["Rate_per_1000"], equal_var=False)
```

```
# Plot with mean ± 95% CI bands:
plt.fill_between(
    [start_year, end_year],
    mean_rate - 1.96 * (sd/√n),
    mean_rate + 1.96 * (sd/√n),
    color=..., alpha=0.2
)
```

2.14. When comparing the outputs of the linear regression analysis - the 2008–mid-2015 (1st period): Moderate and stable infection rates, mid-2015–2018 (2nd period): Marked upward trajectory indicates rising infection risk, and post-2018 (3rd period): Distinct decline and lower baseline, to Dr. Drumright's GAM plots [22] (pasted below for convenience) we see that the linear and linear-smooth components for each period matches the corresponding periods' linear trend lines in Figure 2.







[22] Dr. Drumright, Response document

2.15. Dr. Drumright's R code output[23] shows that the change in slope over the 1st period did not reach statistical significance, the change in slope for the 2nd period does reach statistical significance, with the change in slope for the 3rd period not reaching statistical significance. With reference to my linear model output in Table 4 where the period 1 change in slope did not reach statistical significance, but periods 2 and 3 did.

2.16. With consideration to Dr. Drumright's use of GAMs and my use of linear models, to elucidate the change in trend of *Aspergillus* and environmental bacteraemia in the paediatric population, I offer the following reflections.

1. The rates of *Aspergillus* calculated by me closely matches that of Dr. Drumright's.

2. The rates of environmental bacteraemia in paediatric patients differ owing to acknowledged differences in datasets used.

3. When using Dr. Drumright's *Aspergillus* and environmental bacteraemia datasets - the GAM model's output closely matched that of the linear model when the dataset was less sparse in terms of monthly incidence figures, i.e. counts > 5 and less zero infections, as is the case when modelling the environmental bacteraemia dataset - Table 2E.6 [24], as compared to when modelling the *Aspergillus* dataset [25].

4. This is in keeping with Wood's (2017)[26] note that when using penalized smoothers in GAMs, the automatic selection of smoothing parameters can cause the model to over smooth key dynamics in datasets with sparse, zero-heavy observations—potentially missing abrupt changes or short-term trends. In such cases, stepwise or segmented approaches may better capture epidemiologically meaningful shifts. That is, whenever data contain many zeros or infrequent spikes, GAM-based smoothers risk "averaging out" the very signals you're interested in detecting.

5. The linear model output for *Aspergillus* clearly shows a significantly ($p = 0.043$) higher baseline rate of infection for the period June 2015 – February 2022, as compared to the January 2008 – May 2015 baseline rate. The primary change appears to be a step-change rather than a gradual increase, suggesting a discrete shift in infection control environment or exposure risk starting mid-2015. This finding is in line with the move from Yorkhill to RHC in June of 2015. Dr. Drumright's GAM model outputs do not share, for reasons noted previously, these results.

[23] Dr. Drumright, Response document
[24] Bundle 44, Volume 5, Document 2, Page 44, Table 2E.6.
[25] Bundle 44, Volume 5, Document 2, Page 76.
[26] Wood, S. N. (2017). Generalized Additive Models: An Introduction with R (2nd ed.). Chapman & Hall/CRC.

6. The linear model output for environmental bacteraemia in paediatric patients over the three periods – January 2008 – May 2015, June 2015 – September 2018, and October 2018 – February 2022 match that of Dr. Drumright's GAM outputs, confirming a significant upward trend in infections rates for the period June 2015 – September 2018, followed by a drop in infection rates (statistically significant via the linear model, not so on GAM) over the period October 2018 – February 2022. Both periods were preceded by stable infection rates (statistically not significant in either model) over the January 2008 – May 2015 period.

2.17. Questions 7(a), 7(b), 8(a) and 8(b). I have not analysed rates of non-environmental bacteraemias. We therefore only have Dr. Drumright's rates.

SCOTTISH HOSPITALS INQUIRY

Response to Direction in respect of discussion between Experts 22 July 2025

(additionally addressing comments provided by Mr Mookerjee)

Prepared by Lydia N Drumright, BSc, MPH, PhD

11 August 2025

Introduction

1.1. At the request of Mr Fred Mackintosh, AC, Counsel to the Inquiry in the document entitled, "Direction in respect of discussion between Experts 22 July 2025", Mr Mookerjee and I were asked to discuss and submit a statement on areas of agreement and disagreement on a set of provided questions (paragraph 5).

1.2. I conducted the requested analyses based on the questions proposed and sent them to Mr Mookerjee on 27 July 2025. A video conferencing discussion occurred on Friday, 1 August 2025, where I described details of the analyses. Mr Mookerjee had not yet had time to review the documents and indicated that he would get back to me with further information. On 10 August 2025 Mr Mookerjee sent the document entitled, "Expert report. Response to - Direction Note on Discussion between Experts (Dr Drumright and Mr Mookerjee) - 21 July 2025".

1.3. In paragraph 8 we were explicitly asked not to comment on inference that may be drawn from the data and analyses, but rather agreement or disagreement on information provided. I have responded herein to the Directed Discussion and the above noted response from Mr Mookerjee (SD Response) organized by items of original response (as provided in HTML format originally to Mr Mackintosh's Inquiry Team and Mr Mookerjee), agreement and disagreement below.

1.4. The original HTML response document (LND response 1) that I provided has been attached to this document as an appendix.

Response to Questions from the Inquiry Team

2.1 ***Questions 1: Part a: What was the overall rate of Aspergillus infection amongst paediatric haemato-oncology patients at Yorkhill over the whole period from January 2008 to May 2015? Part b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?***

2.1.1. The incidence rate of Aspergillus among paediatric haematology-oncology patients was 0.3487179 per 1,000 bed days across the period of January 2008 to May 2015. Please note that calculating incidence rates over time periods greater than one year is not normally done as it masks year on year trends.

2.1.2. Figure 2.1 provides the requested model plot. The linear component had an estimate of -0.3344 indicating a decreasing slope; however, the p-value was 0.432 indicating that the slope was not significant. The smooth component had 2.416 effective degrees of freedom, indicating that the curvature is somewhere between quadratic (i.e., a parabola or one peak or trough)

and cubic (i.e., having a peak and trough); however, the p-value was 0.172, indicating that it was not statistically significant. For further model details please see Appendix section X.1.3. These data suggest that when examining only the time period of January 2008 to May 2015, the incidence of Aspergillus is roughly constant and having a starting incidence rate of 0.379/1,000 bed days and an ending incidence rate of 0.001/1,000 bed days. All data are provided in the Appendix section X.1.6.

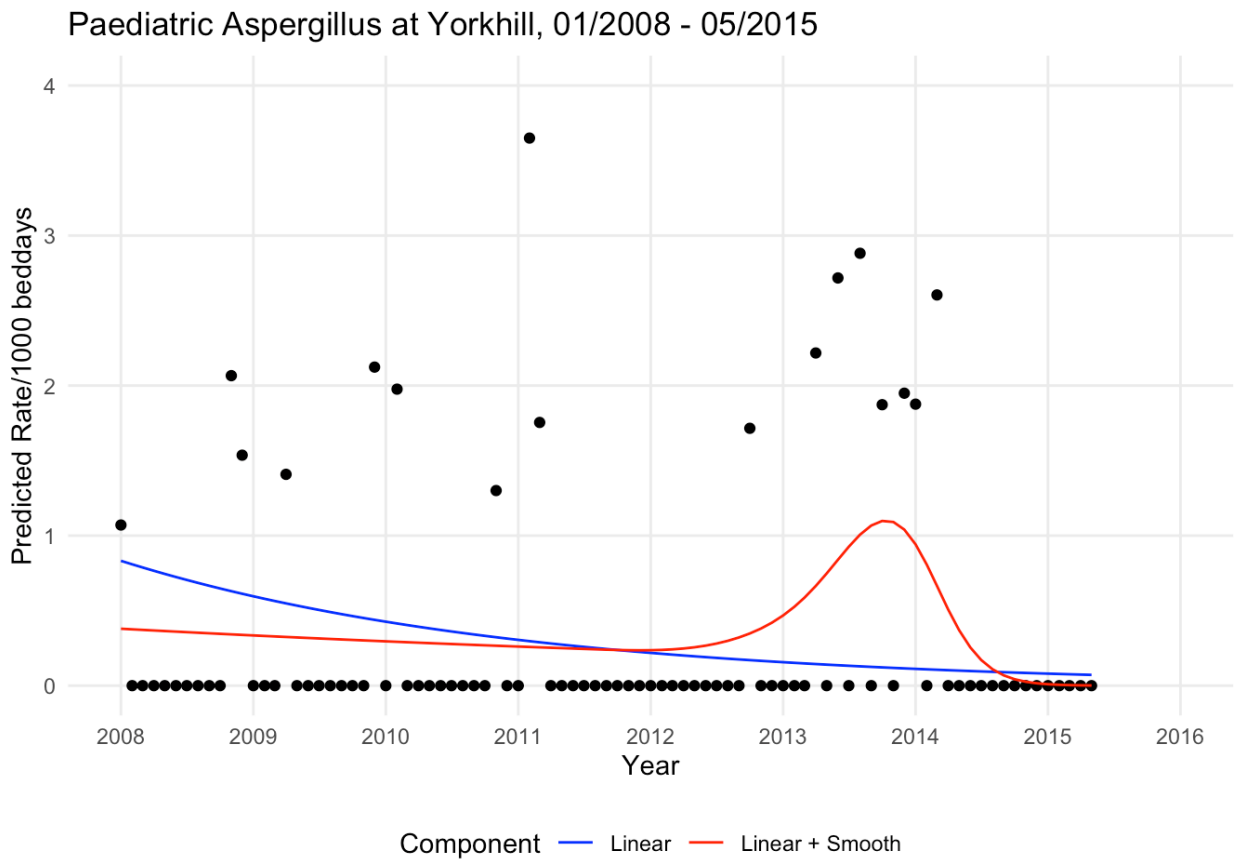


Figure 2.1. GAM model of incidence rates of Aspergillus per 1,000 bed days among paediatric haematology-oncology patients from January 2008 to May 2015

2.2. ***Question 2: Part a: What was the overall rate of Aspergillus infection amongst paediatric haemato-oncology patients at the RHC over the whole period from June 2015 to February 2022? Part b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?***

2.2.1. The incidence rate of Aspergillus among paediatric haematology-oncology patients was 0.7132498 per 1,000 bed days across the period of June 2015 to February 2022. As noted previously calculating incidence rates over time periods greater than one year is not normally done as it masks year on year trends.

2.2.2. Figure 2 provides the GAM plot for the Aspergillus incidence rate from June 2015 to February 2022. The model summary statistics (see Appendix section X.2.3) demonstrate a linear estimate of 0.06413 suggesting a very slight increasing trend; however, the p-value was 0.591 indicating that this was not significant. The smooth component had 1.234 effective degrees of freedom, indicating that the curvature is somewhere between linear (i.e., a line) and quadratic (i.e., a parabola or one peak or trough); however, the p-value was 0.175, indicating that it was not statistically significant. These data suggest that when examining only the time period of from June 2015 to February 2022, the incidence of Aspergillus is roughly constant with a starting incidence rate of 0.267/1,000 bed days and an ending incidence rate of 0.406/1,000 bed days. All data are provided in the appendix section X.2.6.

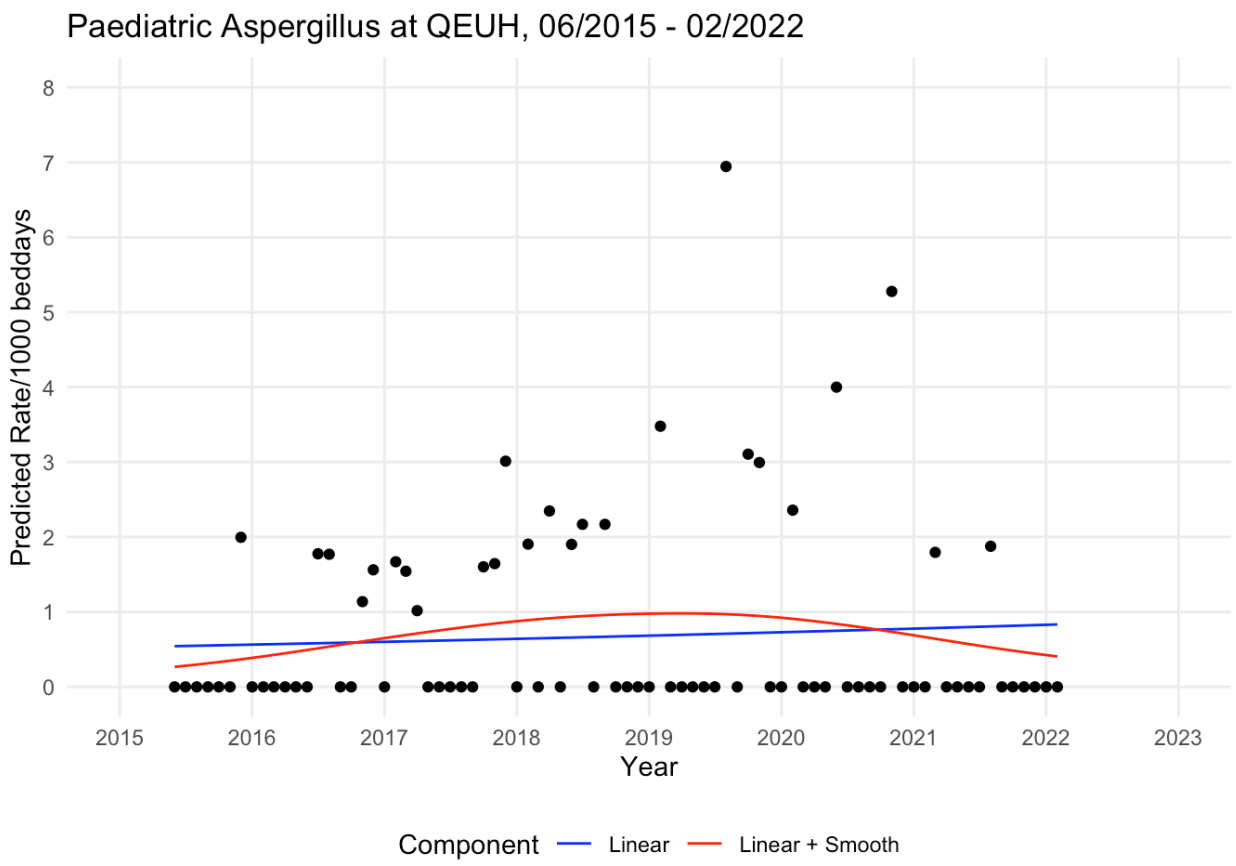


Figure 2.2. GAM model of incidence rates of Aspergillus per 1,000 bed days among paediatric haematology-oncology patients from June 2015 to February 2022

2.2.3. Please note that modelling trend data in separate time periods as requested above reduces power and our ability to observe changes over time. This is why data were not separated in time as modelled in 2.1. and 2.2 above in the Response to Responses to the HAD Report. Figure 2.3 below demonstrates the GAM linear and smooth components plot, from the Response to HAD. In this model, including all data the incidence rate is increasing by ~10% per year (log rate estimate: 0.09947) and the trend is statistically significant at P=0.001.

2.2.4. As noted originally in the HAD report, there are very few cases of Aspergillus among paediatric patients, which limits the power to detect significant trends over time. This is further reduced by splitting the data into two time periods. This also reduces our ability to test for significant changes in incidence rates.

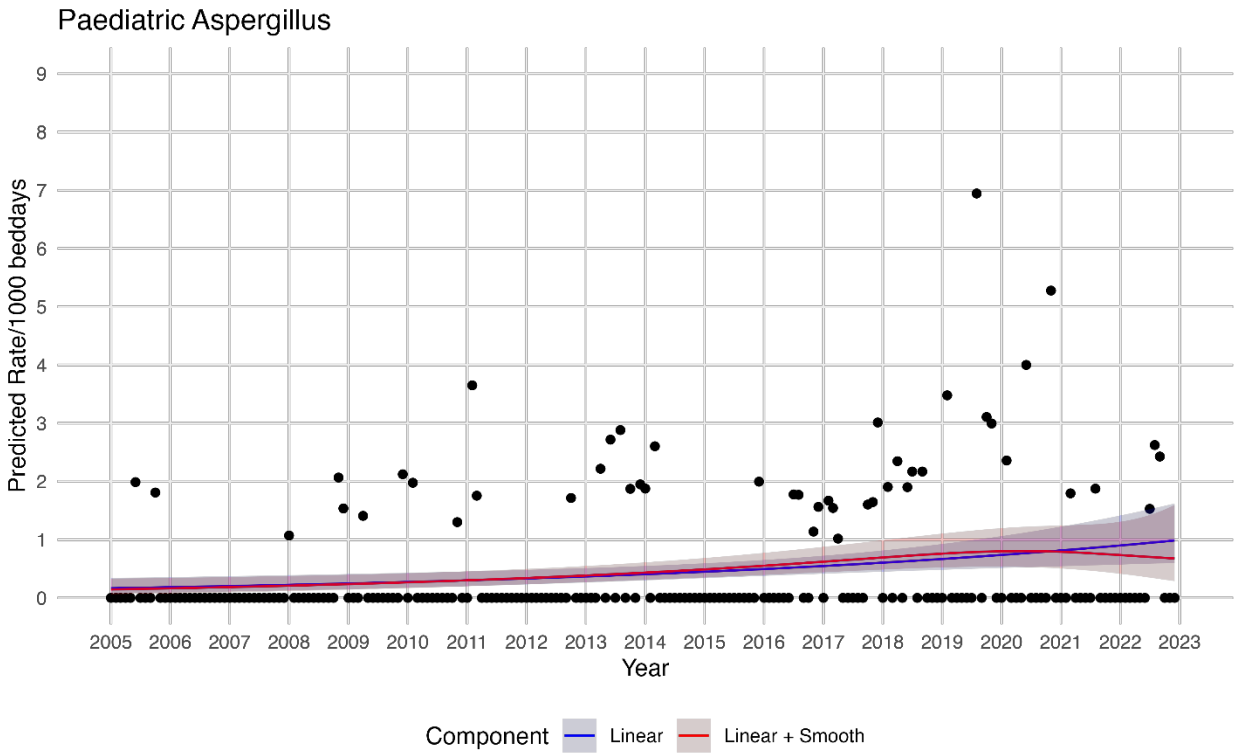


Figure 2.3 (Originally Figure 5C.3 in Response HAD**):** GAM fit for linear (blue line) and smooth (red line) components against incidence rates (black dots) for *Aspergillus* infections among paediatric haematology-oncology patients at Yorkhill (January 2005-April 2015) and QEUH (May 2015-December 2022)

2.3. ***Question 3: Part a: What was overall BSI incidence rate attributed to environmental microorganisms among paediatric haematology-oncology patients in Yorkhill for the whole period from January 2008 to May 2015? Part b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?***

2.3.1. The incidence rate of environmental BSI among paediatric haematology-oncology patients was 4.020513 per 1,000 bed days across the period of 2008 to May 2015.

2.3.2. Figure 4 provides the GAM plot for the environmental BSI incidence rate from 2008 to May 2015. The model summary statistics (see Appendix section X.3.3) demonstrate a linear estimate of -0.08484suggesting a very slight decreasing trend; however, the p-value was 0.0719 indicating that this did not quite reach statistical significance. The smooth component had 0.0002497 effective degrees of freedom, indicating little to no curvature and a p-value of 0.994, which is not statistically significant. These data suggest that when examining this time period alone there appears to be a relatively constant environmental BSI incidence rate. All data are provided in the appendix section X.3.6.

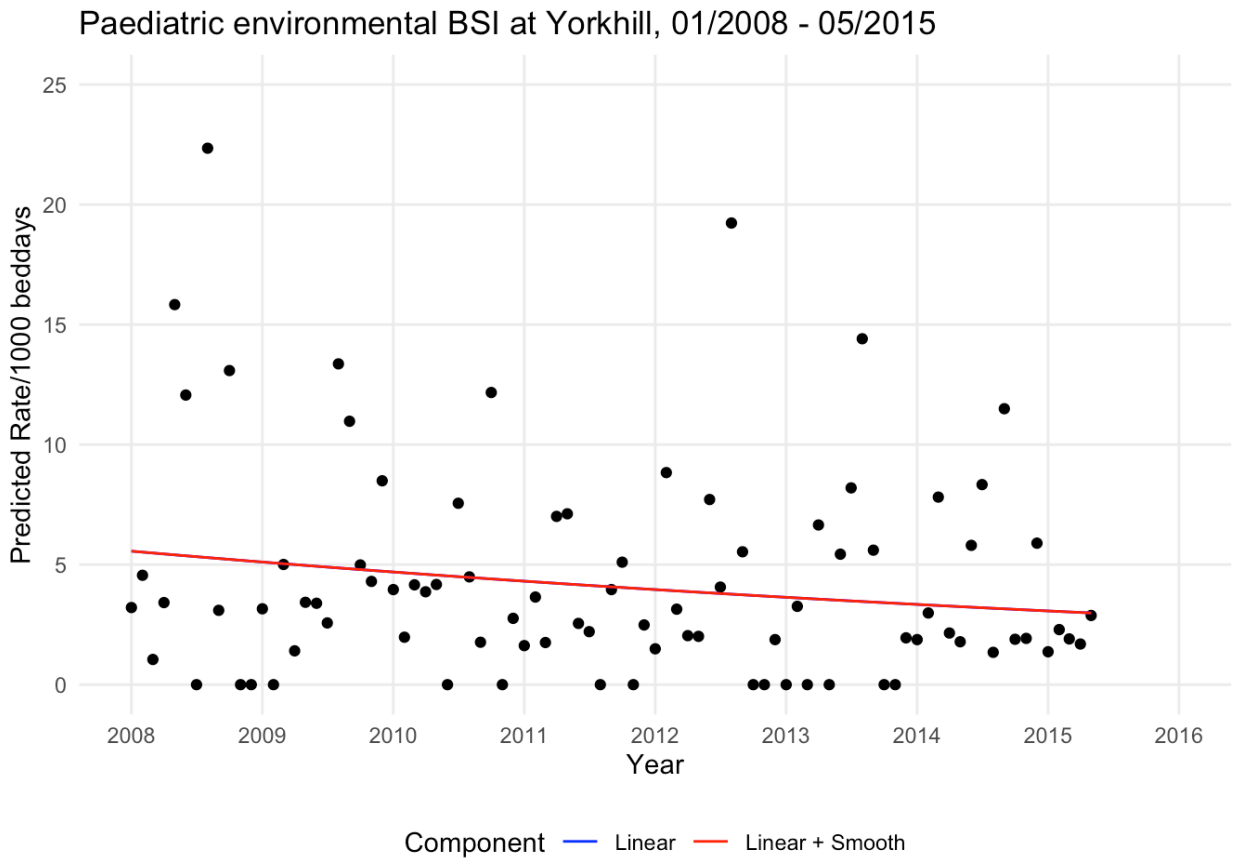


Figure 2.4. GAM model of incidence rates of environmental BSI per 1,000 bed days among paediatric haematology-oncology patients from 2008 to May 2015

2.4. ***Question 4: Part a: What was overall BSI incidence rate attributed to environmental microorganisms among paediatric haematology-oncology patients in the RHC for the whole period from June 2015 to September 2018? Part b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?***

2.4.1. The incidence rate of environmental BSI among paediatric haematology-oncology patients was 4.761318 per 1,000 bed days across the period of June 2015 to September 2018.

2.4.2. Figure 5 provides the GAM plot for the environmental BSI incidence rate from June 2015 to September 2018. The model summary statistics (see Appendix section X.4.3) demonstrate a linear estimate of 1.0842 with a p-value <0.001 indicating a significant increasing trend. The smooth component had 1.299 effective degrees of freedom with a p-value of 0.0381, indicating that the smooth component is the better estimate of trend dynamics in the data. These data suggest that when examining this time period alone there is an increasing trend that is not linear. All data are provided in the appendix section X.4.6.

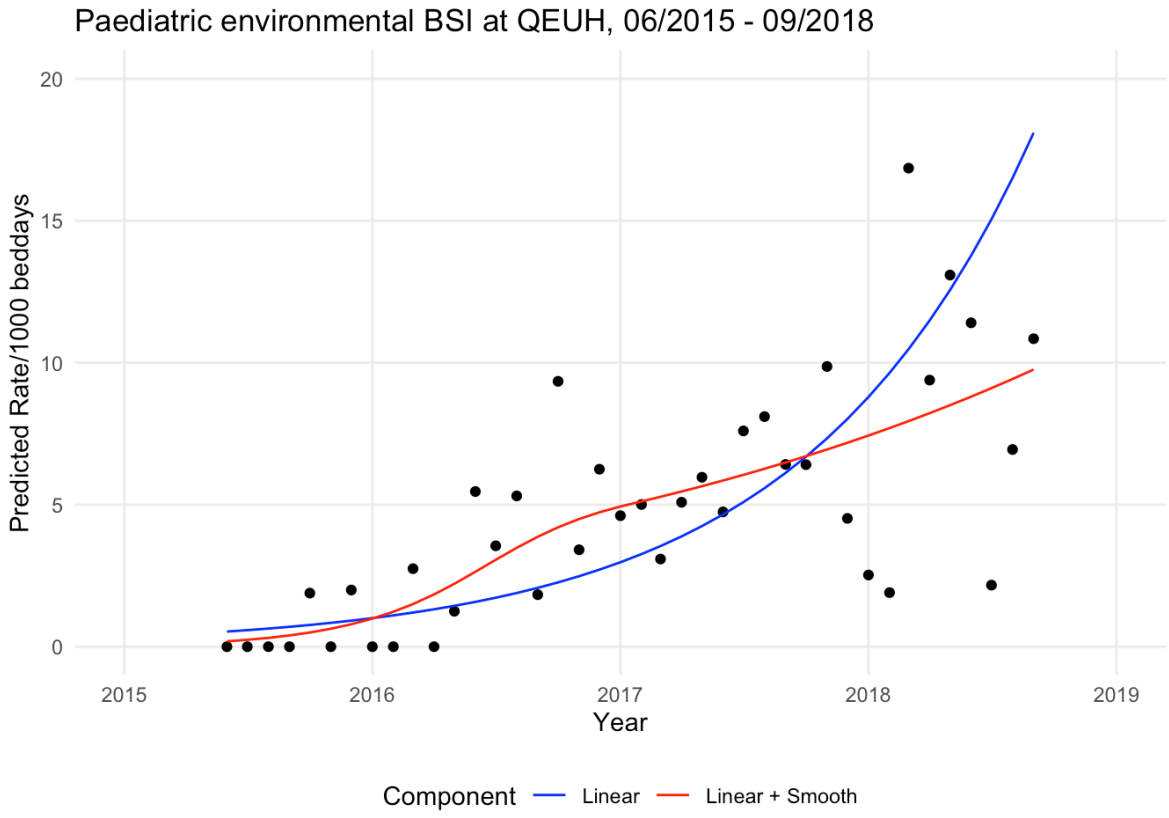


Figure 2.5. GAM model of incidence rates of environmental BSI per 1,000 bed days among paediatric haematology-oncology patients from June 2015 to September 2018

2.5. ***Question 5: Part a: What was overall BSI incidence rate attributed to environmental microorganisms among paediatric haematology-oncology patients in the RHC for the whole period from October 2018 to February 2022? Part b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?***

2.5.1. The incidence rate of environmental BSI among paediatric haematology-oncology patients was 2.881682 per 1,000 bed days across the period of October 2018 to February 2022.

2.5.2. Figure 6 provides the GAM plot for the environmental BSI incidence rate from October 2018 to February 2022. The model summary statistics (see Appendix section X.5.3) demonstrate a linear estimate of -0.2146 with a p-value 0.193 indicating a decreasing trend, but it is not significant. The smooth component had 0.0002019 effective degrees of freedom with a p-value of 0.992, indicating that the smooth component is not significant in trend dynamics in the data. All data are provided in the appendix section X.5.6.

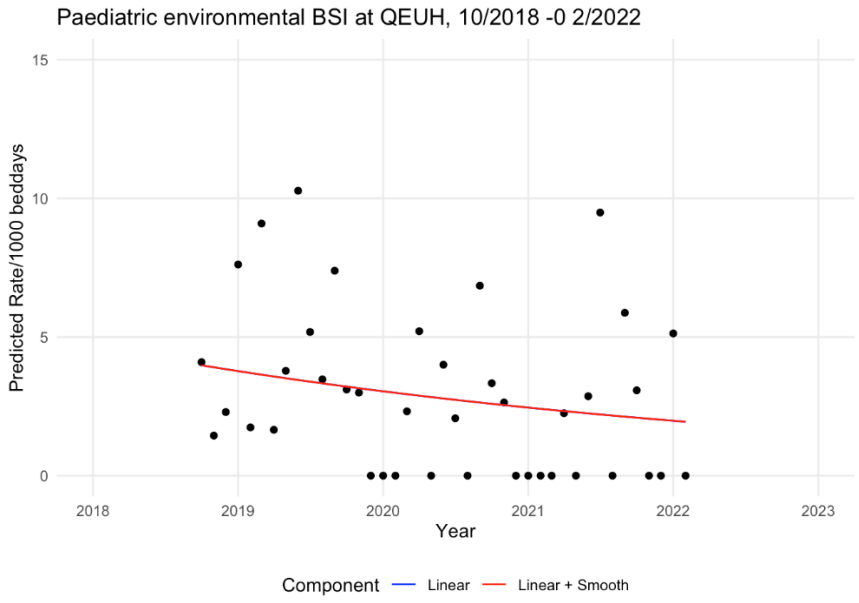
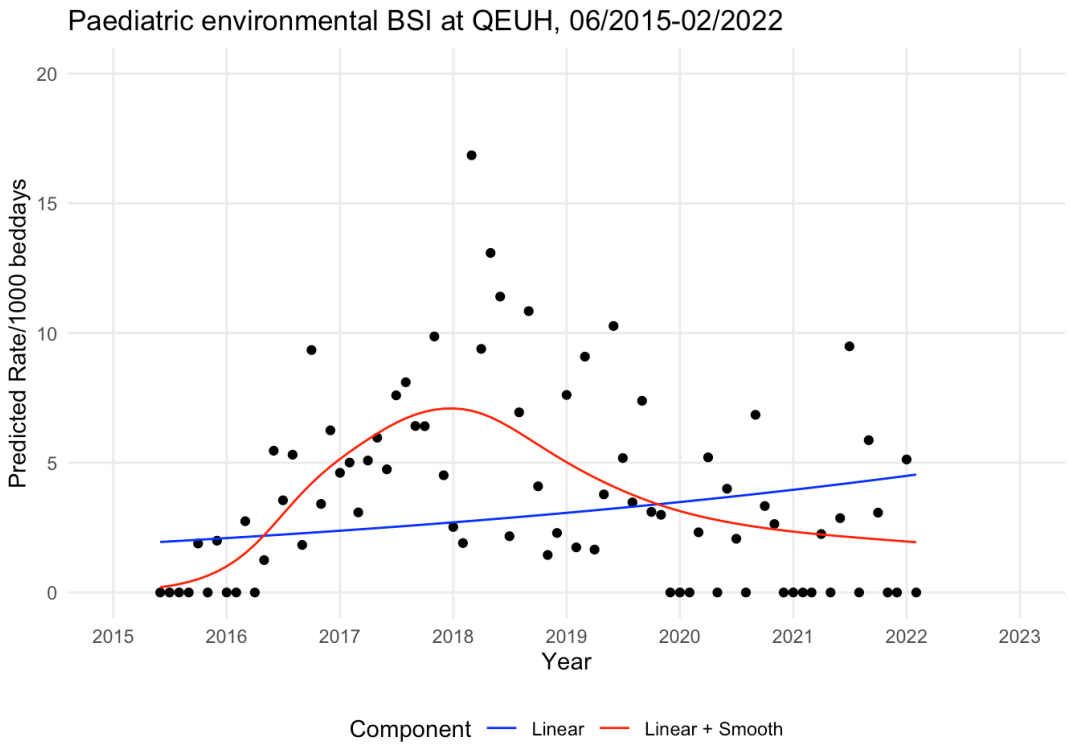


Figure 2.6. GAM model of incidence rates of environmental BSI per 1,000 bed days among paediatric haematology-oncology patients from October 2018 to February 2022

2.6. ***Question 6: Part a: What was overall BSI incidence rate attributed to environmental microorganisms among paediatric haematology-oncology patients in the RHC for the whole period from June 2015 to February 2022? Part b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?***

2.6.1. The incidence rate of environmental BSI among paediatric haematology-oncology patients was 3.970424 per 1,000 bed days across the period of June 2015 to February 2022.

2.6.2. Figure 7 provides the GAM plot for the environmental BSI incidence rate from June 2015 to February 2022. The model summary statistics (see Appendix section X.6.3) demonstrate a linear estimate of 0.12717 with a p-value 0.159 indicating a slightly increasing trend, but it is not significant. The smooth component had 3.043 effective degrees of freedom with a p-value of <0.001, indicating that the smooth component reflects significant nonlinear dynamics in the data. These data suggest that the incidence increased starting around January 2016 and began decreasing in January 2018. All data are provided in the appendix section X.6.6.



<u>Figure 2.7.</u> GAM model of incidence rates of environmental BSI per 1,000 bed days among paediatric haematology-oncology patients from *June 2015 to February 2022*

2.6.3. While the above data show a similar overall trend to that provided in our original GAM plots in the Response to the Response on the HAD Report, the data from the HAD Response (Figure 2.8) provides a more thorough representation of the dynamics in environmental BSI rates as it includes more information. The greater number of data points, the greater power the model has to detect changes over time and unusual fluctuations in the data as seen in figure 2.8.

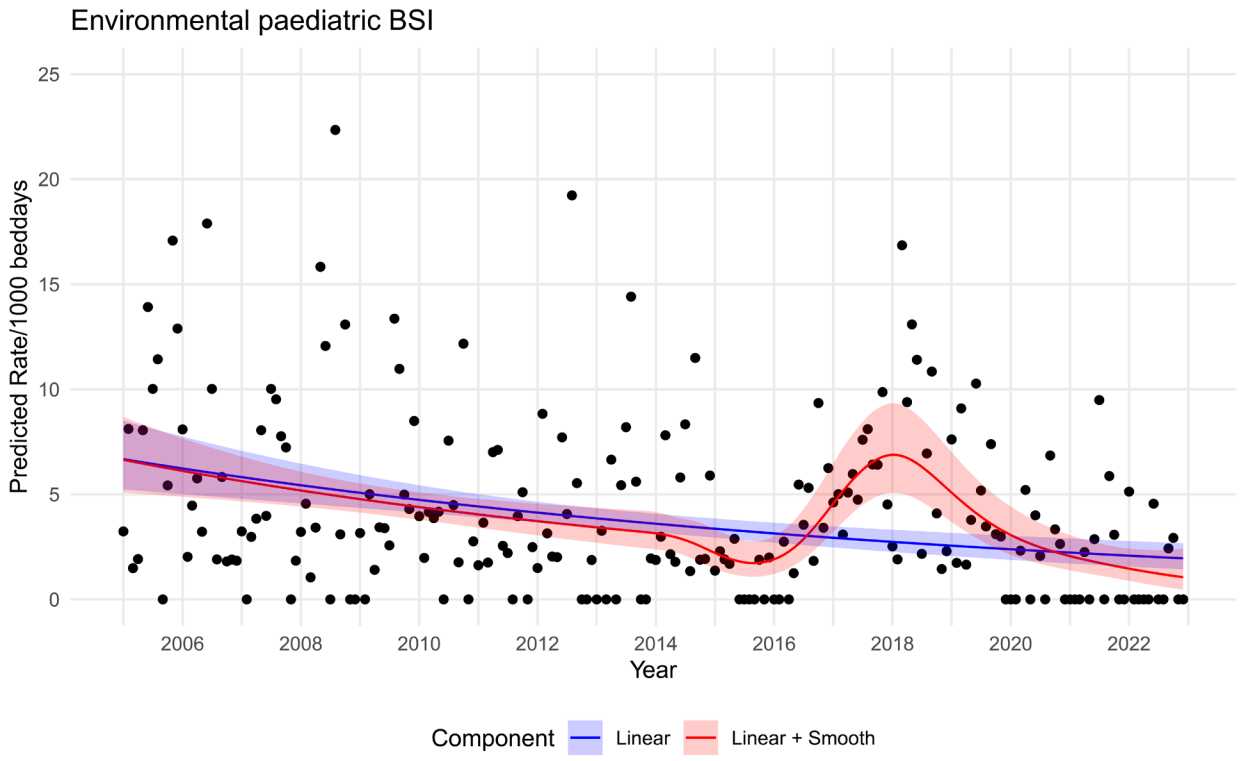


Figure 2.8 (Originally Figure 2.F.3 in the HAD Response): GAM fit for linear (blue line) and smooth (red line) components against incidence rates (black dots) for BSI incidence rates attributed to environmental microorganisms among paediatric haematology-oncology patients in Yorkhill (Jan 2005-April 2015) and RHC at QEUH (May 2015-Dec 2025) - year tick marks are placed at Jan of that year)

2.7. ***Question 7: Part a: What was overall BSI incidence rate attributed to non-environmental microorganisms among paediatric haematology-oncology patients in Yorkhill for the whole period from January 2008 to May 2015? Part b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?***

2.7.1. The incidence rate of non-environmental BSI among paediatric haematology-oncology patients was 12.86154 per 1,000 bed days across the period of January 2008 to May 2015.

2.7.2. Figure 9 provides the GAM plot for the non-environmental BSI incidence rate from January 2008 to May 2015. The model summary statistics (see Appendix section X.7.3) demonstrate a linear estimate of -0.007173 with a p-value 0.769 indicating a relatively constant rate. The smooth component had 0.724 effective degrees of freedom with a p-value of 0.245, indicating that the smooth component does not reflect the dynamics in the data. These data suggest a relatively constant incidence rate on non-environmental BSI over this time period. All data are provided in the appendix section X.7.6.

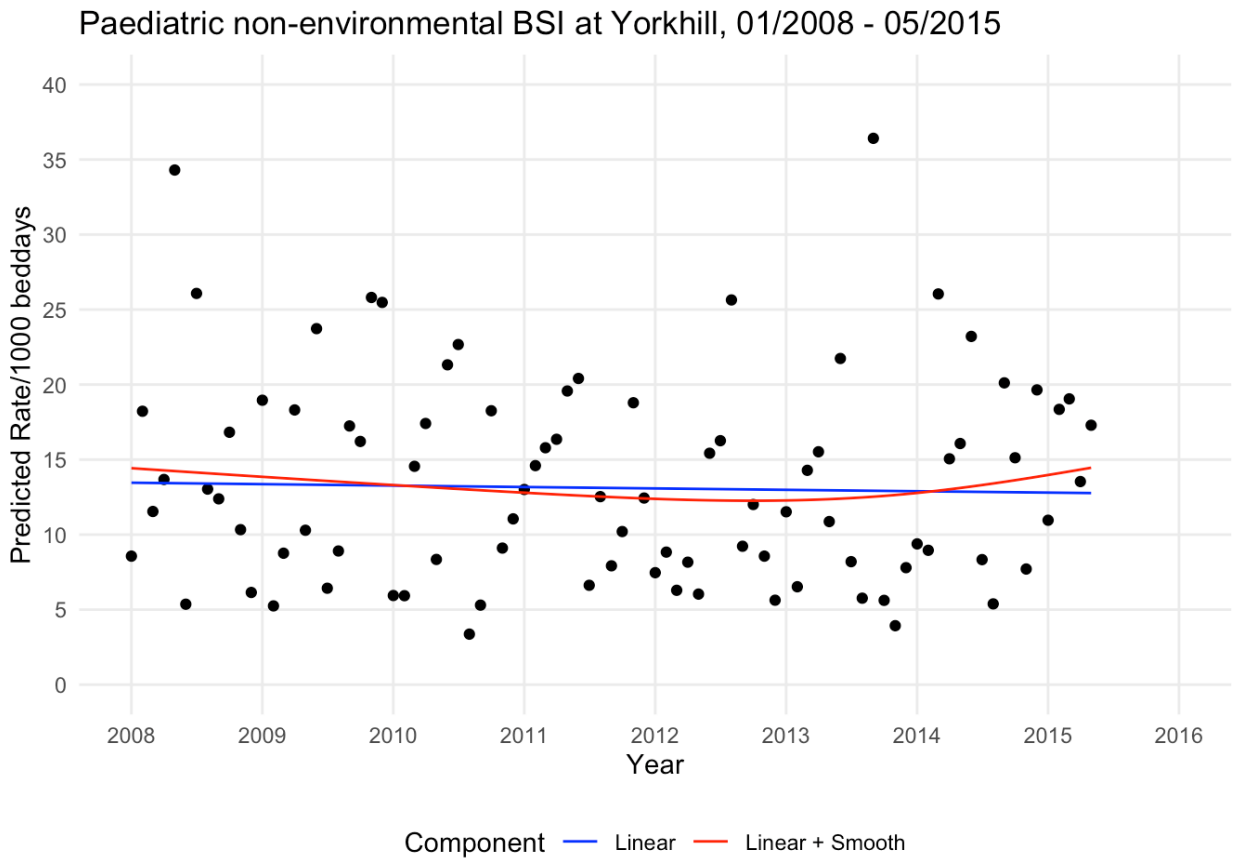
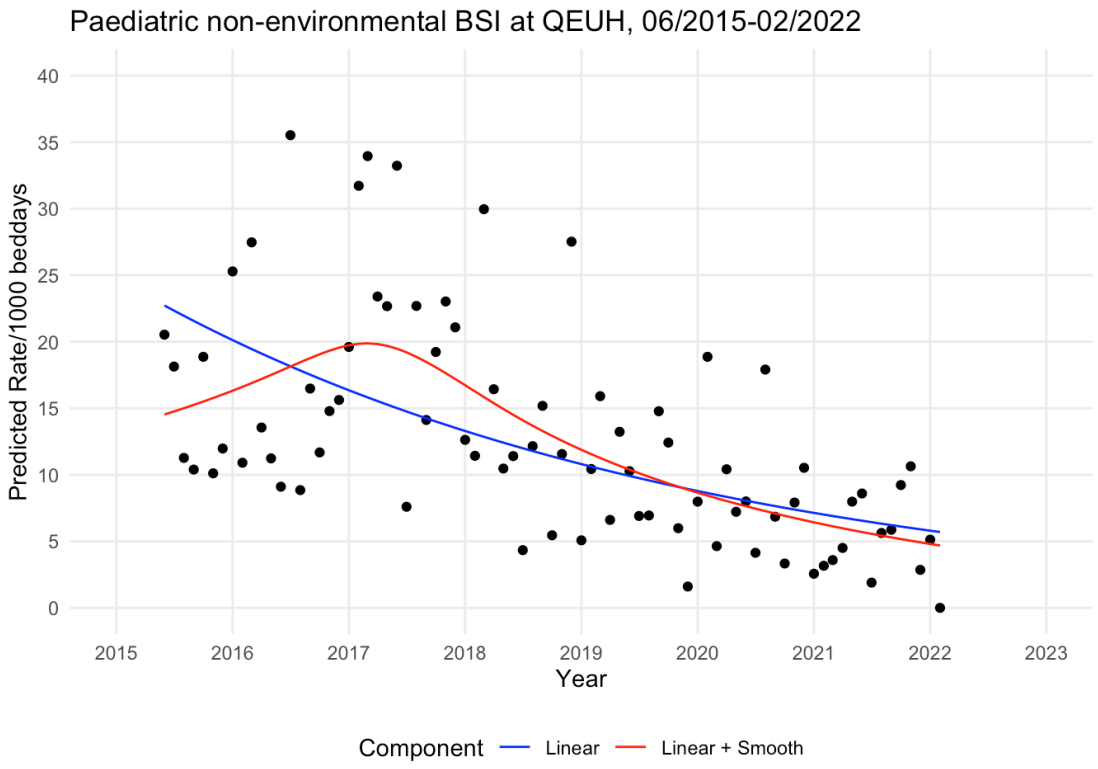


Figure 2.9. GAM model of incidence rates of non-environmental BSI per 1,000 bed days among paediatric haematology-oncology patients from January 2008 to May 2015

2.8. ***Question 8: Part a: What was overall BSI incidence rate attributed to non-environmental microorganisms among paediatric haematology-oncology patients in the RHC over the whole period from June 2015 to February 2022. Part b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?***

2.8.1. The incidence rate of non-environmental BSI among paediatric haematology-oncology patients was 13.5042 per 1,000 bed days across the period of June 2015 to February 2022.

2.8.2. Figure 10 provides the GAM plot for the non-environmental BSI incidence rate from June 2015 to February 2022. The model summary statistics (see Appendix section X.8.3) demonstrate a linear estimate of -0.20728 with a p-value <0.001 indicating a small, but significant decrease in incidence rates over this time period. The smooth component had 1.904 effective degrees of freedom with a p-value of 0.003, indicating that the smooth component reflects the dynamics in the data. These data suggest an increase in non-environmental BSI starting possibly before the start of the dataset with a decline in incidence rates around March 2017. All data are provided in the appendix section X.8.6.



<u>Figure 2.10.</u> GAM model of incidence rates of non-environmental BSI per 1,000 bed days among paediatric haematology-oncology patients from January June 2015 to February 2022

2.8.3. As with the other data, it is recommended that the longest continuous series of incidence rate data be used to examine trends as it will increase power, and it also does not impose unnatural breaks in the data as observed in Figure 2.11. In comparison to Figure 2.10, it is obvious that there was an imposed break in the data where incidence rates were already increasing. This can mask dynamics and result in incorrect interpretation of the data.

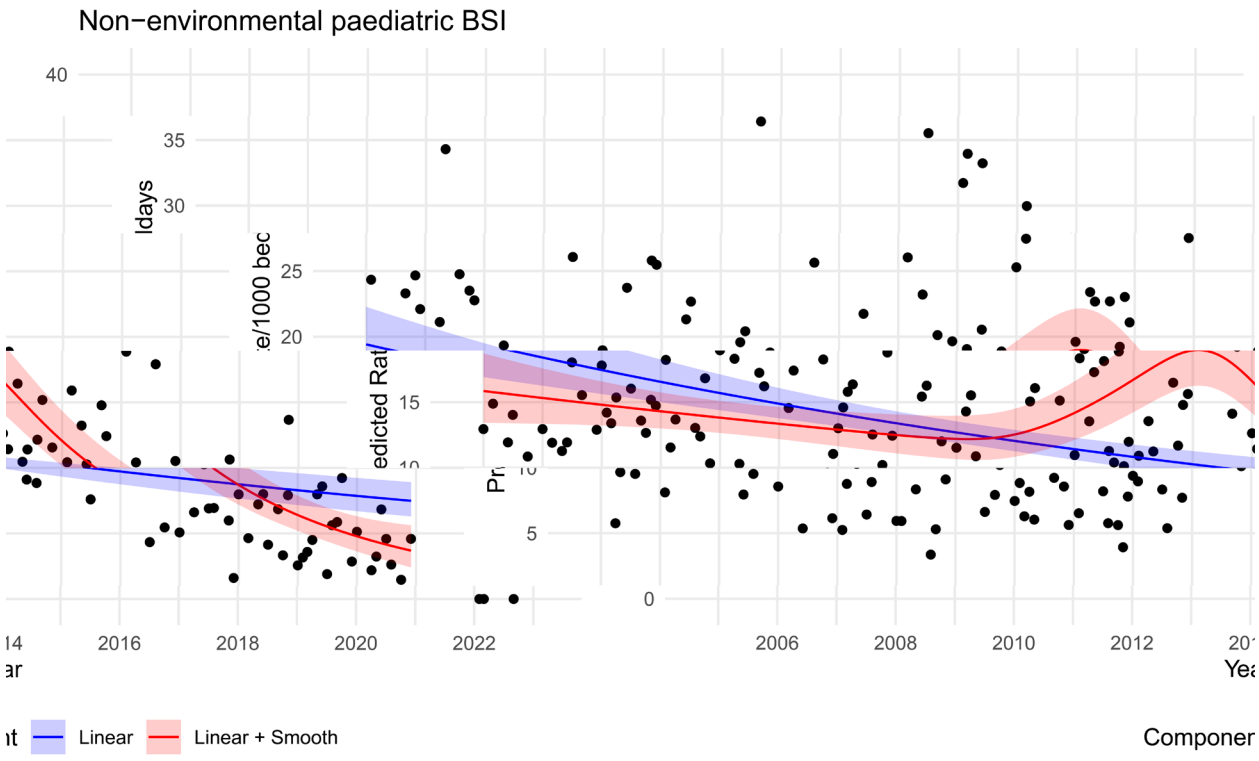


Figure 2.10 (originally Figure 2.F.4 in HAD Response): GAM fit for linear (blue line) and smooth (red line) components against incidence rates (black dots) for BSI attributed to non-environmental microorganisms among paediatric haematology-oncology patients in Yorkhill (Jan 2005-April 2015) and RHC at QEUH (May 2015-Dec 2025) - year tick marks are placed at Jan of that year)

Agreed upon Information and Analyses

3.1. Similarity in incidence rates of Aspergillus over time

3.1.1. In paragraphs 2.2 and 2.3, Mr Mookerjee provides Tables 1 and 2 showing a comparison of incidence rates of Aspergillus among paedatric haematology-oncology patients indicating similarities in incidence rates calculated by each of us, as well as rates for time periods 2008-May 2015 and June 2015-February 2022. We are in agreement that these incidence rates calculated by each of us are similar, and show an approximate two fold increase over the period of observation.

3.2. Differences in incidence rates of BSI are likely due to different data sources

3.2.1. In paragraph 2.7 Mr Mookerjee points out that he did not have the opportunity to analyse BSI data from Yorkhill and therefore has no comparison data. I agree that we can only use the data that I provided.

3.2.2. In paragraph 2.8-2.10, Mr Mookerjee notes differences in incidence rates of BSI. In paragraph 2.11 he notes that these are likely due to his focus on specific wards for number of cases and my focus on all haematology-oncology for these data. As he used bed days for all paediatric haematology-oncology, one would expect these to be different. I agree that this is the likely reason for the differences observed. Note that we could not match data that we modelled due to limitations with the data we were each able to access. Ability to access these data is a concern for future improvements and monitoring of the health system.

3.2. The trends in paediatric BSI incidence rates over time.

3.2.1. I am in agreement with Mr Mookerjee in paragraph 2.14 that we observe similar trends in BSI incidence rates over time, even with different models. I do note however, that he interprets the meaning of these changes, which I have not commented on as we were explicitly asked not to do so in the Directions.

Information and Analyses for which there is Disagreement

4.1. The use of GAMs vs linear regression to understand the data.

4.1.1. In paragraph 2.6 of the SD Response Mr Mookerjee argues that, "Given the characteristics of the Aspergillus dataset – low counts, lots of zeros, small sample size, it is clear that GAM models are not suited to elucidate the trend in these infections, negating the resulting outputs. The outputs from the simpler, more suited linear model…". Linear models assume that residuals (i.e., the difference between observed predicted values) are normally distributed. With low counts this assumption is not met; therefore, linear models are not appropriate for these data analyses.

4.1.2. Generalized linear models (GLMs) are appropriate to model counts and GLMs are a special case of GAMs when there is no evidence for wiggliness (i.e., a significant smooth component). As observed in the models described in 2.1 and 2.2 (and shown in X.1 and X.2 of the Appendix) the smooth component is not significant and therefore the linear component of the GAM essentially becomes a GLM, thereby making them an appropriate type of model.

4.1.3. Furthermore, use of linear regression ignores real and important dynamics in trends that are not linear, such as different rates of increasing or decreasing incidence and/or seasonal trends. Indeed, the environmental and non-environmental BSI data demonstrate significant wiggly trends even after taking into account seasonal trends. For these data it is not appropriate to plot a linear trend line, as the trend is not linear.

4.2. **The trend in paediatric Aspergillus incidence rates over time.**

4.2.1. In paragraph 2.6, Mr Mookerjee correctly cites Wood (2017), stating that GAMs can smooth short-lived increases or decreases (for example a one or two month increase in Aspergillus incidence rates), which is a limitation. Note that all statistical models have limitations. However, Mr Mookerjee's interpretation of the change in Aspergillus over time is a step change in June 2015 that remains constantly high, which is not a short term increase. This type of change would be captured in a GAM if the rates were different enough, for example a significant increase in incidence rate.

4.2.2. When modeling trends over time there are different ways to assess changes. One can make assumptions about where a change occurs, by imposing a breakpoint where a change is expected. Alternatively, one can allow the data to identify change, gradual or sudden, and interpreting those. Mr Mookerjee has chosen to impose a single breakpoint in Aspergillus based on the move date and multiple breakpoints based on ward movements for bloodstream infections (BSI). I have chosen an agnostic approach, allowing the data to identify these changes.

4.2.3. While a linear model is not correct, if one fits a linear model to the data with stable rates before and after a breakpoint, as interpreted by Mr Mookerjee in paragraph 2.5, but allows the data to identify the breakpoint this occurs in July 2019, not June 2015. The incidence rate changes from 0.49/1,000 bed days to 0.91/1,000 bed days in July 2019. This suggest that rates following the Yorkhill to RHC QEUH move more closely resemble the rates at Yorkhill and increase only after decant to Wards 6A and 4B. This was calculated using the 'fastcpd' library in R, assuming an 'lm' (linear model) family.

4.2.4. It is important to understand if changes in rates that we observe (and agree upon) are due to a step change or happen gradually over the entire period. We therefore fitted a series of GLMs: (1) one that assumes that the incidence rate is constant over time; (2) the second that assumes a step change in June 2015 when the paediatric haematology-oncology unit was moved from Yorkhill to RHC at QEUH; and (3) a model where the changes by a constant fraction per year. We compared models using the Akaike's information criterion corrected (AICc) to determine which best fits the data, using the 'model.sel' function from the 'MuMIn' library in R. The step change model had the best fit according to the AICc weight (0.445), closely followed by the gradual change model (0.422), with the no change model (0.133) fitting poorly. The difference in AICc was 0.11 between the step change and gradual change models, with anything less than 2 identified as a non-meaningful difference (Burnham and Anderson (2002), Model Selection and Multimodel Inference: A Practical Information-Theoretic Approach), suggesting that both the step change in July 2019 and the gradual change model are equally well supported by the data. The interpretation therefore, would be that we either are observing a constant, yet small, increase in Aspergillus incidence rate over the time period; or we observed a small, yet significant, increase in Aspergillus incidence starting in July 2019.

Model	Change in rate	AICc	Difference in AICc from best model	Weight
Step change	0.364 (in June 2015)	524.2	0	0.445
Linear change	0.044/yr	524.3	0.11	0.422
Constant	0 (assumed)	526.6	2.41	0.133

4.2.5. Mr Mookerjee in paragraph 2.5, Figure 1, indicates that, "The shading shows there's minimal overlap between pre-2015 and post-2015 confidence intervals". It appears that either shading for the 95% confidence intervals (CI) was omitted or they have been calculated incorrectly, as 95% CI could not be that small on a dataset with some 0 counts. I calculated the 95% confidence intervals for the data that I provided, and that Mr Mookerjee stated he had used in paragraph 2.5, using a linear model and assuming constant rates over the two time periods. For the January 2008-May 2015 time period the point estimate is 0.39 with 95% CI of 0.21-0.57. For June 2015-February 2022 time period, the point estimate is 0.75 with 95% CI of 0.46-1.05. These 95% CI indeed overlap, which would potentially change the interpretation.

4.2.6. In paragraph 2.16 number 3, Mr Mookerjee states that the GAM and linear regression are similar with respect to BSI data, but not Aspergillus data because of limitations in GAMs. However, this is incorrect, as stated above, linear regression assumptions are not met with "thin" data owing to many zero counts and the GAM essentially becomes a GLM, which is an appropriate model for data with many zero counts (see 4.1 for full explanation).

APPENDIX: ORIGINAL RESPONSE TO DIRECTIONS FROM THE INQUIRY TEAM

X.0.1. The following was originally sent to Mr Mackintosh and his team and Mr Mookerjee on 27 July 2025 as an HTML document to enable easily jumping between questions and information provided.

X.0.2. All data are provided below and all code is available on request.

X.0.3. All analyses were completed in R and methods are the same as those provided in the "Response to Responses on the HAD Report" dated 19 July 2025.

Response document

X.1.0. Question 1a: What was the overall rate of Aspergillus infection amongst paediatric haemato-oncology patients at Yorkhill over the whole period from January 2008 to May 2015?

X.1.1. We can get a point estimate of the rate by dividing the total number of aspergillus by the total number of beddays. The rate per bedday is small, so we consider rates by 1000 beddays, a common practice in the literature.

[1] 0.3487179

X.1.2. Question 1b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

X.1.3.Model summary

Family: Negative Binomial(3811740.796)

Link function: log

Formula:

asp ~ decyear2 + offset(log(beddays)) + s(decyear2, bs = "ad",

k = 40, xt = list(bs = "ps"))

Parametric coefficients:

	Estimate	Std. Error	z value	Pr(>|z|)	
(Intercept)	-9.5708	1.9530	-4.901	9.55e-07	***
decyear2	-0.3344	0.4260	-0.785	0.432	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:

	edf	Ref.df	Chi.sq	p-value
s(decyear2)	2.416	3.236	4.872	0.172

Rank: 40/41

R-sq.(adj) = 0.0779 Deviance explained = 17.8%

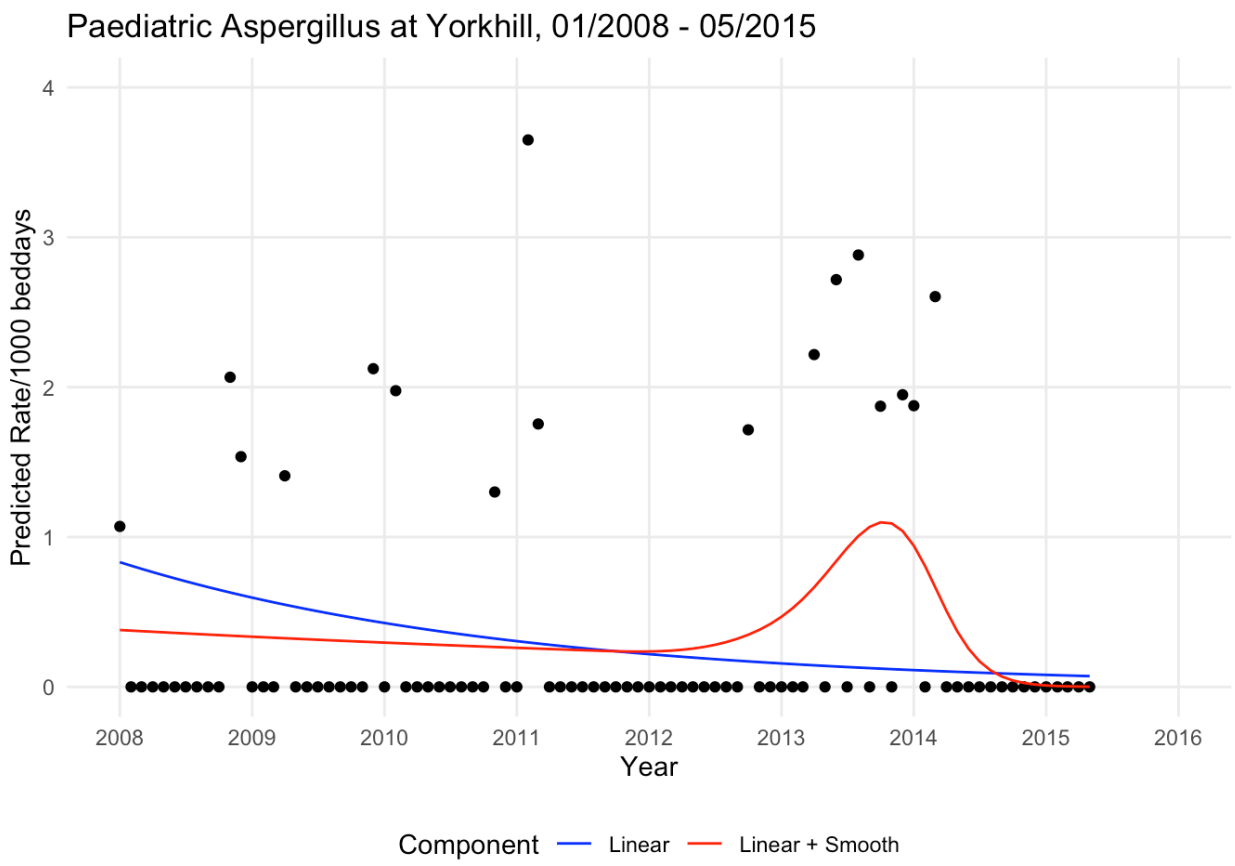
-REML = 45.287 Scale est. = 1 n = 89

X.1.4. First and last timepoints

Paediatric Aspergillus at Yorkhill, 01/2008 - 05/2015

Year	Month	Fit/1000 bed days	Observed Rate
2008	1	0.379346650675025	1.07066380977631
…	…	…	…
2015	5	0.00125075778138357	0

X.1.5. Plot



X.1.6.Raw data and fits

Paediatric Aspergillus at Yorkhill, 01/2008-05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2008	1	1	934	1.070664	Intercept + Linear	0.8319837
2008	2	0	439	0.000000	Intercept + Linear	0.8087503
2008	3	0	953	0.000000	Intercept + Linear	0.7876035
2008	4	0	585	0.000000	Intercept + Linear	0.7656095
2008	5	0	379	0.000000	Intercept + Linear	0.7449098
2008	6	0	746	0.000000	Intercept + Linear	0.7241080
2008	7	0	767	0.000000	Intercept + Linear	0.7045304
2008	8	0	537	0.000000	Intercept + Linear	0.6848562
2008	9	0	646	0.000000	Intercept + Linear	0.6657314

Paediatric Aspergillus at Yorkhill, 01/2008-05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2008	10	0	535	0.000000	Intercept + Linear	0.6477321
2008	11	1	484	2.066116	Intercept + Linear	0.6296440
2008	12	1	651	1.536098	Intercept + Linear	0.6126204
2009	1	0	633	0.000000	Intercept + Linear	0.5955128
2009	2	0	381	0.000000	Intercept + Linear	0.5788380
2009	3	0	799	0.000000	Intercept + Linear	0.5641786
2009	4	1	710	1.408451	Intercept + Linear	0.5483811
2009	5	0	583	0.000000	Intercept + Linear	0.5335146
2009	6	0	590	0.000000	Intercept + Linear	0.5185758
2009	7	0	778	0.000000	Intercept + Linear	0.5045173
2009	8	0	449	0.000000	Intercept + Linear	0.4903904
2009	9	0	638	0.000000	Intercept + Linear	0.4766591
2009	10	0	802	0.000000	Intercept + Linear	0.4637370
2009	11	0	465	0.000000	Intercept + Linear	0.4507520
2009	12	1	471	2.123142	Intercept + Linear	0.4385322
2010	1	0	505	0.000000	Intercept + Linear	0.4262529
2010	2	1	506	1.976285	Intercept + Linear	0.4143175
2010	3	0	481	0.000000	Intercept + Linear	0.4038247
2010	4	0	517	0.000000	Intercept + Linear	0.3925173
2010	5	0	719	0.000000	Intercept + Linear	0.3818762
2010	6	0	516	0.000000	Intercept + Linear	0.3711834
2010	7	0	397	0.000000	Intercept + Linear	0.3611206
2010	8	0	891	0.000000	Intercept + Linear	0.3510090

Paediatric Aspergillus at Yorkhill, 01/2008-05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2010	9	0	566	0.000000	Intercept + Linear	0.3411805
2010	10	0	493	0.000000	Intercept + Linear	0.3319311
2010	11	1	769	1.300390	Intercept + Linear	0.3226368
2010	12	0	724	0.000000	Intercept + Linear	0.3138902
2011	1	0	615	0.000000	Intercept + Linear	0.3051010
2011	2	1	274	3.649635	Intercept + Linear	0.2965579
2011	3	1	570	1.754386	Intercept + Linear	0.2890474
2011	4	0	428	0.000000	Intercept + Linear	0.2809539
2011	5	0	562	0.000000	Intercept + Linear	0.2733373
2011	6	0	392	0.000000	Intercept + Linear	0.2656836
2011	7	0	453	0.000000	Intercept + Linear	0.2584810
2011	8	0	399	0.000000	Intercept + Linear	0.2512433
2011	9	0	505	0.000000	Intercept + Linear	0.2442083
2011	10	0	392	0.000000	Intercept + Linear	0.2375879
2011	11	0	479	0.000000	Intercept + Linear	0.2309352
2011	12	0	402	0.000000	Intercept + Linear	0.2246746
2012	1	0	670	0.000000	Intercept + Linear	0.2183835
2012	2	0	566	0.000000	Intercept + Linear	0.2122851
2012	3	0	954	0.000000	Intercept + Linear	0.2067344
2012	4	0	490	0.000000	Intercept + Linear	0.2009613
2012	5	0	994	0.000000	Intercept + Linear	0.1955279
2012	6	0	389	0.000000	Intercept + Linear	0.1900677
2012	7	0	492	0.000000	Intercept + Linear	0.1849289

Paediatric Aspergillus at Yorkhill, 01/2008-05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2012	8	0	312	0.000000	Intercept + Linear	0.1797647
2012	9	0	542	0.000000	Intercept + Linear	0.1747447
2012	10	1	583	1.715266	Intercept + Linear	0.1700202
2012	11	0	467	0.000000	Intercept + Linear	0.1652723
2012	12	0	533	0.000000	Intercept + Linear	0.1608039
2013	1	0	434	0.000000	Intercept + Linear	0.1563134
2013	2	0	613	0.000000	Intercept + Linear	0.1519365
2013	3	0	560	0.000000	Intercept + Linear	0.1480886
2013	4	1	451	2.217295	Intercept + Linear	0.1439420
2013	5	0	552	0.000000	Intercept + Linear	0.1400398
2013	6	1	368	2.717391	Intercept + Linear	0.1361186
2013	7	0	244	0.000000	Intercept + Linear	0.1324284
2013	8	1	347	2.881844	Intercept + Linear	0.1287203
2013	9	0	357	0.000000	Intercept + Linear	0.1251160
2013	10	1	534	1.872659	Intercept + Linear	0.1217242
2013	11	0	509	0.000000	Intercept + Linear	0.1183158
2013	12	1	513	1.949318	Intercept + Linear	0.1151083
2014	1	1	533	1.876173	Intercept + Linear	0.1118852
2014	2	0	670	0.000000	Intercept + Linear	0.1087523
2014	3	1	384	2.604167	Intercept + Linear	0.1059981
2014	4	0	465	0.000000	Intercept + Linear	0.1030300
2014	5	0	560	0.000000	Intercept + Linear	0.1002369
2014	6	0	517	0.000000	Intercept + Linear	0.0974302

Paediatric Aspergillus at Yorkhill, 01/2008-05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2014	7	0	360	0.000000	Intercept + Linear	0.0947889
2014	8	0	743	0.000000	Intercept + Linear	0.0921347
2014	9	0	348	0.000000	Intercept + Linear	0.0895549
2014	10	0	529	0.000000	Intercept + Linear	0.0871271
2014	11	0	519	0.000000	Intercept + Linear	0.0846874
2014	12	0	509	0.000000	Intercept + Linear	0.0823916
2015	1	0	730	0.000000	Intercept + Linear	0.0800845
2015	2	0	436	0.000000	Intercept + Linear	0.0778421
2015	3	0	525	0.000000	Intercept + Linear	0.0758707
2015	4	0	591	0.000000	Intercept + Linear	0.0737463
2015	5	0	347	0.000000	Intercept + Linear	0.0717470
2008	1	1	934	1.070664	Intercept + Linear + Smooth	0.3793467
2008	2	0	439	0.000000	Intercept + Linear + Smooth	0.3753441
2008	3	0	953	0.000000	Intercept + Linear + Smooth	0.3716381
2008	4	0	585	0.000000	Intercept + Linear + Smooth	0.3677169
2008	5	0	379	0.000000	Intercept + Linear + Smooth	0.3639617
2008	6	0	746	0.000000	Intercept + Linear + Smooth	0.3601215
2008	7	0	767	0.000000	Intercept + Linear + Smooth	0.3564438
2008	8	0	537	0.000000	Intercept + Linear + Smooth	0.3526829
2008	9	0	646	0.000000	Intercept + Linear + Smooth	0.3489617
2008	10	0	535	0.000000	Intercept + Linear + Smooth	0.3453980
2008	11	1	484	2.066116	Intercept + Linear + Smooth	0.3417537
2008	12	1	651	1.536098	Intercept + Linear + Smooth	0.3382635

Paediatric Aspergillus at Yorkhill, 01/2008-05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2009	1	0	633	0.000000	Intercept + Linear + Smooth	0.3346945
2009	2	0	381	0.000000	Intercept + Linear + Smooth	0.3311535
2009	3	0	799	0.000000	Intercept + Linear + Smooth	0.3279874
2009	4	1	710	1.408451	Intercept + Linear + Smooth	0.3245174
2009	5	0	583	0.000000	Intercept + Linear + Smooth	0.3211942
2009	6	0	590	0.000000	Intercept + Linear + Smooth	0.3177960
2009	7	0	778	0.000000	Intercept + Linear + Smooth	0.3145417
2009	8	0	449	0.000000	Intercept + Linear + Smooth	0.3112139
2009	9	0	638	0.000000	Intercept + Linear + Smooth	0.3079214
2009	10	0	802	0.000000	Intercept + Linear + Smooth	0.3047682
2009	11	0	465	0.000000	Intercept + Linear + Smooth	0.3015438
2009	12	1	471	2.123142	Intercept + Linear + Smooth	0.2984559
2010	1	0	505	0.000000	Intercept + Linear + Smooth	0.2952983
2010	2	1	506	1.976285	Intercept + Linear + Smooth	0.2921741
2010	3	0	481	0.000000	Intercept + Linear + Smooth	0.2893807
2010	4	0	517	0.000000	Intercept + Linear + Smooth	0.2863191
2010	5	0	719	0.000000	Intercept + Linear + Smooth	0.2833871
2010	6	0	516	0.000000	Intercept + Linear + Smooth	0.2803889
2010	7	0	397	0.000000	Intercept + Linear + Smooth	0.2775177
2010	8	0	891	0.000000	Intercept + Linear + Smooth	0.2745816
2010	9	0	566	0.000000	Intercept + Linear + Smooth	0.2716766
2010	10	0	493	0.000000	Intercept + Linear + Smooth	0.2688945
2010	11	1	769	1.300390	Intercept + Linear + Smooth	0.2660497

Paediatric Aspergillus at Yorkhill, 01/2008-05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2010	12	0	724	0.000000	Intercept + Linear + Smooth	0.2633252
2011	1	0	615	0.000000	Intercept + Linear + Smooth	0.2605393
2011	2	1	274	3.649635	Intercept + Linear + Smooth	0.2577829
2011	3	1	570	1.754386	Intercept + Linear + Smooth	0.2553182
2011	4	0	428	0.000000	Intercept + Linear + Smooth	0.2526170
2011	5	0	562	0.000000	Intercept + Linear + Smooth	0.2500301
2011	6	0	392	0.000000	Intercept + Linear + Smooth	0.2473849
2011	7	0	453	0.000000	Intercept + Linear + Smooth	0.2448516
2011	8	0	399	0.000000	Intercept + Linear + Smooth	0.2422614
2011	9	0	505	0.000000	Intercept + Linear + Smooth	0.2397790
2011	10	0	392	0.000000	Intercept + Linear + Smooth	0.2377245
2011	11	0	479	0.000000	Intercept + Linear + Smooth	0.2362322
2011	12	0	402	0.000000	Intercept + Linear + Smooth	0.2356547
2012	1	0	670	0.000000	Intercept + Linear + Smooth	0.2362265
2012	2	0	566	0.000000	Intercept + Linear + Smooth	0.2382678
2012	3	0	954	0.000000	Intercept + Linear + Smooth	0.2417880
2012	4	0	490	0.000000	Intercept + Linear + Smooth	0.2476040
2012	5	0	994	0.000000	Intercept + Linear + Smooth	0.2555825
2012	6	0	389	0.000000	Intercept + Linear + Smooth	0.2666741
2012	7	0	492	0.000000	Intercept + Linear + Smooth	0.2805727
2012	8	0	312	0.000000	Intercept + Linear + Smooth	0.2986890
2012	9	0	542	0.000000	Intercept + Linear + Smooth	0.3212001
2012	10	1	583	1.715266	Intercept + Linear + Smooth	0.3477681

Paediatric Aspergillus at Yorkhill, 01/2008-05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2012	11	0	467	0.000000	Intercept + Linear + Smooth	0.3809493
2012	12	0	533	0.000000	Intercept + Linear + Smooth	0.4196445
2013	1	0	434	0.000000	Intercept + Linear + Smooth	0.4678117
2013	2	0	613	0.000000	Intercept + Linear + Smooth	0.5256631
2013	3	0	560	0.000000	Intercept + Linear + Smooth	0.5868091
2013	4	1	451	2.217295	Intercept + Linear + Smooth	0.6644820
2013	5	0	552	0.000000	Intercept + Linear + Smooth	0.7478883
2013	6	1	368	2.717391	Intercept + Linear + Smooth	0.8389302
2013	7	0	244	0.000000	Intercept + Linear + Smooth	0.9259935
2013	8	1	347	2.881844	Intercept + Linear + Smooth	1.0065231
2013	9	0	357	0.000000	Intercept + Linear + Smooth	1.0673851
2013	10	1	534	1.872659	Intercept + Linear + Smooth	1.0977759
2013	11	0	509	0.000000	Intercept + Linear + Smooth	1.0907054
2013	12	1	513	1.949318	Intercept + Linear + Smooth	1.0400961
2014	1	1	533	1.876173	Intercept + Linear + Smooth	0.9418886
2014	2	0	670	0.000000	Intercept + Linear + Smooth	0.8061275
2014	3	1	384	2.604167	Intercept + Linear + Smooth	0.6649147
2014	4	0	465	0.000000	Intercept + Linear + Smooth	0.5068177
2014	5	0	560	0.000000	Intercept + Linear + Smooth	0.3697046
2014	6	0	517	0.000000	Intercept + Linear + Smooth	0.2544875
2014	7	0	360	0.000000	Intercept + Linear + Smooth	0.1706532
2014	8	0	743	0.000000	Intercept + Linear + Smooth	0.1094771
2014	9	0	348	0.000000	Intercept + Linear + Smooth	0.0685442

Paediatric Aspergillus at Yorkhill, 01/2008-05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2014	10	0	529	0.000000	Intercept + Linear + Smooth	0.0427967
2014	11	0	519	0.000000	Intercept + Linear + Smooth	0.0259514
2014	12	0	509	0.000000	Intercept + Linear + Smooth	0.0158420
2015	1	0	730	0.000000	Intercept + Linear + Smooth	0.0094528
2015	2	0	436	0.000000	Intercept + Linear + Smooth	0.0056179
2015	3	0	525	0.000000	Intercept + Linear + Smooth	0.0035045
2015	4	0	591	0.000000	Intercept + Linear + Smooth	0.0020765
2015	5	0	347	0.000000	Intercept + Linear + Smooth	0.0012508

X.2.0.Question 2a: What was the overall rate of Aspergillus infection amongst paediatric haemato-oncology patients at the RHC over the whole period from June 2015 to February 2022?

X.2.1. [1] 0.7132498

X.2.2. Question 2b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

X.2.3. Model summary

Family: Negative Binomial(22579.93)

Link function: log

Formula:

```
asp ~ decyear2 + offset(log(beddays)) + s(decyear2, bs = "ad",
   k = 40, xt = list(bs = "ps"))
```

Parametric coefficients:

```
             Estimate Std. Error z value Pr(>|z|)
(Intercept) -7.51811    0.43567 -17.257   <2e-16 ***
decyear2     0.06413    0.11935   0.537    0.591
```

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:

	edf	Ref.df	Chi.sq	p-value
s(decyear2)	1.234	1.841	3.063	0.175

Rank: 40/41

R-sq.(adj) = 0.00755 Deviance explained = 6.85%

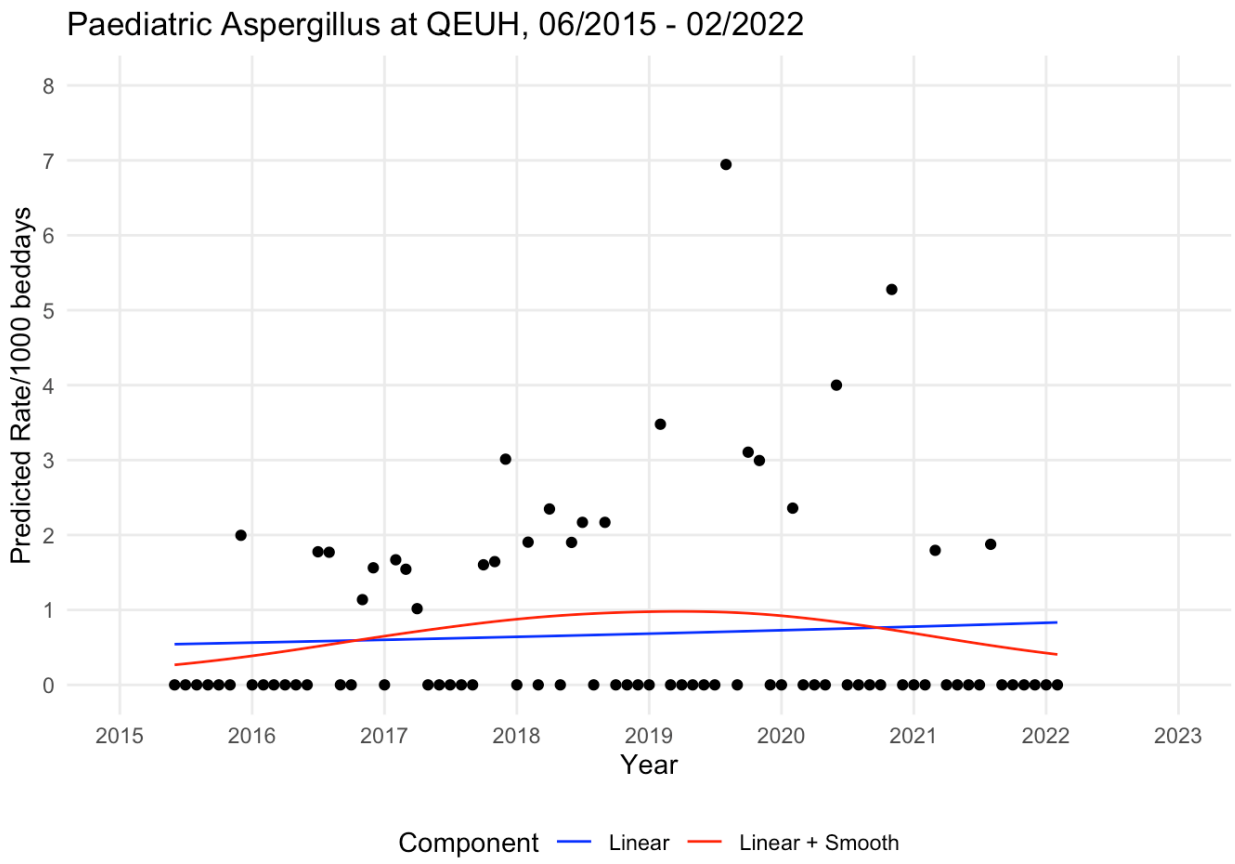
-REML = 63.443 Scale est. = 1 n = 81

X.2.4. First and last timepoints

Paediatric Aspergillus at QEUH, 06/2015 - 02/2022

Year	Month	Fit/1000 bed days	Observed Rate
2015	6	0.267270774122729	0
…	…	…	…
2022	2	0.40613039893815	0

X.2.5. Plot



Raw data and fits

Paediatric Aspergillus at QEUH, 06/2015 - 02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2015	6	0	487	0.000000	Intercept + Linear	0.5431598
2015	7	0	386	0.000000	Intercept + Linear	0.5460303
2015	8	0	621	0.000000	Intercept + Linear	0.5490124
2015	9	0	481	0.000000	Intercept + Linear	0.5520108
2015	10	0	530	0.000000	Intercept + Linear	0.5549281
2015	11	0	791	0.000000	Intercept + Linear	0.5579588
2015	12	1	501	1.996008	Intercept + Linear	0.5609075
2016	1	0	435	0.000000	Intercept + Linear	0.5639709
2016	2	0	550	0.000000	Intercept + Linear	0.5670426

Paediatric Aspergillus at QEUH, 06/2015 - 02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2016	3	0	364	0.000000	Intercept + Linear	0.5699312
2016	4	0	664	0.000000	Intercept + Linear	0.5730354
2016	5	0	801	0.000000	Intercept + Linear	0.5760554
2016	6	0	549	0.000000	Intercept + Linear	0.5791929
2016	7	1	563	1.776199	Intercept + Linear	0.5822455
2016	8	1	565	1.769912	Intercept + Linear	0.5854167
2016	9	0	546	0.000000	Intercept + Linear	0.5886052
2016	10	0	428	0.000000	Intercept + Linear	0.5917073
2016	11	1	879	1.137657	Intercept + Linear	0.5949300
2016	12	1	640	1.562500	Intercept + Linear	0.5980655
2017	1	0	867	0.000000	Intercept + Linear	0.6013229
2017	2	1	599	1.669449	Intercept + Linear	0.6046070
2017	3	1	648	1.543210	Intercept + Linear	0.6075887
2017	4	1	983	1.017294	Intercept + Linear	0.6109070
2017	5	0	838	0.000000	Intercept + Linear	0.6141356
2017	6	0	632	0.000000	Intercept + Linear	0.6174896
2017	7	0	658	0.000000	Intercept + Linear	0.6207530
2017	8	0	617	0.000000	Intercept + Linear	0.6241432
2017	9	0	779	0.000000	Intercept + Linear	0.6275519
2017	10	1	624	1.602564	Intercept + Linear	0.6308684
2017	11	1	608	1.644737	Intercept + Linear	0.6343139
2017	12	2	664	3.012048	Intercept + Linear	0.6376661
2018	1	0	792	0.000000	Intercept + Linear	0.6411487

Paediatric Aspergillus at QEUH, 06/2015 - 02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2018	2	1	525	1.904762	Intercept + Linear	0.6446503
2018	3	0	534	0.000000	Intercept + Linear	0.6478295
2018	4	1	426	2.347418	Intercept + Linear	0.6513676
2018	5	0	764	0.000000	Intercept + Linear	0.6548100
2018	6	1	526	1.901141	Intercept + Linear	0.6583862
2018	7	1	461	2.169197	Intercept + Linear	0.6618656
2018	8	0	576	0.000000	Intercept + Linear	0.6654804
2018	9	1	461	2.169197	Intercept + Linear	0.6691149
2018	10	0	733	0.000000	Intercept + Linear	0.6726511
2018	11	0	692	0.000000	Intercept + Linear	0.6763247
2018	12	0	436	0.000000	Intercept + Linear	0.6798990
2019	1	0	394	0.000000	Intercept + Linear	0.6836122
2019	2	2	575	3.478261	Intercept + Linear	0.6873457
2019	3	0	440	0.000000	Intercept + Linear	0.6907355
2019	4	0	605	0.000000	Intercept + Linear	0.6945079
2019	5	0	529	0.000000	Intercept + Linear	0.6981783
2019	6	0	292	0.000000	Intercept + Linear	0.7019913
2019	7	0	579	0.000000	Intercept + Linear	0.7057012
2019	8	2	288	6.944445	Intercept + Linear	0.7095554
2019	9	0	406	0.000000	Intercept + Linear	0.7134306
2019	10	1	322	3.105590	Intercept + Linear	0.7172010
2019	11	2	668	2.994012	Intercept + Linear	0.7211179
2019	12	0	623	0.000000	Intercept + Linear	0.7249289

Paediatric Aspergillus at QEUH, 06/2015 - 02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2020	1	0	501	0.000000	Intercept + Linear	0.7288881
2020	2	1	424	2.358490	Intercept + Linear	0.7328580
2020	3	0	431	0.000000	Intercept + Linear	0.7365913
2020	4	0	192	0.000000	Intercept + Linear	0.7406032
2020	5	0	277	0.000000	Intercept + Linear	0.7445064
2020	6	1	250	4.000000	Intercept + Linear	0.7485614
2020	7	0	483	0.000000	Intercept + Linear	0.7525065
2020	8	0	335	0.000000	Intercept + Linear	0.7566051
2020	9	0	438	0.000000	Intercept + Linear	0.7607259
2020	10	0	300	0.000000	Intercept + Linear	0.7647352
2020	11	2	379	5.277045	Intercept + Linear	0.7689003
2020	12	0	380	0.000000	Intercept + Linear	0.7729527
2021	1	0	390	0.000000	Intercept + Linear	0.7771626
2021	2	0	316	0.000000	Intercept + Linear	0.7814070
2021	3	1	557	1.795332	Intercept + Linear	0.7852607
2021	4	0	444	0.000000	Intercept + Linear	0.7895493
2021	5	0	501	0.000000	Intercept + Linear	0.7937220
2021	6	0	349	0.000000	Intercept + Linear	0.7980568
2021	7	0	527	0.000000	Intercept + Linear	0.8022744
2021	8	1	533	1.876173	Intercept + Linear	0.8066560
2021	9	0	511	0.000000	Intercept + Linear	0.8110616
2021	10	0	325	0.000000	Intercept + Linear	0.8153479
2021	11	0	376	0.000000	Intercept + Linear	0.8198009

Paediatric Aspergillus at QEUH, 06/2015 - 02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2021	12	0	350	0.000000	Intercept + Linear	0.8241334
2022	1	0	390	0.000000	Intercept + Linear	0.8286343
2022	2	0	157	0.000000	Intercept + Linear	0.8331599
2015	6	0	487	0.000000	Intercept + Linear + Smooth	0.2672708
2015	7	0	386	0.000000	Intercept + Linear + Smooth	0.2817258
2015	8	0	621	0.000000	Intercept + Linear + Smooth	0.2974575
2015	9	0	481	0.000000	Intercept + Linear + Smooth	0.3140139
2015	10	0	530	0.000000	Intercept + Linear + Smooth	0.3308180
2015	11	0	791	0.000000	Intercept + Linear + Smooth	0.3489726
2015	12	1	501	1.996008	Intercept + Linear + Smooth	0.3672800
2016	1	0	435	0.000000	Intercept + Linear + Smooth	0.3869230
2016	2	0	550	0.000000	Intercept + Linear + Smooth	0.4072144
2016	3	0	364	0.000000	Intercept + Linear + Smooth	0.4268067
2016	4	0	664	0.000000	Intercept + Linear + Smooth	0.4483573
2016	5	0	801	0.000000	Intercept + Linear + Smooth	0.4697424
2016	6	0	549	0.000000	Intercept + Linear + Smooth	0.4922925
2016	7	1	563	1.776199	Intercept + Linear + Smooth	0.5144279
2016	8	1	565	1.769912	Intercept + Linear + Smooth	0.5374852
2016	9	0	546	0.000000	Intercept + Linear + Smooth	0.5606130
2016	10	0	428	0.000000	Intercept + Linear + Smooth	0.5829522
2016	11	1	879	1.137657	Intercept + Linear + Smooth	0.6058895
2016	12	1	640	1.562500	Intercept + Linear + Smooth	0.6278505
2017	1	0	867	0.000000	Intercept + Linear + Smooth	0.6502196

Paediatric Aspergillus at QEUH, 06/2015 - 02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2017	2	1	599	1.669449	Intercept + Linear + Smooth	0.6722516
2017	3	1	648	1.543210	Intercept + Linear + Smooth	0.6917717
2017	4	1	983	1.017294	Intercept + Linear + Smooth	0.7129433
2017	5	0	838	0.000000	Intercept + Linear + Smooth	0.7329894
2017	6	0	632	0.000000	Intercept + Linear + Smooth	0.7532653
2017	7	0	658	0.000000	Intercept + Linear + Smooth	0.7724660
2017	8	0	617	0.000000	Intercept + Linear + Smooth	0.7918245
2017	9	0	779	0.000000	Intercept + Linear + Smooth	0.8106209
2017	10	1	624	1.602564	Intercept + Linear + Smooth	0.8281502
2017	11	1	608	1.644737	Intercept + Linear + Smooth	0.8454403
2017	12	2	664	3.012048	Intercept + Linear + Smooth	0.8612669
2018	1	0	792	0.000000	Intercept + Linear + Smooth	0.8765871
2018	2	1	525	1.904762	Intercept + Linear + Smooth	0.8908117
2018	3	0	534	0.000000	Intercept + Linear + Smooth	0.9027077
2018	4	1	426	2.347418	Intercept + Linear + Smooth	0.9148204
2018	5	0	764	0.000000	Intercept + Linear + Smooth	0.9254869
2018	6	1	526	1.901141	Intercept + Linear + Smooth	0.9354278
2018	7	1	461	2.169197	Intercept + Linear + Smooth	0.9440168
2018	8	0	576	0.000000	Intercept + Linear + Smooth	0.9518556
2018	9	1	461	2.169197	Intercept + Linear + Smooth	0.9586932
2018	10	0	733	0.000000	Intercept + Linear + Smooth	0.9644084
2018	11	0	692	0.000000	Intercept + Linear + Smooth	0.9694209
2018	12	0	436	0.000000	Intercept + Linear + Smooth	0.9734326

Paediatric Aspergillus at QEUH, 06/2015 - 02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2019	1	0	394	0.000000	Intercept + Linear + Smooth	0.9766767
2019	2	2	575	3.478261	Intercept + Linear + Smooth	0.9789509
2019	3	0	440	0.000000	Intercept + Linear + Smooth	0.9801308
2019	4	0	605	0.000000	Intercept + Linear + Smooth	0.9804266
2019	5	0	529	0.000000	Intercept + Linear + Smooth	0.9796439
2019	6	0	292	0.000000	Intercept + Linear + Smooth	0.9776535
2019	7	0	579	0.000000	Intercept + Linear + Smooth	0.9744817
2019	8	2	288	6.944445	Intercept + Linear + Smooth	0.9697701
2019	9	0	406	0.000000	Intercept + Linear + Smooth	0.9634742
2019	10	1	322	3.105590	Intercept + Linear + Smooth	0.9557971
2019	11	2	668	2.994012	Intercept + Linear + Smooth	0.9461878
2019	12	0	623	0.000000	Intercept + Linear + Smooth	0.9353123
2020	1	0	501	0.000000	Intercept + Linear + Smooth	0.9225203
2020	2	1	424	2.358490	Intercept + Linear + Smooth	0.9082905
2020	3	0	431	0.000000	Intercept + Linear + Smooth	0.8937454
2020	4	0	192	0.000000	Intercept + Linear + Smooth	0.8769783
2020	5	0	277	0.000000	Intercept + Linear + Smooth	0.8596478
2020	6	1	250	4.000000	Intercept + Linear + Smooth	0.8406953
2020	7	0	483	0.000000	Intercept + Linear + Smooth	0.8214332
2020	8	0	335	0.000000	Intercept + Linear + Smooth	0.8006719
2020	9	0	438	0.000000	Intercept + Linear + Smooth	0.7791351
2020	10	0	300	0.000000	Intercept + Linear + Smooth	0.7576361
2020	11	2	379	5.277045	Intercept + Linear + Smooth	0.7348059

Paediatric Aspergillus at QEUH, 06/2015 - 02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2020	12	0	380	0.000000	Intercept + Linear + Smooth	0.7121978
2021	1	0	390	0.000000	Intercept + Linear + Smooth	0.6884475
2021	2	0	316	0.000000	Intercept + Linear + Smooth	0.6643882
2021	3	1	557	1.795332	Intercept + Linear + Smooth	0.6425769
2021	4	0	444	0.000000	Intercept + Linear + Smooth	0.6184764
2021	5	0	501	0.000000	Intercept + Linear + Smooth	0.5953346
2021	6	0	349	0.000000	Intercept + Linear + Smooth	0.5717418
2021	7	0	527	0.000000	Intercept + Linear + Smooth	0.5493172
2021	8	1	533	1.876173	Intercept + Linear + Smooth	0.5266409
2021	9	0	511	0.000000	Intercept + Linear + Smooth	0.5045442
2021	10	0	325	0.000000	Intercept + Linear + Smooth	0.4837870
2021	11	0	376	0.000000	Intercept + Linear + Smooth	0.4630488
2021	12	0	350	0.000000	Intercept + Linear + Smooth	0.4437134
2022	1	0	390	0.000000	Intercept + Linear + Smooth	0.4245218
2022	2	0	157	0.000000	Intercept + Linear + Smooth	0.4061304

X.2.7.Supplementary information

X.2.7.1. We can also fit a single model to the entire time series, and test whether there is a discontinuity in June 2015.

Family: Negative Binomial(222360.389)

Link function: log

Formula:

asp ~ decyear2 + hosp + offset(log(beddays)) + s(decyear2, bs = "ad",

```
   k = 40, xt = list(bs = "ps"))

Parametric coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept) -7.79274    0.36581 -21.303   <2e-16 ***
decyear2     0.04394    0.07340   0.599    0.549
hospQEUH     0.41116    0.59048   0.696    0.486
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
                edf    Ref.df Chi.sq p-value
s(decyear2) 2.097e-05 4.194e-05      0     0.5

Rank: 41/42
R-sq.(adj) =  0.00911   Deviance explained = 4.47%
-REML = 111.57  Scale est. = 1         n = 170
```

X.3.0. Question 3a: What was overall BSI incidence rate attributed to environmental microorganisms among paediatric haematology-oncology patients in Yorkhill for the whole period from January 2008 to May 2015?

X.3.1. [1] 4.020513

X.3.2. Question 3b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

X.3.3. Model summary

Family: Negative Binomial(2.276)

Link function: log

Formula:

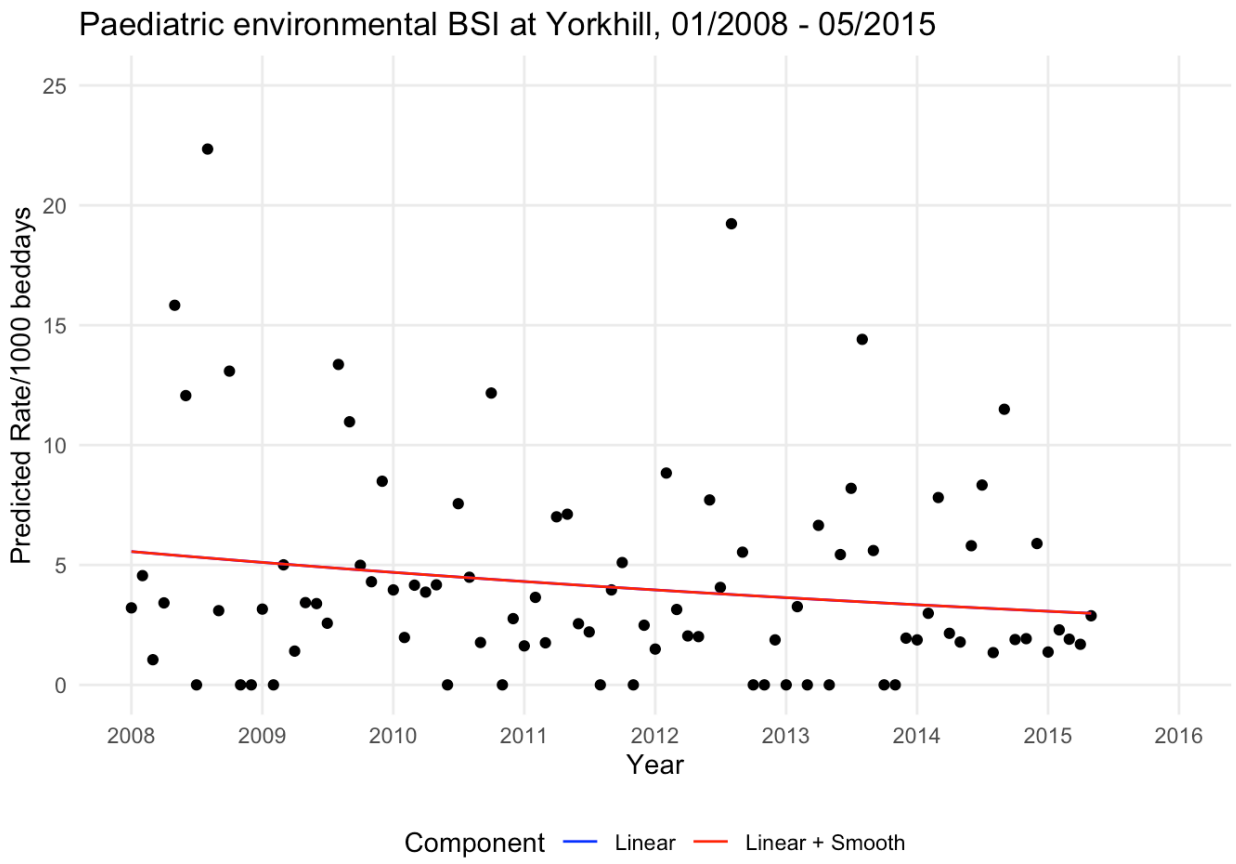
```
env_bsi ~ decyear2 + offset(log(beddays)) + s(decyear2, bs = "ad",
    k = 40, xt = list(bs = "ps"))

Parametric coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept) -5.82114    0.21532  -27.04   <2e-16 ***
decyear2    -0.08484    0.04715   -1.80   0.0719 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
                edf    Ref.df Chi.sq p-value
s(decyear2) 0.0002497 0.0004994      0   0.994

Rank: 40/41
R-sq.(adj) =  -0.0636   Deviance explained = 3.31%
-REML = 176.57  Scale est. = 1         n = 89
```

X.3.4. First and last timepoints

Paediatric environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Fit/1000 bed days	Observed Rate
2008	1	5.56021019650483	3.21199143468951
…	…	…	…
2015	5	2.98571110378286	2.88184438040346

X.3.5. Plot



X.3.6. Raw data and fits

Paediatric environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2008	1	3	934	3.211991	Intercept + Linear	5.560077
2008	2	2	439	4.555809	Intercept + Linear	5.520265
2008	3	1	953	1.049318	Intercept + Linear	5.483279
2008	4	2	585	3.418803	Intercept + Linear	5.444017
2008	5	6	379	15.831135	Intercept + Linear	5.406289
2008	6	9	746	12.064343	Intercept + Linear	5.367578
2008	7	0	767	0.000000	Intercept + Linear	5.330379
2008	8	12	537	22.346369	Intercept + Linear	5.292211
2008	9	2	646	3.095975	Intercept + Linear	5.254317

Paediatric environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2008	10	7	535	13.084112	Intercept + Linear	5.217904
2008	11	0	484	0.000000	Intercept + Linear	5.180542
2008	12	0	651	0.000000	Intercept + Linear	5.144639
2009	1	2	633	3.159558	Intercept + Linear	5.107802
2009	2	0	381	0.000000	Intercept + Linear	5.071128
2009	3	4	799	5.006258	Intercept + Linear	5.038230
2009	4	1	710	1.408451	Intercept + Linear	5.002056
2009	5	2	583	3.430532	Intercept + Linear	4.967296
2009	6	2	590	3.389830	Intercept + Linear	4.931631
2009	7	2	778	2.570694	Intercept + Linear	4.897360
2009	8	6	449	13.363029	Intercept + Linear	4.862198
2009	9	7	638	10.971787	Intercept + Linear	4.827287
2009	10	4	802	4.987531	Intercept + Linear	4.793742
2009	11	2	465	4.301075	Intercept + Linear	4.759323
2009	12	4	471	8.492569	Intercept + Linear	4.726250
2010	1	2	505	3.960396	Intercept + Linear	4.692316
2010	2	1	506	1.976285	Intercept + Linear	4.658625
2010	3	2	481	4.158004	Intercept + Linear	4.628403
2010	4	2	517	3.868472	Intercept + Linear	4.595172
2010	5	3	719	4.172462	Intercept + Linear	4.563239
2010	6	0	516	0.000000	Intercept + Linear	4.530475
2010	7	3	397	7.556675	Intercept + Linear	4.498993
2010	8	4	891	4.489338	Intercept + Linear	4.466690

Paediatric environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2010	9	1	566	1.766784	Intercept + Linear	4.434620
2010	10	6	493	12.170385	Intercept + Linear	4.403803
2010	11	0	769	0.000000	Intercept + Linear	4.372184
2010	12	2	724	2.762431	Intercept + Linear	4.341801
2011	1	1	615	1.626016	Intercept + Linear	4.310627
2011	2	1	274	3.649635	Intercept + Linear	4.279677
2011	3	1	570	1.754386	Intercept + Linear	4.251913
2011	4	3	428	7.009346	Intercept + Linear	4.221385
2011	5	4	562	7.117438	Intercept + Linear	4.192050
2011	6	1	392	2.551020	Intercept + Linear	4.161951
2011	7	1	453	2.207505	Intercept + Linear	4.133029
2011	8	0	399	0.000000	Intercept + Linear	4.103355
2011	9	2	505	3.960396	Intercept + Linear	4.073893
2011	10	2	392	5.102041	Intercept + Linear	4.045583
2011	11	0	479	0.000000	Intercept + Linear	4.016536
2011	12	1	402	2.487562	Intercept + Linear	3.988624
2012	1	1	670	1.492537	Intercept + Linear	3.959986
2012	2	5	566	8.833922	Intercept + Linear	3.931631
2012	3	3	954	3.144654	Intercept + Linear	3.905289
2012	4	1	490	2.040816	Intercept + Linear	3.877326
2012	5	2	994	2.012072	Intercept + Linear	3.850455
2012	6	3	389	7.712082	Intercept + Linear	3.822885
2012	7	2	492	4.065041	Intercept + Linear	3.796391

Paediatric environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2012	8	6	312	19.230769	Intercept + Linear	3.769208
2012	9	3	542	5.535055	Intercept + Linear	3.742219
2012	10	0	583	0.000000	Intercept + Linear	3.716284
2012	11	0	467	0.000000	Intercept + Linear	3.689674
2012	12	1	533	1.876173	Intercept + Linear	3.664104
2013	1	0	434	0.000000	Intercept + Linear	3.637868
2013	2	2	613	3.262643	Intercept + Linear	3.611748
2013	3	0	560	0.000000	Intercept + Linear	3.588317
2013	4	3	451	6.651885	Intercept + Linear	3.562553
2013	5	0	552	0.000000	Intercept + Linear	3.537797
2013	6	2	368	5.434783	Intercept + Linear	3.512396
2013	7	2	244	8.196721	Intercept + Linear	3.487988
2013	8	5	347	14.409222	Intercept + Linear	3.462944
2013	9	2	357	5.602241	Intercept + Linear	3.438080
2013	10	0	534	0.000000	Intercept + Linear	3.414189
2013	11	0	509	0.000000	Intercept + Linear	3.389675
2013	12	1	513	1.949318	Intercept + Linear	3.366120
2014	1	1	533	1.876173	Intercept + Linear	3.341951
2014	2	2	670	2.985075	Intercept + Linear	3.317956
2014	3	3	384	7.812500	Intercept + Linear	3.296432
2014	4	1	465	2.150538	Intercept + Linear	3.272763
2014	5	1	560	1.785714	Intercept + Linear	3.250021
2014	6	3	517	5.802708	Intercept + Linear	3.226686

Paediatric environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2014	7	3	360	8.333333	Intercept + Linear	3.204263
2014	8	1	743	1.345895	Intercept + Linear	3.181256
2014	9	4	348	11.494253	Intercept + Linear	3.158415
2014	10	1	529	1.890359	Intercept + Linear	3.136467
2014	11	1	519	1.926782	Intercept + Linear	3.113948
2014	12	3	509	5.893910	Intercept + Linear	3.092308
2015	1	1	730	1.369863	Intercept + Linear	3.070106
2015	2	1	436	2.293578	Intercept + Linear	3.048062
2015	3	1	525	1.904762	Intercept + Linear	3.028289
2015	4	1	591	1.692047	Intercept + Linear	3.006546
2015	5	1	347	2.881844	Intercept + Linear	2.985653
2008	1	3	934	3.211991	Intercept + Linear + Smooth	5.560210
2008	2	2	439	4.555809	Intercept + Linear + Smooth	5.520390
2008	3	1	953	1.049318	Intercept + Linear + Smooth	5.483396
2008	4	2	585	3.418803	Intercept + Linear + Smooth	5.444126
2008	5	6	379	15.831135	Intercept + Linear + Smooth	5.406390
2008	6	9	746	12.064343	Intercept + Linear + Smooth	5.367670
2008	7	0	767	0.000000	Intercept + Linear + Smooth	5.330464
2008	8	12	537	22.346369	Intercept + Linear + Smooth	5.292288
2008	9	2	646	3.095975	Intercept + Linear + Smooth	5.254386
2008	10	7	535	13.084112	Intercept + Linear + Smooth	5.217965
2008	11	0	484	0.000000	Intercept + Linear + Smooth	5.180595
2008	12	0	651	0.000000	Intercept + Linear + Smooth	5.144685

Paediatric environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2009	1	2	633	3.159558	Intercept + Linear + Smooth	5.107840
2009	2	0	381	0.000000	Intercept + Linear + Smooth	5.071159
2009	3	4	799	5.006258	Intercept + Linear + Smooth	5.038255
2009	4	1	710	1.408451	Intercept + Linear + Smooth	5.002074
2009	5	2	583	3.430532	Intercept + Linear + Smooth	4.967308
2009	6	2	590	3.389830	Intercept + Linear + Smooth	4.931637
2009	7	2	778	2.570694	Intercept + Linear + Smooth	4.897361
2009	8	6	449	13.363029	Intercept + Linear + Smooth	4.862193
2009	9	7	638	10.971787	Intercept + Linear + Smooth	4.827277
2009	10	4	802	4.987531	Intercept + Linear + Smooth	4.793727
2009	11	2	465	4.301075	Intercept + Linear + Smooth	4.759303
2009	12	4	471	8.492569	Intercept + Linear + Smooth	4.726225
2010	1	2	505	3.960396	Intercept + Linear + Smooth	4.692287
2010	2	1	506	1.976285	Intercept + Linear + Smooth	4.658592
2010	3	2	481	4.158004	Intercept + Linear + Smooth	4.628367
2010	4	2	517	3.868472	Intercept + Linear + Smooth	4.595131
2010	5	3	719	4.172462	Intercept + Linear + Smooth	4.563196
2010	6	0	516	0.000000	Intercept + Linear + Smooth	4.530429
2010	7	3	397	7.556675	Intercept + Linear + Smooth	4.498944
2010	8	4	891	4.489338	Intercept + Linear + Smooth	4.466639
2010	9	1	566	1.766784	Intercept + Linear + Smooth	4.434566
2010	10	6	493	12.170385	Intercept + Linear + Smooth	4.403748
2010	11	0	769	0.000000	Intercept + Linear + Smooth	4.372127

Paediatric environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2010	12	2	724	2.762431	Intercept + Linear + Smooth	4.341743
2011	1	1	615	1.626016	Intercept + Linear + Smooth	4.310568
2011	2	1	274	3.649635	Intercept + Linear + Smooth	4.279617
2011	3	1	570	1.754386	Intercept + Linear + Smooth	4.251853
2011	4	3	428	7.009346	Intercept + Linear + Smooth	4.221325
2011	5	4	562	7.117438	Intercept + Linear + Smooth	4.191990
2011	6	1	392	2.551020	Intercept + Linear + Smooth	4.161892
2011	7	1	453	2.207505	Intercept + Linear + Smooth	4.132970
2011	8	0	399	0.000000	Intercept + Linear + Smooth	4.103296
2011	9	2	505	3.960396	Intercept + Linear + Smooth	4.073835
2011	10	2	392	5.102041	Intercept + Linear + Smooth	4.045526
2011	11	0	479	0.000000	Intercept + Linear + Smooth	4.016481
2011	12	1	402	2.487562	Intercept + Linear + Smooth	3.988571
2012	1	1	670	1.492537	Intercept + Linear + Smooth	3.959935
2012	2	5	566	8.833922	Intercept + Linear + Smooth	3.931582
2012	3	3	954	3.144654	Intercept + Linear + Smooth	3.905242
2012	4	1	490	2.040816	Intercept + Linear + Smooth	3.877281
2012	5	2	994	2.012072	Intercept + Linear + Smooth	3.850412
2012	6	3	389	7.712082	Intercept + Linear + Smooth	3.822844
2012	7	2	492	4.065041	Intercept + Linear + Smooth	3.796353
2012	8	6	312	19.230769	Intercept + Linear + Smooth	3.769172
2012	9	3	542	5.535055	Intercept + Linear + Smooth	3.742186
2012	10	0	583	0.000000	Intercept + Linear + Smooth	3.716254

Paediatric environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2012	11	0	467	0.000000	Intercept + Linear + Smooth	3.689647
2012	12	1	533	1.876173	Intercept + Linear + Smooth	3.664080
2013	1	0	434	0.000000	Intercept + Linear + Smooth	3.637847
2013	2	2	613	3.262643	Intercept + Linear + Smooth	3.611730
2013	3	0	560	0.000000	Intercept + Linear + Smooth	3.588302
2013	4	3	451	6.651885	Intercept + Linear + Smooth	3.562542
2013	5	0	552	0.000000	Intercept + Linear + Smooth	3.537788
2013	6	2	368	5.434783	Intercept + Linear + Smooth	3.512390
2013	7	2	244	8.196721	Intercept + Linear + Smooth	3.487986
2013	8	5	347	14.409222	Intercept + Linear + Smooth	3.462946
2013	9	2	357	5.602241	Intercept + Linear + Smooth	3.438085
2013	10	0	534	0.000000	Intercept + Linear + Smooth	3.414197
2013	11	0	509	0.000000	Intercept + Linear + Smooth	3.389686
2013	12	1	513	1.949318	Intercept + Linear + Smooth	3.366134
2014	1	1	533	1.876173	Intercept + Linear + Smooth	3.341969
2014	2	2	670	2.985075	Intercept + Linear + Smooth	3.317977
2014	3	3	384	7.812500	Intercept + Linear + Smooth	3.296455
2014	4	1	465	2.150538	Intercept + Linear + Smooth	3.272790
2014	5	1	560	1.785714	Intercept + Linear + Smooth	3.250050
2014	6	3	517	5.802708	Intercept + Linear + Smooth	3.226718
2014	7	3	360	8.333333	Intercept + Linear + Smooth	3.204298
2014	8	1	743	1.345895	Intercept + Linear + Smooth	3.181294
2014	9	4	348	11.494253	Intercept + Linear + Smooth	3.158456

Paediatric environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2014	10	1	529	1.890359	Intercept + Linear + Smooth	3.136510
2014	11	1	519	1.926782	Intercept + Linear + Smooth	3.113993
2014	12	3	509	5.893910	Intercept + Linear + Smooth	3.092356
2015	1	1	730	1.369863	Intercept + Linear + Smooth	3.070156
2015	2	1	436	2.293578	Intercept + Linear + Smooth	3.048115
2015	3	1	525	1.904762	Intercept + Linear + Smooth	3.028343
2015	4	1	591	1.692047	Intercept + Linear + Smooth	3.006602
2015	5	1	347	2.881844	Intercept + Linear + Smooth	2.985711

X.3.7. Supplementary information

In our model exploration, seasonal effects also were statistically significant.

Family: Negative Binomial(3.138)

Link function: log

Formula:

```
env_bsi ~ decyear2 + offset(log(beddays)) + s(decyear2, bs = "ad",
   k = 40, xt = list(bs = "ps")) + s(fracyear, bs = "cp", k = 12)
```

Parametric coefficients:

```
            Estimate Std. Error z value Pr(>|z|)
(Intercept) -5.84269    0.20565 -28.411   <2e-16 ***
decyear2    -0.07600    0.04476  -1.698   0.0895 .
---
```

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:

	edf	Ref.df	Chi.sq	p-value
s(decyear2)	0.0002817	5.629e-04	0.00	0.991081
s(fracyear)	2.4671602	1.100e+01	14.12	0.000517 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Rank: 51/52

R-sq.(adj) = 0.0444 Deviance explained = 18.4%

-REML = 172.39 Scale est. = 1 n = 89

X.4.0 Question 4a: What was overall BSI incidence rate attributed to environmental microorganisms among paediatric haematology-oncology patients in the RHC for the whole period from June 2015 to the September 2018?

X.4.1. [1] 4.761318

X.4.2. Question 4b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

X.4.3. Model summary

Family: Negative Binomial(910181.205)

Link function: log

Formula:

env_bsi ~ decyear2 + offset(log(beddays)) + s(decyear2, bs = "ad",

k = 40, xt = list(bs = "ps"))

Parametric coefficients:

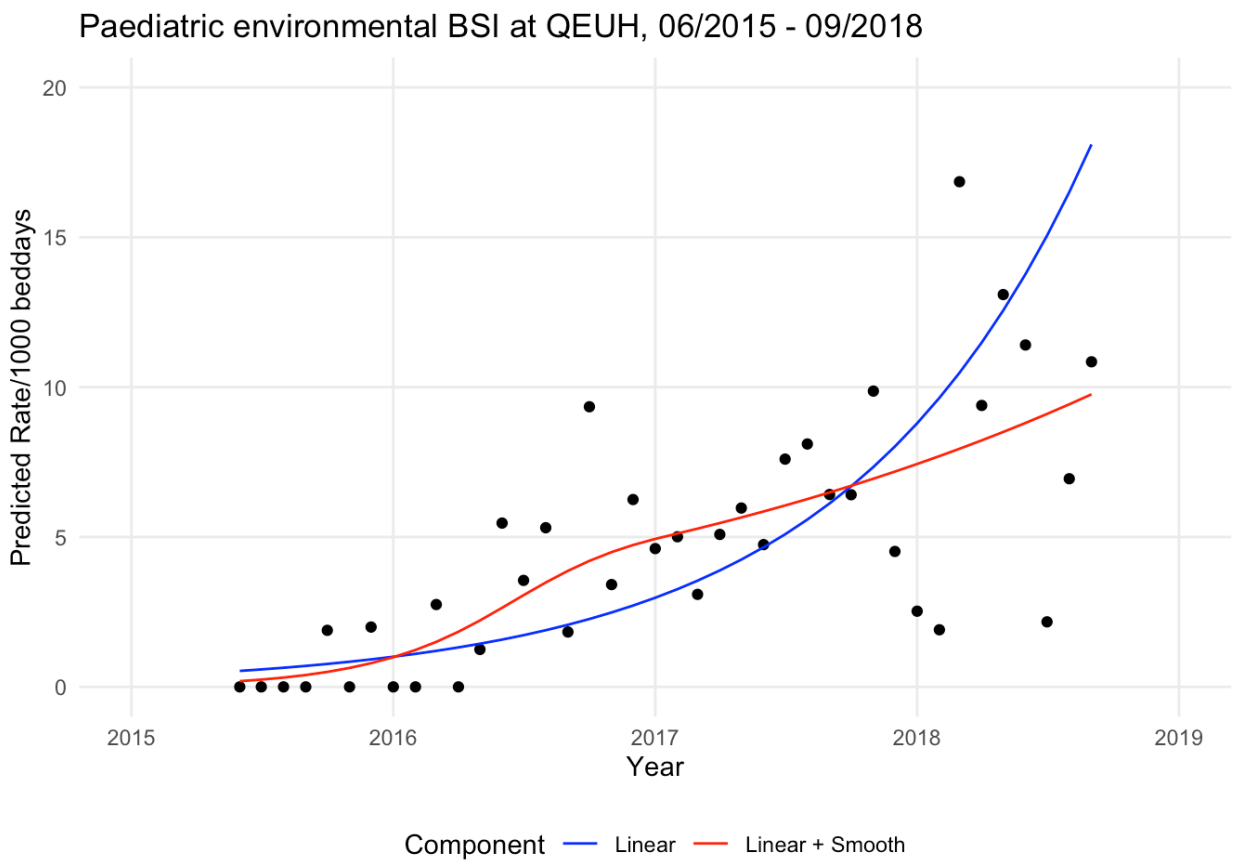
```
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  -7.5378     0.5264 -14.320  < 2e-16 ***
decyear2      1.0842     0.2356   4.602 4.19e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
              edf Ref.df Chi.sq p-value
s(decyear2) 1.299  1.766  7.453  0.0381 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Rank: 40/41
R-sq.(adj) =  0.544   Deviance explained = 60.3%
-REML = 68.324  Scale est. = 1         n = 40
```

X.4.4. First and last timepoints

Paediatric environmental BSI at QEUH, 06/2015 - 09/2018

Year	Month	Fit/1000 bed days	Observed Rate
2015	6	0.191117983615304	0
…	…	…	…
2018	9	9.76048302552672	10.8459869848156

X.4.5. Plot



X.4.6. Raw data and fit

Paediatric environmental BSI at QEUH, 06/2015 - 09/2018

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2015	6	0	487	0.000000	Intercept + Linear	0.5325476
2015	7	0	386	0.000000	Intercept + Linear	0.5821833
2015	8	0	621	0.000000	Intercept + Linear	0.6383385
2015	9	0	481	0.000000	Intercept + Linear	0.6999102
2015	10	1	530	1.886793	Intercept + Linear	0.7651447
2015	11	0	791	0.000000	Intercept + Linear	0.8389477
2015	12	1	501	1.996008	Intercept + Linear	0.9171410
2016	1	0	435	0.000000	Intercept + Linear	1.0056050
2016	2	0	550	0.000000	Intercept + Linear	1.1023245

Paediatric environmental BSI at QEUH, 06/2015 - 09/2018

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2016	3	1	364	2.747253	Intercept + Linear	1.2012087
2016	4	0	664	0.000000	Intercept + Linear	1.3167414
2016	5	1	801	1.248439	Intercept + Linear	1.4391167
2016	6	3	549	5.464481	Intercept + Linear	1.5775315
2016	7	2	563	3.552398	Intercept + Linear	1.7241441
2016	8	3	565	5.309735	Intercept + Linear	1.8899729
2016	9	1	546	1.831502	Intercept + Linear	2.0717513
2016	10	4	428	9.345794	Intercept + Linear	2.2642956
2016	11	3	879	3.412969	Intercept + Linear	2.4820765
2016	12	4	640	6.250000	Intercept + Linear	2.7127557
2017	1	4	867	4.613610	Intercept + Linear	2.9736696
2017	2	3	599	5.008347	Intercept + Linear	3.2604985
2017	3	2	648	3.086420	Intercept + Linear	3.5432776
2017	4	5	983	5.086470	Intercept + Linear	3.8850488
2017	5	5	838	5.966587	Intercept + Linear	4.2471513
2017	6	3	632	4.746835	Intercept + Linear	4.6568155
2017	7	5	658	7.598784	Intercept + Linear	5.0908499
2017	8	5	617	8.103728	Intercept + Linear	5.5818940
2017	9	5	779	6.418485	Intercept + Linear	6.1203025
2017	10	4	624	6.410256	Intercept + Linear	6.6907398
2017	11	6	608	9.868421	Intercept + Linear	7.3361033
2017	12	3	664	4.518072	Intercept + Linear	8.0198583
2018	1	2	792	2.525253	Intercept + Linear	8.7934236

Paediatric environmental BSI at QEUH, 06/2015 - 09/2018

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2018	2	1	525	1.904762	Intercept + Linear	9.6416041
2018	3	9	534	16.853933	Intercept + Linear	10.4778087
2018	4	4	426	9.389671	Intercept + Linear	11.4884586
2018	5	10	764	13.089005	Intercept + Linear	12.5592302
2018	6	6	526	11.406844	Intercept + Linear	13.7706461
2018	7	1	461	2.169197	Intercept + Linear	15.0541269
2018	8	4	576	6.944444	Intercept + Linear	16.5061912
2018	9	5	461	10.845987	Intercept + Linear	18.0983161
2015	6	0	487	0.000000	Intercept + Linear + Smooth	0.1911180
2015	7	0	386	0.000000	Intercept + Linear + Smooth	0.2425029
2015	8	0	621	0.000000	Intercept + Linear + Smooth	0.3099770
2015	9	0	481	0.000000	Intercept + Linear + Smooth	0.3955989
2015	10	1	530	1.886793	Intercept + Linear + Smooth	0.4993740
2015	11	0	791	0.000000	Intercept + Linear + Smooth	0.6322728
2015	12	1	501	1.996008	Intercept + Linear + Smooth	0.7903364
2016	1	0	435	0.000000	Intercept + Linear + Smooth	0.9896090
2016	2	0	550	0.000000	Intercept + Linear + Smooth	1.2312130
2016	3	1	364	2.747253	Intercept + Linear + Smooth	1.5012315
2016	4	0	664	0.000000	Intercept + Linear + Smooth	1.8398793
2016	5	1	801	1.248439	Intercept + Linear + Smooth	2.2148453
2016	6	3	549	5.464481	Intercept + Linear + Smooth	2.6382508
2016	7	2	563	3.552398	Intercept + Linear + Smooth	3.0597545
2016	8	3	565	5.309735	Intercept + Linear + Smooth	3.4820213

Paediatric environmental BSI at QEUH, 06/2015 - 09/2018

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2016	9	1	546	1.831502	Intercept + Linear + Smooth	3.8711396
2016	10	4	428	9.345794	Intercept + Linear + Smooth	4.2039216
2016	11	3	879	3.412969	Intercept + Linear + Smooth	4.4960759
2016	12	4	640	6.250000	Intercept + Linear + Smooth	4.7322246
2017	1	4	867	4.613610	Intercept + Linear + Smooth	4.9364928
2017	2	3	599	5.008347	Intercept + Linear + Smooth	5.1166258
2017	3	2	648	3.086420	Intercept + Linear + Smooth	5.2795253
2017	4	5	983	5.086470	Intercept + Linear + Smooth	5.4659342
2017	5	5	838	5.966587	Intercept + Linear + Smooth	5.6525943
2017	6	3	632	4.746835	Intercept + Linear + Smooth	5.8521755
2017	7	5	658	7.598784	Intercept + Linear + Smooth	6.0520256
2017	8	5	617	8.103728	Intercept + Linear + Smooth	6.2657098
2017	9	5	779	6.418485	Intercept + Linear + Smooth	6.4869388
2017	10	4	624	6.410256	Intercept + Linear + Smooth	6.7084659
2017	11	6	608	9.868421	Intercept + Linear + Smooth	6.9453277
2017	12	3	664	4.518072	Intercept + Linear + Smooth	7.1825086
2018	1	2	792	2.525253	Intercept + Linear + Smooth	7.4361078
2018	2	1	525	1.904762	Intercept + Linear + Smooth	7.6986611
2018	3	9	534	16.853933	Intercept + Linear + Smooth	7.9437650
2018	4	4	426	9.389671	Intercept + Linear + Smooth	8.2242426
2018	5	10	764	13.089005	Intercept + Linear + Smooth	8.5050980
2018	6	6	526	11.406844	Intercept + Linear + Smooth	8.8053951
2018	7	1	461	2.169197	Intercept + Linear + Smooth	9.1060967

Paediatric environmental BSI at QEUH, 06/2015 - 09/2018

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2018	8	4	576	6.944444	Intercept + Linear + Smooth	9.4276138
2018	9	5	461	10.845987	Intercept + Linear + Smooth	9.7604830

X.5.0. Question 5a: What was overall BSI incidence rate attributed to environmental microorganisms among paediatric haematology-oncology patients in the RHC for the whole period from October 2018 to February 2022?

X.5.1. [1] 2.881682

X.5.2. Question 5b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

(Note that the smooth is slightly different than the rest (k=35), due to numerical issues.)

X.5.3. Model summary

Family: Negative Binomial(4.009)

Link function: log

Formula:

```
env_bsi ~ decyear2 + offset(log(beddays)) + s(decyear2, bs = "ad",
   k = 35, xt = list(bs = "ps"))
```

Parametric coefficients:

```
             Estimate Std. Error z value Pr(>|z|)
(Intercept)  -4.8110     0.8009  -6.007 1.89e-09 ***
decyear2     -0.2146     0.1648  -1.302    0.193
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Approximate significance of smooth terms:

	edf	Ref.df	Chi.sq	p-value
s(decyear2)	0.0002019	0.0004039	0	0.992

Rank: 35/36

R-sq.(adj) = 0.0448 Deviance explained = 3.96%

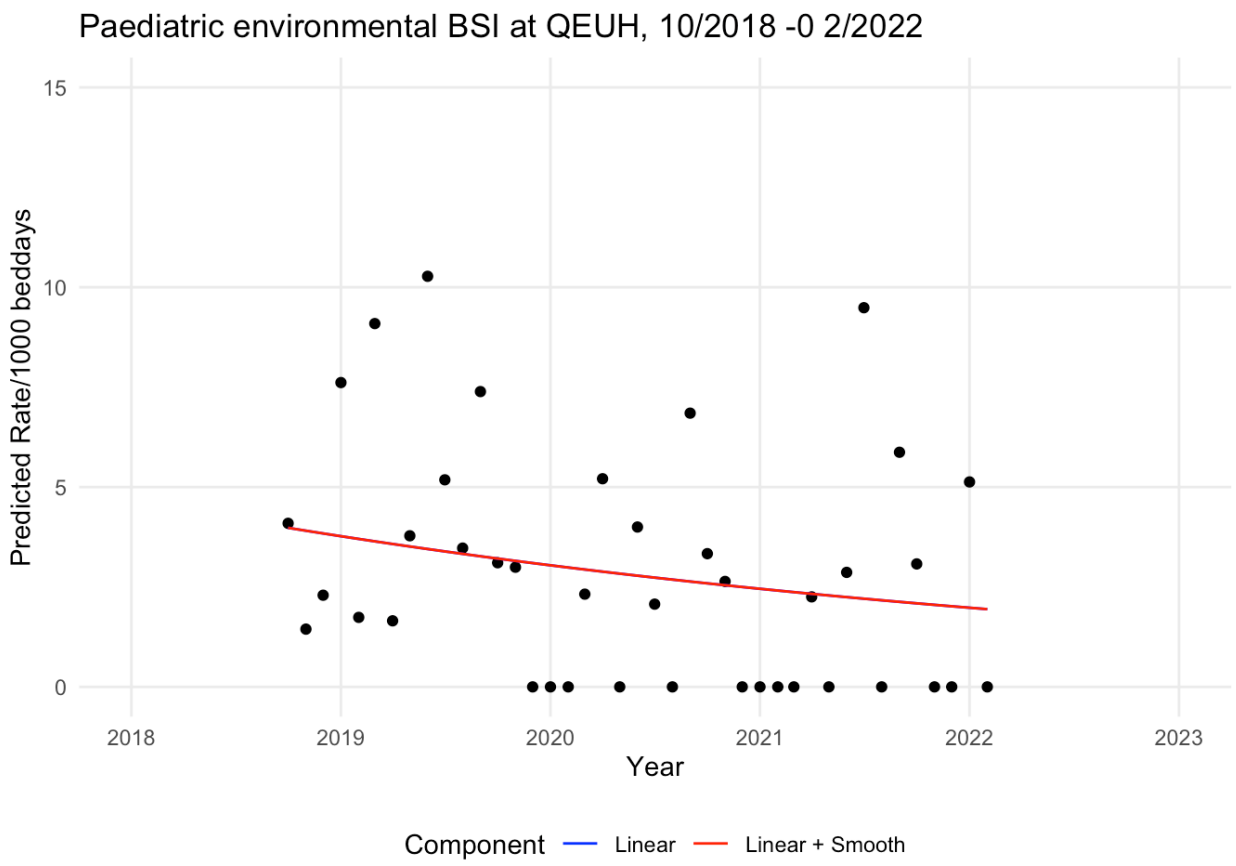
-REML = 60.151 Scale est. = 1 n = 41

X.5.4. First and last timepoints

Paediatric environmental BSI at QEUH, 10/2018 -02/2022

Year	Month	Fit/1000 bed days	Observed Rate
2018	10	3.97972823068664	4.09276944065484
…	…	…	…
2022	2	1.94468925436228	0

X.5.5. Plot



X.5.6. Raw data and fit

Paediatric environmental BSI at QEUH, 10/2018 - 2/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2018	10	3	733	4.092769	Intercept + Linear	3.979583
2018	11	1	692	1.445087	Intercept + Linear	3.907707
2018	12	1	436	2.293578	Intercept + Linear	3.839385
2019	1	3	394	7.614213	Intercept + Linear	3.770041
2019	2	1	575	1.739130	Intercept + Linear	3.701949
2019	3	4	440	9.090909	Intercept + Linear	3.641505
2019	4	1	605	1.652893	Intercept + Linear	3.575734
2019	5	2	529	3.780718	Intercept + Linear	3.513217
2019	6	3	292	10.273973	Intercept + Linear	3.449764

Paediatric environmental BSI at QEUH, 10/2018 - 2/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2019	7	3	579	5.181347	Intercept + Linear	3.389449
2019	8	1	288	3.472222	Intercept + Linear	3.328231
2019	9	3	406	7.389163	Intercept + Linear	3.268119
2019	10	1	322	3.105590	Intercept + Linear	3.210980
2019	11	2	668	2.994012	Intercept + Linear	3.152986
2019	12	0	623	0.000000	Intercept + Linear	3.097860
2020	1	0	501	0.000000	Intercept + Linear	3.041908
2020	2	0	424	0.000000	Intercept + Linear	2.987117
2020	3	1	431	2.320186	Intercept + Linear	2.936753
2020	4	1	192	5.208333	Intercept + Linear	2.883856
2020	5	0	277	0.000000	Intercept + Linear	2.833571
2020	6	1	250	4.000000	Intercept + Linear	2.782532
2020	7	1	483	2.070393	Intercept + Linear	2.734015
2020	8	0	335	0.000000	Intercept + Linear	2.684769
2020	9	3	438	6.849315	Intercept + Linear	2.636410
2020	10	1	300	3.333333	Intercept + Linear	2.590440
2020	11	1	379	2.638522	Intercept + Linear	2.543780
2020	12	0	380	0.000000	Intercept + Linear	2.499426
2021	1	0	390	0.000000	Intercept + Linear	2.454405
2021	2	0	316	0.000000	Intercept + Linear	2.410075
2021	3	0	557	0.000000	Intercept + Linear	2.370724
2021	4	1	444	2.252252	Intercept + Linear	2.327906
2021	5	0	501	0.000000	Intercept + Linear	2.287205

Paediatric environmental BSI at QEUH, 10/2018 - 2/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2021	6	1	349	2.865330	Intercept + Linear	2.245896
2021	7	5	527	9.487666	Intercept + Linear	2.206629
2021	8	0	533	0.000000	Intercept + Linear	2.166774
2021	9	3	511	5.870842	Intercept + Linear	2.127640
2021	10	1	325	3.076923	Intercept + Linear	2.090441
2021	11	0	376	0.000000	Intercept + Linear	2.052684
2021	12	0	350	0.000000	Intercept + Linear	2.016796
2022	1	2	390	5.128205	Intercept + Linear	1.980370
2022	2	0	157	0.000000	Intercept + Linear	1.944602
2018	10	3	733	4.092769	Intercept + Linear + Smooth	3.979728
2018	11	1	692	1.445087	Intercept + Linear + Smooth	3.907837
2018	12	1	436	2.293578	Intercept + Linear + Smooth	3.839501
2019	1	3	394	7.614213	Intercept + Linear + Smooth	3.770142
2019	2	1	575	1.739130	Intercept + Linear + Smooth	3.702036
2019	3	4	440	9.090909	Intercept + Linear + Smooth	3.641578
2019	4	1	605	1.652893	Intercept + Linear + Smooth	3.575792
2019	5	2	529	3.780718	Intercept + Linear + Smooth	3.513260
2019	6	3	292	10.273973	Intercept + Linear + Smooth	3.449792
2019	7	3	579	5.181347	Intercept + Linear + Smooth	3.389462
2019	8	1	288	3.472222	Intercept + Linear + Smooth	3.328229
2019	9	3	406	7.389163	Intercept + Linear + Smooth	3.268103
2019	10	1	322	3.105590	Intercept + Linear + Smooth	3.210951
2019	11	2	668	2.994012	Intercept + Linear + Smooth	3.152945

Paediatric environmental BSI at QEUH, 10/2018 - 2/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2019	12	0	623	0.000000	Intercept + Linear + Smooth	3.097808
2020	1	0	501	0.000000	Intercept + Linear + Smooth	3.041848
2020	2	0	424	0.000000	Intercept + Linear + Smooth	2.987049
2020	3	1	431	2.320186	Intercept + Linear + Smooth	2.936681
2020	4	1	192	5.208333	Intercept + Linear + Smooth	2.883779
2020	5	0	277	0.000000	Intercept + Linear + Smooth	2.833493
2020	6	1	250	4.000000	Intercept + Linear + Smooth	2.782453
2020	7	1	483	2.070393	Intercept + Linear + Smooth	2.733937
2020	8	0	335	0.000000	Intercept + Linear + Smooth	2.684693
2020	9	3	438	6.849315	Intercept + Linear + Smooth	2.636337
2020	10	1	300	3.333333	Intercept + Linear + Smooth	2.590372
2020	11	1	379	2.638522	Intercept + Linear + Smooth	2.543717
2020	12	0	380	0.000000	Intercept + Linear + Smooth	2.499369
2021	1	0	390	0.000000	Intercept + Linear + Smooth	2.454356
2021	2	0	316	0.000000	Intercept + Linear + Smooth	2.410036
2021	3	0	557	0.000000	Intercept + Linear + Smooth	2.370693
2021	4	1	444	2.252252	Intercept + Linear + Smooth	2.327885
2021	5	0	501	0.000000	Intercept + Linear + Smooth	2.287196
2021	6	1	349	2.865330	Intercept + Linear + Smooth	2.245898
2021	7	5	527	9.487666	Intercept + Linear + Smooth	2.206643
2021	8	0	533	0.000000	Intercept + Linear + Smooth	2.166800
2021	9	3	511	5.870842	Intercept + Linear + Smooth	2.127676
2021	10	1	325	3.076923	Intercept + Linear + Smooth	2.090488

Paediatric environmental BSI at QEUH, 10/2018 - 2/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2021	11	0	376	0.000000	Intercept + Linear + Smooth	2.052742
2021	12	0	350	0.000000	Intercept + Linear + Smooth	2.016864
2022	1	2	390	5.128205	Intercept + Linear + Smooth	1.980448
2022	2	0	157	0.000000	Intercept + Linear + Smooth	1.944689

X.5.7. Supplementary information

In model explorations, seasonality was statistically significant.

Family: Negative Binomial(10.956)

Link function: log

Formula:

```
env_bsi ~ decyear2 + offset(log(beddays)) + s(decyear2, bs = "ad",
   k = 35, xt = list(bs = "ps")) + s(fracyear, bs = "cp", k = 12)
```

Parametric coefficients:

```
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  -4.7864     0.7591  -6.305 2.88e-10 ***
decyear2     -0.2330     0.1580  -1.475     0.14
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Approximate significance of smooth terms:

```
               edf  Ref.df Chi.sq p-value
s(decyear2) 0.4937  0.8308  0.801  0.3707
s(fracyear) 1.7999 11.0000  6.343  0.0162 *
```

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Rank: 46/47

R-sq.(adj) = 0.194 Deviance explained = 21.9%

-REML = 58.735 Scale est. = 1 n = 41

X.6.0. Question 6a: What was overall BSI incidence rate attributed to environmental microorganisms among paediatric haematology-oncology patients in the RHC for the whole period from June 2015 to February 2022?

X.6.1. [1] 3.970424

X.6.2. Question 6b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

X.6.3. Model summary

Family: Negative Binomial(15.743)

Link function: log

Formula:

env_bsi ~ decyear2 + offset(log(beddays)) + s(decyear2, bs = "ad",

k = 40, xt = list(bs = "ps"))

Parametric coefficients:

	Estimate	Std. Error	z value	Pr(>|z|)	
(Intercept)	-6.24217	0.35001	-17.834	<2e-16	***
decyear2	0.12717	0.09028	1.409	0.159	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:

edf Ref.df Chi.sq p-value

s(decyear2) 3.043 4.08 32.09 1.6e-06 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Rank: 40/41

R-sq.(adj) = 0.456 Deviance explained = 38.8%

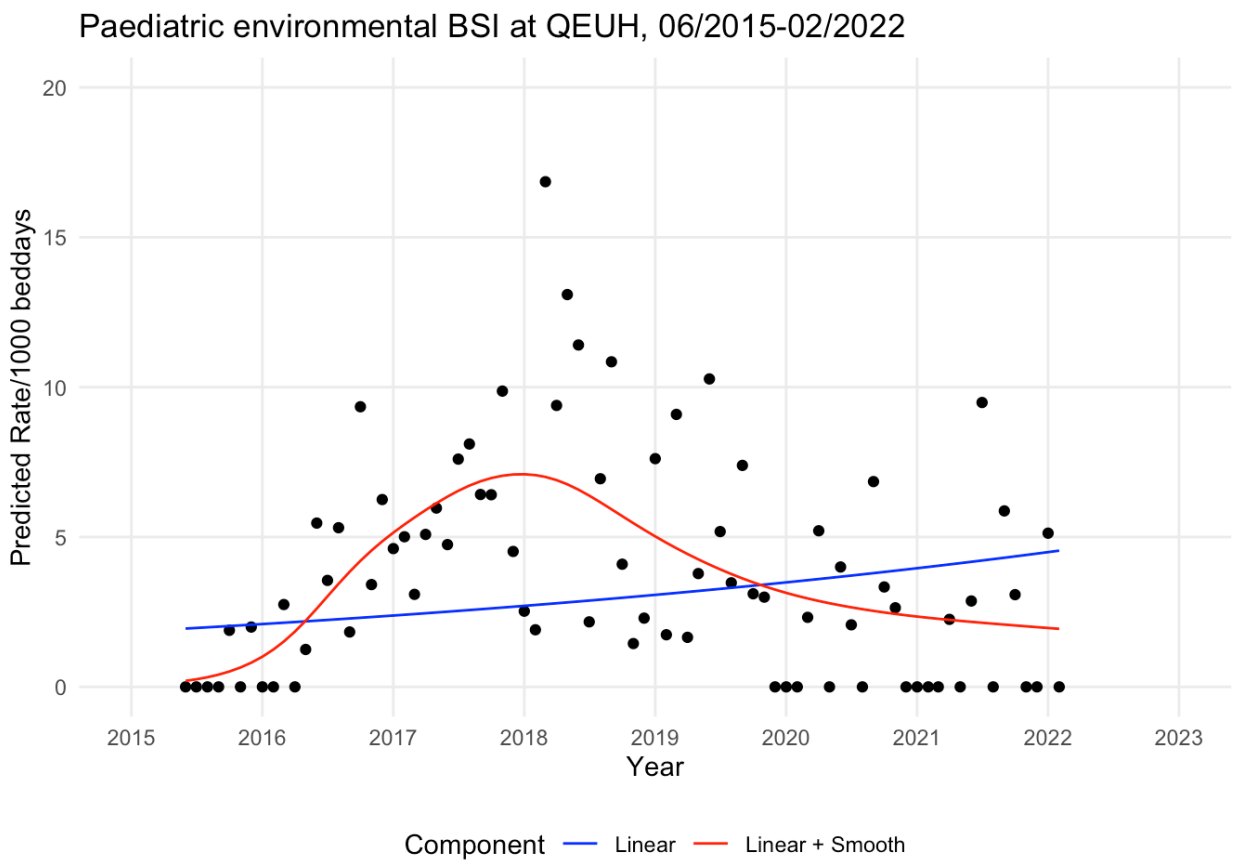
-REML = 133.94 Scale est. = 1 n = 81

X.6.4. First and last timepoints

Paediatric environmental BSI at QEUH, 06/2015-02/2022

Year	Month	Fit/1000 bed days	Observed Rate
2015	6	0.200434401442463	0
…	…	…	…
2022	2	1.93668071437307	0

X.6.5. Plot



X.6.6. Raw data and fit

Paediatric environmental BSI at QEUH, 06/2015-02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2015	6	0	487	0.000000	Intercept + Linear	1.9456364
2015	7	0	386	0.000000	Intercept + Linear	1.9660787
2015	8	0	621	0.000000	Intercept + Linear	1.9874281
2015	9	0	481	0.000000	Intercept + Linear	2.0090093
2015	10	1	530	1.886793	Intercept + Linear	2.0301175
2015	11	0	791	0.000000	Intercept + Linear	2.0521622
2015	12	1	501	1.996008	Intercept + Linear	2.0737238
2016	1	0	435	0.000000	Intercept + Linear	2.0962421
2016	2	0	550	0.000000	Intercept + Linear	2.1189423

Paediatric environmental BSI at QEUH, 06/2015-02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2016	3	1	364	2.747253	Intercept + Linear	2.1404006
2016	4	0	664	0.000000	Intercept + Linear	2.1635790
2016	5	1	801	1.248439	Intercept + Linear	2.1862488
2016	6	3	549	5.464481	Intercept + Linear	2.2099237
2016	7	2	563	3.552398	Intercept + Linear	2.2330790
2016	8	3	565	5.309735	Intercept + Linear	2.2572611
2016	9	1	546	1.831502	Intercept + Linear	2.2817051
2016	10	4	428	9.345794	Intercept + Linear	2.3056125
2016	11	3	879	3.412969	Intercept + Linear	2.3305801
2016	12	4	640	6.250000	Intercept + Linear	2.3549996
2017	1	4	867	4.613610	Intercept + Linear	2.3805020
2017	2	3	599	5.008347	Intercept + Linear	2.4063515
2017	3	2	648	3.086420	Intercept + Linear	2.4299407
2017	4	5	983	5.086470	Intercept + Linear	2.4563271
2017	5	5	838	5.966587	Intercept + Linear	2.4821351
2017	6	3	632	4.746835	Intercept + Linear	2.5090882
2017	7	5	658	7.598784	Intercept + Linear	2.5354506
2017	8	5	617	8.103728	Intercept + Linear	2.5629827
2017	9	5	779	6.418485	Intercept + Linear	2.5908137
2017	10	4	624	6.410256	Intercept + Linear	2.6180348
2017	11	6	608	9.868421	Intercept + Linear	2.6464636
2017	12	3	664	4.518072	Intercept + Linear	2.6742693
2018	1	2	792	2.525253	Intercept + Linear	2.7033089

Paediatric environmental BSI at QEUH, 06/2015-02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2018	2	1	525	1.904762	Intercept + Linear	2.7326637
2018	3	9	534	16.853933	Intercept + Linear	2.7594517
2018	4	4	426	9.389671	Intercept + Linear	2.7894162
2018	5	10	764	13.089005	Intercept + Linear	2.8187238
2018	6	6	526	11.406844	Intercept + Linear	2.8493320
2018	7	1	461	2.169197	Intercept + Linear	2.8792692
2018	8	4	576	6.944444	Intercept + Linear	2.9105348
2018	9	5	461	10.845987	Intercept + Linear	2.9421399
2018	10	3	733	4.092769	Intercept + Linear	2.9730522
2018	11	1	692	1.445087	Intercept + Linear	3.0053361
2018	12	1	436	2.293578	Intercept + Linear	3.0369124
2019	1	3	394	7.614213	Intercept + Linear	3.0698898
2019	2	1	575	1.739130	Intercept + Linear	3.1032253
2019	3	4	440	9.090909	Intercept + Linear	3.1336458
2019	4	1	605	1.652893	Intercept + Linear	3.1676737
2019	5	2	529	3.780718	Intercept + Linear	3.2009556
2019	6	3	292	10.273973	Intercept + Linear	3.2357143
2019	7	3	579	5.181347	Intercept + Linear	3.2697111
2019	8	1	288	3.472222	Intercept + Linear	3.3052165
2019	9	3	406	7.389163	Intercept + Linear	3.3411074
2019	10	1	322	3.105590	Intercept + Linear	3.3762115
2019	11	2	668	2.994012	Intercept + Linear	3.4128733
2019	12	0	623	0.000000	Intercept + Linear	3.4487315

Paediatric environmental BSI at QEUH, 06/2015-02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2020	1	0	501	0.000000	Intercept + Linear	3.4861808
2020	2	0	424	0.000000	Intercept + Linear	3.5239328
2020	3	1	431	2.320186	Intercept + Linear	3.5596191
2020	4	1	192	5.208333	Intercept + Linear	3.5981664
2020	5	0	277	0.000000	Intercept + Linear	3.6358675
2020	6	1	250	4.000000	Intercept + Linear	3.6752405
2020	7	1	483	2.070393	Intercept + Linear	3.7137492
2020	8	0	335	0.000000	Intercept + Linear	3.7539655
2020	9	3	438	6.849315	Intercept + Linear	3.7946173
2020	10	1	300	3.333333	Intercept + Linear	3.8343769
2020	11	1	379	2.638522	Intercept + Linear	3.8758995
2020	12	0	380	0.000000	Intercept + Linear	3.9165107
2021	1	0	390	0.000000	Intercept + Linear	3.9589227
2021	2	0	316	0.000000	Intercept + Linear	4.0019121
2021	3	0	557	0.000000	Intercept + Linear	4.0411424
2021	4	1	444	2.252252	Intercept + Linear	4.0850246
2021	5	0	501	0.000000	Intercept + Linear	4.1279449
2021	6	1	349	2.865330	Intercept + Linear	4.1727696
2021	7	5	527	9.487666	Intercept + Linear	4.2166119
2021	8	0	533	0.000000	Intercept + Linear	4.2623995
2021	9	3	511	5.870842	Intercept + Linear	4.3086843
2021	10	1	325	3.076923	Intercept + Linear	4.3539545
2021	11	0	376	0.000000	Intercept + Linear	4.4012335

Paediatric environmental BSI at QEUH, 06/2015-02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2021	12	0	350	0.000000	Intercept + Linear	4.4474761
2022	1	2	390	5.128205	Intercept + Linear	4.4957706
2022	2	0	157	0.000000	Intercept + Linear	4.5445896
2015	6	0	487	0.000000	Intercept + Linear + Smooth	0.2004344
2015	7	0	386	0.000000	Intercept + Linear + Smooth	0.2530014
2015	8	0	621	0.000000	Intercept + Linear + Smooth	0.3216128
2015	9	0	481	0.000000	Intercept + Linear + Smooth	0.4082509
2015	10	1	530	1.886793	Intercept + Linear + Smooth	0.5129717
2015	11	0	791	0.000000	Intercept + Linear + Smooth	0.6469616
2015	12	1	501	1.996008	Intercept + Linear + Smooth	0.8061374
2016	1	0	435	0.000000	Intercept + Linear + Smooth	1.0063423
2016	2	0	550	0.000000	Intercept + Linear + Smooth	1.2473172
2016	3	1	364	2.747253	Intercept + Linear + Smooth	1.5140546
2016	4	0	664	0.000000	Intercept + Linear + Smooth	1.8447996
2016	5	1	801	1.248439	Intercept + Linear + Smooth	2.2058648
2016	6	3	549	5.464481	Intercept + Linear + Smooth	2.6114429
2016	7	2	563	3.552398	Intercept + Linear + Smooth	3.0201118
2016	8	3	565	5.309735	Intercept + Linear + Smooth	3.4393845
2016	9	1	546	1.831502	Intercept + Linear + Smooth	3.8416412
2016	10	4	428	9.345794	Intercept + Linear + Smooth	4.2050199
2016	11	3	879	3.412969	Intercept + Linear + Smooth	4.5499429
2016	12	4	640	6.250000	Intercept + Linear + Smooth	4.8553163
2017	1	4	867	4.613610	Intercept + Linear + Smooth	5.1456417

Paediatric environmental BSI at QEUH, 06/2015-02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2017	2	3	599	5.008347	Intercept + Linear + Smooth	5.4178398
2017	3	2	648	3.086420	Intercept + Linear + Smooth	5.6514829
2017	4	5	983	5.086470	Intercept + Linear + Smooth	5.8989962
2017	5	5	838	5.966587	Intercept + Linear + Smooth	6.1273450
2017	6	3	632	4.746835	Intercept + Linear + Smooth	6.3476000
2017	7	5	658	7.598784	Intercept + Linear + Smooth	6.5409883
2017	8	5	617	8.103728	Intercept + Linear + Smooth	6.7153158
2017	9	5	779	6.418485	Intercept + Linear + Smooth	6.8591128
2017	10	4	624	6.410256	Intercept + Linear + Smooth	6.9668616
2017	11	6	608	9.868421	Intercept + Linear + Smooth	7.0442571
2017	12	3	664	4.518072	Intercept + Linear + Smooth	7.0858290
2018	1	2	792	2.525253	Intercept + Linear + Smooth	7.0942293
2018	2	1	525	1.904762	Intercept + Linear + Smooth	7.0653139
2018	3	9	534	16.853933	Intercept + Linear + Smooth	7.0047466
2018	4	4	426	9.389671	Intercept + Linear + Smooth	6.8989219
2018	5	10	764	13.089005	Intercept + Linear + Smooth	6.7589076
2018	6	6	526	11.406844	Intercept + Linear + Smooth	6.5799395
2018	7	1	461	2.169197	Intercept + Linear + Smooth	6.3815416
2018	8	4	576	6.944444	Intercept + Linear + Smooth	6.1587587
2018	9	5	461	10.845987	Intercept + Linear + Smooth	5.9257775
2018	10	3	733	4.092769	Intercept + Linear + Smooth	5.6971115
2018	11	1	692	1.445087	Intercept + Linear + Smooth	5.4626797
2018	12	1	436	2.293578	Intercept + Linear + Smooth	5.2414555

Paediatric environmental BSI at QEUH, 06/2015-02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2019	1	3	394	7.614213	Intercept + Linear + Smooth	5.0206576
2019	2	1	575	1.739130	Intercept + Linear + Smooth	4.8089380
2019	3	4	440	9.090909	Intercept + Linear + Smooth	4.6259504
2019	4	1	605	1.652893	Intercept + Linear + Smooth	4.4326521
2019	5	2	529	3.780718	Intercept + Linear + Smooth	4.2548736
2019	6	3	292	10.273973	Intercept + Linear + Smooth	4.0806033
2019	7	3	579	5.181347	Intercept + Linear + Smooth	3.9209777
2019	8	1	288	3.472222	Intercept + Linear + Smooth	3.7653163
2019	9	3	406	7.389163	Intercept + Linear + Smooth	3.6190902
2019	10	1	322	3.105590	Intercept + Linear + Smooth	3.4866598
2019	11	2	668	2.994012	Intercept + Linear + Smooth	3.3592365
2019	12	0	623	0.000000	Intercept + Linear + Smooth	3.2449804
2020	1	0	501	0.000000	Intercept + Linear + Smooth	3.1361097
2020	2	0	424	0.000000	Intercept + Linear + Smooth	3.0363267
2020	3	1	431	2.320186	Intercept + Linear + Smooth	2.9503923
2020	4	1	192	5.208333	Intercept + Linear + Smooth	2.8657709
2020	5	0	277	0.000000	Intercept + Linear + Smooth	2.7903211
2020	6	1	250	4.000000	Intercept + Linear + Smooth	2.7183567
2020	7	1	483	2.070393	Intercept + Linear + Smooth	2.6539469
2020	8	0	335	0.000000	Intercept + Linear + Smooth	2.5922526
2020	9	3	438	6.849315	Intercept + Linear + Smooth	2.5349952
2020	10	1	300	3.333333	Intercept + Linear + Smooth	2.4834026
2020	11	1	379	2.638522	Intercept + Linear + Smooth	2.4337195

Paediatric environmental BSI at QEUH, 06/2015-02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2020	12	0	380	0.000000	Intercept + Linear + Smooth	2.3888825
2021	1	0	390	0.000000	Intercept + Linear + Smooth	2.3456495
2021	2	0	316	0.000000	Intercept + Linear + Smooth	2.3052041
2021	3	0	557	0.000000	Intercept + Linear + Smooth	2.2708946
2021	4	1	444	2.252252	Intercept + Linear + Smooth	2.2350443
2021	5	0	501	0.000000	Intercept + Linear + Smooth	2.2021242
2021	6	1	349	2.865330	Intercept + Linear + Smooth	2.1695391
2021	7	5	527	9.487666	Intercept + Linear + Smooth	2.1390614
2021	8	0	533	0.000000	Intercept + Linear + Smooth	2.1083665
2021	9	3	511	5.870842	Intercept + Linear + Smooth	2.0782793
2021	10	1	325	3.076923	Intercept + Linear + Smooth	2.0496571
2021	11	0	376	0.000000	Intercept + Linear + Smooth	2.0205355
2021	12	0	350	0.000000	Intercept + Linear + Smooth	1.9927784
2022	1	2	390	5.128205	Intercept + Linear + Smooth	1.9645228
2022	2	0	157	0.000000	Intercept + Linear + Smooth	1.9366807

X.6.7. Supplementary information

In model exploration, seasonality was statistically significant.

Family: Negative Binomial(36.491)

Link function: log

Formula:

```
env_bsi ~ decyear2 + offset(log(beddays)) + s(decyear2, bs = "ad",
    k = 40, xt = list(bs = "ps")) + s(fracyear, bs = "cp", k = 12)

Parametric coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept) -6.26933    0.34538 -18.152   <2e-16 ***
decyear2     0.13097    0.08917   1.469    0.142
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
               edf Ref.df Chi.sq  p-value
s(decyear2) 3.207  4.255 34.491 4.02e-07 ***
s(fracyear) 1.809 11.000  6.409   0.0153 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Rank: 51/52
R-sq.(adj) =  0.511   Deviance explained =   45%
-REML = 132.37  Scale est. = 1         n = 81
```

X.7.0. Question 7a: What was overall BSI incidence rate attributed to non-environmental microorganisms among paediatric haematology-oncology patients in Yorkhill for the whole period from January 2008 to May 2015?

X.7.1. [1] 12.86154

X.7.2. Question 7b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

X.7.3. Model summary

Family: Negative Binomial(9.494)

Link function: log

Formula:

nebsi ~ decyear2 + offset(log(beddays)) + s(decyear2, bs = "ad",

k = 40, xt = list(bs = "ps"))

Parametric coefficients:

	Estimate	Std. Error	z value	Pr(>|z|)	
(Intercept)	-4.361266	0.108304	-40.269	<2e-16	***
decyear2	-0.007173	0.024414	-0.294	0.769	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:

	edf	Ref.df	Chi.sq	p-value
s(decyear2)	0.724	1.14	1.474	0.245

Rank: 40/41

R-sq.(adj) = -0.168 Deviance explained = 2.73%

-REML = 236.55 Scale est. = 1 n = 89

X.7.4. First and last timepoints

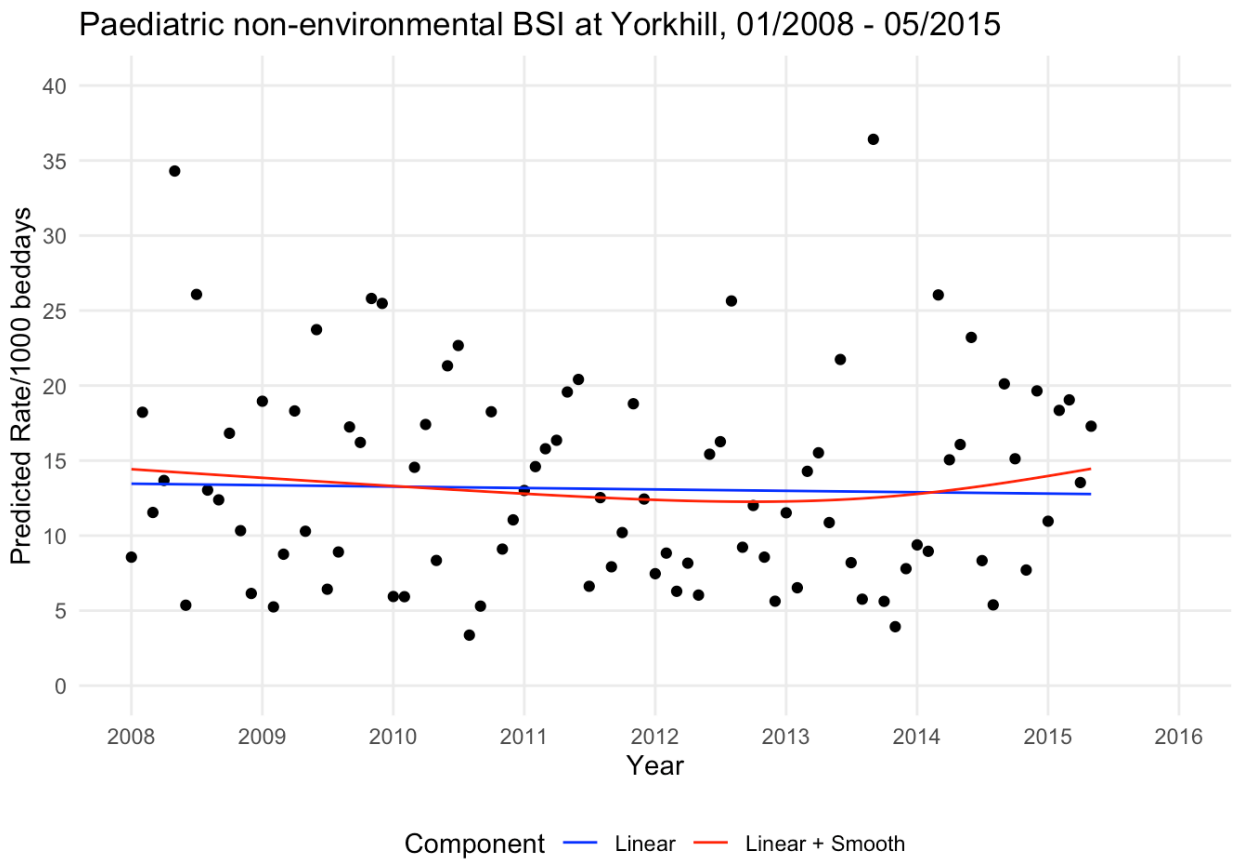
Paediatric non-environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Fit/1000 bed days	Observed Rate
2008	1	14.4271113406771	8.56531049250535
…	…	…	…

Paediatric non-environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Fit/1000 bed days	Observed Rate
2015	5	14.4566054013559	17.2910662824208

X.7.5. Plot



X.7.6. Raw data and fit

Paediatric non-environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2008	1	8	934	8.565311	Intercept + Linear	13.45922
2008	2	8	439	18.223235	Intercept + Linear	13.45105
2008	3	11	953	11.542497	Intercept + Linear	13.44341
2008	4	8	585	13.675214	Intercept + Linear	13.43524

Paediatric non-environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2008	5	13	379	34.300792	Intercept + Linear	13.42735
2008	6	4	746	5.361930	Intercept + Linear	13.41919
2008	7	20	767	26.075619	Intercept + Linear	13.41131
2008	8	7	537	13.035382	Intercept + Linear	13.40316
2008	9	8	646	12.383901	Intercept + Linear	13.39502
2008	10	9	535	16.822430	Intercept + Linear	13.38715
2008	11	5	484	10.330578	Intercept + Linear	13.37902
2008	12	4	651	6.144393	Intercept + Linear	13.37115
2009	1	12	633	18.957346	Intercept + Linear	13.36303
2009	2	2	381	5.249344	Intercept + Linear	13.35490
2009	3	7	799	8.760951	Intercept + Linear	13.34755
2009	4	13	710	18.309859	Intercept + Linear	13.33942
2009	5	6	583	10.291595	Intercept + Linear	13.33156
2009	6	14	590	23.728814	Intercept + Linear	13.32344
2009	7	5	778	6.426735	Intercept + Linear	13.31559
2009	8	4	449	8.908686	Intercept + Linear	13.30748
2009	9	11	638	17.241379	Intercept + Linear	13.29937
2009	10	13	802	16.209476	Intercept + Linear	13.29154
2009	11	12	465	25.806452	Intercept + Linear	13.28344
2009	12	12	471	25.477707	Intercept + Linear	13.27561
2010	1	3	505	5.940594	Intercept + Linear	13.26753
2010	2	3	506	5.928854	Intercept + Linear	13.25945
2010	3	7	481	14.553015	Intercept + Linear	13.25216

Paediatric non-environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2010	4	9	517	17.408124	Intercept + Linear	13.24409
2010	5	6	719	8.344924	Intercept + Linear	13.23628
2010	6	11	516	21.317829	Intercept + Linear	13.22822
2010	7	9	397	22.670025	Intercept + Linear	13.22042
2010	8	3	891	3.367003	Intercept + Linear	13.21237
2010	9	3	566	5.300353	Intercept + Linear	13.20433
2010	10	9	493	18.255578	Intercept + Linear	13.19654
2010	11	7	769	9.102731	Intercept + Linear	13.18851
2010	12	8	724	11.049724	Intercept + Linear	13.18073
2011	1	8	615	13.008130	Intercept + Linear	13.17271
2011	2	4	274	14.598540	Intercept + Linear	13.16469
2011	3	9	570	15.789474	Intercept + Linear	13.15744
2011	4	7	428	16.355140	Intercept + Linear	13.14943
2011	5	11	562	19.572954	Intercept + Linear	13.14168
2011	6	8	392	20.408163	Intercept + Linear	13.13368
2011	7	3	453	6.622517	Intercept + Linear	13.12594
2011	8	5	399	12.531328	Intercept + Linear	13.11794
2011	9	4	505	7.920792	Intercept + Linear	13.10996
2011	10	4	392	10.204082	Intercept + Linear	13.10223
2011	11	9	479	18.789144	Intercept + Linear	13.09425
2011	12	5	402	12.437811	Intercept + Linear	13.08653
2012	1	5	670	7.462687	Intercept + Linear	13.07856
2012	2	5	566	8.833922	Intercept + Linear	13.07062

Paediatric non-environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2012	3	6	954	6.289308	Intercept + Linear	13.06319
2012	4	4	490	8.163265	Intercept + Linear	13.05526
2012	5	6	994	6.036217	Intercept + Linear	13.04759
2012	6	6	389	15.424164	Intercept + Linear	13.03966
2012	7	8	492	16.260163	Intercept + Linear	13.03200
2012	8	8	312	25.641026	Intercept + Linear	13.02409
2012	9	5	542	9.225092	Intercept + Linear	13.01618
2012	10	7	583	12.006861	Intercept + Linear	13.00853
2012	11	4	467	8.565311	Intercept + Linear	13.00062
2012	12	3	533	5.628518	Intercept + Linear	12.99298
2013	1	5	434	11.520737	Intercept + Linear	12.98509
2013	2	4	613	6.525285	Intercept + Linear	12.97719
2013	3	8	560	14.285714	Intercept + Linear	12.97005
2013	4	7	451	15.521064	Intercept + Linear	12.96215
2013	5	6	552	10.869565	Intercept + Linear	12.95451
2013	6	8	368	21.739130	Intercept + Linear	12.94662
2013	7	2	244	8.196721	Intercept + Linear	12.93899
2013	8	2	347	5.763689	Intercept + Linear	12.93111
2013	9	13	357	36.414566	Intercept + Linear	12.92324
2013	10	3	534	5.617978	Intercept + Linear	12.91562
2013	11	2	509	3.929273	Intercept + Linear	12.90775
2013	12	4	513	7.797271	Intercept + Linear	12.90015
2014	1	5	533	9.380863	Intercept + Linear	12.89229

Paediatric non-environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2014	2	6	670	8.955224	Intercept + Linear	12.88444
2014	3	10	384	26.041667	Intercept + Linear	12.87735
2014	4	7	465	15.053763	Intercept + Linear	12.86951
2014	5	9	560	16.071429	Intercept + Linear	12.86192
2014	6	12	517	23.210832	Intercept + Linear	12.85409
2014	7	3	360	8.333333	Intercept + Linear	12.84652
2014	8	4	743	5.383580	Intercept + Linear	12.83869
2014	9	7	348	20.114943	Intercept + Linear	12.83087
2014	10	8	529	15.122873	Intercept + Linear	12.82331
2014	11	4	519	7.707129	Intercept + Linear	12.81550
2014	12	10	509	19.646365	Intercept + Linear	12.80795
2015	1	8	730	10.958904	Intercept + Linear	12.80015
2015	2	8	436	18.348624	Intercept + Linear	12.79236
2015	3	10	525	19.047619	Intercept + Linear	12.78532
2015	4	8	591	13.536379	Intercept + Linear	12.77753
2015	5	6	347	17.291066	Intercept + Linear	12.77000
2008	1	8	934	8.565311	Intercept + Linear + Smooth	14.42711
2008	2	8	439	18.223235	Intercept + Linear + Smooth	14.37763
2008	3	11	953	11.542497	Intercept + Linear + Smooth	14.33148
2008	4	8	585	13.675214	Intercept + Linear + Smooth	14.28229
2008	5	13	379	34.300792	Intercept + Linear + Smooth	14.23483
2008	6	4	746	5.361930	Intercept + Linear + Smooth	14.18592
2008	7	20	767	26.075619	Intercept + Linear + Smooth	14.13871

Paediatric non-environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2008	8	7	537	13.035382	Intercept + Linear + Smooth	14.09008
2008	9	8	646	12.383901	Intercept + Linear + Smooth	14.04159
2008	10	9	535	16.822430	Intercept + Linear + Smooth	13.99483
2008	11	5	484	10.330578	Intercept + Linear + Smooth	13.94669
2008	12	4	651	6.144393	Intercept + Linear + Smooth	13.90028
2009	1	12	633	18.957346	Intercept + Linear + Smooth	13.85253
2009	2	2	381	5.249344	Intercept + Linear + Smooth	13.80486
2009	3	7	799	8.760951	Intercept + Linear + Smooth	13.76198
2009	4	13	710	18.309859	Intercept + Linear + Smooth	13.71471
2009	5	6	583	10.291595	Intercept + Linear + Smooth	13.66916
2009	6	14	590	23.728814	Intercept + Linear + Smooth	13.62229
2009	7	5	778	6.426735	Intercept + Linear + Smooth	13.57711
2009	8	4	449	8.908686	Intercept + Linear + Smooth	13.53061
2009	9	11	638	17.241379	Intercept + Linear + Smooth	13.48430
2009	10	13	802	16.209476	Intercept + Linear + Smooth	13.43964
2009	11	12	465	25.806452	Intercept + Linear + Smooth	13.39366
2009	12	12	471	25.477707	Intercept + Linear + Smooth	13.34934
2010	1	3	505	5.940594	Intercept + Linear + Smooth	13.30373
2010	2	3	506	5.928854	Intercept + Linear + Smooth	13.25835
2010	3	7	481	14.553015	Intercept + Linear + Smooth	13.21757
2010	4	9	517	17.408124	Intercept + Linear + Smooth	13.17270
2010	5	6	719	8.344924	Intercept + Linear + Smooth	13.12957
2010	6	11	516	21.317829	Intercept + Linear + Smooth	13.08534

Paediatric non-environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2010	7	9	397	22.670025	Intercept + Linear + Smooth	13.04289
2010	8	3	891	3.367003	Intercept + Linear + Smooth	12.99946
2010	9	3	566	5.300353	Intercept + Linear + Smooth	12.95649
2010	10	9	493	18.255578	Intercept + Linear + Smooth	12.91540
2010	11	7	769	9.102731	Intercept + Linear + Smooth	12.87349
2010	12	8	724	11.049724	Intercept + Linear + Smooth	12.83350
2011	1	8	615	13.008130	Intercept + Linear + Smooth	12.79278
2011	2	4	274	14.598540	Intercept + Linear + Smooth	12.75272
2011	3	9	570	15.789474	Intercept + Linear + Smooth	12.71713
2011	4	7	428	16.355140	Intercept + Linear + Smooth	12.67842
2011	5	11	562	19.572954	Intercept + Linear + Smooth	12.64171
2011	6	8	392	20.408163	Intercept + Linear + Smooth	12.60463
2011	7	3	453	6.622517	Intercept + Linear + Smooth	12.56969
2011	8	5	399	12.531328	Intercept + Linear + Smooth	12.53467
2011	9	4	505	7.920792	Intercept + Linear + Smooth	12.50090
2011	10	4	392	10.204082	Intercept + Linear + Smooth	12.46957
2011	11	9	479	18.789144	Intercept + Linear + Smooth	12.43874
2011	12	5	402	12.437811	Intercept + Linear + Smooth	12.41059
2012	1	5	670	7.462687	Intercept + Linear + Smooth	12.38343
2012	2	5	566	8.833922	Intercept + Linear + Smooth	12.35850
2012	3	6	954	6.289308	Intercept + Linear + Smooth	12.33732
2012	4	4	490	8.163265	Intercept + Linear + Smooth	12.31718
2012	5	6	994	6.036217	Intercept + Linear + Smooth	12.30029

Paediatric non-environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2012	6	6	389	15.424164	Intercept + Linear + Smooth	12.28568
2012	7	8	492	16.260163	Intercept + Linear + Smooth	12.27443
2012	8	8	312	25.641026	Intercept + Linear + Smooth	12.26592
2012	9	5	542	9.225092	Intercept + Linear + Smooth	12.26075
2012	10	7	583	12.006861	Intercept + Linear + Smooth	12.25916
2012	11	4	467	8.565311	Intercept + Linear + Smooth	12.26128
2012	12	3	533	5.628518	Intercept + Linear + Smooth	12.26722
2013	1	5	434	11.520737	Intercept + Linear + Smooth	12.27761
2013	2	4	613	6.525285	Intercept + Linear + Smooth	12.29259
2013	3	8	560	14.285714	Intercept + Linear + Smooth	12.31014
2013	4	7	451	15.521064	Intercept + Linear + Smooth	12.33417
2013	5	6	552	10.869565	Intercept + Linear + Smooth	12.36209
2013	6	8	368	21.739130	Intercept + Linear + Smooth	12.39586
2013	7	2	244	8.196721	Intercept + Linear + Smooth	12.43342
2013	8	2	347	5.763689	Intercept + Linear + Smooth	12.47739
2013	9	13	357	36.414566	Intercept + Linear + Smooth	12.52677
2013	10	3	534	5.617978	Intercept + Linear + Smooth	12.57992
2013	11	2	509	3.929273	Intercept + Linear + Smooth	12.64058
2013	12	4	513	7.797271	Intercept + Linear + Smooth	12.70494
2014	1	5	533	9.380863	Intercept + Linear + Smooth	12.77737
2014	2	6	670	8.955224	Intercept + Linear + Smooth	12.85561
2014	3	10	384	26.041667	Intercept + Linear + Smooth	12.93093
2014	4	7	465	15.053763	Intercept + Linear + Smooth	13.01908

Paediatric non-environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2014	5	9	560	16.071429	Intercept + Linear + Smooth	13.10878
2014	6	12	517	23.210832	Intercept + Linear + Smooth	13.20565
2014	7	3	360	8.333333	Intercept + Linear + Smooth	13.30327
2014	8	4	743	5.383580	Intercept + Linear + Smooth	13.40802
2014	9	7	348	20.114943	Intercept + Linear + Smooth	13.51655
2014	10	8	529	15.122873	Intercept + Linear + Smooth	13.62490
2014	11	4	519	7.707129	Intercept + Linear + Smooth	13.74000
2014	12	10	509	19.646365	Intercept + Linear + Smooth	13.85408
2015	1	8	730	10.958904	Intercept + Linear + Smooth	13.97436
2015	2	8	436	18.348624	Intercept + Linear + Smooth	14.09671
2015	3	10	525	19.047619	Intercept + Linear + Smooth	14.20870
2015	4	8	591	13.536379	Intercept + Linear + Smooth	14.33405
2015	5	6	347	17.291066	Intercept + Linear + Smooth	14.45661

X.8.0. Question 8a: What was overall BSI incidence rate attributed to non-environmental microorganisms among paediatric haematology-oncology patients in the RHC over the whole period from June 2015 to February 2022?

X.8.1. [1] 13.5042

X.8.2. Question 8b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

X.8.3. Model summary

Family: Negative Binomial(13.851)

Link function: log

Formula:

nebsi ~ decyear2 + offset(log(beddays)) + s(decyear2, bs = "ad",

k = 40, xt = list(bs = "ps"))

Parametric coefficients:

Estimate Std. Error z value Pr(>|z|)

(Intercept) -3.78436 0.10443 -36.24 < 2e-16 ***

decyear2 -0.20728 0.03371 -6.15 7.77e-10 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:

edf Ref.df Chi.sq p-value

s(decyear2) 1.904 2.586 13.16 0.00264 **

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Rank: 40/41

R-sq.(adj) = 0.601 Deviance explained = 46.1%

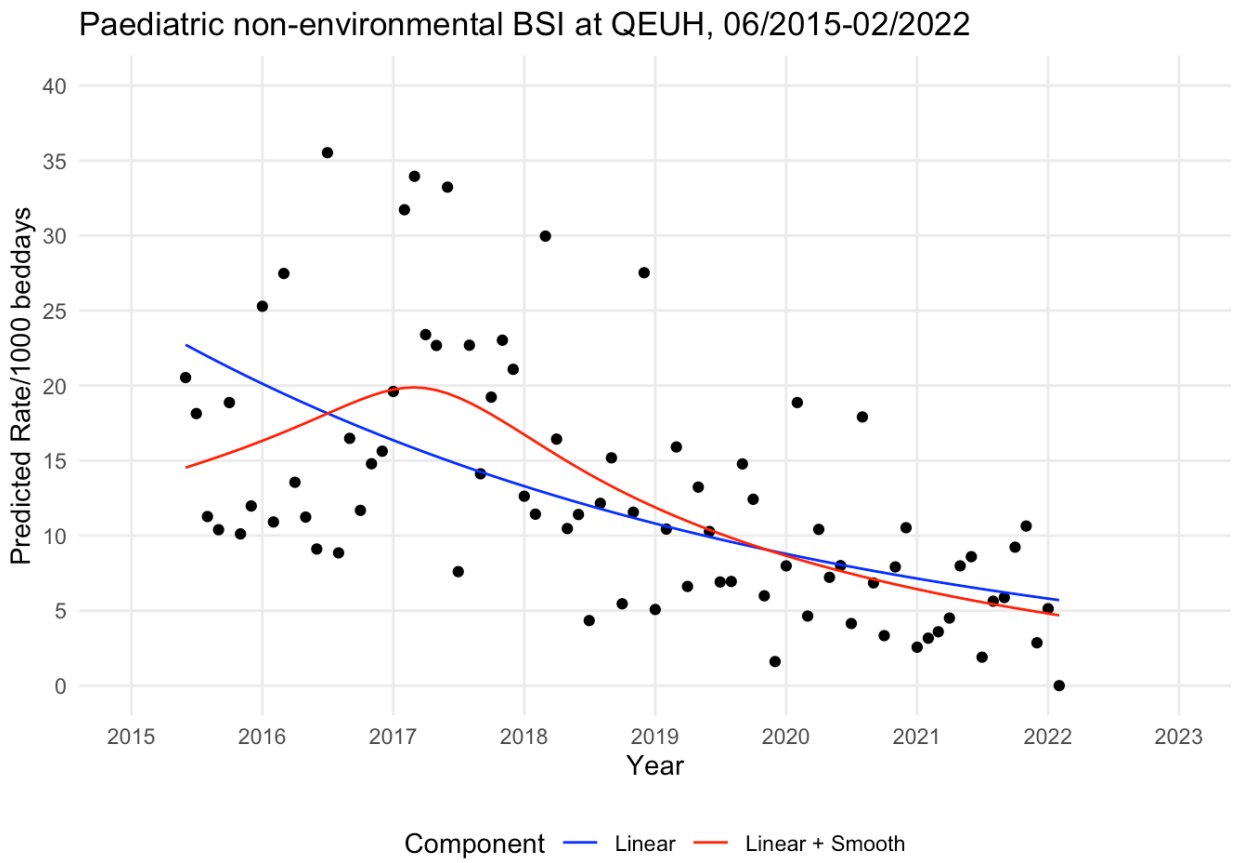
-REML = 199.57 Scale est. = 1 n = 81

X.8.4. First and last timepoints

Paediatric non-environmental BSI at QEUH, 06/2015-02/2022

Year	Month	Fit/1000 bed days	Observed Rate
2015	6	14.530378813886	20.5338809034908
…	…	…	…
2022	2	4.68863281395484	0

X.8.5. Plot



X.8.6. Raw data and fit

Paediatric non-environmental BSI at QEUH, 06/2015-02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2015	6	10	487	20.533881	Intercept + Linear	22.723427
2015	7	7	386	18.134715	Intercept + Linear	22.339568
2015	8	7	621	11.272142	Intercept + Linear	21.949725
2015	9	5	481	10.395010	Intercept + Linear	21.566685
2015	10	10	530	18.867925	Intercept + Linear	21.202366
2015	11	8	791	10.113780	Intercept + Linear	20.832368
2015	12	6	501	11.976048	Intercept + Linear	20.480454
2016	1	11	435	25.287356	Intercept + Linear	20.123054

Paediatric non-environmental BSI at QEUH, 06/2015-02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2016	2	6	550	10.909091	Intercept + Linear	19.772842
2016	3	10	364	27.472528	Intercept + Linear	19.450744
2016	4	9	664	13.554217	Intercept + Linear	19.112232
2016	5	9	801	11.235955	Intercept + Linear	18.790250
2016	6	5	549	9.107468	Intercept + Linear	18.463234
2016	7	20	563	35.523979	Intercept + Linear	18.152186
2016	8	5	565	8.849557	Intercept + Linear	17.836274
2016	9	9	546	16.483517	Intercept + Linear	17.525859
2016	10	5	428	11.682243	Intercept + Linear	17.230603
2016	11	13	879	14.789534	Intercept + Linear	16.930730
2016	12	10	640	15.625000	Intercept + Linear	16.645500
2017	1	17	867	19.607843	Intercept + Linear	16.355809
2017	2	19	599	31.719533	Intercept + Linear	16.070387
2017	3	22	648	33.950617	Intercept + Linear	15.816871
2017	4	23	983	23.397762	Intercept + Linear	15.540854
2017	5	19	838	22.673031	Intercept + Linear	15.278327
2017	6	21	632	33.227848	Intercept + Linear	15.011708
2017	7	5	658	7.598784	Intercept + Linear	14.758121
2017	8	14	617	22.690438	Intercept + Linear	14.500580
2017	9	11	779	14.120667	Intercept + Linear	14.247533
2017	10	12	624	19.230769	Intercept + Linear	14.006855
2017	11	14	608	23.026316	Intercept + Linear	13.762424
2017	12	14	664	21.084337	Intercept + Linear	13.529940

Paediatric non-environmental BSI at QEUH, 06/2015-02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2018	1	10	792	12.626263	Intercept + Linear	13.293832
2018	2	6	525	11.428571	Intercept + Linear	13.061844
2018	3	16	534	29.962547	Intercept + Linear	12.855788
2018	4	7	426	16.431925	Intercept + Linear	12.631445
2018	5	8	764	10.471204	Intercept + Linear	12.418066
2018	6	6	526	11.406844	Intercept + Linear	12.201361
2018	7	2	461	4.338395	Intercept + Linear	11.995247
2018	8	7	576	12.152778	Intercept + Linear	11.785921
2018	9	7	461	15.184382	Intercept + Linear	11.580247
2018	10	4	733	5.457026	Intercept + Linear	11.384626
2018	11	8	692	11.560694	Intercept + Linear	11.185955
2018	12	12	436	27.522936	Intercept + Linear	10.996995
2019	1	2	394	5.076142	Intercept + Linear	10.805089
2019	2	6	575	10.434783	Intercept + Linear	10.616531
2019	3	7	440	15.909091	Intercept + Linear	10.449051
2019	4	4	605	6.611570	Intercept + Linear	10.266707
2019	5	7	529	13.232514	Intercept + Linear	10.093275
2019	6	3	292	10.273973	Intercept + Linear	9.917139
2019	7	4	579	6.908463	Intercept + Linear	9.749613
2019	8	2	288	6.944444	Intercept + Linear	9.579474
2019	9	6	406	14.778325	Intercept + Linear	9.412305
2019	10	4	322	12.422360	Intercept + Linear	9.253306
2019	11	4	668	5.988024	Intercept + Linear	9.091828

Paediatric non-environmental BSI at QEUH, 06/2015-02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2019	12	1	623	1.605136	Intercept + Linear	8.938243
2020	1	4	501	7.984032	Intercept + Linear	8.782264
2020	2	8	424	18.867925	Intercept + Linear	8.629421
2020	3	2	431	4.640371	Intercept + Linear	8.488849
2020	4	2	192	10.416667	Intercept + Linear	8.341113
2020	5	2	277	7.220217	Intercept + Linear	8.200591
2020	6	2	250	8.000000	Intercept + Linear	8.057872
2020	7	2	483	4.140787	Intercept + Linear	7.922122
2020	8	6	335	17.910448	Intercept + Linear	7.784249
2020	9	3	438	6.849315	Intercept + Linear	7.648776
2020	10	1	300	3.333333	Intercept + Linear	7.519918
2020	11	3	379	7.915567	Intercept + Linear	7.389044
2020	12	4	380	10.526316	Intercept + Linear	7.264562
2021	1	1	390	2.564103	Intercept + Linear	7.138133
2021	2	1	316	3.164557	Intercept + Linear	7.013567
2021	3	2	557	3.590664	Intercept + Linear	6.902925
2021	4	2	444	4.504505	Intercept + Linear	6.782463
2021	5	4	501	7.984032	Intercept + Linear	6.667890
2021	6	3	349	8.595989	Intercept + Linear	6.551530
2021	7	1	527	1.897533	Intercept + Linear	6.440857
2021	8	3	533	5.628518	Intercept + Linear	6.328459
2021	9	3	511	5.870842	Intercept + Linear	6.218022
2021	10	3	325	9.230769	Intercept + Linear	6.112983

Paediatric non-environmental BSI at QEUH, 06/2015-02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2021	11	4	376	10.638298	Intercept + Linear	6.006307
2021	12	1	350	2.857143	Intercept + Linear	5.904845
2022	1	2	390	5.128205	Intercept + Linear	5.801800
2022	2	0	157	0.000000	Intercept + Linear	5.700554
2015	6	10	487	20.533881	Intercept + Linear + Smooth	14.530379
2015	7	7	386	18.134715	Intercept + Linear + Smooth	14.761519
2015	8	7	621	11.272142	Intercept + Linear + Smooth	15.005542
2015	9	5	481	10.395010	Intercept + Linear + Smooth	15.255925
2015	10	10	530	18.867925	Intercept + Linear + Smooth	15.505305
2015	11	8	791	10.113780	Intercept + Linear + Smooth	15.771325
2015	12	6	501	11.976048	Intercept + Linear + Smooth	16.037249
2016	1	11	435	25.287356	Intercept + Linear + Smooth	16.320931
2016	2	6	550	10.909091	Intercept + Linear + Smooth	16.612650
2016	3	10	364	27.472528	Intercept + Linear + Smooth	16.893104
2016	4	9	664	13.554217	Intercept + Linear + Smooth	17.200561
2016	5	9	801	11.235955	Intercept + Linear + Smooth	17.505274
2016	6	5	549	9.107468	Intercept + Linear + Smooth	17.826033
2016	7	20	563	35.523979	Intercept + Linear + Smooth	18.138481
2016	8	5	565	8.849557	Intercept + Linear + Smooth	18.458861
2016	9	9	546	16.483517	Intercept + Linear + Smooth	18.770989
2016	10	5	428	11.682243	Intercept + Linear + Smooth	19.058623
2016	11	13	879	14.789534	Intercept + Linear + Smooth	19.330389
2016	12	10	640	15.625000	Intercept + Linear + Smooth	19.556923

Paediatric non-environmental BSI at QEUH, 06/2015-02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2017	1	17	867	19.607843	Intercept + Linear + Smooth	19.738038
2017	2	19	599	31.719533	Intercept + Linear + Smooth	19.848887
2017	3	22	648	33.950617	Intercept + Linear + Smooth	19.878600
2017	4	23	983	23.397762	Intercept + Linear + Smooth	19.827686
2017	5	19	838	22.673031	Intercept + Linear + Smooth	19.694807
2017	6	21	632	33.227848	Intercept + Linear + Smooth	19.479218
2017	7	5	658	7.598784	Intercept + Linear + Smooth	19.204699
2017	8	14	617	22.690438	Intercept + Linear + Smooth	18.865643
2017	9	11	779	14.120667	Intercept + Linear + Smooth	18.482725
2017	10	12	624	19.230769	Intercept + Linear + Smooth	18.080115
2017	11	14	608	23.026316	Intercept + Linear + Smooth	17.640075
2017	12	14	664	21.084337	Intercept + Linear + Smooth	17.198609
2018	1	10	792	12.626263	Intercept + Linear + Smooth	16.733416
2018	2	6	525	11.428571	Intercept + Linear + Smooth	16.265091
2018	3	16	534	29.962547	Intercept + Linear + Smooth	15.843747
2018	4	7	426	16.431925	Intercept + Linear + Smooth	15.383169
2018	5	8	764	10.471204	Intercept + Linear + Smooth	14.946750
2018	6	6	526	11.406844	Intercept + Linear + Smooth	14.508132
2018	7	2	461	4.338395	Intercept + Linear + Smooth	14.097309
2018	8	7	576	12.152778	Intercept + Linear + Smooth	13.687918
2018	9	7	461	15.184382	Intercept + Linear + Smooth	13.293809
2018	10	4	733	5.457026	Intercept + Linear + Smooth	12.926604
2018	11	8	692	11.560694	Intercept + Linear + Smooth	12.561045

Paediatric non-environmental BSI at QEUH, 06/2015-02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2018	12	12	436	27.522936	Intercept + Linear + Smooth	12.219953
2019	1	2	394	5.076142	Intercept + Linear + Smooth	11.879914
2019	2	6	575	10.434783	Intercept + Linear + Smooth	11.551889
2019	3	7	440	15.909091	Intercept + Linear + Smooth	11.265513
2019	4	4	605	6.611570	Intercept + Linear + Smooth	10.959013
2019	5	7	529	13.232514	Intercept + Linear + Smooth	10.672560
2019	6	3	292	10.273973	Intercept + Linear + Smooth	10.386632
2019	7	4	579	6.908463	Intercept + Linear + Smooth	10.119268
2019	8	2	288	6.944444	Intercept + Linear + Smooth	9.852210
2019	9	6	406	14.778325	Intercept + Linear + Smooth	9.594094
2019	10	4	322	12.422360	Intercept + Linear + Smooth	9.352425
2019	11	4	668	5.988024	Intercept + Linear + Smooth	9.110703
2019	12	1	623	1.605136	Intercept + Linear + Smooth	8.884175
2020	1	4	501	7.984032	Intercept + Linear + Smooth	8.657377
2020	2	8	424	18.867925	Intercept + Linear + Smooth	8.438141
2020	3	2	431	4.640371	Intercept + Linear + Smooth	8.238948
2020	4	2	192	10.416667	Intercept + Linear + Smooth	8.032004
2020	5	2	277	7.220217	Intercept + Linear + Smooth	7.837357
2020	6	2	250	8.000000	Intercept + Linear + Smooth	7.641774
2020	7	2	483	4.140787	Intercept + Linear + Smooth	7.457646
2020	8	6	335	17.910448	Intercept + Linear + Smooth	7.272485
2020	9	3	438	6.849315	Intercept + Linear + Smooth	7.092318
2020	10	1	300	3.333333	Intercept + Linear + Smooth	6.922557

Paediatric non-environmental BSI at QEUH, 06/2015-02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2020	11	3	379	7.915567	Intercept + Linear + Smooth	6.751756
2020	12	4	380	10.526316	Intercept + Linear + Smooth	6.590814
2021	1	1	390	2.564103	Intercept + Linear + Smooth	6.428889
2021	2	1	316	3.164557	Intercept + Linear + Smooth	6.270875
2021	3	2	557	3.590664	Intercept + Linear + Smooth	6.131786
2021	4	2	444	4.504505	Intercept + Linear + Smooth	5.981685
2021	5	4	501	7.984032	Intercept + Linear + Smooth	5.840174
2021	6	3	349	8.595989	Intercept + Linear + Smooth	5.697658
2021	7	1	527	1.897533	Intercept + Linear + Smooth	5.563191
2021	8	3	533	5.628518	Intercept + Linear + Smooth	5.427673
2021	9	3	511	5.870842	Intercept + Linear + Smooth	5.295509
2021	10	3	325	9.230769	Intercept + Linear + Smooth	5.170679
2021	11	4	376	10.638298	Intercept + Linear + Smooth	5.044753
2021	12	1	350	2.857143	Intercept + Linear + Smooth	4.925778
2022	1	2	390	5.128205	Intercept + Linear + Smooth	4.805753
2022	2	0	157	0.000000	Intercept + Linear + Smooth	4.688633

Response document

Question 1a: What was the overall rate of Aspergillus infection amongst paediatric haemato-oncology patients at Yorkhill over the whole period from January 2008 to May 2015?

We can get a point estimate of the rate by dividing the total number of aspergillus by the total number of beddays. The rate per bedday is small, so we consider rates by 1000 beddays, a common practice in the literature.

```
[1] 0.3487179
```

Question 1b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

Model summary

```
Family: Negative Binomial(3811740.796)
Link function: log

Formula:
asp ~ decyear2 + offset(log(beddays)) + s(decyear2, bs = "ad",
    k = 40, xt = list(bs = "ps"))

Parametric coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  -9.5708     1.9530  -4.901 9.55e-07 ***
decyear2     -0.3344     0.4260  -0.785    0.432
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
              edf Ref.df Chi.sq p-value
s(decyear2) 2.416  3.236  4.872   0.172

Rank: 40/41
R-sq.(adj) =  0.0779   Deviance explained = 17.8%
-REML = 45.287  Scale est. = 1         n = 89
```

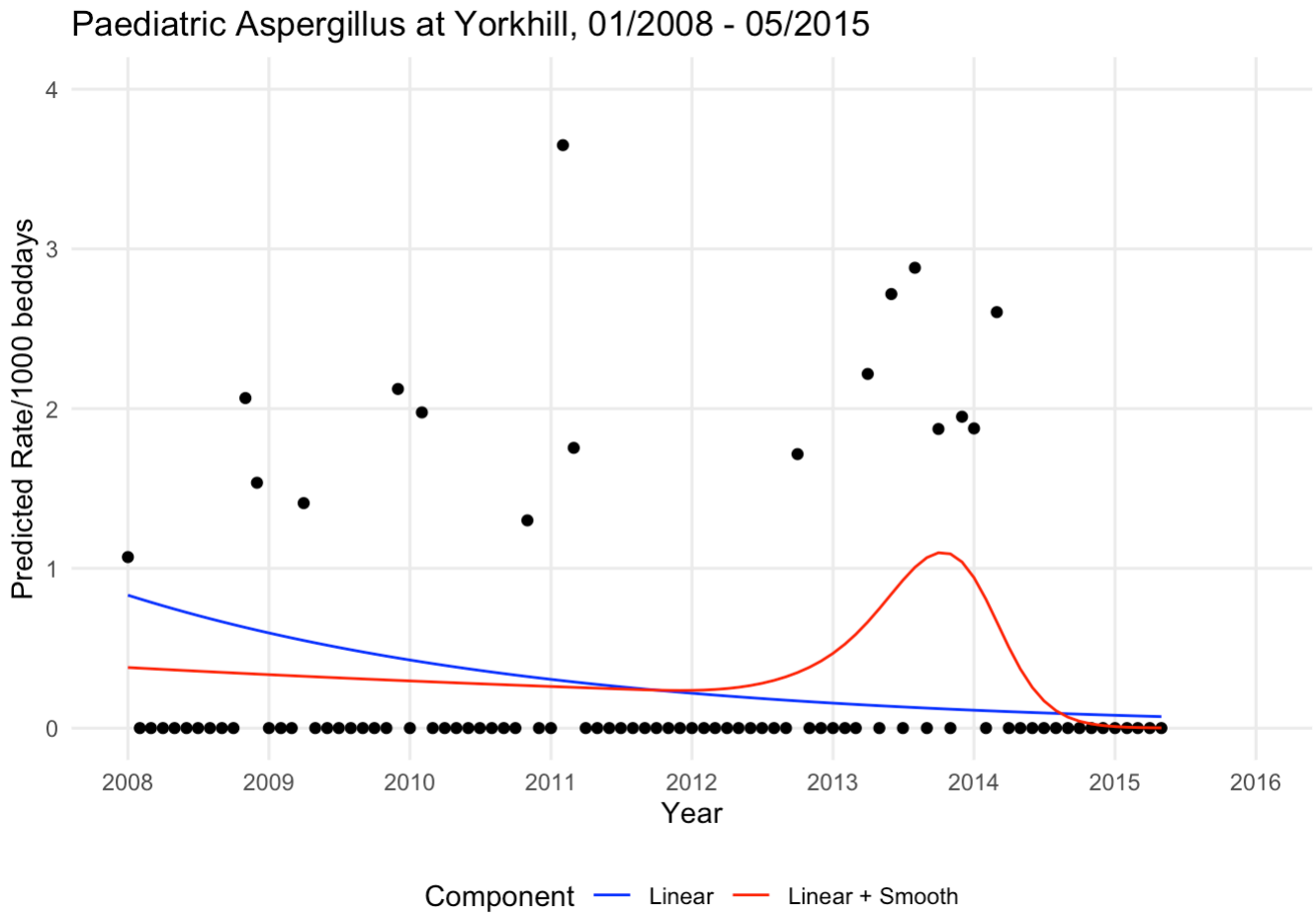
First and last timepoints

Paediatric Aspergillus at Yorkhill, 01/2008 - 05/2015

Year	Month	Fit/1000 bed days	Observed Rate
2008	1	0.379346650675025	1.07066380977631
...	...	...	...

Year	Month	Fit/1000 bed days	Observed Rate
2015	5	0.00125075778138357	0

Plot



Raw data and fits

Paediatric Aspergillus at Yorkhill, 01/2008-05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2008	1	1	934	1.070664	Intercept + Linear	0.8319837
2008	2	0	439	0.000000	Intercept + Linear	0.8087503
2008	3	0	953	0.000000	Intercept + Linear	0.7876035
2008	4	0	585	0.000000	Intercept + Linear	0.7656095
2008	5	0	379	0.000000	Intercept + Linear	0.7449098
2008	6	0	746	0.000000	Intercept + Linear	0.7241080
2008	7	0	767	0.000000	Intercept + Linear	0.7045304
2008	8	0	537	0.000000	Intercept + Linear	0.6848562
2008	9	0	646	0.000000	Intercept + Linear	0.6657314
2008	10	0	535	0.000000	Intercept + Linear	0.6477321
2008	11	1	484	2.066116	Intercept + Linear	0.6296440

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2008	12	1	651	1.536098	Intercept + Linear	0.6126204
2009	1	0	633	0.000000	Intercept + Linear	0.5955128
2009	2	0	381	0.000000	Intercept + Linear	0.5788380
2009	3	0	799	0.000000	Intercept + Linear	0.5641786
2009	4	1	710	1.408451	Intercept + Linear	0.5483811
2009	5	0	583	0.000000	Intercept + Linear	0.5335146
2009	6	0	590	0.000000	Intercept + Linear	0.5185758
2009	7	0	778	0.000000	Intercept + Linear	0.5045173
2009	8	0	449	0.000000	Intercept + Linear	0.4903904
2009	9	0	638	0.000000	Intercept + Linear	0.4766591
2009	10	0	802	0.000000	Intercept + Linear	0.4637370
2009	11	0	465	0.000000	Intercept + Linear	0.4507520
2009	12	1	471	2.123142	Intercept + Linear	0.4385322
2010	1	0	505	0.000000	Intercept + Linear	0.4262529
2010	2	1	506	1.976285	Intercept + Linear	0.4143175
2010	3	0	481	0.000000	Intercept + Linear	0.4038247
2010	4	0	517	0.000000	Intercept + Linear	0.3925173
2010	5	0	719	0.000000	Intercept + Linear	0.3818762
2010	6	0	516	0.000000	Intercept + Linear	0.3711834
2010	7	0	397	0.000000	Intercept + Linear	0.3611206
2010	8	0	891	0.000000	Intercept + Linear	0.3510090
2010	9	0	566	0.000000	Intercept + Linear	0.3411805
2010	10	0	493	0.000000	Intercept + Linear	0.3319311
2010	11	1	769	1.300390	Intercept + Linear	0.3226368
2010	12	0	724	0.000000	Intercept + Linear	0.3138902
2011	1	0	615	0.000000	Intercept + Linear	0.3051010
2011	2	1	274	3.649635	Intercept + Linear	0.2965579
2011	3	1	570	1.754386	Intercept + Linear	0.2890474
2011	4	0	428	0.000000	Intercept + Linear	0.2809539
2011	5	0	562	0.000000	Intercept + Linear	0.2733373
2011	6	0	392	0.000000	Intercept + Linear	0.2656836
2011	7	0	453	0.000000	Intercept + Linear	0.2584810
2011	8	0	399	0.000000	Intercept + Linear	0.2512433
2011	9	0	505	0.000000	Intercept + Linear	0.2442083
2011	10	0	392	0.000000	Intercept + Linear	0.2375879
2011	11	0	479	0.000000	Intercept + Linear	0.2309352
2011	12	0	402	0.000000	Intercept + Linear	0.2246746

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2012	1	0	670	0.000000	Intercept + Linear	0.2183835
2012	2	0	566	0.000000	Intercept + Linear	0.2122851
2012	3	0	954	0.000000	Intercept + Linear	0.2067344
2012	4	0	490	0.000000	Intercept + Linear	0.2009613
2012	5	0	994	0.000000	Intercept + Linear	0.1955279
2012	6	0	389	0.000000	Intercept + Linear	0.1900677
2012	7	0	492	0.000000	Intercept + Linear	0.1849289
2012	8	0	312	0.000000	Intercept + Linear	0.1797647
2012	9	0	542	0.000000	Intercept + Linear	0.1747447
2012	10	1	583	1.715266	Intercept + Linear	0.1700202
2012	11	0	467	0.000000	Intercept + Linear	0.1652723
2012	12	0	533	0.000000	Intercept + Linear	0.1608039
2013	1	0	434	0.000000	Intercept + Linear	0.1563134
2013	2	0	613	0.000000	Intercept + Linear	0.1519365
2013	3	0	560	0.000000	Intercept + Linear	0.1480886
2013	4	1	451	2.217295	Intercept + Linear	0.1439420
2013	5	0	552	0.000000	Intercept + Linear	0.1400398
2013	6	1	368	2.717391	Intercept + Linear	0.1361186
2013	7	0	244	0.000000	Intercept + Linear	0.1324284
2013	8	1	347	2.881844	Intercept + Linear	0.1287203
2013	9	0	357	0.000000	Intercept + Linear	0.1251160
2013	10	1	534	1.872659	Intercept + Linear	0.1217242
2013	11	0	509	0.000000	Intercept + Linear	0.1183158
2013	12	1	513	1.949318	Intercept + Linear	0.1151083
2014	1	1	533	1.876173	Intercept + Linear	0.1118852
2014	2	0	670	0.000000	Intercept + Linear	0.1087523
2014	3	1	384	2.604167	Intercept + Linear	0.1059981
2014	4	0	465	0.000000	Intercept + Linear	0.1030300
2014	5	0	560	0.000000	Intercept + Linear	0.1002369
2014	6	0	517	0.000000	Intercept + Linear	0.0974302
2014	7	0	360	0.000000	Intercept + Linear	0.0947889
2014	8	0	743	0.000000	Intercept + Linear	0.0921347
2014	9	0	348	0.000000	Intercept + Linear	0.0895549
2014	10	0	529	0.000000	Intercept + Linear	0.0871271
2014	11	0	519	0.000000	Intercept + Linear	0.0846874
2014	12	0	509	0.000000	Intercept + Linear	0.0823916
2015	1	0	730	0.000000	Intercept + Linear	0.0800845

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2015	2	0	436	0.000000	Intercept + Linear	0.0778421
2015	3	0	525	0.000000	Intercept + Linear	0.0758707
2015	4	0	591	0.000000	Intercept + Linear	0.0737463
2015	5	0	347	0.000000	Intercept + Linear	0.0717470
2008	1	1	934	1.070664	Intercept + Linear + Smooth	0.3793467
2008	2	0	439	0.000000	Intercept + Linear + Smooth	0.3753441
2008	3	0	953	0.000000	Intercept + Linear + Smooth	0.3716381
2008	4	0	585	0.000000	Intercept + Linear + Smooth	0.3677169
2008	5	0	379	0.000000	Intercept + Linear + Smooth	0.3639617
2008	6	0	746	0.000000	Intercept + Linear + Smooth	0.3601215
2008	7	0	767	0.000000	Intercept + Linear + Smooth	0.3564438
2008	8	0	537	0.000000	Intercept + Linear + Smooth	0.3526829
2008	9	0	646	0.000000	Intercept + Linear + Smooth	0.3489617
2008	10	0	535	0.000000	Intercept + Linear + Smooth	0.3453980
2008	11	1	484	2.066116	Intercept + Linear + Smooth	0.3417537
2008	12	1	651	1.536098	Intercept + Linear + Smooth	0.3382635
2009	1	0	633	0.000000	Intercept + Linear + Smooth	0.3346945
2009	2	0	381	0.000000	Intercept + Linear + Smooth	0.3311535
2009	3	0	799	0.000000	Intercept + Linear + Smooth	0.3279874
2009	4	1	710	1.408451	Intercept + Linear + Smooth	0.3245174
2009	5	0	583	0.000000	Intercept + Linear + Smooth	0.3211942
2009	6	0	590	0.000000	Intercept + Linear + Smooth	0.3177960
2009	7	0	778	0.000000	Intercept + Linear + Smooth	0.3145417
2009	8	0	449	0.000000	Intercept + Linear + Smooth	0.3112139
2009	9	0	638	0.000000	Intercept + Linear + Smooth	0.3079214
2009	10	0	802	0.000000	Intercept + Linear + Smooth	0.3047682
2009	11	0	465	0.000000	Intercept + Linear + Smooth	0.3015438
2009	12	1	471	2.123142	Intercept + Linear + Smooth	0.2984559
2010	1	0	505	0.000000	Intercept + Linear + Smooth	0.2952983
2010	2	1	506	1.976285	Intercept + Linear + Smooth	0.2921741
2010	3	0	481	0.000000	Intercept + Linear + Smooth	0.2893807
2010	4	0	517	0.000000	Intercept + Linear + Smooth	0.2863191
2010	5	0	719	0.000000	Intercept + Linear + Smooth	0.2833871
2010	6	0	516	0.000000	Intercept + Linear + Smooth	0.2803889
2010	7	0	397	0.000000	Intercept + Linear + Smooth	0.2775177
2010	8	0	891	0.000000	Intercept + Linear + Smooth	0.2745816
2010	9	0	566	0.000000	Intercept + Linear + Smooth	0.2716766

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2010	10	0	493	0.000000	Intercept + Linear + Smooth	0.2688945
2010	11	1	769	1.300390	Intercept + Linear + Smooth	0.2660497
2010	12	0	724	0.000000	Intercept + Linear + Smooth	0.2633252
2011	1	0	615	0.000000	Intercept + Linear + Smooth	0.2605393
2011	2	1	274	3.649635	Intercept + Linear + Smooth	0.2577829
2011	3	1	570	1.754386	Intercept + Linear + Smooth	0.2553182
2011	4	0	428	0.000000	Intercept + Linear + Smooth	0.2526170
2011	5	0	562	0.000000	Intercept + Linear + Smooth	0.2500301
2011	6	0	392	0.000000	Intercept + Linear + Smooth	0.2473849
2011	7	0	453	0.000000	Intercept + Linear + Smooth	0.2448516
2011	8	0	399	0.000000	Intercept + Linear + Smooth	0.2422614
2011	9	0	505	0.000000	Intercept + Linear + Smooth	0.2397790
2011	10	0	392	0.000000	Intercept + Linear + Smooth	0.2377245
2011	11	0	479	0.000000	Intercept + Linear + Smooth	0.2362322
2011	12	0	402	0.000000	Intercept + Linear + Smooth	0.2356547
2012	1	0	670	0.000000	Intercept + Linear + Smooth	0.2362265
2012	2	0	566	0.000000	Intercept + Linear + Smooth	0.2382678
2012	3	0	954	0.000000	Intercept + Linear + Smooth	0.2417880
2012	4	0	490	0.000000	Intercept + Linear + Smooth	0.2476040
2012	5	0	994	0.000000	Intercept + Linear + Smooth	0.2555825
2012	6	0	389	0.000000	Intercept + Linear + Smooth	0.2666741
2012	7	0	492	0.000000	Intercept + Linear + Smooth	0.2805727
2012	8	0	312	0.000000	Intercept + Linear + Smooth	0.2986890
2012	9	0	542	0.000000	Intercept + Linear + Smooth	0.3212001
2012	10	1	583	1.715266	Intercept + Linear + Smooth	0.3477681
2012	11	0	467	0.000000	Intercept + Linear + Smooth	0.3809493
2012	12	0	533	0.000000	Intercept + Linear + Smooth	0.4196445
2013	1	0	434	0.000000	Intercept + Linear + Smooth	0.4678117
2013	2	0	613	0.000000	Intercept + Linear + Smooth	0.5256631
2013	3	0	560	0.000000	Intercept + Linear + Smooth	0.5868091
2013	4	1	451	2.217295	Intercept + Linear + Smooth	0.6644820
2013	5	0	552	0.000000	Intercept + Linear + Smooth	0.7478883
2013	6	1	368	2.717391	Intercept + Linear + Smooth	0.8389302
2013	7	0	244	0.000000	Intercept + Linear + Smooth	0.9259935
2013	8	1	347	2.881844	Intercept + Linear + Smooth	1.0065231
2013	9	0	357	0.000000	Intercept + Linear + Smooth	1.0673851
2013	10	1	534	1.872659	Intercept + Linear + Smooth	1.0977759

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2013	11	0	509	0.000000	Intercept + Linear + Smooth	1.0907054
2013	12	1	513	1.949318	Intercept + Linear + Smooth	1.0400961
2014	1	1	533	1.876173	Intercept + Linear + Smooth	0.9418886
2014	2	0	670	0.000000	Intercept + Linear + Smooth	0.8061275
2014	3	1	384	2.604167	Intercept + Linear + Smooth	0.6649147
2014	4	0	465	0.000000	Intercept + Linear + Smooth	0.5068177
2014	5	0	560	0.000000	Intercept + Linear + Smooth	0.3697046
2014	6	0	517	0.000000	Intercept + Linear + Smooth	0.2544875
2014	7	0	360	0.000000	Intercept + Linear + Smooth	0.1706532
2014	8	0	743	0.000000	Intercept + Linear + Smooth	0.1094771
2014	9	0	348	0.000000	Intercept + Linear + Smooth	0.0685442
2014	10	0	529	0.000000	Intercept + Linear + Smooth	0.0427967
2014	11	0	519	0.000000	Intercept + Linear + Smooth	0.0259514
2014	12	0	509	0.000000	Intercept + Linear + Smooth	0.0158420
2015	1	0	730	0.000000	Intercept + Linear + Smooth	0.0094528
2015	2	0	436	0.000000	Intercept + Linear + Smooth	0.0056179
2015	3	0	525	0.000000	Intercept + Linear + Smooth	0.0035045
2015	4	0	591	0.000000	Intercept + Linear + Smooth	0.0020765
2015	5	0	347	0.000000	Intercept + Linear + Smooth	0.0012508

Question 2a: What was the overall rate of Aspergillus infection amongst paediatric haemato-oncology patients at the RHC over the whole period from June 2015 to February 2022?

```
[1] 0.7132498
```

Question 2b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

Model summary

```
Family: Negative Binomial(22579.93)
Link function: log

Formula:
asp ~ decyear2 + offset(log(beddays)) + s(decyear2, bs = "ad",
    k = 40, xt = list(bs = "ps"))
```

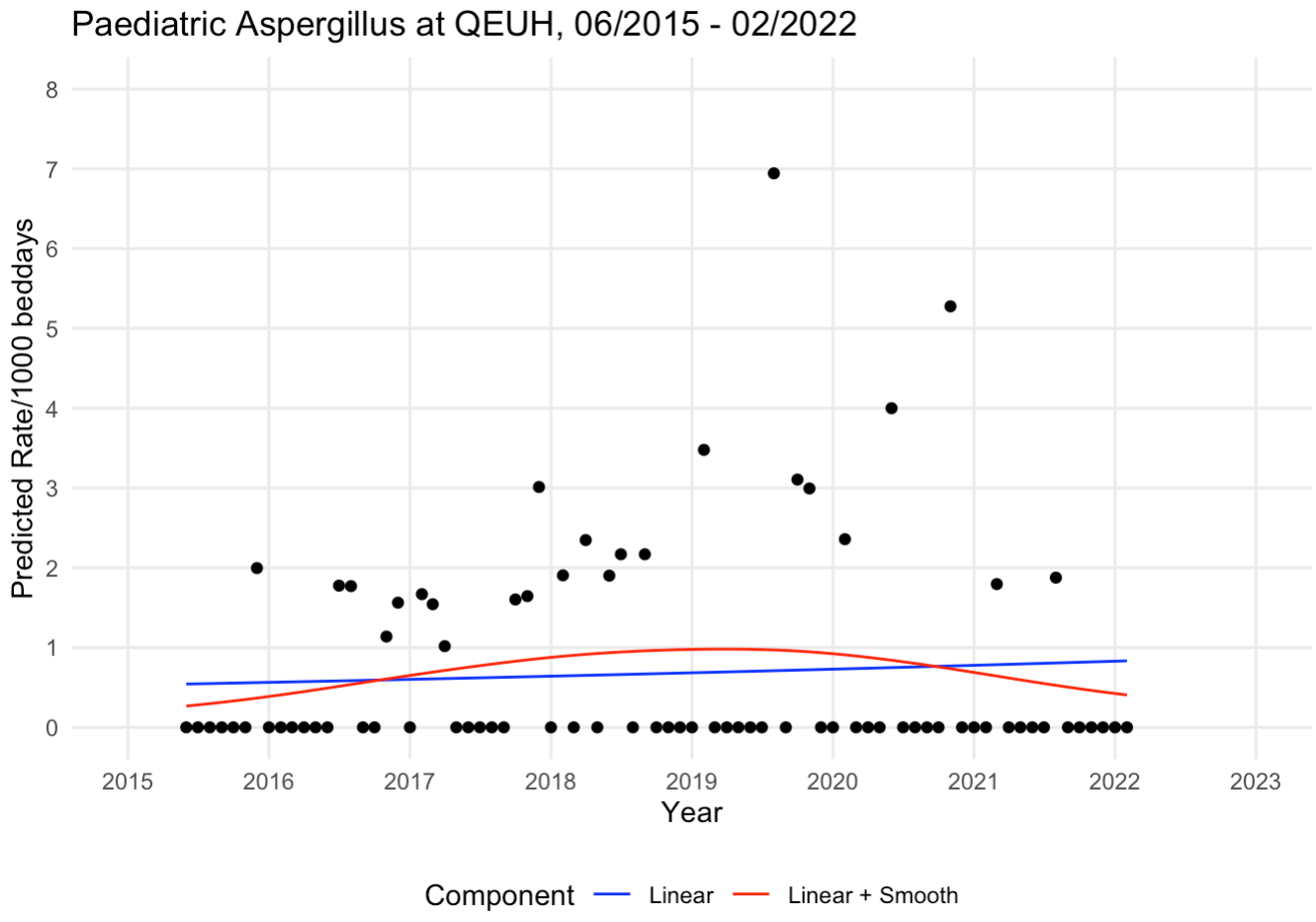
```
Parametric coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept) -7.51811    0.43567 -17.257   <2e-16 ***
decyear2     0.06413    0.11935   0.537    0.591
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
              edf Ref.df Chi.sq p-value
s(decyear2) 1.234  1.841  3.063   0.175

Rank: 40/41
R-sq.(adj) =  0.00755   Deviance explained = 6.85%
-REML = 63.443  Scale est. = 1         n = 81
```

First and last timepoints

Paediatric Aspergillus at QEUH, 06/2015 - 02/2022

Year	Month	Fit/1000 bed days	Observed Rate
2015	6	0.267270774122729	0
...	...	...	...
2022	2	0.40613039893815	0

Plot



Raw data and fits

Paediatric Aspergillus at QEUH, 06/2015 - 02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2015	6	0	487	0.000000	Intercept + Linear	0.5431598
2015	7	0	386	0.000000	Intercept + Linear	0.5460303
2015	8	0	621	0.000000	Intercept + Linear	0.5490124
2015	9	0	481	0.000000	Intercept + Linear	0.5520108
2015	10	0	530	0.000000	Intercept + Linear	0.5549281
2015	11	0	791	0.000000	Intercept + Linear	0.5579588
2015	12	1	501	1.996008	Intercept + Linear	0.5609075
2016	1	0	435	0.000000	Intercept + Linear	0.5639709
2016	2	0	550	0.000000	Intercept + Linear	0.5670426
2016	3	0	364	0.000000	Intercept + Linear	0.5699312
2016	4	0	664	0.000000	Intercept + Linear	0.5730354
2016	5	0	801	0.000000	Intercept + Linear	0.5760554
2016	6	0	549	0.000000	Intercept + Linear	0.5791929
2016	7	1	563	1.776199	Intercept + Linear	0.5822455
2016	8	1	565	1.769912	Intercept + Linear	0.5854167
2016	9	0	546	0.000000	Intercept + Linear	0.5886052
2016	10	0	428	0.000000	Intercept + Linear	0.5917073
2016	11	1	879	1.137657	Intercept + Linear	0.5949300
2016	12	1	640	1.562500	Intercept + Linear	0.5980655
2017	1	0	867	0.000000	Intercept + Linear	0.6013229
2017	2	1	599	1.669449	Intercept + Linear	0.6046070
2017	3	1	648	1.543210	Intercept + Linear	0.6075887
2017	4	1	983	1.017294	Intercept + Linear	0.6109070
2017	5	0	838	0.000000	Intercept + Linear	0.6141356
2017	6	0	632	0.000000	Intercept + Linear	0.6174896
2017	7	0	658	0.000000	Intercept + Linear	0.6207530
2017	8	0	617	0.000000	Intercept + Linear	0.6241432
2017	9	0	779	0.000000	Intercept + Linear	0.6275519
2017	10	1	624	1.602564	Intercept + Linear	0.6308684
2017	11	1	608	1.644737	Intercept + Linear	0.6343139
2017	12	2	664	3.012048	Intercept + Linear	0.6376661
2018	1	0	792	0.000000	Intercept + Linear	0.6411487
2018	2	1	525	1.904762	Intercept + Linear	0.6446503
2018	3	0	534	0.000000	Intercept + Linear	0.6478295

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2018	4	1	426	2.347418	Intercept + Linear	0.6513676
2018	5	0	764	0.000000	Intercept + Linear	0.6548100
2018	6	1	526	1.901141	Intercept + Linear	0.6583862
2018	7	1	461	2.169197	Intercept + Linear	0.6618656
2018	8	0	576	0.000000	Intercept + Linear	0.6654804
2018	9	1	461	2.169197	Intercept + Linear	0.6691149
2018	10	0	733	0.000000	Intercept + Linear	0.6726511
2018	11	0	692	0.000000	Intercept + Linear	0.6763247
2018	12	0	436	0.000000	Intercept + Linear	0.6798990
2019	1	0	394	0.000000	Intercept + Linear	0.6836122
2019	2	2	575	3.478261	Intercept + Linear	0.6873457
2019	3	0	440	0.000000	Intercept + Linear	0.6907355
2019	4	0	605	0.000000	Intercept + Linear	0.6945079
2019	5	0	529	0.000000	Intercept + Linear	0.6981783
2019	6	0	292	0.000000	Intercept + Linear	0.7019913
2019	7	0	579	0.000000	Intercept + Linear	0.7057012
2019	8	2	288	6.944445	Intercept + Linear	0.7095554
2019	9	0	406	0.000000	Intercept + Linear	0.7134306
2019	10	1	322	3.105590	Intercept + Linear	0.7172010
2019	11	2	668	2.994012	Intercept + Linear	0.7211179
2019	12	0	623	0.000000	Intercept + Linear	0.7249289
2020	1	0	501	0.000000	Intercept + Linear	0.7288881
2020	2	1	424	2.358490	Intercept + Linear	0.7328580
2020	3	0	431	0.000000	Intercept + Linear	0.7365913
2020	4	0	192	0.000000	Intercept + Linear	0.7406032
2020	5	0	277	0.000000	Intercept + Linear	0.7445064
2020	6	1	250	4.000000	Intercept + Linear	0.7485614
2020	7	0	483	0.000000	Intercept + Linear	0.7525065
2020	8	0	335	0.000000	Intercept + Linear	0.7566051
2020	9	0	438	0.000000	Intercept + Linear	0.7607259
2020	10	0	300	0.000000	Intercept + Linear	0.7647352
2020	11	2	379	5.277045	Intercept + Linear	0.7689003
2020	12	0	380	0.000000	Intercept + Linear	0.7729527
2021	1	0	390	0.000000	Intercept + Linear	0.7771626
2021	2	0	316	0.000000	Intercept + Linear	0.7814070
2021	3	1	557	1.795332	Intercept + Linear	0.7852607
2021	4	0	444	0.000000	Intercept + Linear	0.7895493

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2021	5	0	501	0.000000	Intercept + Linear	0.7937220
2021	6	0	349	0.000000	Intercept + Linear	0.7980568
2021	7	0	527	0.000000	Intercept + Linear	0.8022744
2021	8	1	533	1.876173	Intercept + Linear	0.8066560
2021	9	0	511	0.000000	Intercept + Linear	0.8110616
2021	10	0	325	0.000000	Intercept + Linear	0.8153479
2021	11	0	376	0.000000	Intercept + Linear	0.8198009
2021	12	0	350	0.000000	Intercept + Linear	0.8241334
2022	1	0	390	0.000000	Intercept + Linear	0.8286343
2022	2	0	157	0.000000	Intercept + Linear	0.8331599
2015	6	0	487	0.000000	Intercept + Linear + Smooth	0.2672708
2015	7	0	386	0.000000	Intercept + Linear + Smooth	0.2817258
2015	8	0	621	0.000000	Intercept + Linear + Smooth	0.2974575
2015	9	0	481	0.000000	Intercept + Linear + Smooth	0.3140139
2015	10	0	530	0.000000	Intercept + Linear + Smooth	0.3308180
2015	11	0	791	0.000000	Intercept + Linear + Smooth	0.3489726
2015	12	1	501	1.996008	Intercept + Linear + Smooth	0.3672800
2016	1	0	435	0.000000	Intercept + Linear + Smooth	0.3869230
2016	2	0	550	0.000000	Intercept + Linear + Smooth	0.4072144
2016	3	0	364	0.000000	Intercept + Linear + Smooth	0.4268067
2016	4	0	664	0.000000	Intercept + Linear + Smooth	0.4483573
2016	5	0	801	0.000000	Intercept + Linear + Smooth	0.4697424
2016	6	0	549	0.000000	Intercept + Linear + Smooth	0.4922925
2016	7	1	563	1.776199	Intercept + Linear + Smooth	0.5144279
2016	8	1	565	1.769912	Intercept + Linear + Smooth	0.5374852
2016	9	0	546	0.000000	Intercept + Linear + Smooth	0.5606130
2016	10	0	428	0.000000	Intercept + Linear + Smooth	0.5829522
2016	11	1	879	1.137657	Intercept + Linear + Smooth	0.6058895
2016	12	1	640	1.562500	Intercept + Linear + Smooth	0.6278505
2017	1	0	867	0.000000	Intercept + Linear + Smooth	0.6502196
2017	2	1	599	1.669449	Intercept + Linear + Smooth	0.6722516
2017	3	1	648	1.543210	Intercept + Linear + Smooth	0.6917717
2017	4	1	983	1.017294	Intercept + Linear + Smooth	0.7129433
2017	5	0	838	0.000000	Intercept + Linear + Smooth	0.7329894
2017	6	0	632	0.000000	Intercept + Linear + Smooth	0.7532653
2017	7	0	658	0.000000	Intercept + Linear + Smooth	0.7724660
2017	8	0	617	0.000000	Intercept + Linear + Smooth	0.7918245

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2017	9	0	779	0.000000	Intercept + Linear + Smooth	0.8106209
2017	10	1	624	1.602564	Intercept + Linear + Smooth	0.8281502
2017	11	1	608	1.644737	Intercept + Linear + Smooth	0.8454403
2017	12	2	664	3.012048	Intercept + Linear + Smooth	0.8612669
2018	1	0	792	0.000000	Intercept + Linear + Smooth	0.8765871
2018	2	1	525	1.904762	Intercept + Linear + Smooth	0.8908117
2018	3	0	534	0.000000	Intercept + Linear + Smooth	0.9027077
2018	4	1	426	2.347418	Intercept + Linear + Smooth	0.9148204
2018	5	0	764	0.000000	Intercept + Linear + Smooth	0.9254869
2018	6	1	526	1.901141	Intercept + Linear + Smooth	0.9354278
2018	7	1	461	2.169197	Intercept + Linear + Smooth	0.9440168
2018	8	0	576	0.000000	Intercept + Linear + Smooth	0.9518556
2018	9	1	461	2.169197	Intercept + Linear + Smooth	0.9586932
2018	10	0	733	0.000000	Intercept + Linear + Smooth	0.9644084
2018	11	0	692	0.000000	Intercept + Linear + Smooth	0.9694209
2018	12	0	436	0.000000	Intercept + Linear + Smooth	0.9734326
2019	1	0	394	0.000000	Intercept + Linear + Smooth	0.9766767
2019	2	2	575	3.478261	Intercept + Linear + Smooth	0.9789509
2019	3	0	440	0.000000	Intercept + Linear + Smooth	0.9801308
2019	4	0	605	0.000000	Intercept + Linear + Smooth	0.9804266
2019	5	0	529	0.000000	Intercept + Linear + Smooth	0.9796439
2019	6	0	292	0.000000	Intercept + Linear + Smooth	0.9776535
2019	7	0	579	0.000000	Intercept + Linear + Smooth	0.9744817
2019	8	2	288	6.944445	Intercept + Linear + Smooth	0.9697701
2019	9	0	406	0.000000	Intercept + Linear + Smooth	0.9634742
2019	10	1	322	3.105590	Intercept + Linear + Smooth	0.9557971
2019	11	2	668	2.994012	Intercept + Linear + Smooth	0.9461878
2019	12	0	623	0.000000	Intercept + Linear + Smooth	0.9353123
2020	1	0	501	0.000000	Intercept + Linear + Smooth	0.9225203
2020	2	1	424	2.358490	Intercept + Linear + Smooth	0.9082905
2020	3	0	431	0.000000	Intercept + Linear + Smooth	0.8937454
2020	4	0	192	0.000000	Intercept + Linear + Smooth	0.8769783
2020	5	0	277	0.000000	Intercept + Linear + Smooth	0.8596478
2020	6	1	250	4.000000	Intercept + Linear + Smooth	0.8406953
2020	7	0	483	0.000000	Intercept + Linear + Smooth	0.8214332
2020	8	0	335	0.000000	Intercept + Linear + Smooth	0.8006719
2020	9	0	438	0.000000	Intercept + Linear + Smooth	0.7791351

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2020	10	0	300	0.000000	Intercept + Linear + Smooth	0.7576361
2020	11	2	379	5.277045	Intercept + Linear + Smooth	0.7348059
2020	12	0	380	0.000000	Intercept + Linear + Smooth	0.7121978
2021	1	0	390	0.000000	Intercept + Linear + Smooth	0.6884475
2021	2	0	316	0.000000	Intercept + Linear + Smooth	0.6643882
2021	3	1	557	1.795332	Intercept + Linear + Smooth	0.6425769
2021	4	0	444	0.000000	Intercept + Linear + Smooth	0.6184764
2021	5	0	501	0.000000	Intercept + Linear + Smooth	0.5953346
2021	6	0	349	0.000000	Intercept + Linear + Smooth	0.5717418
2021	7	0	527	0.000000	Intercept + Linear + Smooth	0.5493172
2021	8	1	533	1.876173	Intercept + Linear + Smooth	0.5266409
2021	9	0	511	0.000000	Intercept + Linear + Smooth	0.5045442
2021	10	0	325	0.000000	Intercept + Linear + Smooth	0.4837870
2021	11	0	376	0.000000	Intercept + Linear + Smooth	0.4630488
2021	12	0	350	0.000000	Intercept + Linear + Smooth	0.4437134
2022	1	0	390	0.000000	Intercept + Linear + Smooth	0.4245218
2022	2	0	157	0.000000	Intercept + Linear + Smooth	0.4061304

Supplementary information

We can also fit a single model to the entire time series, and test whether there is a discontinuity in June 2015.

```
Family: Negative Binomial(222360.389)
Link function: log

Formula:
asp ~ decyear2 + hosp + offset(log(beddays)) + s(decyear2, bs = "ad",
    k = 40, xt = list(bs = "ps"))

Parametric coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept) -7.79274    0.36581 -21.303   <2e-16 ***
decyear2     0.04394    0.07340   0.599    0.549
hospQEUH     0.41116    0.59048   0.696    0.486
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
                  edf    Ref.df Chi.sq p-value
s(decyear2) 2.097e-05 4.194e-05      0     0.5

Rank: 41/42
```

```
R-sq.(adj) =  0.00911   Deviance explained = 4.47%
-REML = 111.57  Scale est. = 1         n = 170
```

Question 3a: What was overall BSI incidence rate attributed to environmental microorganisms among paediatric haematology-oncology patients in Yorkhill for the whole period from January 2008 to May 2015?

```
[1] 4.020513
```

Question 3b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

Model summary

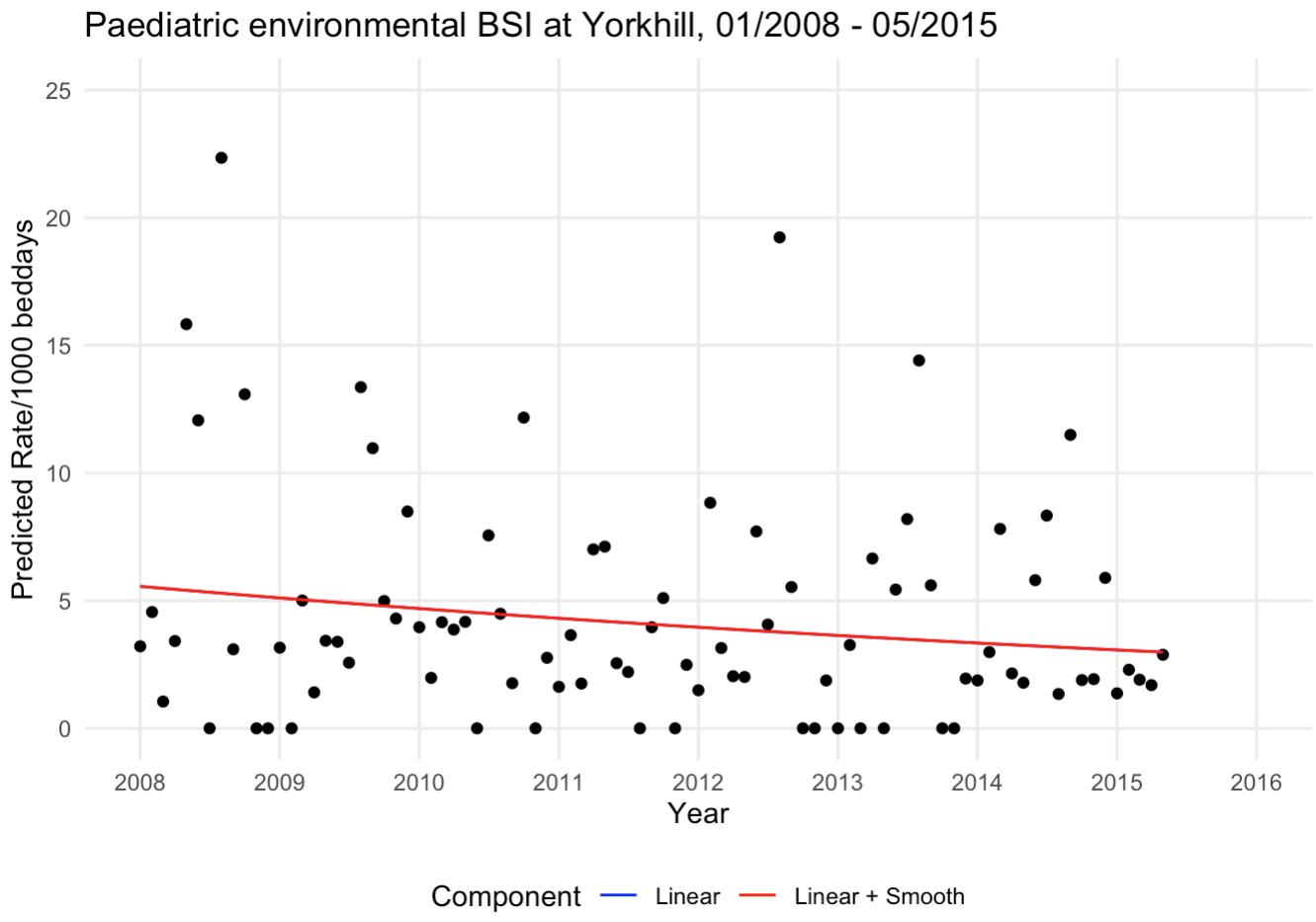
```
Family: Negative Binomial(2.276)
Link function: log

Formula:
env_bsi ~ decyear2 + offset(log(beddays)) + s(decyear2, bs = "ad",
    k = 40, xt = list(bs = "ps"))

Parametric coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept) -5.82114    0.21532  -27.04   <2e-16 ***
decyear2    -0.08484    0.04715   -1.80   0.0719 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
                  edf    Ref.df Chi.sq p-value
s(decyear2) 0.0002497 0.0004994      0   0.994

Rank: 40/41
R-sq.(adj) =  -0.0636   Deviance explained = 3.31%
-REML = 176.57  Scale est. = 1         n = 89
```

First and last timepoints

Paediatric environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Fit/1000 bed days	Observed Rate
2008	1	5.56021019650483	3.21199143468951
...	...	...	...
2015	5	2.98571110378286	2.88184438040346

Plot



Raw data and fits

Paediatric environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2008	1	3	934	3.211991	Intercept + Linear	5.560077
2008	2	2	439	4.555809	Intercept + Linear	5.520265
2008	3	1	953	1.049318	Intercept + Linear	5.483279
2008	4	2	585	3.418803	Intercept + Linear	5.444017
2008	5	6	379	15.831135	Intercept + Linear	5.406289
2008	6	9	746	12.064343	Intercept + Linear	5.367578
2008	7	0	767	0.000000	Intercept + Linear	5.330379
2008	8	12	537	22.346369	Intercept + Linear	5.292211
2008	9	2	646	3.095975	Intercept + Linear	5.254317
2008	10	7	535	13.084112	Intercept + Linear	5.217904
2008	11	0	484	0.000000	Intercept + Linear	5.180542
2008	12	0	651	0.000000	Intercept + Linear	5.144639
2009	1	2	633	3.159558	Intercept + Linear	5.107802
2009	2	0	381	0.000000	Intercept + Linear	5.071128

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2009	3	4	799	5.006258	Intercept + Linear	5.038230
2009	4	1	710	1.408451	Intercept + Linear	5.002056
2009	5	2	583	3.430532	Intercept + Linear	4.967296
2009	6	2	590	3.389830	Intercept + Linear	4.931631
2009	7	2	778	2.570694	Intercept + Linear	4.897360
2009	8	6	449	13.363029	Intercept + Linear	4.862198
2009	9	7	638	10.971787	Intercept + Linear	4.827287
2009	10	4	802	4.987531	Intercept + Linear	4.793742
2009	11	2	465	4.301075	Intercept + Linear	4.759323
2009	12	4	471	8.492569	Intercept + Linear	4.726250
2010	1	2	505	3.960396	Intercept + Linear	4.692316
2010	2	1	506	1.976285	Intercept + Linear	4.658625
2010	3	2	481	4.158004	Intercept + Linear	4.628403
2010	4	2	517	3.868472	Intercept + Linear	4.595172
2010	5	3	719	4.172462	Intercept + Linear	4.563239
2010	6	0	516	0.000000	Intercept + Linear	4.530475
2010	7	3	397	7.556675	Intercept + Linear	4.498993
2010	8	4	891	4.489338	Intercept + Linear	4.466690
2010	9	1	566	1.766784	Intercept + Linear	4.434620
2010	10	6	493	12.170385	Intercept + Linear	4.403803
2010	11	0	769	0.000000	Intercept + Linear	4.372184
2010	12	2	724	2.762431	Intercept + Linear	4.341801
2011	1	1	615	1.626016	Intercept + Linear	4.310627
2011	2	1	274	3.649635	Intercept + Linear	4.279677
2011	3	1	570	1.754386	Intercept + Linear	4.251913
2011	4	3	428	7.009346	Intercept + Linear	4.221385
2011	5	4	562	7.117438	Intercept + Linear	4.192050
2011	6	1	392	2.551020	Intercept + Linear	4.161951
2011	7	1	453	2.207505	Intercept + Linear	4.133029
2011	8	0	399	0.000000	Intercept + Linear	4.103355
2011	9	2	505	3.960396	Intercept + Linear	4.073893
2011	10	2	392	5.102041	Intercept + Linear	4.045583
2011	11	0	479	0.000000	Intercept + Linear	4.016536
2011	12	1	402	2.487562	Intercept + Linear	3.988624
2012	1	1	670	1.492537	Intercept + Linear	3.959986
2012	2	5	566	8.833922	Intercept + Linear	3.931631
2012	3	3	954	3.144654	Intercept + Linear	3.905289

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2012	4	1	490	2.040816	Intercept + Linear	3.877326
2012	5	2	994	2.012072	Intercept + Linear	3.850455
2012	6	3	389	7.712082	Intercept + Linear	3.822885
2012	7	2	492	4.065041	Intercept + Linear	3.796391
2012	8	6	312	19.230769	Intercept + Linear	3.769208
2012	9	3	542	5.535055	Intercept + Linear	3.742219
2012	10	0	583	0.000000	Intercept + Linear	3.716284
2012	11	0	467	0.000000	Intercept + Linear	3.689674
2012	12	1	533	1.876173	Intercept + Linear	3.664104
2013	1	0	434	0.000000	Intercept + Linear	3.637868
2013	2	2	613	3.262643	Intercept + Linear	3.611748
2013	3	0	560	0.000000	Intercept + Linear	3.588317
2013	4	3	451	6.651885	Intercept + Linear	3.562553
2013	5	0	552	0.000000	Intercept + Linear	3.537797
2013	6	2	368	5.434783	Intercept + Linear	3.512396
2013	7	2	244	8.196721	Intercept + Linear	3.487988
2013	8	5	347	14.409222	Intercept + Linear	3.462944
2013	9	2	357	5.602241	Intercept + Linear	3.438080
2013	10	0	534	0.000000	Intercept + Linear	3.414189
2013	11	0	509	0.000000	Intercept + Linear	3.389675
2013	12	1	513	1.949318	Intercept + Linear	3.366120
2014	1	1	533	1.876173	Intercept + Linear	3.341951
2014	2	2	670	2.985075	Intercept + Linear	3.317956
2014	3	3	384	7.812500	Intercept + Linear	3.296432
2014	4	1	465	2.150538	Intercept + Linear	3.272763
2014	5	1	560	1.785714	Intercept + Linear	3.250021
2014	6	3	517	5.802708	Intercept + Linear	3.226686
2014	7	3	360	8.333333	Intercept + Linear	3.204263
2014	8	1	743	1.345895	Intercept + Linear	3.181256
2014	9	4	348	11.494253	Intercept + Linear	3.158415
2014	10	1	529	1.890359	Intercept + Linear	3.136467
2014	11	1	519	1.926782	Intercept + Linear	3.113948
2014	12	3	509	5.893910	Intercept + Linear	3.092308
2015	1	1	730	1.369863	Intercept + Linear	3.070106
2015	2	1	436	2.293578	Intercept + Linear	3.048062
2015	3	1	525	1.904762	Intercept + Linear	3.028289
2015	4	1	591	1.692047	Intercept + Linear	3.006546

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2015	5	1	347	2.881844	Intercept + Linear	2.985653
2008	1	3	934	3.211991	Intercept + Linear + Smooth	5.560210
2008	2	2	439	4.555809	Intercept + Linear + Smooth	5.520390
2008	3	1	953	1.049318	Intercept + Linear + Smooth	5.483396
2008	4	2	585	3.418803	Intercept + Linear + Smooth	5.444126
2008	5	6	379	15.831135	Intercept + Linear + Smooth	5.406390
2008	6	9	746	12.064343	Intercept + Linear + Smooth	5.367670
2008	7	0	767	0.000000	Intercept + Linear + Smooth	5.330464
2008	8	12	537	22.346369	Intercept + Linear + Smooth	5.292288
2008	9	2	646	3.095975	Intercept + Linear + Smooth	5.254386
2008	10	7	535	13.084112	Intercept + Linear + Smooth	5.217965
2008	11	0	484	0.000000	Intercept + Linear + Smooth	5.180595
2008	12	0	651	0.000000	Intercept + Linear + Smooth	5.144685
2009	1	2	633	3.159558	Intercept + Linear + Smooth	5.107840
2009	2	0	381	0.000000	Intercept + Linear + Smooth	5.071159
2009	3	4	799	5.006258	Intercept + Linear + Smooth	5.038255
2009	4	1	710	1.408451	Intercept + Linear + Smooth	5.002074
2009	5	2	583	3.430532	Intercept + Linear + Smooth	4.967308
2009	6	2	590	3.389830	Intercept + Linear + Smooth	4.931637
2009	7	2	778	2.570694	Intercept + Linear + Smooth	4.897361
2009	8	6	449	13.363029	Intercept + Linear + Smooth	4.862193
2009	9	7	638	10.971787	Intercept + Linear + Smooth	4.827277
2009	10	4	802	4.987531	Intercept + Linear + Smooth	4.793727
2009	11	2	465	4.301075	Intercept + Linear + Smooth	4.759303
2009	12	4	471	8.492569	Intercept + Linear + Smooth	4.726225
2010	1	2	505	3.960396	Intercept + Linear + Smooth	4.692287
2010	2	1	506	1.976285	Intercept + Linear + Smooth	4.658592
2010	3	2	481	4.158004	Intercept + Linear + Smooth	4.628367
2010	4	2	517	3.868472	Intercept + Linear + Smooth	4.595131
2010	5	3	719	4.172462	Intercept + Linear + Smooth	4.563196
2010	6	0	516	0.000000	Intercept + Linear + Smooth	4.530429
2010	7	3	397	7.556675	Intercept + Linear + Smooth	4.498944
2010	8	4	891	4.489338	Intercept + Linear + Smooth	4.466639
2010	9	1	566	1.766784	Intercept + Linear + Smooth	4.434566
2010	10	6	493	12.170385	Intercept + Linear + Smooth	4.403748
2010	11	0	769	0.000000	Intercept + Linear + Smooth	4.372127
2010	12	2	724	2.762431	Intercept + Linear + Smooth	4.341743

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2011	1	1	615	1.626016	Intercept + Linear + Smooth	4.310568
2011	2	1	274	3.649635	Intercept + Linear + Smooth	4.279617
2011	3	1	570	1.754386	Intercept + Linear + Smooth	4.251853
2011	4	3	428	7.009346	Intercept + Linear + Smooth	4.221325
2011	5	4	562	7.117438	Intercept + Linear + Smooth	4.191990
2011	6	1	392	2.551020	Intercept + Linear + Smooth	4.161892
2011	7	1	453	2.207505	Intercept + Linear + Smooth	4.132970
2011	8	0	399	0.000000	Intercept + Linear + Smooth	4.103296
2011	9	2	505	3.960396	Intercept + Linear + Smooth	4.073835
2011	10	2	392	5.102041	Intercept + Linear + Smooth	4.045526
2011	11	0	479	0.000000	Intercept + Linear + Smooth	4.016481
2011	12	1	402	2.487562	Intercept + Linear + Smooth	3.988571
2012	1	1	670	1.492537	Intercept + Linear + Smooth	3.959935
2012	2	5	566	8.833922	Intercept + Linear + Smooth	3.931582
2012	3	3	954	3.144654	Intercept + Linear + Smooth	3.905242
2012	4	1	490	2.040816	Intercept + Linear + Smooth	3.877281
2012	5	2	994	2.012072	Intercept + Linear + Smooth	3.850412
2012	6	3	389	7.712082	Intercept + Linear + Smooth	3.822844
2012	7	2	492	4.065041	Intercept + Linear + Smooth	3.796353
2012	8	6	312	19.230769	Intercept + Linear + Smooth	3.769172
2012	9	3	542	5.535055	Intercept + Linear + Smooth	3.742186
2012	10	0	583	0.000000	Intercept + Linear + Smooth	3.716254
2012	11	0	467	0.000000	Intercept + Linear + Smooth	3.689647
2012	12	1	533	1.876173	Intercept + Linear + Smooth	3.664080
2013	1	0	434	0.000000	Intercept + Linear + Smooth	3.637847
2013	2	2	613	3.262643	Intercept + Linear + Smooth	3.611730
2013	3	0	560	0.000000	Intercept + Linear + Smooth	3.588302
2013	4	3	451	6.651885	Intercept + Linear + Smooth	3.562542
2013	5	0	552	0.000000	Intercept + Linear + Smooth	3.537788
2013	6	2	368	5.434783	Intercept + Linear + Smooth	3.512390
2013	7	2	244	8.196721	Intercept + Linear + Smooth	3.487986
2013	8	5	347	14.409222	Intercept + Linear + Smooth	3.462946
2013	9	2	357	5.602241	Intercept + Linear + Smooth	3.438085
2013	10	0	534	0.000000	Intercept + Linear + Smooth	3.414197
2013	11	0	509	0.000000	Intercept + Linear + Smooth	3.389686
2013	12	1	513	1.949318	Intercept + Linear + Smooth	3.366134
2014	1	1	533	1.876173	Intercept + Linear + Smooth	3.341969

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2014	2	2	670	2.985075	Intercept + Linear + Smooth	3.317977
2014	3	3	384	7.812500	Intercept + Linear + Smooth	3.296455
2014	4	1	465	2.150538	Intercept + Linear + Smooth	3.272790
2014	5	1	560	1.785714	Intercept + Linear + Smooth	3.250050
2014	6	3	517	5.802708	Intercept + Linear + Smooth	3.226718
2014	7	3	360	8.333333	Intercept + Linear + Smooth	3.204298
2014	8	1	743	1.345895	Intercept + Linear + Smooth	3.181294
2014	9	4	348	11.494253	Intercept + Linear + Smooth	3.158456
2014	10	1	529	1.890359	Intercept + Linear + Smooth	3.136510
2014	11	1	519	1.926782	Intercept + Linear + Smooth	3.113993
2014	12	3	509	5.893910	Intercept + Linear + Smooth	3.092356
2015	1	1	730	1.369863	Intercept + Linear + Smooth	3.070156
2015	2	1	436	2.293578	Intercept + Linear + Smooth	3.048115
2015	3	1	525	1.904762	Intercept + Linear + Smooth	3.028343
2015	4	1	591	1.692047	Intercept + Linear + Smooth	3.006602
2015	5	1	347	2.881844	Intercept + Linear + Smooth	2.985711

Supplementary information

In our model exploration, seasonal effects also were statistically significant.

```
Family: Negative Binomial(3.138)
Link function: log

Formula:
env_bsi ~ decyear2 + offset(log(beddays)) + s(decyear2, bs = "ad",
    k = 40, xt = list(bs = "ps")) + s(fracyear, bs = "cp", k = 12)

Parametric coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept) -5.84269    0.20565 -28.411   <2e-16 ***
decyear2    -0.07600    0.04476  -1.698   0.0895 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
                  edf    Ref.df Chi.sq  p-value
s(decyear2) 0.0002817 5.629e-04   0.00 0.991081
s(fracyear) 2.4671602 1.100e+01  14.12 0.000517 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Rank: 51/52
```

```
R-sq.(adj) =  0.0444   Deviance explained = 18.4%
-REML = 172.39  Scale est. = 1         n = 89
```

Question 4a: What was overall BSI incidence rate attributed to environmental microorganisms among paediatric haematology-oncology patients in the RHC for the whole period from June 2015 to the September 2018?

```
[1] 4.761318
```

Question 4b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

Model summary

```
Family: Negative Binomial(910181.205)
Link function: log

Formula:
env_bsi ~ decyear2 + offset(log(beddays)) + s(decyear2, bs = "ad",
    k = 40, xt = list(bs = "ps"))

Parametric coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  -7.5378     0.5264 -14.320  < 2e-16 ***
decyear2      1.0842     0.2356   4.602 4.19e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
              edf Ref.df Chi.sq p-value
s(decyear2) 1.299  1.766  7.453  0.0381 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Rank: 40/41
R-sq.(adj) =  0.544   Deviance explained = 60.3%
-REML = 68.324  Scale est. = 1         n = 40
```

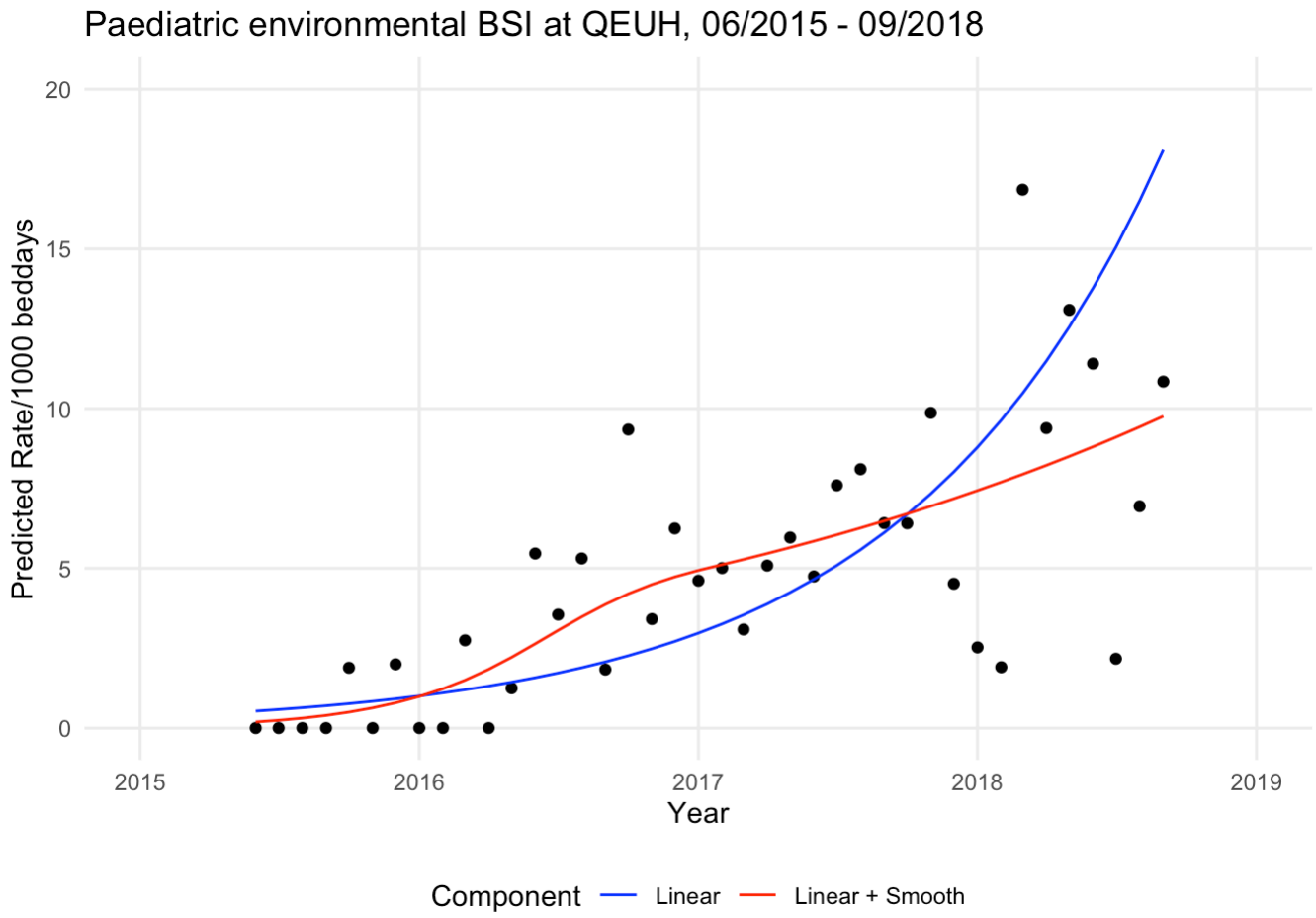
First and last timepoints

Paediatric environmental BSI at QEUH, 06/2015 - 09/2018

Year	Month	Fit/1000 bed days	Observed Rate
2015	6	0.191117983615304	0
...	...	...	...

Year	Month	Fit/1000 bed days	Observed Rate
2018	9	9.76048302552672	10.8459869848156

Plot



Raw data and fit

Paediatric environmental BSI at QEUH, 06/2015 - 09/2018

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2015	6	0	487	0.000000	Intercept + Linear	0.5325476
2015	7	0	386	0.000000	Intercept + Linear	0.5821833
2015	8	0	621	0.000000	Intercept + Linear	0.6383385
2015	9	0	481	0.000000	Intercept + Linear	0.6999102
2015	10	1	530	1.886793	Intercept + Linear	0.7651447
2015	11	0	791	0.000000	Intercept + Linear	0.8389477
2015	12	1	501	1.996008	Intercept + Linear	0.9171410
2016	1	0	435	0.000000	Intercept + Linear	1.0056050
2016	2	0	550	0.000000	Intercept + Linear	1.1023245
2016	3	1	364	2.747253	Intercept + Linear	1.2012087
2016	4	0	664	0.000000	Intercept + Linear	1.3167414

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2016	5	1	801	1.248439	Intercept + Linear	1.4391167
2016	6	3	549	5.464481	Intercept + Linear	1.5775315
2016	7	2	563	3.552398	Intercept + Linear	1.7241441
2016	8	3	565	5.309735	Intercept + Linear	1.8899729
2016	9	1	546	1.831502	Intercept + Linear	2.0717513
2016	10	4	428	9.345794	Intercept + Linear	2.2642956
2016	11	3	879	3.412969	Intercept + Linear	2.4820765
2016	12	4	640	6.250000	Intercept + Linear	2.7127557
2017	1	4	867	4.613610	Intercept + Linear	2.9736696
2017	2	3	599	5.008347	Intercept + Linear	3.2604985
2017	3	2	648	3.086420	Intercept + Linear	3.5432776
2017	4	5	983	5.086470	Intercept + Linear	3.8850488
2017	5	5	838	5.966587	Intercept + Linear	4.2471513
2017	6	3	632	4.746835	Intercept + Linear	4.6568155
2017	7	5	658	7.598784	Intercept + Linear	5.0908499
2017	8	5	617	8.103728	Intercept + Linear	5.5818940
2017	9	5	779	6.418485	Intercept + Linear	6.1203025
2017	10	4	624	6.410256	Intercept + Linear	6.6907398
2017	11	6	608	9.868421	Intercept + Linear	7.3361033
2017	12	3	664	4.518072	Intercept + Linear	8.0198583
2018	1	2	792	2.525253	Intercept + Linear	8.7934236
2018	2	1	525	1.904762	Intercept + Linear	9.6416041
2018	3	9	534	16.853933	Intercept + Linear	10.4778087
2018	4	4	426	9.389671	Intercept + Linear	11.4884586
2018	5	10	764	13.089005	Intercept + Linear	12.5592302
2018	6	6	526	11.406844	Intercept + Linear	13.7706461
2018	7	1	461	2.169197	Intercept + Linear	15.0541269
2018	8	4	576	6.944444	Intercept + Linear	16.5061912
2018	9	5	461	10.845987	Intercept + Linear	18.0983161
2015	6	0	487	0.000000	Intercept + Linear + Smooth	0.1911180
2015	7	0	386	0.000000	Intercept + Linear + Smooth	0.2425029
2015	8	0	621	0.000000	Intercept + Linear + Smooth	0.3099770
2015	9	0	481	0.000000	Intercept + Linear + Smooth	0.3955989
2015	10	1	530	1.886793	Intercept + Linear + Smooth	0.4993740
2015	11	0	791	0.000000	Intercept + Linear + Smooth	0.6322728
2015	12	1	501	1.996008	Intercept + Linear + Smooth	0.7903364
2016	1	0	435	0.000000	Intercept + Linear + Smooth	0.9896090

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2016	2	0	550	0.000000	Intercept + Linear + Smooth	1.2312130
2016	3	1	364	2.747253	Intercept + Linear + Smooth	1.5012315
2016	4	0	664	0.000000	Intercept + Linear + Smooth	1.8398793
2016	5	1	801	1.248439	Intercept + Linear + Smooth	2.2148453
2016	6	3	549	5.464481	Intercept + Linear + Smooth	2.6382508
2016	7	2	563	3.552398	Intercept + Linear + Smooth	3.0597545
2016	8	3	565	5.309735	Intercept + Linear + Smooth	3.4820213
2016	9	1	546	1.831502	Intercept + Linear + Smooth	3.8711396
2016	10	4	428	9.345794	Intercept + Linear + Smooth	4.2039216
2016	11	3	879	3.412969	Intercept + Linear + Smooth	4.4960759
2016	12	4	640	6.250000	Intercept + Linear + Smooth	4.7322246
2017	1	4	867	4.613610	Intercept + Linear + Smooth	4.9364928
2017	2	3	599	5.008347	Intercept + Linear + Smooth	5.1166258
2017	3	2	648	3.086420	Intercept + Linear + Smooth	5.2795253
2017	4	5	983	5.086470	Intercept + Linear + Smooth	5.4659342
2017	5	5	838	5.966587	Intercept + Linear + Smooth	5.6525943
2017	6	3	632	4.746835	Intercept + Linear + Smooth	5.8521755
2017	7	5	658	7.598784	Intercept + Linear + Smooth	6.0520256
2017	8	5	617	8.103728	Intercept + Linear + Smooth	6.2657098
2017	9	5	779	6.418485	Intercept + Linear + Smooth	6.4869388
2017	10	4	624	6.410256	Intercept + Linear + Smooth	6.7084659
2017	11	6	608	9.868421	Intercept + Linear + Smooth	6.9453277
2017	12	3	664	4.518072	Intercept + Linear + Smooth	7.1825086
2018	1	2	792	2.525253	Intercept + Linear + Smooth	7.4361078
2018	2	1	525	1.904762	Intercept + Linear + Smooth	7.6986611
2018	3	9	534	16.853933	Intercept + Linear + Smooth	7.9437650
2018	4	4	426	9.389671	Intercept + Linear + Smooth	8.2242426
2018	5	10	764	13.089005	Intercept + Linear + Smooth	8.5050980
2018	6	6	526	11.406844	Intercept + Linear + Smooth	8.8053951
2018	7	1	461	2.169197	Intercept + Linear + Smooth	9.1060967
2018	8	4	576	6.944444	Intercept + Linear + Smooth	9.4276138
2018	9	5	461	10.845987	Intercept + Linear + Smooth	9.7604830

Question 5a: What was overall BSI incidence rate attributed to environmental microorganisms among paediatric haematology-

oncology patients in the RHC for the whole period from October 2018 to February 2022?

```
[1] 2.881682
```

Question 5b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

(Note that the smooth is slightly different than the rest (`k=35`), due to numerical issues.)

Model summary

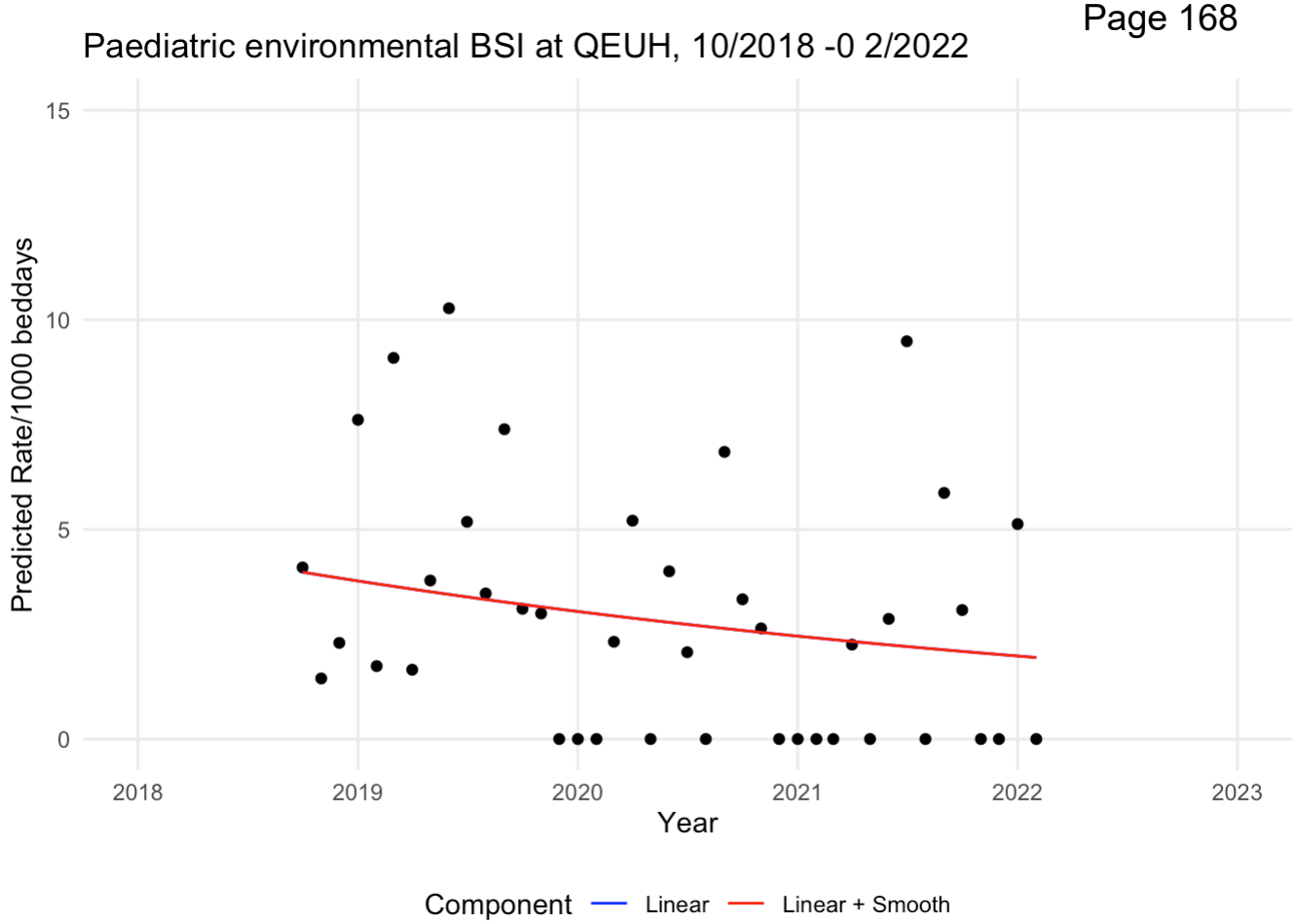
```
Family: Negative Binomial(4.009)
Link function: log

Formula:
env_bsi ~ decyear2 + offset(log(beddays)) + s(decyear2, bs = "ad",
    k = 35, xt = list(bs = "ps"))

Parametric coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  -4.8110     0.8009  -6.007 1.89e-09 ***
decyear2     -0.2146     0.1648  -1.302    0.193
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
                  edf    Ref.df Chi.sq p-value
s(decyear2) 0.0002019 0.0004039      0   0.992

Rank: 35/36
R-sq.(adj) =  0.0448   Deviance explained = 3.96%
-REML = 60.151  Scale est. = 1         n = 41
```

First and last timepoints

Paediatric environmental BSI at QEUH, 10/2018 -02/2022

Year	Month	Fit/1000 bed days	Observed Rate
2018	10	3.97972823068664	4.09276944065484
...	...	...	...
2022	2	1.94468925436228	0

Plot



Raw data and fit

Paediatric environmental BSI at QEUH, 10/2018 - 2/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2018	10	3	733	4.092769	Intercept + Linear	3.979583
2018	11	1	692	1.445087	Intercept + Linear	3.907707
2018	12	1	436	2.293578	Intercept + Linear	3.839385
2019	1	3	394	7.614213	Intercept + Linear	3.770041
2019	2	1	575	1.739130	Intercept + Linear	3.701949
2019	3	4	440	9.090909	Intercept + Linear	3.641505
2019	4	1	605	1.652893	Intercept + Linear	3.575734
2019	5	2	529	3.780718	Intercept + Linear	3.513217
2019	6	3	292	10.273973	Intercept + Linear	3.449764
2019	7	3	579	5.181347	Intercept + Linear	3.389449
2019	8	1	288	3.472222	Intercept + Linear	3.328231
2019	9	3	406	7.389163	Intercept + Linear	3.268119
2019	10	1	322	3.105590	Intercept + Linear	3.210980
2019	11	2	668	2.994012	Intercept + Linear	3.152986
2019	12	0	623	0.000000	Intercept + Linear	3.097860

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2020	1	0	501	0.000000	Intercept + Linear	3.041908
2020	2	0	424	0.000000	Intercept + Linear	2.987117
2020	3	1	431	2.320186	Intercept + Linear	2.936753
2020	4	1	192	5.208333	Intercept + Linear	2.883856
2020	5	0	277	0.000000	Intercept + Linear	2.833571
2020	6	1	250	4.000000	Intercept + Linear	2.782532
2020	7	1	483	2.070393	Intercept + Linear	2.734015
2020	8	0	335	0.000000	Intercept + Linear	2.684769
2020	9	3	438	6.849315	Intercept + Linear	2.636410
2020	10	1	300	3.333333	Intercept + Linear	2.590440
2020	11	1	379	2.638522	Intercept + Linear	2.543780
2020	12	0	380	0.000000	Intercept + Linear	2.499426
2021	1	0	390	0.000000	Intercept + Linear	2.454405
2021	2	0	316	0.000000	Intercept + Linear	2.410075
2021	3	0	557	0.000000	Intercept + Linear	2.370724
2021	4	1	444	2.252252	Intercept + Linear	2.327906
2021	5	0	501	0.000000	Intercept + Linear	2.287205
2021	6	1	349	2.865330	Intercept + Linear	2.245896
2021	7	5	527	9.487666	Intercept + Linear	2.206629
2021	8	0	533	0.000000	Intercept + Linear	2.166774
2021	9	3	511	5.870842	Intercept + Linear	2.127640
2021	10	1	325	3.076923	Intercept + Linear	2.090441
2021	11	0	376	0.000000	Intercept + Linear	2.052684
2021	12	0	350	0.000000	Intercept + Linear	2.016796
2022	1	2	390	5.128205	Intercept + Linear	1.980370
2022	2	0	157	0.000000	Intercept + Linear	1.944602
2018	10	3	733	4.092769	Intercept + Linear + Smooth	3.979728
2018	11	1	692	1.445087	Intercept + Linear + Smooth	3.907837
2018	12	1	436	2.293578	Intercept + Linear + Smooth	3.839501
2019	1	3	394	7.614213	Intercept + Linear + Smooth	3.770142
2019	2	1	575	1.739130	Intercept + Linear + Smooth	3.702036
2019	3	4	440	9.090909	Intercept + Linear + Smooth	3.641578
2019	4	1	605	1.652893	Intercept + Linear + Smooth	3.575792
2019	5	2	529	3.780718	Intercept + Linear + Smooth	3.513260
2019	6	3	292	10.273973	Intercept + Linear + Smooth	3.449792
2019	7	3	579	5.181347	Intercept + Linear + Smooth	3.389462
2019	8	1	288	3.472222	Intercept + Linear + Smooth	3.328229

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2019	9	3	406	7.389163	Intercept + Linear + Smooth	3.268103
2019	10	1	322	3.105590	Intercept + Linear + Smooth	3.210951
2019	11	2	668	2.994012	Intercept + Linear + Smooth	3.152945
2019	12	0	623	0.000000	Intercept + Linear + Smooth	3.097808
2020	1	0	501	0.000000	Intercept + Linear + Smooth	3.041848
2020	2	0	424	0.000000	Intercept + Linear + Smooth	2.987049
2020	3	1	431	2.320186	Intercept + Linear + Smooth	2.936681
2020	4	1	192	5.208333	Intercept + Linear + Smooth	2.883779
2020	5	0	277	0.000000	Intercept + Linear + Smooth	2.833493
2020	6	1	250	4.000000	Intercept + Linear + Smooth	2.782453
2020	7	1	483	2.070393	Intercept + Linear + Smooth	2.733937
2020	8	0	335	0.000000	Intercept + Linear + Smooth	2.684693
2020	9	3	438	6.849315	Intercept + Linear + Smooth	2.636337
2020	10	1	300	3.333333	Intercept + Linear + Smooth	2.590372
2020	11	1	379	2.638522	Intercept + Linear + Smooth	2.543717
2020	12	0	380	0.000000	Intercept + Linear + Smooth	2.499369
2021	1	0	390	0.000000	Intercept + Linear + Smooth	2.454356
2021	2	0	316	0.000000	Intercept + Linear + Smooth	2.410036
2021	3	0	557	0.000000	Intercept + Linear + Smooth	2.370693
2021	4	1	444	2.252252	Intercept + Linear + Smooth	2.327885
2021	5	0	501	0.000000	Intercept + Linear + Smooth	2.287196
2021	6	1	349	2.865330	Intercept + Linear + Smooth	2.245898
2021	7	5	527	9.487666	Intercept + Linear + Smooth	2.206643
2021	8	0	533	0.000000	Intercept + Linear + Smooth	2.166800
2021	9	3	511	5.870842	Intercept + Linear + Smooth	2.127676
2021	10	1	325	3.076923	Intercept + Linear + Smooth	2.090488
2021	11	0	376	0.000000	Intercept + Linear + Smooth	2.052742
2021	12	0	350	0.000000	Intercept + Linear + Smooth	2.016864
2022	1	2	390	5.128205	Intercept + Linear + Smooth	1.980448
2022	2	0	157	0.000000	Intercept + Linear + Smooth	1.944689

Supplementary information

In model explorations, seasonality was statistically significant.

```
Family: Negative Binomial(10.956)
Link function: log
```

```
Formula:
env_bsi ~ decyear2 + offset(log(beddays)) + s(decyear2, bs = "ad",
    k = 35, xt = list(bs = "ps")) + s(fracyear, bs = "cp", k = 12)

Parametric coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  -4.7864     0.7591  -6.305 2.88e-10 ***
decyear2     -0.2330     0.1580  -1.475     0.14
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
               edf  Ref.df Chi.sq p-value
s(decyear2) 0.4937  0.8308  0.801  0.3707
s(fracyear) 1.7999 11.0000  6.343  0.0162 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Rank: 46/47
R-sq.(adj) =  0.194   Deviance explained = 21.9%
-REML = 58.735  Scale est. = 1         n = 41
```

Question 6a: What was overall BSI incidence rate attributed to environmental microorganisms among paediatric haematology-oncology patients in the RHC for the whole period from June 2015 to February 2022?

```
[1] 3.970424
```

Question 6b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

Model summary

```
Family: Negative Binomial(15.743)
Link function: log

Formula:
env_bsi ~ decyear2 + offset(log(beddays)) + s(decyear2, bs = "ad",
    k = 40, xt = list(bs = "ps"))

Parametric coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept) -6.24217    0.35001 -17.834   <2e-16 ***
decyear2     0.12717    0.09028   1.409    0.159
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

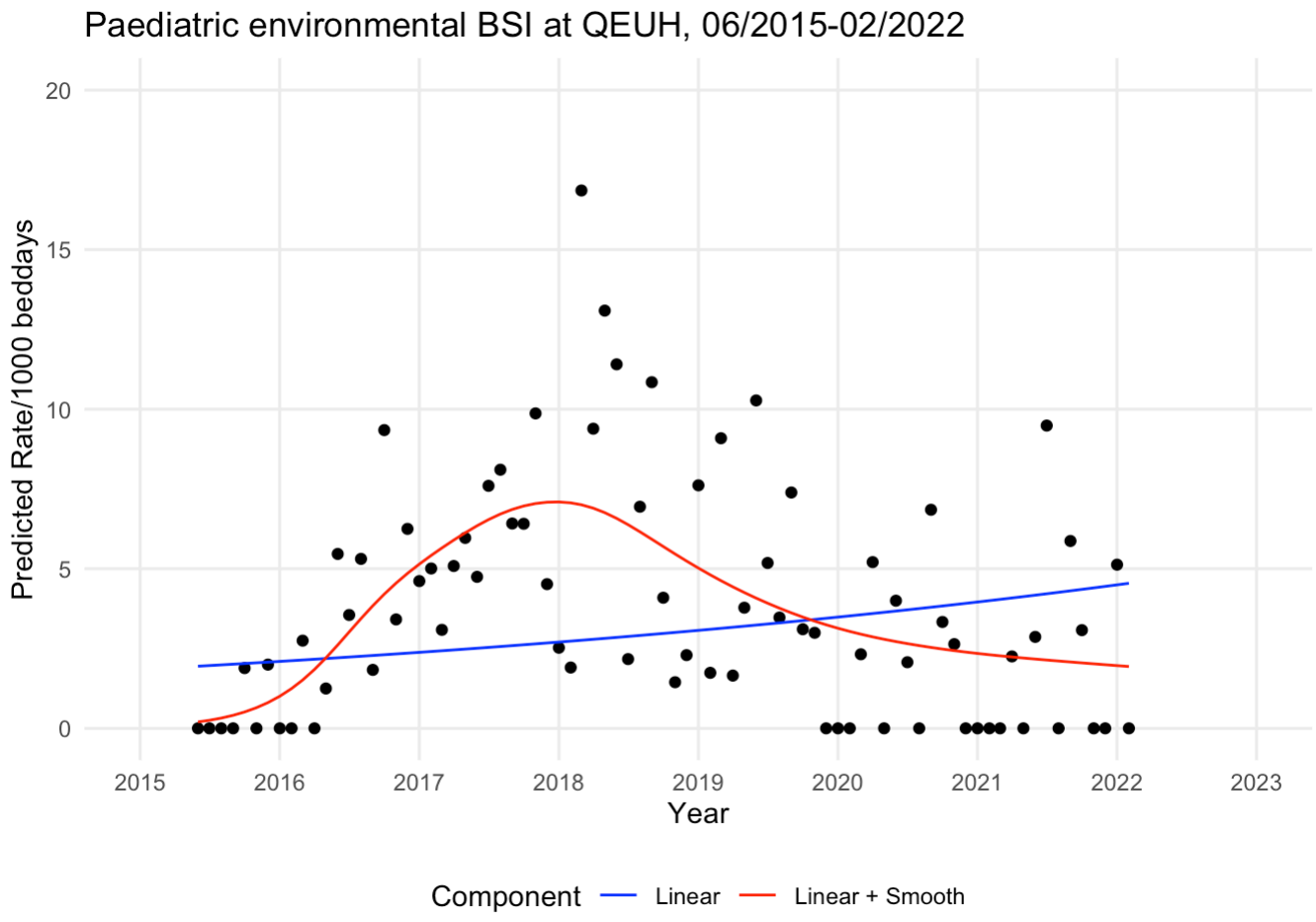
```
Approximate significance of smooth terms:
              edf Ref.df Chi.sq p-value
s(decyear2) 3.043   4.08  32.09 1.6e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Rank: 40/41
R-sq.(adj) =  0.456   Deviance explained = 38.8%
-REML = 133.94  Scale est. = 1         n = 81
```

First and last timepoints

Paediatric environmental BSI at QEUH, 06/2015-02/2022

Year	Month	Fit/1000 bed days	Observed Rate
2015	6	0.200434401442463	0
...	...	...	...
2022	2	1.93668071437307	0

Plot



Raw data and fit

Paediatric environmental BSI at QEUH, 06/2015-02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2015	6	0	487	0.000000	Intercept + Linear	1.9456364
2015	7	0	386	0.000000	Intercept + Linear	1.9660787
2015	8	0	621	0.000000	Intercept + Linear	1.9874281
2015	9	0	481	0.000000	Intercept + Linear	2.0090093
2015	10	1	530	1.886793	Intercept + Linear	2.0301175
2015	11	0	791	0.000000	Intercept + Linear	2.0521622
2015	12	1	501	1.996008	Intercept + Linear	2.0737238
2016	1	0	435	0.000000	Intercept + Linear	2.0962421
2016	2	0	550	0.000000	Intercept + Linear	2.1189423
2016	3	1	364	2.747253	Intercept + Linear	2.1404006
2016	4	0	664	0.000000	Intercept + Linear	2.1635790
2016	5	1	801	1.248439	Intercept + Linear	2.1862488
2016	6	3	549	5.464481	Intercept + Linear	2.2099237
2016	7	2	563	3.552398	Intercept + Linear	2.2330790
2016	8	3	565	5.309735	Intercept + Linear	2.2572611
2016	9	1	546	1.831502	Intercept + Linear	2.2817051
2016	10	4	428	9.345794	Intercept + Linear	2.3056125
2016	11	3	879	3.412969	Intercept + Linear	2.3305801
2016	12	4	640	6.250000	Intercept + Linear	2.3549996
2017	1	4	867	4.613610	Intercept + Linear	2.3805020
2017	2	3	599	5.008347	Intercept + Linear	2.4063515
2017	3	2	648	3.086420	Intercept + Linear	2.4299407
2017	4	5	983	5.086470	Intercept + Linear	2.4563271
2017	5	5	838	5.966587	Intercept + Linear	2.4821351
2017	6	3	632	4.746835	Intercept + Linear	2.5090882
2017	7	5	658	7.598784	Intercept + Linear	2.5354506
2017	8	5	617	8.103728	Intercept + Linear	2.5629827
2017	9	5	779	6.418485	Intercept + Linear	2.5908137
2017	10	4	624	6.410256	Intercept + Linear	2.6180348
2017	11	6	608	9.868421	Intercept + Linear	2.6464636
2017	12	3	664	4.518072	Intercept + Linear	2.6742693
2018	1	2	792	2.525253	Intercept + Linear	2.7033089
2018	2	1	525	1.904762	Intercept + Linear	2.7326637
2018	3	9	534	16.853933	Intercept + Linear	2.7594517
2018	4	4	426	9.389671	Intercept + Linear	2.7894162

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2018	5	10	764	13.089005	Intercept + Linear	2.8187238
2018	6	6	526	11.406844	Intercept + Linear	2.8493320
2018	7	1	461	2.169197	Intercept + Linear	2.8792692
2018	8	4	576	6.944444	Intercept + Linear	2.9105348
2018	9	5	461	10.845987	Intercept + Linear	2.9421399
2018	10	3	733	4.092769	Intercept + Linear	2.9730522
2018	11	1	692	1.445087	Intercept + Linear	3.0053361
2018	12	1	436	2.293578	Intercept + Linear	3.0369124
2019	1	3	394	7.614213	Intercept + Linear	3.0698898
2019	2	1	575	1.739130	Intercept + Linear	3.1032253
2019	3	4	440	9.090909	Intercept + Linear	3.1336458
2019	4	1	605	1.652893	Intercept + Linear	3.1676737
2019	5	2	529	3.780718	Intercept + Linear	3.2009556
2019	6	3	292	10.273973	Intercept + Linear	3.2357143
2019	7	3	579	5.181347	Intercept + Linear	3.2697111
2019	8	1	288	3.472222	Intercept + Linear	3.3052165
2019	9	3	406	7.389163	Intercept + Linear	3.3411074
2019	10	1	322	3.105590	Intercept + Linear	3.3762115
2019	11	2	668	2.994012	Intercept + Linear	3.4128733
2019	12	0	623	0.000000	Intercept + Linear	3.4487315
2020	1	0	501	0.000000	Intercept + Linear	3.4861808
2020	2	0	424	0.000000	Intercept + Linear	3.5239328
2020	3	1	431	2.320186	Intercept + Linear	3.5596191
2020	4	1	192	5.208333	Intercept + Linear	3.5981664
2020	5	0	277	0.000000	Intercept + Linear	3.6358675
2020	6	1	250	4.000000	Intercept + Linear	3.6752405
2020	7	1	483	2.070393	Intercept + Linear	3.7137492
2020	8	0	335	0.000000	Intercept + Linear	3.7539655
2020	9	3	438	6.849315	Intercept + Linear	3.7946173
2020	10	1	300	3.333333	Intercept + Linear	3.8343769
2020	11	1	379	2.638522	Intercept + Linear	3.8758995
2020	12	0	380	0.000000	Intercept + Linear	3.9165107
2021	1	0	390	0.000000	Intercept + Linear	3.9589227
2021	2	0	316	0.000000	Intercept + Linear	4.0019121
2021	3	0	557	0.000000	Intercept + Linear	4.0411424
2021	4	1	444	2.252252	Intercept + Linear	4.0850246
2021	5	0	501	0.000000	Intercept + Linear	4.1279449

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2021	6	1	349	2.865330	Intercept + Linear	4.1727696
2021	7	5	527	9.487666	Intercept + Linear	4.2166119
2021	8	0	533	0.000000	Intercept + Linear	4.2623995
2021	9	3	511	5.870842	Intercept + Linear	4.3086843
2021	10	1	325	3.076923	Intercept + Linear	4.3539545
2021	11	0	376	0.000000	Intercept + Linear	4.4012335
2021	12	0	350	0.000000	Intercept + Linear	4.4474761
2022	1	2	390	5.128205	Intercept + Linear	4.4957706
2022	2	0	157	0.000000	Intercept + Linear	4.5445896
2015	6	0	487	0.000000	Intercept + Linear + Smooth	0.2004344
2015	7	0	386	0.000000	Intercept + Linear + Smooth	0.2530014
2015	8	0	621	0.000000	Intercept + Linear + Smooth	0.3216128
2015	9	0	481	0.000000	Intercept + Linear + Smooth	0.4082509
2015	10	1	530	1.886793	Intercept + Linear + Smooth	0.5129717
2015	11	0	791	0.000000	Intercept + Linear + Smooth	0.6469616
2015	12	1	501	1.996008	Intercept + Linear + Smooth	0.8061374
2016	1	0	435	0.000000	Intercept + Linear + Smooth	1.0063423
2016	2	0	550	0.000000	Intercept + Linear + Smooth	1.2473172
2016	3	1	364	2.747253	Intercept + Linear + Smooth	1.5140546
2016	4	0	664	0.000000	Intercept + Linear + Smooth	1.8447996
2016	5	1	801	1.248439	Intercept + Linear + Smooth	2.2058648
2016	6	3	549	5.464481	Intercept + Linear + Smooth	2.6114429
2016	7	2	563	3.552398	Intercept + Linear + Smooth	3.0201118
2016	8	3	565	5.309735	Intercept + Linear + Smooth	3.4393845
2016	9	1	546	1.831502	Intercept + Linear + Smooth	3.8416412
2016	10	4	428	9.345794	Intercept + Linear + Smooth	4.2050199
2016	11	3	879	3.412969	Intercept + Linear + Smooth	4.5499429
2016	12	4	640	6.250000	Intercept + Linear + Smooth	4.8553163
2017	1	4	867	4.613610	Intercept + Linear + Smooth	5.1456417
2017	2	3	599	5.008347	Intercept + Linear + Smooth	5.4178398
2017	3	2	648	3.086420	Intercept + Linear + Smooth	5.6514829
2017	4	5	983	5.086470	Intercept + Linear + Smooth	5.8989962
2017	5	5	838	5.966587	Intercept + Linear + Smooth	6.1273450
2017	6	3	632	4.746835	Intercept + Linear + Smooth	6.3476000
2017	7	5	658	7.598784	Intercept + Linear + Smooth	6.5409883
2017	8	5	617	8.103728	Intercept + Linear + Smooth	6.7153158
2017	9	5	779	6.418485	Intercept + Linear + Smooth	6.8591128

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2017	10	4	624	6.410256	Intercept + Linear + Smooth	6.9668616
2017	11	6	608	9.868421	Intercept + Linear + Smooth	7.0442571
2017	12	3	664	4.518072	Intercept + Linear + Smooth	7.0858290
2018	1	2	792	2.525253	Intercept + Linear + Smooth	7.0942293
2018	2	1	525	1.904762	Intercept + Linear + Smooth	7.0653139
2018	3	9	534	16.853933	Intercept + Linear + Smooth	7.0047466
2018	4	4	426	9.389671	Intercept + Linear + Smooth	6.8989219
2018	5	10	764	13.089005	Intercept + Linear + Smooth	6.7589076
2018	6	6	526	11.406844	Intercept + Linear + Smooth	6.5799395
2018	7	1	461	2.169197	Intercept + Linear + Smooth	6.3815416
2018	8	4	576	6.944444	Intercept + Linear + Smooth	6.1587587
2018	9	5	461	10.845987	Intercept + Linear + Smooth	5.9257775
2018	10	3	733	4.092769	Intercept + Linear + Smooth	5.6971115
2018	11	1	692	1.445087	Intercept + Linear + Smooth	5.4626797
2018	12	1	436	2.293578	Intercept + Linear + Smooth	5.2414555
2019	1	3	394	7.614213	Intercept + Linear + Smooth	5.0206576
2019	2	1	575	1.739130	Intercept + Linear + Smooth	4.8089380
2019	3	4	440	9.090909	Intercept + Linear + Smooth	4.6259504
2019	4	1	605	1.652893	Intercept + Linear + Smooth	4.4326521
2019	5	2	529	3.780718	Intercept + Linear + Smooth	4.2548736
2019	6	3	292	10.273973	Intercept + Linear + Smooth	4.0806033
2019	7	3	579	5.181347	Intercept + Linear + Smooth	3.9209777
2019	8	1	288	3.472222	Intercept + Linear + Smooth	3.7653163
2019	9	3	406	7.389163	Intercept + Linear + Smooth	3.6190902
2019	10	1	322	3.105590	Intercept + Linear + Smooth	3.4866598
2019	11	2	668	2.994012	Intercept + Linear + Smooth	3.3592365
2019	12	0	623	0.000000	Intercept + Linear + Smooth	3.2449804
2020	1	0	501	0.000000	Intercept + Linear + Smooth	3.1361097
2020	2	0	424	0.000000	Intercept + Linear + Smooth	3.0363267
2020	3	1	431	2.320186	Intercept + Linear + Smooth	2.9503923
2020	4	1	192	5.208333	Intercept + Linear + Smooth	2.8657709
2020	5	0	277	0.000000	Intercept + Linear + Smooth	2.7903211
2020	6	1	250	4.000000	Intercept + Linear + Smooth	2.7183567
2020	7	1	483	2.070393	Intercept + Linear + Smooth	2.6539469
2020	8	0	335	0.000000	Intercept + Linear + Smooth	2.5922526
2020	9	3	438	6.849315	Intercept + Linear + Smooth	2.5349952
2020	10	1	300	3.333333	Intercept + Linear + Smooth	2.4834026

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2020	11	1	379	2.638522	Intercept + Linear + Smooth	2.4337195
2020	12	0	380	0.000000	Intercept + Linear + Smooth	2.3888825
2021	1	0	390	0.000000	Intercept + Linear + Smooth	2.3456495
2021	2	0	316	0.000000	Intercept + Linear + Smooth	2.3052041
2021	3	0	557	0.000000	Intercept + Linear + Smooth	2.2708946
2021	4	1	444	2.252252	Intercept + Linear + Smooth	2.2350443
2021	5	0	501	0.000000	Intercept + Linear + Smooth	2.2021242
2021	6	1	349	2.865330	Intercept + Linear + Smooth	2.1695391
2021	7	5	527	9.487666	Intercept + Linear + Smooth	2.1390614
2021	8	0	533	0.000000	Intercept + Linear + Smooth	2.1083665
2021	9	3	511	5.870842	Intercept + Linear + Smooth	2.0782793
2021	10	1	325	3.076923	Intercept + Linear + Smooth	2.0496571
2021	11	0	376	0.000000	Intercept + Linear + Smooth	2.0205355
2021	12	0	350	0.000000	Intercept + Linear + Smooth	1.9927784
2022	1	2	390	5.128205	Intercept + Linear + Smooth	1.9645228
2022	2	0	157	0.000000	Intercept + Linear + Smooth	1.9366807

Supplementary information

In model exploration, seasonality was statistically significant.

```
Family: Negative Binomial(36.491)
Link function: log

Formula:
env_bsi ~ decyear2 + offset(log(beddays)) + s(decyear2, bs = "ad",
    k = 40, xt = list(bs = "ps")) + s(fracyear, bs = "cp", k = 12)

Parametric coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept) -6.26933    0.34538 -18.152   <2e-16 ***
decyear2     0.13097    0.08917   1.469    0.142
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
              edf Ref.df Chi.sq  p-value
s(decyear2) 3.207  4.255 34.491 4.02e-07 ***
s(fracyear) 1.809 11.000  6.409   0.0153 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Rank: 51/52
```

```
R-sq.(adj) =  0.511   Deviance explained =   45%
-REML = 132.37  Scale est. = 1         n = 81
```

Question 7a: What was overall BSI incidence rate attributed to non-environmental microorganisms among paediatric haematology-oncology patients in Yorkhill for the whole period from January 2008 to May 2015?

```
[1] 12.86154
```

Question 7b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

Model summary

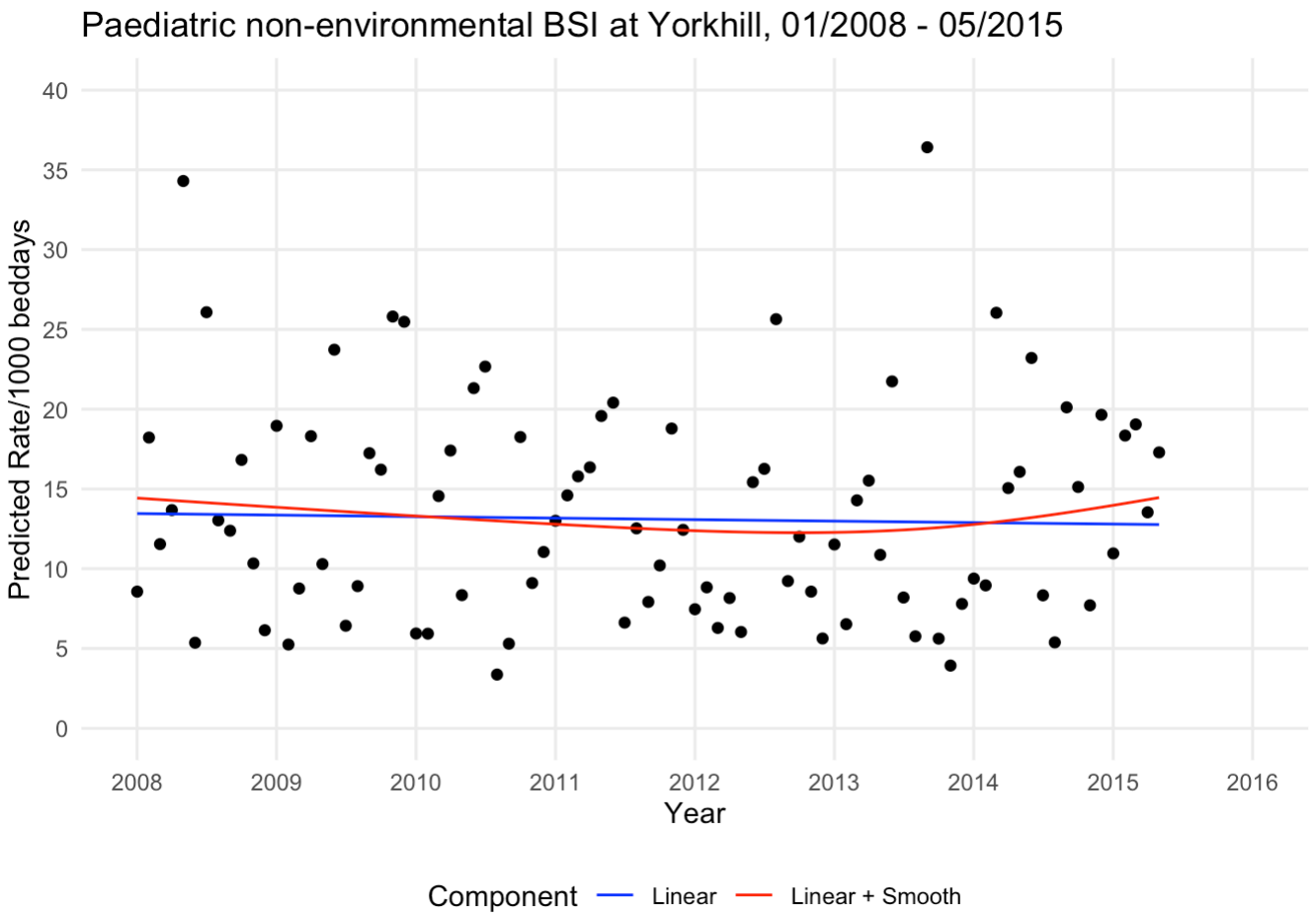
```
Family: Negative Binomial(9.494)
Link function: log

Formula:
nebsi ~ decyear2 + offset(log(beddays)) + s(decyear2, bs = "ad",
    k = 40, xt = list(bs = "ps"))

Parametric coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept) -4.361266   0.108304 -40.269   <2e-16 ***
decyear2    -0.007173   0.024414  -0.294    0.769
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
              edf Ref.df Chi.sq p-value
s(decyear2) 0.724   1.14  1.474   0.245

Rank: 40/41
R-sq.(adj) =  -0.168   Deviance explained = 2.73%
-REML = 236.55  Scale est. = 1         n = 89
```

First and last timepoints

Paediatric non-environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Fit/1000 bed days	Observed Rate
2008	1	14.4271113406771	8.56531049250535
...	...	...	...
2015	5	14.4566054013559	17.2910662824208

Plot



Raw data and fit

Paediatric non-environmental BSI at Yorkhill, 01/2008 - 05/2015

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2008	1	8	934	8.565311	Intercept + Linear	13.45922
2008	2	8	439	18.223235	Intercept + Linear	13.45105
2008	3	11	953	11.542497	Intercept + Linear	13.44341
2008	4	8	585	13.675214	Intercept + Linear	13.43524
2008	5	13	379	34.300792	Intercept + Linear	13.42735
2008	6	4	746	5.361930	Intercept + Linear	13.41919
2008	7	20	767	26.075619	Intercept + Linear	13.41131
2008	8	7	537	13.035382	Intercept + Linear	13.40316
2008	9	8	646	12.383901	Intercept + Linear	13.39502
2008	10	9	535	16.822430	Intercept + Linear	13.38715
2008	11	5	484	10.330578	Intercept + Linear	13.37902
2008	12	4	651	6.144393	Intercept + Linear	13.37115
2009	1	12	633	18.957346	Intercept + Linear	13.36303
2009	2	2	381	5.249344	Intercept + Linear	13.35490

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2009	3	7	799	8.760951	Intercept + Linear	13.34755
2009	4	13	710	18.309859	Intercept + Linear	13.33942
2009	5	6	583	10.291595	Intercept + Linear	13.33156
2009	6	14	590	23.728814	Intercept + Linear	13.32344
2009	7	5	778	6.426735	Intercept + Linear	13.31559
2009	8	4	449	8.908686	Intercept + Linear	13.30748
2009	9	11	638	17.241379	Intercept + Linear	13.29937
2009	10	13	802	16.209476	Intercept + Linear	13.29154
2009	11	12	465	25.806452	Intercept + Linear	13.28344
2009	12	12	471	25.477707	Intercept + Linear	13.27561
2010	1	3	505	5.940594	Intercept + Linear	13.26753
2010	2	3	506	5.928854	Intercept + Linear	13.25945
2010	3	7	481	14.553015	Intercept + Linear	13.25216
2010	4	9	517	17.408124	Intercept + Linear	13.24409
2010	5	6	719	8.344924	Intercept + Linear	13.23628
2010	6	11	516	21.317829	Intercept + Linear	13.22822
2010	7	9	397	22.670025	Intercept + Linear	13.22042
2010	8	3	891	3.367003	Intercept + Linear	13.21237
2010	9	3	566	5.300353	Intercept + Linear	13.20433
2010	10	9	493	18.255578	Intercept + Linear	13.19654
2010	11	7	769	9.102731	Intercept + Linear	13.18851
2010	12	8	724	11.049724	Intercept + Linear	13.18073
2011	1	8	615	13.008130	Intercept + Linear	13.17271
2011	2	4	274	14.598540	Intercept + Linear	13.16469
2011	3	9	570	15.789474	Intercept + Linear	13.15744
2011	4	7	428	16.355140	Intercept + Linear	13.14943
2011	5	11	562	19.572954	Intercept + Linear	13.14168
2011	6	8	392	20.408163	Intercept + Linear	13.13368
2011	7	3	453	6.622517	Intercept + Linear	13.12594
2011	8	5	399	12.531328	Intercept + Linear	13.11794
2011	9	4	505	7.920792	Intercept + Linear	13.10996
2011	10	4	392	10.204082	Intercept + Linear	13.10223
2011	11	9	479	18.789144	Intercept + Linear	13.09425
2011	12	5	402	12.437811	Intercept + Linear	13.08653
2012	1	5	670	7.462687	Intercept + Linear	13.07856
2012	2	5	566	8.833922	Intercept + Linear	13.07062
2012	3	6	954	6.289308	Intercept + Linear	13.06319

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2012	4	4	490	8.163265	Intercept + Linear	13.05526
2012	5	6	994	6.036217	Intercept + Linear	13.04759
2012	6	6	389	15.424164	Intercept + Linear	13.03966
2012	7	8	492	16.260163	Intercept + Linear	13.03200
2012	8	8	312	25.641026	Intercept + Linear	13.02409
2012	9	5	542	9.225092	Intercept + Linear	13.01618
2012	10	7	583	12.006861	Intercept + Linear	13.00853
2012	11	4	467	8.565311	Intercept + Linear	13.00062
2012	12	3	533	5.628518	Intercept + Linear	12.99298
2013	1	5	434	11.520737	Intercept + Linear	12.98509
2013	2	4	613	6.525285	Intercept + Linear	12.97719
2013	3	8	560	14.285714	Intercept + Linear	12.97005
2013	4	7	451	15.521064	Intercept + Linear	12.96215
2013	5	6	552	10.869565	Intercept + Linear	12.95451
2013	6	8	368	21.739130	Intercept + Linear	12.94662
2013	7	2	244	8.196721	Intercept + Linear	12.93899
2013	8	2	347	5.763689	Intercept + Linear	12.93111
2013	9	13	357	36.414566	Intercept + Linear	12.92324
2013	10	3	534	5.617978	Intercept + Linear	12.91562
2013	11	2	509	3.929273	Intercept + Linear	12.90775
2013	12	4	513	7.797271	Intercept + Linear	12.90015
2014	1	5	533	9.380863	Intercept + Linear	12.89229
2014	2	6	670	8.955224	Intercept + Linear	12.88444
2014	3	10	384	26.041667	Intercept + Linear	12.87735
2014	4	7	465	15.053763	Intercept + Linear	12.86951
2014	5	9	560	16.071429	Intercept + Linear	12.86192
2014	6	12	517	23.210832	Intercept + Linear	12.85409
2014	7	3	360	8.333333	Intercept + Linear	12.84652
2014	8	4	743	5.383580	Intercept + Linear	12.83869
2014	9	7	348	20.114943	Intercept + Linear	12.83087
2014	10	8	529	15.122873	Intercept + Linear	12.82331
2014	11	4	519	7.707129	Intercept + Linear	12.81550
2014	12	10	509	19.646365	Intercept + Linear	12.80795
2015	1	8	730	10.958904	Intercept + Linear	12.80015
2015	2	8	436	18.348624	Intercept + Linear	12.79236
2015	3	10	525	19.047619	Intercept + Linear	12.78532
2015	4	8	591	13.536379	Intercept + Linear	12.77753

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2015	5	6	347	17.291066	Intercept + Linear	12.77000
2008	1	8	934	8.565311	Intercept + Linear + Smooth	14.42711
2008	2	8	439	18.223235	Intercept + Linear + Smooth	14.37763
2008	3	11	953	11.542497	Intercept + Linear + Smooth	14.33148
2008	4	8	585	13.675214	Intercept + Linear + Smooth	14.28229
2008	5	13	379	34.300792	Intercept + Linear + Smooth	14.23483
2008	6	4	746	5.361930	Intercept + Linear + Smooth	14.18592
2008	7	20	767	26.075619	Intercept + Linear + Smooth	14.13871
2008	8	7	537	13.035382	Intercept + Linear + Smooth	14.09008
2008	9	8	646	12.383901	Intercept + Linear + Smooth	14.04159
2008	10	9	535	16.822430	Intercept + Linear + Smooth	13.99483
2008	11	5	484	10.330578	Intercept + Linear + Smooth	13.94669
2008	12	4	651	6.144393	Intercept + Linear + Smooth	13.90028
2009	1	12	633	18.957346	Intercept + Linear + Smooth	13.85253
2009	2	2	381	5.249344	Intercept + Linear + Smooth	13.80486
2009	3	7	799	8.760951	Intercept + Linear + Smooth	13.76198
2009	4	13	710	18.309859	Intercept + Linear + Smooth	13.71471
2009	5	6	583	10.291595	Intercept + Linear + Smooth	13.66916
2009	6	14	590	23.728814	Intercept + Linear + Smooth	13.62229
2009	7	5	778	6.426735	Intercept + Linear + Smooth	13.57711
2009	8	4	449	8.908686	Intercept + Linear + Smooth	13.53061
2009	9	11	638	17.241379	Intercept + Linear + Smooth	13.48430
2009	10	13	802	16.209476	Intercept + Linear + Smooth	13.43964
2009	11	12	465	25.806452	Intercept + Linear + Smooth	13.39366
2009	12	12	471	25.477707	Intercept + Linear + Smooth	13.34934
2010	1	3	505	5.940594	Intercept + Linear + Smooth	13.30373
2010	2	3	506	5.928854	Intercept + Linear + Smooth	13.25835
2010	3	7	481	14.553015	Intercept + Linear + Smooth	13.21757
2010	4	9	517	17.408124	Intercept + Linear + Smooth	13.17270
2010	5	6	719	8.344924	Intercept + Linear + Smooth	13.12957
2010	6	11	516	21.317829	Intercept + Linear + Smooth	13.08534
2010	7	9	397	22.670025	Intercept + Linear + Smooth	13.04289
2010	8	3	891	3.367003	Intercept + Linear + Smooth	12.99946
2010	9	3	566	5.300353	Intercept + Linear + Smooth	12.95649
2010	10	9	493	18.255578	Intercept + Linear + Smooth	12.91540
2010	11	7	769	9.102731	Intercept + Linear + Smooth	12.87349
2010	12	8	724	11.049724	Intercept + Linear + Smooth	12.83350

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2011	1	8	615	13.008130	Intercept + Linear + Smooth	12.79278
2011	2	4	274	14.598540	Intercept + Linear + Smooth	12.75272
2011	3	9	570	15.789474	Intercept + Linear + Smooth	12.71713
2011	4	7	428	16.355140	Intercept + Linear + Smooth	12.67842
2011	5	11	562	19.572954	Intercept + Linear + Smooth	12.64171
2011	6	8	392	20.408163	Intercept + Linear + Smooth	12.60463
2011	7	3	453	6.622517	Intercept + Linear + Smooth	12.56969
2011	8	5	399	12.531328	Intercept + Linear + Smooth	12.53467
2011	9	4	505	7.920792	Intercept + Linear + Smooth	12.50090
2011	10	4	392	10.204082	Intercept + Linear + Smooth	12.46957
2011	11	9	479	18.789144	Intercept + Linear + Smooth	12.43874
2011	12	5	402	12.437811	Intercept + Linear + Smooth	12.41059
2012	1	5	670	7.462687	Intercept + Linear + Smooth	12.38343
2012	2	5	566	8.833922	Intercept + Linear + Smooth	12.35850
2012	3	6	954	6.289308	Intercept + Linear + Smooth	12.33732
2012	4	4	490	8.163265	Intercept + Linear + Smooth	12.31718
2012	5	6	994	6.036217	Intercept + Linear + Smooth	12.30029
2012	6	6	389	15.424164	Intercept + Linear + Smooth	12.28568
2012	7	8	492	16.260163	Intercept + Linear + Smooth	12.27443
2012	8	8	312	25.641026	Intercept + Linear + Smooth	12.26592
2012	9	5	542	9.225092	Intercept + Linear + Smooth	12.26075
2012	10	7	583	12.006861	Intercept + Linear + Smooth	12.25916
2012	11	4	467	8.565311	Intercept + Linear + Smooth	12.26128
2012	12	3	533	5.628518	Intercept + Linear + Smooth	12.26722
2013	1	5	434	11.520737	Intercept + Linear + Smooth	12.27761
2013	2	4	613	6.525285	Intercept + Linear + Smooth	12.29259
2013	3	8	560	14.285714	Intercept + Linear + Smooth	12.31014
2013	4	7	451	15.521064	Intercept + Linear + Smooth	12.33417
2013	5	6	552	10.869565	Intercept + Linear + Smooth	12.36209
2013	6	8	368	21.739130	Intercept + Linear + Smooth	12.39586
2013	7	2	244	8.196721	Intercept + Linear + Smooth	12.43342
2013	8	2	347	5.763689	Intercept + Linear + Smooth	12.47739
2013	9	13	357	36.414566	Intercept + Linear + Smooth	12.52677
2013	10	3	534	5.617978	Intercept + Linear + Smooth	12.57992
2013	11	2	509	3.929273	Intercept + Linear + Smooth	12.64058
2013	12	4	513	7.797271	Intercept + Linear + Smooth	12.70494
2014	1	5	533	9.380863	Intercept + Linear + Smooth	12.77737

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2014	2	6	670	8.955224	Intercept + Linear + Smooth	12.85561
2014	3	10	384	26.041667	Intercept + Linear + Smooth	12.93093
2014	4	7	465	15.053763	Intercept + Linear + Smooth	13.01908
2014	5	9	560	16.071429	Intercept + Linear + Smooth	13.10878
2014	6	12	517	23.210832	Intercept + Linear + Smooth	13.20565
2014	7	3	360	8.333333	Intercept + Linear + Smooth	13.30327
2014	8	4	743	5.383580	Intercept + Linear + Smooth	13.40802
2014	9	7	348	20.114943	Intercept + Linear + Smooth	13.51655
2014	10	8	529	15.122873	Intercept + Linear + Smooth	13.62490
2014	11	4	519	7.707129	Intercept + Linear + Smooth	13.74000
2014	12	10	509	19.646365	Intercept + Linear + Smooth	13.85408
2015	1	8	730	10.958904	Intercept + Linear + Smooth	13.97436
2015	2	8	436	18.348624	Intercept + Linear + Smooth	14.09671
2015	3	10	525	19.047619	Intercept + Linear + Smooth	14.20870
2015	4	8	591	13.536379	Intercept + Linear + Smooth	14.33405
2015	5	6	347	17.291066	Intercept + Linear + Smooth	14.45661

Question 8a: What was overall BSI incidence rate attributed to non-environmental microorganisms among paediatric haematology-oncology patients in the RHC over the whole period from June 2015 to February 2022?

```
[1] 13.5042
```

Question 8b: During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

Model summary

```
Family: Negative Binomial(13.851)
Link function: log

Formula:
nebsi ~ decyear2 + offset(log(beddays)) + s(decyear2, bs = "ad",
    k = 40, xt = list(bs = "ps"))

Parametric coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept) -3.78436    0.10443  -36.24  < 2e-16 ***
```

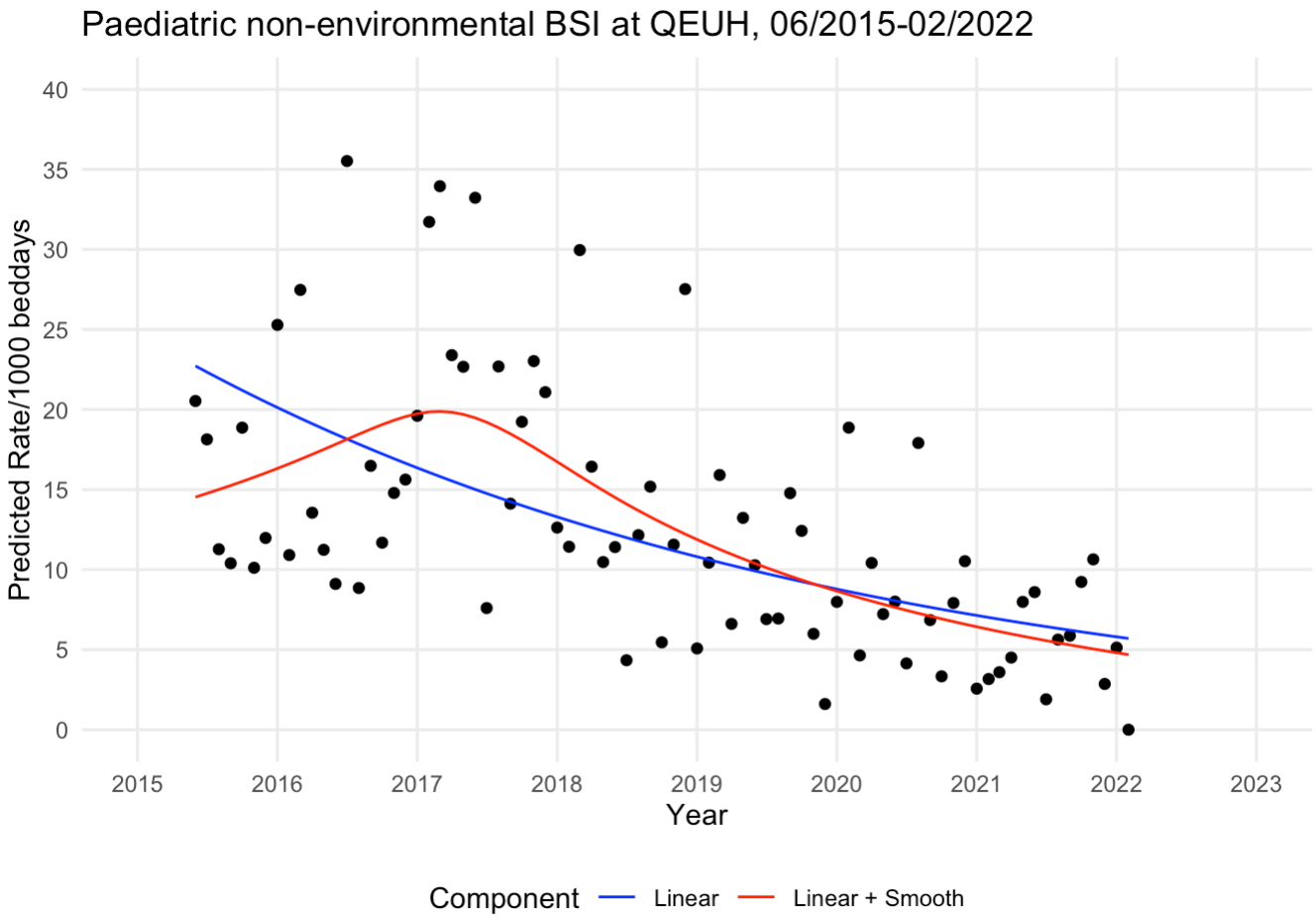
```
decyear2    -0.20728    0.03371   -6.15 7.77e-10 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
              edf Ref.df Chi.sq p-value
s(decyear2) 1.904  2.586  13.16 0.00264 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Rank: 40/41
R-sq.(adj) =  0.601   Deviance explained = 46.1%
-REML = 199.57  Scale est. = 1         n = 81
```

First and last timepoints

Paediatric non-environmental BSI at QEUH, 06/2015-02/2022

Year	Month	Fit/1000 bed days	Observed Rate
2015	6	14.530378813886	20.5338809034908
...	...	...	...
2022	2	4.68863281395484	0

Plot



Raw data and fit

Paediatric non-environmental BSI at QEUH, 06/2015-02/2022

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2015	6	10	487	20.533881	Intercept + Linear	22.723427
2015	7	7	386	18.134715	Intercept + Linear	22.339568
2015	8	7	621	11.272142	Intercept + Linear	21.949725
2015	9	5	481	10.395010	Intercept + Linear	21.566685
2015	10	10	530	18.867925	Intercept + Linear	21.202366
2015	11	8	791	10.113780	Intercept + Linear	20.832368
2015	12	6	501	11.976048	Intercept + Linear	20.480454
2016	1	11	435	25.287356	Intercept + Linear	20.123054
2016	2	6	550	10.909091	Intercept + Linear	19.772842
2016	3	10	364	27.472528	Intercept + Linear	19.450744
2016	4	9	664	13.554217	Intercept + Linear	19.112232
2016	5	9	801	11.235955	Intercept + Linear	18.790250
2016	6	5	549	9.107468	Intercept + Linear	18.463234
2016	7	20	563	35.523979	Intercept + Linear	18.152186
2016	8	5	565	8.849557	Intercept + Linear	17.836274
2016	9	9	546	16.483517	Intercept + Linear	17.525859
2016	10	5	428	11.682243	Intercept + Linear	17.230603
2016	11	13	879	14.789534	Intercept + Linear	16.930730
2016	12	10	640	15.625000	Intercept + Linear	16.645500
2017	1	17	867	19.607843	Intercept + Linear	16.355809
2017	2	19	599	31.719533	Intercept + Linear	16.070387
2017	3	22	648	33.950617	Intercept + Linear	15.816871
2017	4	23	983	23.397762	Intercept + Linear	15.540854
2017	5	19	838	22.673031	Intercept + Linear	15.278327
2017	6	21	632	33.227848	Intercept + Linear	15.011708
2017	7	5	658	7.598784	Intercept + Linear	14.758121
2017	8	14	617	22.690438	Intercept + Linear	14.500580
2017	9	11	779	14.120667	Intercept + Linear	14.247533
2017	10	12	624	19.230769	Intercept + Linear	14.006855
2017	11	14	608	23.026316	Intercept + Linear	13.762424
2017	12	14	664	21.084337	Intercept + Linear	13.529940
2018	1	10	792	12.626263	Intercept + Linear	13.293832
2018	2	6	525	11.428571	Intercept + Linear	13.061844
2018	3	16	534	29.962547	Intercept + Linear	12.855788

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2018	4	7	426	16.431925	Intercept + Linear	12.631445
2018	5	8	764	10.471204	Intercept + Linear	12.418066
2018	6	6	526	11.406844	Intercept + Linear	12.201361
2018	7	2	461	4.338395	Intercept + Linear	11.995247
2018	8	7	576	12.152778	Intercept + Linear	11.785921
2018	9	7	461	15.184382	Intercept + Linear	11.580247
2018	10	4	733	5.457026	Intercept + Linear	11.384626
2018	11	8	692	11.560694	Intercept + Linear	11.185955
2018	12	12	436	27.522936	Intercept + Linear	10.996995
2019	1	2	394	5.076142	Intercept + Linear	10.805089
2019	2	6	575	10.434783	Intercept + Linear	10.616531
2019	3	7	440	15.909091	Intercept + Linear	10.449051
2019	4	4	605	6.611570	Intercept + Linear	10.266707
2019	5	7	529	13.232514	Intercept + Linear	10.093275
2019	6	3	292	10.273973	Intercept + Linear	9.917139
2019	7	4	579	6.908463	Intercept + Linear	9.749613
2019	8	2	288	6.944444	Intercept + Linear	9.579474
2019	9	6	406	14.778325	Intercept + Linear	9.412305
2019	10	4	322	12.422360	Intercept + Linear	9.253306
2019	11	4	668	5.988024	Intercept + Linear	9.091828
2019	12	1	623	1.605136	Intercept + Linear	8.938243
2020	1	4	501	7.984032	Intercept + Linear	8.782264
2020	2	8	424	18.867925	Intercept + Linear	8.629421
2020	3	2	431	4.640371	Intercept + Linear	8.488849
2020	4	2	192	10.416667	Intercept + Linear	8.341113
2020	5	2	277	7.220217	Intercept + Linear	8.200591
2020	6	2	250	8.000000	Intercept + Linear	8.057872
2020	7	2	483	4.140787	Intercept + Linear	7.922122
2020	8	6	335	17.910448	Intercept + Linear	7.784249
2020	9	3	438	6.849315	Intercept + Linear	7.648776
2020	10	1	300	3.333333	Intercept + Linear	7.519918
2020	11	3	379	7.915567	Intercept + Linear	7.389044
2020	12	4	380	10.526316	Intercept + Linear	7.264562
2021	1	1	390	2.564103	Intercept + Linear	7.138133
2021	2	1	316	3.164557	Intercept + Linear	7.013567
2021	3	2	557	3.590664	Intercept + Linear	6.902925
2021	4	2	444	4.504505	Intercept + Linear	6.782463

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2021	5	4	501	7.984032	Intercept + Linear	6.667890
2021	6	3	349	8.595989	Intercept + Linear	6.551530
2021	7	1	527	1.897533	Intercept + Linear	6.440857
2021	8	3	533	5.628518	Intercept + Linear	6.328459
2021	9	3	511	5.870842	Intercept + Linear	6.218022
2021	10	3	325	9.230769	Intercept + Linear	6.112983
2021	11	4	376	10.638298	Intercept + Linear	6.006307
2021	12	1	350	2.857143	Intercept + Linear	5.904845
2022	1	2	390	5.128205	Intercept + Linear	5.801800
2022	2	0	157	0.000000	Intercept + Linear	5.700554
2015	6	10	487	20.533881	Intercept + Linear + Smooth	14.530379
2015	7	7	386	18.134715	Intercept + Linear + Smooth	14.761519
2015	8	7	621	11.272142	Intercept + Linear + Smooth	15.005542
2015	9	5	481	10.395010	Intercept + Linear + Smooth	15.255925
2015	10	10	530	18.867925	Intercept + Linear + Smooth	15.505305
2015	11	8	791	10.113780	Intercept + Linear + Smooth	15.771325
2015	12	6	501	11.976048	Intercept + Linear + Smooth	16.037249
2016	1	11	435	25.287356	Intercept + Linear + Smooth	16.320931
2016	2	6	550	10.909091	Intercept + Linear + Smooth	16.612650
2016	3	10	364	27.472528	Intercept + Linear + Smooth	16.893104
2016	4	9	664	13.554217	Intercept + Linear + Smooth	17.200561
2016	5	9	801	11.235955	Intercept + Linear + Smooth	17.505274
2016	6	5	549	9.107468	Intercept + Linear + Smooth	17.826033
2016	7	20	563	35.523979	Intercept + Linear + Smooth	18.138481
2016	8	5	565	8.849557	Intercept + Linear + Smooth	18.458861
2016	9	9	546	16.483517	Intercept + Linear + Smooth	18.770989
2016	10	5	428	11.682243	Intercept + Linear + Smooth	19.058623
2016	11	13	879	14.789534	Intercept + Linear + Smooth	19.330389
2016	12	10	640	15.625000	Intercept + Linear + Smooth	19.556923
2017	1	17	867	19.607843	Intercept + Linear + Smooth	19.738038
2017	2	19	599	31.719533	Intercept + Linear + Smooth	19.848887
2017	3	22	648	33.950617	Intercept + Linear + Smooth	19.878600
2017	4	23	983	23.397762	Intercept + Linear + Smooth	19.827686
2017	5	19	838	22.673031	Intercept + Linear + Smooth	19.694807
2017	6	21	632	33.227848	Intercept + Linear + Smooth	19.479218
2017	7	5	658	7.598784	Intercept + Linear + Smooth	19.204699
2017	8	14	617	22.690438	Intercept + Linear + Smooth	18.865643

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2017	9	11	779	14.120667	Intercept + Linear + Smooth	18.482725
2017	10	12	624	19.230769	Intercept + Linear + Smooth	18.080115
2017	11	14	608	23.026316	Intercept + Linear + Smooth	17.640075
2017	12	14	664	21.084337	Intercept + Linear + Smooth	17.198609
2018	1	10	792	12.626263	Intercept + Linear + Smooth	16.733416
2018	2	6	525	11.428571	Intercept + Linear + Smooth	16.265091
2018	3	16	534	29.962547	Intercept + Linear + Smooth	15.843747
2018	4	7	426	16.431925	Intercept + Linear + Smooth	15.383169
2018	5	8	764	10.471204	Intercept + Linear + Smooth	14.946750
2018	6	6	526	11.406844	Intercept + Linear + Smooth	14.508132
2018	7	2	461	4.338395	Intercept + Linear + Smooth	14.097309
2018	8	7	576	12.152778	Intercept + Linear + Smooth	13.687918
2018	9	7	461	15.184382	Intercept + Linear + Smooth	13.293809
2018	10	4	733	5.457026	Intercept + Linear + Smooth	12.926604
2018	11	8	692	11.560694	Intercept + Linear + Smooth	12.561045
2018	12	12	436	27.522936	Intercept + Linear + Smooth	12.219953
2019	1	2	394	5.076142	Intercept + Linear + Smooth	11.879914
2019	2	6	575	10.434783	Intercept + Linear + Smooth	11.551889
2019	3	7	440	15.909091	Intercept + Linear + Smooth	11.265513
2019	4	4	605	6.611570	Intercept + Linear + Smooth	10.959013
2019	5	7	529	13.232514	Intercept + Linear + Smooth	10.672560
2019	6	3	292	10.273973	Intercept + Linear + Smooth	10.386632
2019	7	4	579	6.908463	Intercept + Linear + Smooth	10.119268
2019	8	2	288	6.944444	Intercept + Linear + Smooth	9.852210
2019	9	6	406	14.778325	Intercept + Linear + Smooth	9.594094
2019	10	4	322	12.422360	Intercept + Linear + Smooth	9.352425
2019	11	4	668	5.988024	Intercept + Linear + Smooth	9.110703
2019	12	1	623	1.605136	Intercept + Linear + Smooth	8.884175
2020	1	4	501	7.984032	Intercept + Linear + Smooth	8.657377
2020	2	8	424	18.867925	Intercept + Linear + Smooth	8.438141
2020	3	2	431	4.640371	Intercept + Linear + Smooth	8.238948
2020	4	2	192	10.416667	Intercept + Linear + Smooth	8.032004
2020	5	2	277	7.220217	Intercept + Linear + Smooth	7.837357
2020	6	2	250	8.000000	Intercept + Linear + Smooth	7.641774
2020	7	2	483	4.140787	Intercept + Linear + Smooth	7.457646
2020	8	6	335	17.910448	Intercept + Linear + Smooth	7.272485
2020	9	3	438	6.849315	Intercept + Linear + Smooth	7.092318

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays
2020	10	1	300	3.333333	Intercept + Linear + Smooth	6.922557
2020	11	3	379	7.915567	Intercept + Linear + Smooth	6.751756
2020	12	4	380	10.526316	Intercept + Linear + Smooth	6.590814
2021	1	1	390	2.564103	Intercept + Linear + Smooth	6.428889
2021	2	1	316	3.164557	Intercept + Linear + Smooth	6.270875
2021	3	2	557	3.590664	Intercept + Linear + Smooth	6.131786
2021	4	2	444	4.504505	Intercept + Linear + Smooth	5.981685
2021	5	4	501	7.984032	Intercept + Linear + Smooth	5.840174
2021	6	3	349	8.595989	Intercept + Linear + Smooth	5.697658
2021	7	1	527	1.897533	Intercept + Linear + Smooth	5.563191
2021	8	3	533	5.628518	Intercept + Linear + Smooth	5.427673
2021	9	3	511	5.870842	Intercept + Linear + Smooth	5.295509
2021	10	3	325	9.230769	Intercept + Linear + Smooth	5.170679
2021	11	4	376	10.638298	Intercept + Linear + Smooth	5.044753
2021	12	1	350	2.857143	Intercept + Linear + Smooth	4.925778
2022	1	2	390	5.128205	Intercept + Linear + Smooth	4.805753
2022	2	0	157	0.000000	Intercept + Linear + Smooth	4.688633

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays	Hospital	Organism
2008	1	1	934	1.07066381	Intercept + Linear	0.831983726	Yorkhill	Aspergillus
2008	2	0	439	0	Intercept + Linear	0.808750311	Yorkhill	Aspergillus
2008	3	0	953	0	Intercept + Linear	0.787603546	Yorkhill	Aspergillus
2008	4	0	585	0	Intercept + Linear	0.765609462	Yorkhill	Aspergillus
2008	5	0	379	0	Intercept + Linear	0.744909834	Yorkhill	Aspergillus
2008	6	0	746	0	Intercept + Linear	0.724107985	Yorkhill	Aspergillus
2008	7	0	767	0	Intercept + Linear	0.704530424	Yorkhill	Aspergillus
2008	8	0	537	0	Intercept + Linear	0.684856184	Yorkhill	Aspergillus
2008	9	0	646	0	Intercept + Linear	0.665731354	Yorkhill	Aspergillus
2008	10	0	535	0	Intercept + Linear	0.64773211	Yorkhill	Aspergillus
2008	11	1	484	2.066115618	Intercept + Linear	0.629643981	Yorkhill	Aspergillus
2008	12	1	651	1.536098361	Intercept + Linear	0.612620424	Yorkhill	Aspergillus
2009	1	0	633	0	Intercept + Linear	0.595512801	Yorkhill	Aspergillus
2009	2	0	381	0	Intercept + Linear	0.578837996	Yorkhill	Aspergillus
2009	3	0	799	0	Intercept + Linear	0.564178563	Yorkhill	Aspergillus
2009	4	1	710	1.408450723	Intercept + Linear	0.54838114	Yorkhill	Aspergillus
2009	5	0	583	0	Intercept + Linear	0.533514606	Yorkhill	Aspergillus
2009	6	0	590	0	Intercept + Linear	0.518575796	Yorkhill	Aspergillus
2009	7	0	778	0	Intercept + Linear	0.50451728	Yorkhill	Aspergillus
2009	8	0	449	0	Intercept + Linear	0.490390418	Yorkhill	Aspergillus
2009	9	0	638	0	Intercept + Linear	0.476659119	Yorkhill	Aspergillus
2009	10	0	802	0	Intercept + Linear	0.463736958	Yorkhill	Aspergillus
2009	11	0	465	0	Intercept + Linear	0.450751975	Yorkhill	Aspergillus
2009	12	1	471	2.123142242	Intercept + Linear	0.438532153	Yorkhill	Aspergillus
2010	1	0	505	0	Intercept + Linear	0.426252924	Yorkhill	Aspergillus
2010	2	1	506	1.976284623	Intercept + Linear	0.414317522	Yorkhill	Aspergillus
2010	3	0	481	0	Intercept + Linear	0.403824673	Yorkhill	Aspergillus
2010	4	0	517	0	Intercept + Linear	0.392517279	Yorkhill	Aspergillus
2010	5	0	719	0	Intercept + Linear	0.381876192	Yorkhill	Aspergillus
2010	6	0	516	0	Intercept + Linear	0.371183372	Yorkhill	Aspergillus
2010	7	0	397	0	Intercept + Linear	0.361120644	Yorkhill	Aspergillus
2010	8	0	891	0	Intercept + Linear	0.351008995	Yorkhill	Aspergillus
2010	9	0	566	0	Intercept + Linear	0.34118048	Yorkhill	Aspergillus
2010	10	0	493	0	Intercept + Linear	0.331931125	Yorkhill	Aspergillus
2010	11	1	769	1.300390124	Intercept + Linear	0.322636805	Yorkhill	Aspergillus
2010	12	0	724	0	Intercept + Linear	0.313890167	Yorkhill	Aspergillus
2011	1	0	615	0	Intercept + Linear	0.305101007	Yorkhill	Aspergillus
2011	2	1	274	3.649635077	Intercept + Linear	0.29655795	Yorkhill	Aspergillus
2011	3	1	570	1.754385948	Intercept + Linear	0.289047435	Yorkhill	Aspergillus
2011	4	0	428	0	Intercept + Linear	0.28095389	Yorkhill	Aspergillus
2011	5	0	562	0	Intercept + Linear	0.27333727	Yorkhill	Aspergillus
2011	6	0	392	0	Intercept + Linear	0.265683622	Yorkhill	Aspergillus
2011	7	0	453	0	Intercept + Linear	0.258480976	Yorkhill	Aspergillus
2011	8	0	399	0	Intercept + Linear	0.251243315	Yorkhill	Aspergillus
2011	9	0	505	0	Intercept + Linear	0.244208314	Yorkhill	Aspergillus
2011	10	0	392	0	Intercept + Linear	0.237587861	Yorkhill	Aspergillus
2011	11	0	479	0	Intercept + Linear	0.230935223	Yorkhill	Aspergillus
2011	12	0	402	0	Intercept + Linear	0.224674602	Yorkhill	Aspergillus
2012	1	0	670	0	Intercept + Linear	0.218383545	Yorkhill	Aspergillus
2012	2	0	566	0	Intercept + Linear	0.212285113	Yorkhill	Aspergillus
2012	3	0	954	0	Intercept + Linear	0.206734397	Yorkhill	Aspergillus
2012	4	0	490	0	Intercept + Linear	0.200961272	Yorkhill	Aspergillus
2012	5	0	994	0	Intercept + Linear	0.195527923	Yorkhill	Aspergillus
2012	6	0	389	0	Intercept + Linear	0.190067742	Yorkhill	Aspergillus

2012	7	0	492	0	Intercept + Linear	0.184928919	Yorkhill	Aspergillus
2012	8	0	312	0	Intercept + Linear	0.179764719	Yorkhill	Aspergillus
2012	9	0	542	0	Intercept + Linear	0.174744731	Yorkhill	Aspergillus
2012	10	1	583	1.71526587	Intercept + Linear	0.170020194	Yorkhill	Aspergillus
2012	11	0	467	0	Intercept + Linear	0.165272325	Yorkhill	Aspergillus
2012	12	0	533	0	Intercept + Linear	0.16080389	Yorkhill	Aspergillus
2013	1	0	434	0	Intercept + Linear	0.15631339	Yorkhill	Aspergillus
2013	2	0	613	0	Intercept + Linear	0.151936497	Yorkhill	Aspergillus
2013	3	0	560	0	Intercept + Linear	0.148088611	Yorkhill	Aspergillus
2013	4	1	451	2.217294931	Intercept + Linear	0.143942019	Yorkhill	Aspergillus
2013	5	0	552	0	Intercept + Linear	0.140039771	Yorkhill	Aspergillus
2013	6	1	368	2.717391253	Intercept + Linear	0.136118553	Yorkhill	Aspergillus
2013	7	0	244	0	Intercept + Linear	0.132428398	Yorkhill	Aspergillus
2013	8	1	347	2.881844282	Intercept + Linear	0.128720304	Yorkhill	Aspergillus
2013	9	0	357	0	Intercept + Linear	0.125116038	Yorkhill	Aspergillus
2013	10	1	534	1.872659206	Intercept + Linear	0.12172416	Yorkhill	Aspergillus
2013	11	0	509	0	Intercept + Linear	0.118315793	Yorkhill	Aspergillus
2013	12	1	513	1.949317694	Intercept + Linear	0.115108268	Yorkhill	Aspergillus
2014	1	1	533	1.876172662	Intercept + Linear	0.111885151	Yorkhill	Aspergillus
2014	2	0	670	0	Intercept + Linear	0.108752282	Yorkhill	Aspergillus
2014	3	1	384	2.604166746	Intercept + Linear	0.105998063	Yorkhill	Aspergillus
2014	4	0	465	0	Intercept + Linear	0.103030038	Yorkhill	Aspergillus
2014	5	0	560	0	Intercept + Linear	0.100236908	Yorkhill	Aspergillus
2014	6	0	517	0	Intercept + Linear	0.0974302	Yorkhill	Aspergillus
2014	7	0	360	0	Intercept + Linear	0.094788881	Yorkhill	Aspergillus
2014	8	0	743	0	Intercept + Linear	0.092134721	Yorkhill	Aspergillus
2014	9	0	348	0	Intercept + Linear	0.08955488	Yorkhill	Aspergillus
2014	10	0	529	0	Intercept + Linear	0.08712706	Yorkhill	Aspergillus
2014	11	0	519	0	Intercept + Linear	0.084687437	Yorkhill	Aspergillus
2014	12	0	509	0	Intercept + Linear	0.082391572	Yorkhill	Aspergillus
2015	1	0	730	0	Intercept + Linear	0.080084546	Yorkhill	Aspergillus
2015	2	0	436	0	Intercept + Linear	0.077842119	Yorkhill	Aspergillus
2015	3	0	525	0	Intercept + Linear	0.075870719	Yorkhill	Aspergillus
2015	4	0	591	0	Intercept + Linear	0.073746282	Yorkhill	Aspergillus
2015	5	0	347	0	Intercept + Linear	0.071747031	Yorkhill	Aspergillus
2008	1	1	934	1.07066381	Intercept + Linear + Smooth	0.379346651	Yorkhill	Aspergillus
2008	2	0	439	0	Intercept + Linear + Smooth	0.375344148	Yorkhill	Aspergillus
2008	3	0	953	0	Intercept + Linear + Smooth	0.371638111	Yorkhill	Aspergillus
2008	4	0	585	0	Intercept + Linear + Smooth	0.367716941	Yorkhill	Aspergillus
2008	5	0	379	0	Intercept + Linear + Smooth	0.363961658	Yorkhill	Aspergillus
2008	6	0	746	0	Intercept + Linear + Smooth	0.360121482	Yorkhill	Aspergillus
2008	7	0	767	0	Intercept + Linear + Smooth	0.356443767	Yorkhill	Aspergillus
2008	8	0	537	0	Intercept + Linear + Smooth	0.352682913	Yorkhill	Aspergillus
2008	9	0	646	0	Intercept + Linear + Smooth	0.34896174	Yorkhill	Aspergillus
2008	10	0	535	0	Intercept + Linear + Smooth	0.345397993	Yorkhill	Aspergillus
2008	11	1	484	2.066115618	Intercept + Linear + Smooth	0.341753683	Yorkhill	Aspergillus
2008	12	1	651	1.536098361	Intercept + Linear + Smooth	0.338263548	Yorkhill	Aspergillus
2009	1	0	633	0	Intercept + Linear + Smooth	0.334694514	Yorkhill	Aspergillus
2009	2	0	381	0	Intercept + Linear + Smooth	0.331153514	Yorkhill	Aspergillus
2009	3	0	799	0	Intercept + Linear + Smooth	0.327987403	Yorkhill	Aspergillus
2009	4	1	710	1.408450723	Intercept + Linear + Smooth	0.324517363	Yorkhill	Aspergillus
2009	5	0	583	0	Intercept + Linear + Smooth	0.321194219	Yorkhill	Aspergillus
2009	6	0	590	0	Intercept + Linear + Smooth	0.317796049	Yorkhill	Aspergillus
2009	7	0	778	0	Intercept + Linear + Smooth	0.314541733	Yorkhill	Aspergillus
2009	8	0	449	0	Intercept + Linear + Smooth	0.311213945	Yorkhill	Aspergillus

2009	9	0	638	0	Intercept + Linear + Smooth	0.307921364	Yorkhill	Aspergillus
2009	10	0	802	0	Intercept + Linear + Smooth	0.304768167	Yorkhill	Aspergillus
2009	11	0	465	0	Intercept + Linear + Smooth	0.301543782	Yorkhill	Aspergillus
2009	12	1	471	2.123142242	Intercept + Linear + Smooth	0.298455893	Yorkhill	Aspergillus
2010	1	0	505	0	Intercept + Linear + Smooth	0.29529829	Yorkhill	Aspergillus
2010	2	1	506	1.976284623	Intercept + Linear + Smooth	0.292174094	Yorkhill	Aspergillus
2010	3	0	481	0	Intercept + Linear + Smooth	0.289380659	Yorkhill	Aspergillus
2010	4	0	517	0	Intercept + Linear + Smooth	0.28631907	Yorkhill	Aspergillus
2010	5	0	719	0	Intercept + Linear + Smooth	0.283387086	Yorkhill	Aspergillus
2010	6	0	516	0	Intercept + Linear + Smooth	0.280388908	Yorkhill	Aspergillus
2010	7	0	397	0	Intercept + Linear + Smooth	0.27751765	Yorkhill	Aspergillus
2010	8	0	891	0	Intercept + Linear + Smooth	0.274581569	Yorkhill	Aspergillus
2010	9	0	566	0	Intercept + Linear + Smooth	0.271676551	Yorkhill	Aspergillus
2010	10	0	493	0	Intercept + Linear + Smooth	0.268894509	Yorkhill	Aspergillus
2010	11	1	769	1.300390124	Intercept + Linear + Smooth	0.266049659	Yorkhill	Aspergillus
2010	12	0	724	0	Intercept + Linear + Smooth	0.263325237	Yorkhill	Aspergillus
2011	1	0	615	0	Intercept + Linear + Smooth	0.260539308	Yorkhill	Aspergillus
2011	2	1	274	3.649635077	Intercept + Linear + Smooth	0.257782851	Yorkhill	Aspergillus
2011	3	1	570	1.754385948	Intercept + Linear + Smooth	0.255318223	Yorkhill	Aspergillus
2011	4	0	428	0	Intercept + Linear + Smooth	0.252617002	Yorkhill	Aspergillus
2011	5	0	562	0	Intercept + Linear + Smooth	0.250030129	Yorkhill	Aspergillus
2011	6	0	392	0	Intercept + Linear + Smooth	0.24738485	Yorkhill	Aspergillus
2011	7	0	453	0	Intercept + Linear + Smooth	0.244851552	Yorkhill	Aspergillus
2011	8	0	399	0	Intercept + Linear + Smooth	0.242261373	Yorkhill	Aspergillus
2011	9	0	505	0	Intercept + Linear + Smooth	0.239778955	Yorkhill	Aspergillus
2011	10	0	392	0	Intercept + Linear + Smooth	0.237724533	Yorkhill	Aspergillus
2011	11	0	479	0	Intercept + Linear + Smooth	0.23623224	Yorkhill	Aspergillus
2011	12	0	402	0	Intercept + Linear + Smooth	0.235654702	Yorkhill	Aspergillus
2012	1	0	670	0	Intercept + Linear + Smooth	0.236226526	Yorkhill	Aspergillus
2012	2	0	566	0	Intercept + Linear + Smooth	0.238267821	Yorkhill	Aspergillus
2012	3	0	954	0	Intercept + Linear + Smooth	0.241788023	Yorkhill	Aspergillus
2012	4	0	490	0	Intercept + Linear + Smooth	0.247603963	Yorkhill	Aspergillus
2012	5	0	994	0	Intercept + Linear + Smooth	0.255582526	Yorkhill	Aspergillus
2012	6	0	389	0	Intercept + Linear + Smooth	0.26667405	Yorkhill	Aspergillus
2012	7	0	492	0	Intercept + Linear + Smooth	0.28057268	Yorkhill	Aspergillus
2012	8	0	312	0	Intercept + Linear + Smooth	0.298688981	Yorkhill	Aspergillus
2012	9	0	542	0	Intercept + Linear + Smooth	0.321200148	Yorkhill	Aspergillus
2012	10	1	583	1.71526587	Intercept + Linear + Smooth	0.34776814	Yorkhill	Aspergillus
2012	11	0	467	0	Intercept + Linear + Smooth	0.380949298	Yorkhill	Aspergillus
2012	12	0	533	0	Intercept + Linear + Smooth	0.419644507	Yorkhill	Aspergillus
2013	1	0	434	0	Intercept + Linear + Smooth	0.467811731	Yorkhill	Aspergillus
2013	2	0	613	0	Intercept + Linear + Smooth	0.525663069	Yorkhill	Aspergillus
2013	3	0	560	0	Intercept + Linear + Smooth	0.586809149	Yorkhill	Aspergillus
2013	4	1	451	2.217294931	Intercept + Linear + Smooth	0.664482007	Yorkhill	Aspergillus
2013	5	0	552	0	Intercept + Linear + Smooth	0.747888295	Yorkhill	Aspergillus
2013	6	1	368	2.717391253	Intercept + Linear + Smooth	0.838930154	Yorkhill	Aspergillus
2013	7	0	244	0	Intercept + Linear + Smooth	0.925993504	Yorkhill	Aspergillus
2013	8	1	347	2.881844282	Intercept + Linear + Smooth	1.006523132	Yorkhill	Aspergillus
2013	9	0	357	0	Intercept + Linear + Smooth	1.067385123	Yorkhill	Aspergillus
2013	10	1	534	1.872659206	Intercept + Linear + Smooth	1.097775944	Yorkhill	Aspergillus
2013	11	0	509	0	Intercept + Linear + Smooth	1.090705368	Yorkhill	Aspergillus
2013	12	1	513	1.949317694	Intercept + Linear + Smooth	1.040096115	Yorkhill	Aspergillus
2014	1	1	533	1.876172662	Intercept + Linear + Smooth	0.941888623	Yorkhill	Aspergillus
2014	2	0	670	0	Intercept + Linear + Smooth	0.806127544	Yorkhill	Aspergillus
2014	3	1	384	2.604166746	Intercept + Linear + Smooth	0.664914719	Yorkhill	Aspergillus

2014	4	0	465	0	Intercept + Linear + Smooth	0.506817686	Yorkhill	Aspergillus
2014	5	0	560	0	Intercept + Linear + Smooth	0.369704576	Yorkhill	Aspergillus
2014	6	0	517	0	Intercept + Linear + Smooth	0.254487476	Yorkhill	Aspergillus
2014	7	0	360	0	Intercept + Linear + Smooth	0.170653195	Yorkhill	Aspergillus
2014	8	0	743	0	Intercept + Linear + Smooth	0.109477084	Yorkhill	Aspergillus
2014	9	0	348	0	Intercept + Linear + Smooth	0.06854416	Yorkhill	Aspergillus
2014	10	0	529	0	Intercept + Linear + Smooth	0.042796682	Yorkhill	Aspergillus
2014	11	0	519	0	Intercept + Linear + Smooth	0.025951397	Yorkhill	Aspergillus
2014	12	0	509	0	Intercept + Linear + Smooth	0.01584197	Yorkhill	Aspergillus
2015	1	0	730	0	Intercept + Linear + Smooth	0.009452837	Yorkhill	Aspergillus
2015	2	0	436	0	Intercept + Linear + Smooth	0.005617902	Yorkhill	Aspergillus
2015	3	0	525	0	Intercept + Linear + Smooth	0.003504519	Yorkhill	Aspergillus
2015	4	0	591	0	Intercept + Linear + Smooth	0.002076514	Yorkhill	Aspergillus
2015	5	0	347	0	Intercept + Linear + Smooth	0.001250758	Yorkhill	Aspergillus

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays	Hospital	Organism
2015	6	0	487	0	Intercept + Linear	0.543159779	QEUH	Aspergillus
2015	7	0	386	0	Intercept + Linear	0.546030283	QEUH	Aspergillus
2015	8	0	621	0	Intercept + Linear	0.549012408	QEUH	Aspergillus
2015	9	0	481	0	Intercept + Linear	0.55201082	QEUH	Aspergillus
2015	10	0	530	0	Intercept + Linear	0.5549281	QEUH	Aspergillus
2015	11	0	791	0	Intercept + Linear	0.55795882	QEUH	Aspergillus
2015	12	1	501	1.996008039	Intercept + Linear	0.560907534	QEUH	Aspergillus
2016	1	0	435	0	Intercept + Linear	0.563970911	QEUH	Aspergillus
2016	2	0	550	0	Intercept + Linear	0.56704258	QEUH	Aspergillus
2016	3	0	364	0	Intercept + Linear	0.569931221	QEUH	Aspergillus
2016	4	0	664	0	Intercept + Linear	0.573035352	QEUH	Aspergillus
2016	5	0	801	0	Intercept + Linear	0.576055447	QEUH	Aspergillus
2016	6	0	549	0	Intercept + Linear	0.579192935	QEUH	Aspergillus
2016	7	1	563	1.776198983	Intercept + Linear	0.582245482	QEUH	Aspergillus
2016	8	1	565	1.769911528	Intercept + Linear	0.585416683	QEUH	Aspergillus
2016	9	0	546	0	Intercept + Linear	0.588605157	QEUH	Aspergillus
2016	10	0	428	0	Intercept + Linear	0.59170731	QEUH	Aspergillus
2016	11	1	879	1.13765645	Intercept + Linear	0.594930045	QEUH	Aspergillus
2016	12	1	640	1.5625	Intercept + Linear	0.598065533	QEUH	Aspergillus
2017	1	0	867	0	Intercept + Linear	0.601322898	QEUH	Aspergillus
2017	2	1	599	1.669449091	Intercept + Linear	0.604607002	QEUH	Aspergillus
2017	3	1	648	1.54320991	Intercept + Linear	0.607588703	QEUH	Aspergillus
2017	4	1	983	1.017294049	Intercept + Linear	0.610907027	QEUH	Aspergillus
2017	5	0	838	0	Intercept + Linear	0.614135564	QEUH	Aspergillus
2017	6	0	632	0	Intercept + Linear	0.617489643	QEUH	Aspergillus
2017	7	0	658	0	Intercept + Linear	0.620752967	QEUH	Aspergillus
2017	8	0	617	0	Intercept + Linear	0.624143188	QEUH	Aspergillus
2017	9	0	779	0	Intercept + Linear	0.627551924	QEUH	Aspergillus
2017	10	1	624	1.602564096	Intercept + Linear	0.630868426	QEUH	Aspergillus
2017	11	1	608	1.644736886	Intercept + Linear	0.634313891	QEUH	Aspergillus
2017	12	2	664	3.012048244	Intercept + Linear	0.637666129	QEUH	Aspergillus
2018	1	0	792	0	Intercept + Linear	0.64114872	QEUH	Aspergillus
2018	2	1	525	1.90476191	Intercept + Linear	0.644650331	QEUH	Aspergillus
2018	3	0	534	0	Intercept + Linear	0.647829511	QEUH	Aspergillus
2018	4	1	426	2.347417831	Intercept + Linear	0.651367609	QEUH	Aspergillus
2018	5	0	764	0	Intercept + Linear	0.654809973	QEUH	Aspergillus
2018	6	1	526	1.90114069	Intercept + Linear	0.658386194	QEUH	Aspergillus
2018	7	1	461	2.169197321	Intercept + Linear	0.661865649	QEUH	Aspergillus
2018	8	0	576	0	Intercept + Linear	0.665480405	QEUH	Aspergillus
2018	9	1	461	2.169197321	Intercept + Linear	0.669114903	QEUH	Aspergillus
2018	10	0	733	0	Intercept + Linear	0.672651058	QEUH	Aspergillus
2018	11	0	692	0	Intercept + Linear	0.676324718	QEUH	Aspergillus
2018	12	0	436	0	Intercept + Linear	0.679898975	QEUH	Aspergillus
2019	1	0	394	0	Intercept + Linear	0.683612219	QEUH	Aspergillus
2019	2	2	575	3.478260756	Intercept + Linear	0.687345744	QEUH	Aspergillus
2019	3	0	440	0	Intercept + Linear	0.690735482	QEUH	Aspergillus
2019	4	0	605	0	Intercept + Linear	0.69450791	QEUH	Aspergillus
2019	5	0	529	0	Intercept + Linear	0.698178262	QEUH	Aspergillus
2019	6	0	292	0	Intercept + Linear	0.701991338	QEUH	Aspergillus
2019	7	0	579	0	Intercept + Linear	0.705701238	QEUH	Aspergillus
2019	8	2	288	6.944444656	Intercept + Linear	0.709555401	QEUH	Aspergillus
2019	9	0	406	0	Intercept + Linear	0.713430613	QEUH	Aspergillus
2019	10	1	322	3.105590105	Intercept + Linear	0.717200968	QEUH	Aspergillus
2019	11	2	668	2.994011879	Intercept + Linear	0.721117936	QEUH	Aspergillus

2019	12	0	623	0	Intercept + Linear	0.724928917	QEUH	Aspergillus
2020	1	0	501	0	Intercept + Linear	0.728888091	QEUH	Aspergillus
2020	2	1	424	2.358490467	Intercept + Linear	0.732857982	QEUH	Aspergillus
2020	3	0	431	0	Intercept + Linear	0.736591323	QEUH	Aspergillus
2020	4	0	192	0	Intercept + Linear	0.740603169	QEUH	Aspergillus
2020	5	0	277	0	Intercept + Linear	0.744506405	QEUH	Aspergillus
2020	6	1	250	4	Intercept + Linear	0.74856136	QEUH	Aspergillus
2020	7	0	483	0	Intercept + Linear	0.752506538	QEUH	Aspergillus
2020	8	0	335	0	Intercept + Linear	0.756605067	QEUH	Aspergillus
2020	9	0	438	0	Intercept + Linear	0.760725918	QEUH	Aspergillus
2020	10	0	300	0	Intercept + Linear	0.764735207	QEUH	Aspergillus
2020	11	2	379	5.277044773	Intercept + Linear	0.768900339	QEUH	Aspergillus
2020	12	0	380	0	Intercept + Linear	0.772952711	QEUH	Aspergillus
2021	1	0	390	0	Intercept + Linear	0.777162599	QEUH	Aspergillus
2021	2	0	316	0	Intercept + Linear	0.781407046	QEUH	Aspergillus
2021	3	1	557	1.795332193	Intercept + Linear	0.78526066	QEUH	Aspergillus
2021	4	0	444	0	Intercept + Linear	0.789549334	QEUH	Aspergillus
2021	5	0	501	0	Intercept + Linear	0.793721963	QEUH	Aspergillus
2021	6	0	349	0	Intercept + Linear	0.798056847	QEUH	Aspergillus
2021	7	0	527	0	Intercept + Linear	0.802274437	QEUH	Aspergillus
2021	8	1	533	1.876172662	Intercept + Linear	0.806656031	QEUH	Aspergillus
2021	9	0	511	0	Intercept + Linear	0.811061555	QEUH	Aspergillus
2021	10	0	325	0	Intercept + Linear	0.815347872	QEUH	Aspergillus
2021	11	0	376	0	Intercept + Linear	0.819800866	QEUH	Aspergillus
2021	12	0	350	0	Intercept + Linear	0.824133369	QEUH	Aspergillus
2022	1	0	390	0	Intercept + Linear	0.828634345	QEUH	Aspergillus
2022	2	0	157	0	Intercept + Linear	0.833159902	QEUH	Aspergillus
2015	6	0	487	0	Intercept + Linear + Smooth	0.267270774	QEUH	Aspergillus
2015	7	0	386	0	Intercept + Linear + Smooth	0.281725782	QEUH	Aspergillus
2015	8	0	621	0	Intercept + Linear + Smooth	0.297457467	QEUH	Aspergillus
2015	9	0	481	0	Intercept + Linear + Smooth	0.314013943	QEUH	Aspergillus
2015	10	0	530	0	Intercept + Linear + Smooth	0.33081799	QEUH	Aspergillus
2015	11	0	791	0	Intercept + Linear + Smooth	0.348972559	QEUH	Aspergillus
2015	12	1	501	1.996008039	Intercept + Linear + Smooth	0.367279981	QEUH	Aspergillus
2016	1	0	435	0	Intercept + Linear + Smooth	0.386923007	QEUH	Aspergillus
2016	2	0	550	0	Intercept + Linear + Smooth	0.407214402	QEUH	Aspergillus
2016	3	0	364	0	Intercept + Linear + Smooth	0.426806697	QEUH	Aspergillus
2016	4	0	664	0	Intercept + Linear + Smooth	0.448357316	QEUH	Aspergillus
2016	5	0	801	0	Intercept + Linear + Smooth	0.469742427	QEUH	Aspergillus
2016	6	0	549	0	Intercept + Linear + Smooth	0.492292483	QEUH	Aspergillus
2016	7	1	563	1.776198983	Intercept + Linear + Smooth	0.514427933	QEUH	Aspergillus
2016	8	1	565	1.769911528	Intercept + Linear + Smooth	0.537485215	QEUH	Aspergillus
2016	9	0	546	0	Intercept + Linear + Smooth	0.560613032	QEUH	Aspergillus
2016	10	0	428	0	Intercept + Linear + Smooth	0.58295219	QEUH	Aspergillus
2016	11	1	879	1.13765645	Intercept + Linear + Smooth	0.605889527	QEUH	Aspergillus
2016	12	1	640	1.5625	Intercept + Linear + Smooth	0.627850533	QEUH	Aspergillus
2017	1	0	867	0	Intercept + Linear + Smooth	0.65021963	QEUH	Aspergillus
2017	2	1	599	1.669449091	Intercept + Linear + Smooth	0.672251631	QEUH	Aspergillus
2017	3	1	648	1.54320991	Intercept + Linear + Smooth	0.691771683	QEUH	Aspergillus
2017	4	1	983	1.017294049	Intercept + Linear + Smooth	0.7129433	QEUH	Aspergillus
2017	5	0	838	0	Intercept + Linear + Smooth	0.732989371	QEUH	Aspergillus
2017	6	0	632	0	Intercept + Linear + Smooth	0.753265321	QEUH	Aspergillus
2017	7	0	658	0	Intercept + Linear + Smooth	0.772466048	QEUH	Aspergillus
2017	8	0	617	0	Intercept + Linear + Smooth	0.791824502	QEUH	Aspergillus
2017	9	0	779	0	Intercept + Linear + Smooth	0.810620869	QEUH	Aspergillus

2017	10	1	624	1.602564096	Intercept + Linear + Smooth	0.828150211	QEUH	Aspergillus
2017	11	1	608	1.644736886	Intercept + Linear + Smooth	0.845440311	QEUH	Aspergillus
2017	12	2	664	3.012048244	Intercept + Linear + Smooth	0.861266926	QEUH	Aspergillus
2018	1	0	792	0	Intercept + Linear + Smooth	0.876587143	QEUH	Aspergillus
2018	2	1	525	1.90476191	Intercept + Linear + Smooth	0.890811737	QEUH	Aspergillus
2018	3	0	534	0	Intercept + Linear + Smooth	0.902707729	QEUH	Aspergillus
2018	4	1	426	2.347417831	Intercept + Linear + Smooth	0.914820387	QEUH	Aspergillus
2018	5	0	764	0	Intercept + Linear + Smooth	0.925486877	QEUH	Aspergillus
2018	6	1	526	1.90114069	Intercept + Linear + Smooth	0.935427829	QEUH	Aspergillus
2018	7	1	461	2.169197321	Intercept + Linear + Smooth	0.944016834	QEUH	Aspergillus
2018	8	0	576	0	Intercept + Linear + Smooth	0.951855625	QEUH	Aspergillus
2018	9	1	461	2.169197321	Intercept + Linear + Smooth	0.958693231	QEUH	Aspergillus
2018	10	0	733	0	Intercept + Linear + Smooth	0.964408433	QEUH	Aspergillus
2018	11	0	692	0	Intercept + Linear + Smooth	0.969420925	QEUH	Aspergillus
2018	12	0	436	0	Intercept + Linear + Smooth	0.973432624	QEUH	Aspergillus
2019	1	0	394	0	Intercept + Linear + Smooth	0.976676653	QEUH	Aspergillus
2019	2	2	575	3.478260756	Intercept + Linear + Smooth	0.978950935	QEUH	Aspergillus
2019	3	0	440	0	Intercept + Linear + Smooth	0.980130772	QEUH	Aspergillus
2019	4	0	605	0	Intercept + Linear + Smooth	0.98042663	QEUH	Aspergillus
2019	5	0	529	0	Intercept + Linear + Smooth	0.979643891	QEUH	Aspergillus
2019	6	0	292	0	Intercept + Linear + Smooth	0.977653503	QEUH	Aspergillus
2019	7	0	579	0	Intercept + Linear + Smooth	0.974481725	QEUH	Aspergillus
2019	8	2	288	6.944444656	Intercept + Linear + Smooth	0.969770068	QEUH	Aspergillus
2019	9	0	406	0	Intercept + Linear + Smooth	0.963474199	QEUH	Aspergillus
2019	10	1	322	3.105590105	Intercept + Linear + Smooth	0.955797067	QEUH	Aspergillus
2019	11	2	668	2.994011879	Intercept + Linear + Smooth	0.946187795	QEUH	Aspergillus
2019	12	0	623	0	Intercept + Linear + Smooth	0.935312257	QEUH	Aspergillus
2020	1	0	501	0	Intercept + Linear + Smooth	0.922520258	QEUH	Aspergillus
2020	2	1	424	2.358490467	Intercept + Linear + Smooth	0.908290502	QEUH	Aspergillus
2020	3	0	431	0	Intercept + Linear + Smooth	0.893745441	QEUH	Aspergillus
2020	4	0	192	0	Intercept + Linear + Smooth	0.876978325	QEUH	Aspergillus
2020	5	0	277	0	Intercept + Linear + Smooth	0.859647813	QEUH	Aspergillus
2020	6	1	250	4	Intercept + Linear + Smooth	0.840695276	QEUH	Aspergillus
2020	7	0	483	0	Intercept + Linear + Smooth	0.821433221	QEUH	Aspergillus
2020	8	0	335	0	Intercept + Linear + Smooth	0.800671911	QEUH	Aspergillus
2020	9	0	438	0	Intercept + Linear + Smooth	0.77913509	QEUH	Aspergillus
2020	10	0	300	0	Intercept + Linear + Smooth	0.75763607	QEUH	Aspergillus
2020	11	2	379	5.277044773	Intercept + Linear + Smooth	0.734805915	QEUH	Aspergillus
2020	12	0	380	0	Intercept + Linear + Smooth	0.712197767	QEUH	Aspergillus
2021	1	0	390	0	Intercept + Linear + Smooth	0.688447511	QEUH	Aspergillus
2021	2	0	316	0	Intercept + Linear + Smooth	0.664388168	QEUH	Aspergillus
2021	3	1	557	1.795332193	Intercept + Linear + Smooth	0.642576861	QEUH	Aspergillus
2021	4	0	444	0	Intercept + Linear + Smooth	0.618476373	QEUH	Aspergillus
2021	5	0	501	0	Intercept + Linear + Smooth	0.595334625	QEUH	Aspergillus
2021	6	0	349	0	Intercept + Linear + Smooth	0.571741793	QEUH	Aspergillus
2021	7	0	527	0	Intercept + Linear + Smooth	0.549317223	QEUH	Aspergillus
2021	8	1	533	1.876172662	Intercept + Linear + Smooth	0.526640881	QEUH	Aspergillus
2021	9	0	511	0	Intercept + Linear + Smooth	0.504544205	QEUH	Aspergillus
2021	10	0	325	0	Intercept + Linear + Smooth	0.483787014	QEUH	Aspergillus
2021	11	0	376	0	Intercept + Linear + Smooth	0.463048797	QEUH	Aspergillus
2021	12	0	350	0	Intercept + Linear + Smooth	0.443713448	QEUH	Aspergillus
2022	1	0	390	0	Intercept + Linear + Smooth	0.424521848	QEUH	Aspergillus
2022	2	0	157	0	Intercept + Linear + Smooth	0.406130399	QEUH	Aspergillus

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays	Hospital	Organism
2008	1	3	934	3.211991435	Intercept + Linear	5.560077102	Yorkhill	Environmental BSI
2008	2	2	439	4.555808656	Intercept + Linear	5.52026481	Yorkhill	Environmental BSI
2008	3	1	953	1.049317943	Intercept + Linear	5.48327917	Yorkhill	Environmental BSI
2008	4	2	585	3.418803419	Intercept + Linear	5.444016781	Yorkhill	Environmental BSI
2008	5	6	379	15.83113456	Intercept + Linear	5.406288618	Yorkhill	Environmental BSI
2008	6	9	746	12.06434316	Intercept + Linear	5.36757751	Yorkhill	Environmental BSI
2008	7	0	767	0	Intercept + Linear	5.330379087	Yorkhill	Environmental BSI
2008	8	12	537	22.34636872	Intercept + Linear	5.292211521	Yorkhill	Environmental BSI
2008	9	2	646	3.095975232	Intercept + Linear	5.25431725	Yorkhill	Environmental BSI
2008	10	7	535	13.08411215	Intercept + Linear	5.217903743	Yorkhill	Environmental BSI
2008	11	0	484	0	Intercept + Linear	5.180541544	Yorkhill	Environmental BSI
2008	12	0	651	0	Intercept + Linear	5.144639319	Yorkhill	Environmental BSI
2009	1	2	633	3.159557662	Intercept + Linear	5.107801721	Yorkhill	Environmental BSI
2009	2	0	381	0	Intercept + Linear	5.071128053	Yorkhill	Environmental BSI
2009	3	4	799	5.006257822	Intercept + Linear	5.038229827	Yorkhill	Environmental BSI
2009	4	1	710	1.408450704	Intercept + Linear	5.00205568	Yorkhill	Environmental BSI
2009	5	2	583	3.430531732	Intercept + Linear	4.967295756	Yorkhill	Environmental BSI
2009	6	2	590	3.389830508	Intercept + Linear	4.931630912	Yorkhill	Environmental BSI
2009	7	2	778	2.570694087	Intercept + Linear	4.897360378	Yorkhill	Environmental BSI
2009	8	6	449	13.36302895	Intercept + Linear	4.862197665	Yorkhill	Environmental BSI
2009	9	7	638	10.97178683	Intercept + Linear	4.827287417	Yorkhill	Environmental BSI
2009	10	4	802	4.987531172	Intercept + Linear	4.79374198	Yorkhill	Environmental BSI
2009	11	2	465	4.301075269	Intercept + Linear	4.75932324	Yorkhill	Environmental BSI
2009	12	4	471	8.492569002	Intercept + Linear	4.726250095	Yorkhill	Environmental BSI
2010	1	2	505	3.96039604	Intercept + Linear	4.692315941	Yorkhill	Environmental BSI
2010	2	1	506	1.976284585	Intercept + Linear	4.658625433	Yorkhill	Environmental BSI
2010	3	2	481	4.158004158	Intercept + Linear	4.628403259	Yorkhill	Environmental BSI
2010	4	2	517	3.868471954	Intercept + Linear	4.595171639	Yorkhill	Environmental BSI
2010	5	3	719	4.172461752	Intercept + Linear	4.563239205	Yorkhill	Environmental BSI
2010	6	0	516	0	Intercept + Linear	4.530475458	Yorkhill	Environmental BSI
2010	7	3	397	7.556675063	Intercept + Linear	4.498992606	Yorkhill	Environmental BSI
2010	8	4	891	4.489337823	Intercept + Linear	4.466690146	Yorkhill	Environmental BSI
2010	9	1	566	1.766784452	Intercept + Linear	4.434619615	Yorkhill	Environmental BSI
2010	10	6	493	12.1703854	Intercept + Linear	4.403802877	Yorkhill	Environmental BSI
2010	11	0	769	0	Intercept + Linear	4.372183872	Yorkhill	Environmental BSI
2010	12	2	724	2.762430939	Intercept + Linear	4.341801008	Yorkhill	Environmental BSI
2011	1	1	615	1.62601626	Intercept + Linear	4.310627173	Yorkhill	Environmental BSI
2011	2	1	274	3.649635036	Intercept + Linear	4.279677164	Yorkhill	Environmental BSI
2011	3	1	570	1.754385965	Intercept + Linear	4.251913363	Yorkhill	Environmental BSI
2011	4	3	428	7.009345794	Intercept + Linear	4.221384915	Yorkhill	Environmental BSI
2011	5	4	562	7.117437722	Intercept + Linear	4.192049972	Yorkhill	Environmental BSI
2011	6	1	392	2.551020408	Intercept + Linear	4.161951339	Yorkhill	Environmental BSI
2011	7	1	453	2.207505519	Intercept + Linear	4.133029408	Yorkhill	Environmental BSI
2011	8	0	399	0	Intercept + Linear	4.103354539	Yorkhill	Environmental BSI
2011	9	2	505	3.96039604	Intercept + Linear	4.073892733	Yorkhill	Environmental BSI
2011	10	2	392	5.102040816	Intercept + Linear	4.045582732	Yorkhill	Environmental BSI
2011	11	0	479	0	Intercept + Linear	4.016535724	Yorkhill	Environmental BSI
2011	12	1	402	2.487562189	Intercept + Linear	3.988624304	Yorkhill	Environmental BSI
2012	1	1	670	1.492537313	Intercept + Linear	3.959986254	Yorkhill	Environmental BSI
2012	2	5	566	8.833922261	Intercept + Linear	3.931631228	Yorkhill	Environmental BSI
2012	3	3	954	3.144654088	Intercept + Linear	3.905289394	Yorkhill	Environmental BSI
2012	4	1	490	2.040816327	Intercept + Linear	3.877326019	Yorkhill	Environmental BSI
2012	5	2	994	2.012072435	Intercept + Linear	3.850455347	Yorkhill	Environmental BSI
2012	6	3	389	7.712082262	Intercept + Linear	3.822884605	Yorkhill	Environmental BSI

2012	7	2	492	4.06504065	Intercept + Linear	3.796391223	Yorkhill	Environmental BSI
2012	8	6	312	19.23076923	Intercept + Linear	3.769207601	Yorkhill	Environmental BSI
2012	9	3	542	5.535055351	Intercept + Linear	3.742218623	Yorkhill	Environmental BSI
2012	10	0	583	0	Intercept + Linear	3.716284274	Yorkhill	Environmental BSI
2012	11	0	467	0	Intercept + Linear	3.689674248	Yorkhill	Environmental BSI
2012	12	1	533	1.876172608	Intercept + Linear	3.664104042	Yorkhill	Environmental BSI
2013	1	0	434	0	Intercept + Linear	3.637867646	Yorkhill	Environmental BSI
2013	2	2	613	3.262642741	Intercept + Linear	3.611748005	Yorkhill	Environmental BSI
2013	3	0	560	0	Intercept + Linear	3.5883173	Yorkhill	Environmental BSI
2013	4	3	451	6.651884701	Intercept + Linear	3.562553427	Yorkhill	Environmental BSI
2013	5	0	552	0	Intercept + Linear	3.537796788	Yorkhill	Environmental BSI
2013	6	2	368	5.434782609	Intercept + Linear	3.512395648	Yorkhill	Environmental BSI
2013	7	2	244	8.196721311	Intercept + Linear	3.487987562	Yorkhill	Environmental BSI
2013	8	5	347	14.4092219	Intercept + Linear	3.462944049	Yorkhill	Environmental BSI
2013	9	2	357	5.602240896	Intercept + Linear	3.438080347	Yorkhill	Environmental BSI
2013	10	0	534	0	Intercept + Linear	3.414188688	Yorkhill	Environmental BSI
2013	11	0	509	0	Intercept + Linear	3.389675046	Yorkhill	Environmental BSI
2013	12	1	513	1.949317739	Intercept + Linear	3.366119761	Yorkhill	Environmental BSI
2014	1	1	533	1.876172608	Intercept + Linear	3.341951251	Yorkhill	Environmental BSI
2014	2	2	670	2.985074627	Intercept + Linear	3.317956269	Yorkhill	Environmental BSI
2014	3	3	384	7.8125	Intercept + Linear	3.296431496	Yorkhill	Environmental BSI
2014	4	1	465	2.150537634	Intercept + Linear	3.272763343	Yorkhill	Environmental BSI
2014	5	1	560	1.785714286	Intercept + Linear	3.250020492	Yorkhill	Environmental BSI
2014	6	3	517	5.80270793	Intercept + Linear	3.226685567	Yorkhill	Environmental BSI
2014	7	3	360	8.333333333	Intercept + Linear	3.204262917	Yorkhill	Environmental BSI
2014	8	1	743	1.34589502	Intercept + Linear	3.181256528	Yorkhill	Environmental BSI
2014	9	4	348	11.49425287	Intercept + Linear	3.158415323	Yorkhill	Environmental BSI
2014	10	1	529	1.890359168	Intercept + Linear	3.136467091	Yorkhill	Environmental BSI
2014	11	1	519	1.926782274	Intercept + Linear	3.113947471	Yorkhill	Environmental BSI
2014	12	3	509	5.893909627	Intercept + Linear	3.092308253	Yorkhill	Environmental BSI
2015	1	1	730	1.369863014	Intercept + Linear	3.07010569	Yorkhill	Environmental BSI
2015	2	1	436	2.293577982	Intercept + Linear	3.048062541	Yorkhill	Environmental BSI
2015	3	1	525	1.904761905	Intercept + Linear	3.028288666	Yorkhill	Environmental BSI
2015	4	1	591	1.692047377	Intercept + Linear	3.00654576	Yorkhill	Environmental BSI
2015	5	1	347	2.88184438	Intercept + Linear	2.985652889	Yorkhill	Environmental BSI
2008	1	3	934	3.211991435	Intercept + Linear + Smooth	5.560210197	Yorkhill	Environmental BSI
2008	2	2	439	4.555808656	Intercept + Linear + Smooth	5.520389606	Yorkhill	Environmental BSI
2008	3	1	953	1.049317943	Intercept + Linear + Smooth	5.483396274	Yorkhill	Environmental BSI
2008	4	2	585	3.418803419	Intercept + Linear + Smooth	5.444125715	Yorkhill	Environmental BSI
2008	5	6	379	15.83113456	Intercept + Linear + Smooth	5.406389675	Yorkhill	Environmental BSI
2008	6	9	746	12.06434316	Intercept + Linear + Smooth	5.367670432	Yorkhill	Environmental BSI
2008	7	0	767	0	Intercept + Linear + Smooth	5.330464131	Yorkhill	Environmental BSI
2008	8	12	537	22.34636872	Intercept + Linear + Smooth	5.292288438	Yorkhill	Environmental BSI
2008	9	2	646	3.095975232	Intercept + Linear + Smooth	5.254386079	Yorkhill	Environmental BSI
2008	10	7	535	13.08411215	Intercept + Linear + Smooth	5.21796483	Yorkhill	Environmental BSI
2008	11	0	484	0	Intercept + Linear + Smooth	5.180594773	Yorkhill	Environmental BSI
2008	12	0	651	0	Intercept + Linear + Smooth	5.144685127	Yorkhill	Environmental BSI
2009	1	2	633	3.159557662	Intercept + Linear + Smooth	5.107840095	Yorkhill	Environmental BSI
2009	2	0	381	0	Intercept + Linear + Smooth	5.071159243	Yorkhill	Environmental BSI
2009	3	4	799	5.006257822	Intercept + Linear + Smooth	5.038254774	Yorkhill	Environmental BSI
2009	4	1	710	1.408450704	Intercept + Linear + Smooth	5.002073993	Yorkhill	Environmental BSI
2009	5	2	583	3.430531732	Intercept + Linear + Smooth	4.967307923	Yorkhill	Environmental BSI
2009	6	2	590	3.389830508	Intercept + Linear + Smooth	4.931637003	Yorkhill	Environmental BSI
2009	7	2	778	2.570694087	Intercept + Linear + Smooth	4.897360844	Yorkhill	Environmental BSI
2009	8	6	449	13.36302895	Intercept + Linear + Smooth	4.862192564	Yorkhill	Environmental BSI

2009	9	7	638	10.97178683	Intercept + Linear + Smooth	4.827276988	Yorkhill	Environmental BSI
2009	10	4	802	4.987531172	Intercept + Linear + Smooth	4.793726621	Yorkhill	Environmental BSI
2009	11	2	465	4.301075269	Intercept + Linear + Smooth	4.759303021	Yorkhill	Environmental BSI
2009	12	4	471	8.492569002	Intercept + Linear + Smooth	4.726225408	Yorkhill	Environmental BSI
2010	1	2	505	3.96039604	Intercept + Linear + Smooth	4.692286892	Yorkhill	Environmental BSI
2010	2	1	506	1.976284585	Intercept + Linear + Smooth	4.658592289	Yorkhill	Environmental BSI
2010	3	2	481	4.158004158	Intercept + Linear + Smooth	4.628366656	Yorkhill	Environmental BSI
2010	4	2	517	3.868471954	Intercept + Linear + Smooth	4.59513148	Yorkhill	Environmental BSI
2010	5	3	719	4.172461752	Intercept + Linear + Smooth	4.563195881	Yorkhill	Environmental BSI
2010	6	0	516	0	Intercept + Linear + Smooth	4.530429153	Yorkhill	Environmental BSI
2010	7	3	397	7.556675063	Intercept + Linear + Smooth	4.498943696	Yorkhill	Environmental BSI
2010	8	4	891	4.489337823	Intercept + Linear + Smooth	4.466638832	Yorkhill	Environmental BSI
2010	9	1	566	1.766784452	Intercept + Linear + Smooth	4.434566189	Yorkhill	Environmental BSI
2010	10	6	493	12.1703854	Intercept + Linear + Smooth	4.403747681	Yorkhill	Environmental BSI
2010	11	0	769	0	Intercept + Linear + Smooth	4.372127132	Yorkhill	Environmental BSI
2010	12	2	724	2.762430939	Intercept + Linear + Smooth	4.341743045	Yorkhill	Environmental BSI
2011	1	1	615	1.62601626	Intercept + Linear + Smooth	4.310568226	Yorkhill	Environmental BSI
2011	2	1	274	3.649635036	Intercept + Linear + Smooth	4.279617514	Yorkhill	Environmental BSI
2011	3	1	570	1.754385965	Intercept + Linear + Smooth	4.251853313	Yorkhill	Environmental BSI
2011	4	3	428	7.009345794	Intercept + Linear + Smooth	4.221324675	Yorkhill	Environmental BSI
2011	5	4	562	7.117437722	Intercept + Linear + Smooth	4.191989792	Yorkhill	Environmental BSI
2011	6	1	392	2.551020408	Intercept + Linear + Smooth	4.161891466	Yorkhill	Environmental BSI
2011	7	1	453	2.207505519	Intercept + Linear + Smooth	4.132970064	Yorkhill	Environmental BSI
2011	8	0	399	0	Intercept + Linear + Smooth	4.103295973	Yorkhill	Environmental BSI
2011	9	2	505	3.96039604	Intercept + Linear + Smooth	4.073835176	Yorkhill	Environmental BSI
2011	10	2	392	5.102040816	Intercept + Linear + Smooth	4.04552636	Yorkhill	Environmental BSI
2011	11	0	479	0	Intercept + Linear + Smooth	4.016480783	Yorkhill	Environmental BSI
2011	12	1	402	2.487562189	Intercept + Linear + Smooth	3.988570935	Yorkhill	Environmental BSI
2012	1	1	670	1.492537313	Intercept + Linear + Smooth	3.95993469	Yorkhill	Environmental BSI
2012	2	5	566	8.833922261	Intercept + Linear + Smooth	3.931581635	Yorkhill	Environmental BSI
2012	3	3	954	3.144654088	Intercept + Linear + Smooth	3.905241784	Yorkhill	Environmental BSI
2012	4	1	490	2.040816327	Intercept + Linear + Smooth	3.877280664	Yorkhill	Environmental BSI
2012	5	2	994	2.012072435	Intercept + Linear + Smooth	3.850412294	Yorkhill	Environmental BSI
2012	6	3	389	7.712082262	Intercept + Linear + Smooth	3.822844041	Yorkhill	Environmental BSI
2012	7	2	492	4.06504065	Intercept + Linear + Smooth	3.796353164	Yorkhill	Environmental BSI
2012	8	6	312	19.23076923	Intercept + Linear + Smooth	3.769172215	Yorkhill	Environmental BSI
2012	9	3	542	5.535055351	Intercept + Linear + Smooth	3.742185993	Yorkhill	Environmental BSI
2012	10	0	583	0	Intercept + Linear + Smooth	3.716254386	Yorkhill	Environmental BSI
2012	11	0	467	0	Intercept + Linear + Smooth	3.689647276	Yorkhill	Environmental BSI
2012	12	1	533	1.876172608	Intercept + Linear + Smooth	3.664079968	Yorkhill	Environmental BSI
2013	1	0	434	0	Intercept + Linear + Smooth	3.637846648	Yorkhill	Environmental BSI
2013	2	2	613	3.262642741	Intercept + Linear + Smooth	3.611730164	Yorkhill	Environmental BSI
2013	3	0	560	0	Intercept + Linear + Smooth	3.588302367	Yorkhill	Environmental BSI
2013	4	3	451	6.651884701	Intercept + Linear + Smooth	3.562541764	Yorkhill	Environmental BSI
2013	5	0	552	0	Intercept + Linear + Smooth	3.537788327	Yorkhill	Environmental BSI
2013	6	2	368	5.434782609	Intercept + Linear + Smooth	3.512390518	Yorkhill	Environmental BSI
2013	7	2	244	8.196721311	Intercept + Linear + Smooth	3.487985662	Yorkhill	Environmental BSI
2013	8	5	347	14.4092219	Intercept + Linear + Smooth	3.462945481	Yorkhill	Environmental BSI
2013	9	2	357	5.602240896	Intercept + Linear + Smooth	3.438085093	Yorkhill	Environmental BSI
2013	10	0	534	0	Intercept + Linear + Smooth	3.414196623	Yorkhill	Environmental BSI
2013	11	0	509	0	Intercept + Linear + Smooth	3.389686257	Yorkhill	Environmental BSI
2013	12	1	513	1.949317739	Intercept + Linear + Smooth	3.36613412	Yorkhill	Environmental BSI
2014	1	1	533	1.876172608	Intercept + Linear + Smooth	3.341968835	Yorkhill	Environmental BSI
2014	2	2	670	2.985074627	Intercept + Linear + Smooth	3.317977041	Yorkhill	Environmental BSI
2014	3	3	384	7.8125	Intercept + Linear + Smooth	3.296455105	Yorkhill	Environmental BSI

2014	4	1	465	2.150537634	Intercept + Linear + Smooth	3.272790034	Yorkhill	Environmental BSI
2014	5	1	560	1.785714286	Intercept + Linear + Smooth	3.250050096	Yorkhill	Environmental BSI
2014	6	3	517	5.80270793	Intercept + Linear + Smooth	3.226718097	Yorkhill	Environmental BSI
2014	7	3	360	8.333333333	Intercept + Linear + Smooth	3.204298188	Yorkhill	Environmental BSI
2014	8	1	743	1.34589502	Intercept + Linear + Smooth	3.18129453	Yorkhill	Environmental BSI
2014	9	4	348	11.49425287	Intercept + Linear + Smooth	3.158455949	Yorkhill	Environmental BSI
2014	10	1	529	1.890359168	Intercept + Linear + Smooth	3.136510157	Yorkhill	Environmental BSI
2014	11	1	519	1.926782274	Intercept + Linear + Smooth	3.11399296	Yorkhill	Environmental BSI
2014	12	3	509	5.893909627	Intercept + Linear + Smooth	3.092355999	Yorkhill	Environmental BSI
2015	1	1	730	1.369863014	Intercept + Linear + Smooth	3.070155693	Yorkhill	Environmental BSI
2015	2	1	436	2.293577982	Intercept + Linear + Smooth	3.048114734	Yorkhill	Environmental BSI
2015	3	1	525	1.904761905	Intercept + Linear + Smooth	3.028342791	Yorkhill	Environmental BSI
2015	4	1	591	1.692047377	Intercept + Linear + Smooth	3.006601982	Yorkhill	Environmental BSI
2015	5	1	347	2.88184438	Intercept + Linear + Smooth	2.985711104	Yorkhill	Environmental BSI

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays	Hospital	Organism
2015	6	0	487	0	Intercept + Linear	0.532547644	QEUH	Environmental BSI
2015	7	0	386	0	Intercept + Linear	0.582183274	QEUH	Environmental BSI
2015	8	0	621	0	Intercept + Linear	0.638338475	QEUH	Environmental BSI
2015	9	0	481	0	Intercept + Linear	0.699910196	QEUH	Environmental BSI
2015	10	1	530	1.886792453	Intercept + Linear	0.765144703	QEUH	Environmental BSI
2015	11	0	791	0	Intercept + Linear	0.838947674	QEUH	Environmental BSI
2015	12	1	501	1.996007984	Intercept + Linear	0.917141046	QEUH	Environmental BSI
2016	1	0	435	0	Intercept + Linear	1.00560501	QEUH	Environmental BSI
2016	2	0	550	0	Intercept + Linear	1.102324501	QEUH	Environmental BSI
2016	3	1	364	2.747252747	Intercept + Linear	1.201208671	QEUH	Environmental BSI
2016	4	0	664	0	Intercept + Linear	1.3167414	QEUH	Environmental BSI
2016	5	1	801	1.248439451	Intercept + Linear	1.439116676	QEUH	Environmental BSI
2016	6	3	549	5.464480874	Intercept + Linear	1.577531492	QEUH	Environmental BSI
2016	7	2	563	3.552397869	Intercept + Linear	1.72414407	QEUH	Environmental BSI
2016	8	3	565	5.309734513	Intercept + Linear	1.889972935	QEUH	Environmental BSI
2016	9	1	546	1.831501832	Intercept + Linear	2.071751286	QEUH	Environmental BSI
2016	10	4	428	9.345794393	Intercept + Linear	2.26429565	QEUH	Environmental BSI
2016	11	3	879	3.412969283	Intercept + Linear	2.482076509	QEUH	Environmental BSI
2016	12	4	640	6.25	Intercept + Linear	2.712755667	QEUH	Environmental BSI
2017	1	4	867	4.61361015	Intercept + Linear	2.973669589	QEUH	Environmental BSI
2017	2	3	599	5.008347245	Intercept + Linear	3.260498536	QEUH	Environmental BSI
2017	3	2	648	3.086419753	Intercept + Linear	3.543277626	QEUH	Environmental BSI
2017	4	5	983	5.08646999	Intercept + Linear	3.885048814	QEUH	Environmental BSI
2017	5	5	838	5.966587112	Intercept + Linear	4.247151335	QEUH	Environmental BSI
2017	6	3	632	4.746835443	Intercept + Linear	4.656815525	QEUH	Environmental BSI
2017	7	5	658	7.598784195	Intercept + Linear	5.090849875	QEUH	Environmental BSI
2017	8	5	617	8.103727715	Intercept + Linear	5.581894042	QEUH	Environmental BSI
2017	9	5	779	6.418485237	Intercept + Linear	6.120302476	QEUH	Environmental BSI
2017	10	4	624	6.41025641	Intercept + Linear	6.690739827	QEUH	Environmental BSI
2017	11	6	608	9.868421053	Intercept + Linear	7.336103341	QEUH	Environmental BSI
2017	12	3	664	4.518072289	Intercept + Linear	8.01985833	QEUH	Environmental BSI
2018	1	2	792	2.525252525	Intercept + Linear	8.793423599	QEUH	Environmental BSI
2018	2	1	525	1.904761905	Intercept + Linear	9.641604054	QEUH	Environmental BSI
2018	3	9	534	16.85393258	Intercept + Linear	10.4778087	QEUH	Environmental BSI
2018	4	4	426	9.389671362	Intercept + Linear	11.48845859	QEUH	Environmental BSI
2018	5	10	764	13.08900524	Intercept + Linear	12.55923015	QEUH	Environmental BSI
2018	6	6	526	11.40684411	Intercept + Linear	13.7706461	QEUH	Environmental BSI
2018	7	1	461	2.169197397	Intercept + Linear	15.05412692	QEUH	Environmental BSI
2018	8	4	576	6.944444444	Intercept + Linear	16.5061912	QEUH	Environmental BSI
2018	9	5	461	10.84598698	Intercept + Linear	18.09831611	QEUH	Environmental BSI
2015	6	0	487	0	Intercept + Linear + Smooth	0.191117984	QEUH	Environmental BSI
2015	7	0	386	0	Intercept + Linear + Smooth	0.242502906	QEUH	Environmental BSI
2015	8	0	621	0	Intercept + Linear + Smooth	0.309976959	QEUH	Environmental BSI
2015	9	0	481	0	Intercept + Linear + Smooth	0.395598893	QEUH	Environmental BSI
2015	10	1	530	1.886792453	Intercept + Linear + Smooth	0.499373974	QEUH	Environmental BSI
2015	11	0	791	0	Intercept + Linear + Smooth	0.632272775	QEUH	Environmental BSI
2015	12	1	501	1.996007984	Intercept + Linear + Smooth	0.790336449	QEUH	Environmental BSI
2016	1	0	435	0	Intercept + Linear + Smooth	0.989609029	QEUH	Environmental BSI
2016	2	0	550	0	Intercept + Linear + Smooth	1.231213027	QEUH	Environmental BSI
2016	3	1	364	2.747252747	Intercept + Linear + Smooth	1.501231464	QEUH	Environmental BSI
2016	4	0	664	0	Intercept + Linear + Smooth	1.839879303	QEUH	Environmental BSI
2016	5	1	801	1.248439451	Intercept + Linear + Smooth	2.214845301	QEUH	Environmental BSI
2016	6	3	549	5.464480874	Intercept + Linear + Smooth	2.638250839	QEUH	Environmental BSI
2016	7	2	563	3.552397869	Intercept + Linear + Smooth	3.059754529	QEUH	Environmental BSI

2016	8	3	565	5.309734513	Intercept + Linear + Smooth	3.482021318	QEUH	Environmental BSI
2016	9	1	546	1.831501832	Intercept + Linear + Smooth	3.871139578	QEUH	Environmental BSI
2016	10	4	428	9.345794393	Intercept + Linear + Smooth	4.203921582	QEUH	Environmental BSI
2016	11	3	879	3.412969283	Intercept + Linear + Smooth	4.496075922	QEUH	Environmental BSI
2016	12	4	640	6.25	Intercept + Linear + Smooth	4.732224603	QEUH	Environmental BSI
2017	1	4	867	4.61361015	Intercept + Linear + Smooth	4.936492808	QEUH	Environmental BSI
2017	2	3	599	5.008347245	Intercept + Linear + Smooth	5.116625828	QEUH	Environmental BSI
2017	3	2	648	3.086419753	Intercept + Linear + Smooth	5.279525291	QEUH	Environmental BSI
2017	4	5	983	5.08646999	Intercept + Linear + Smooth	5.465934243	QEUH	Environmental BSI
2017	5	5	838	5.966587112	Intercept + Linear + Smooth	5.652594287	QEUH	Environmental BSI
2017	6	3	632	4.746835443	Intercept + Linear + Smooth	5.852175493	QEUH	Environmental BSI
2017	7	5	658	7.598784195	Intercept + Linear + Smooth	6.052025552	QEUH	Environmental BSI
2017	8	5	617	8.103727715	Intercept + Linear + Smooth	6.265709829	QEUH	Environmental BSI
2017	9	5	779	6.418485237	Intercept + Linear + Smooth	6.486938845	QEUH	Environmental BSI
2017	10	4	624	6.41025641	Intercept + Linear + Smooth	6.70846588	QEUH	Environmental BSI
2017	11	6	608	9.868421053	Intercept + Linear + Smooth	6.945327679	QEUH	Environmental BSI
2017	12	3	664	4.518072289	Intercept + Linear + Smooth	7.182508556	QEUH	Environmental BSI
2018	1	2	792	2.525252525	Intercept + Linear + Smooth	7.436107804	QEUH	Environmental BSI
2018	2	1	525	1.904761905	Intercept + Linear + Smooth	7.698661107	QEUH	Environmental BSI
2018	3	9	534	16.85393258	Intercept + Linear + Smooth	7.943764976	QEUH	Environmental BSI
2018	4	4	426	9.389671362	Intercept + Linear + Smooth	8.224242584	QEUH	Environmental BSI
2018	5	10	764	13.08900524	Intercept + Linear + Smooth	8.505098024	QEUH	Environmental BSI
2018	6	6	526	11.40684411	Intercept + Linear + Smooth	8.80539512	QEUH	Environmental BSI
2018	7	1	461	2.169197397	Intercept + Linear + Smooth	9.106096746	QEUH	Environmental BSI
2018	8	4	576	6.944444444	Intercept + Linear + Smooth	9.42761384	QEUH	Environmental BSI
2018	9	5	461	10.84598698	Intercept + Linear + Smooth	9.760483026	QEUH	Environmental BSI

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays	Hospital	Organism
2018	10	3	733	4.092769441	Intercept + Linear	3.979582765	QEUH	Environmental BSI
2018	11	1	692	1.445086705	Intercept + Linear	3.90770646	QEUH	Environmental BSI
2018	12	1	436	2.293577982	Intercept + Linear	3.839385024	QEUH	Environmental BSI
2019	1	3	394	7.614213198	Intercept + Linear	3.770040868	QEUH	Environmental BSI
2019	2	1	575	1.739130435	Intercept + Linear	3.701949155	QEUH	Environmental BSI
2019	3	4	440	9.090909091	Intercept + Linear	3.64150464	QEUH	Environmental BSI
2019	4	1	605	1.652892562	Intercept + Linear	3.575734454	QEUH	Environmental BSI
2019	5	2	529	3.780718336	Intercept + Linear	3.51321714	QEUH	Environmental BSI
2019	6	3	292	10.2739726	Intercept + Linear	3.449763989	QEUH	Environmental BSI
2019	7	3	579	5.18134715	Intercept + Linear	3.389449114	QEUH	Environmental BSI
2019	8	1	288	3.472222222	Intercept + Linear	3.32823137	QEUH	Environmental BSI
2019	9	3	406	7.389162562	Intercept + Linear	3.268119296	QEUH	Environmental BSI
2019	10	1	322	3.105590062	Intercept + Linear	3.210980254	QEUH	Environmental BSI
2019	11	2	668	2.994011976	Intercept + Linear	3.152985884	QEUH	Environmental BSI
2019	12	0	623	0	Intercept + Linear	3.097859808	QEUH	Environmental BSI
2020	1	0	501	0	Intercept + Linear	3.041908536	QEUH	Environmental BSI
2020	2	0	424	0	Intercept + Linear	2.987116567	QEUH	Environmental BSI
2020	3	1	431	2.320185615	Intercept + Linear	2.936753388	QEUH	Environmental BSI
2020	4	1	192	5.208333333	Intercept + Linear	2.883855511	QEUH	Environmental BSI
2020	5	0	277	0	Intercept + Linear	2.833571402	QEUH	Environmental BSI
2020	6	1	250	4	Intercept + Linear	2.782532077	QEUH	Environmental BSI
2020	7	1	483	2.070393375	Intercept + Linear	2.734014685	QEUH	Environmental BSI
2020	8	0	335	0	Intercept + Linear	2.684768612	QEUH	Environmental BSI
2020	9	3	438	6.849315068	Intercept + Linear	2.636409577	QEUH	Environmental BSI
2020	10	1	300	3.333333333	Intercept + Linear	2.590440039	QEUH	Environmental BSI
2020	11	1	379	2.638522427	Intercept + Linear	2.543780085	QEUH	Environmental BSI
2020	12	0	380	0	Intercept + Linear	2.499425673	QEUH	Environmental BSI
2021	1	0	390	0	Intercept + Linear	2.454405103	QEUH	Environmental BSI
2021	2	0	316	0	Intercept + Linear	2.410075438	QEUH	Environmental BSI
2021	3	0	557	0	Intercept + Linear	2.370724319	QEUH	Environmental BSI
2021	4	1	444	2.252252252	Intercept + Linear	2.327906036	QEUH	Environmental BSI
2021	5	0	501	0	Intercept + Linear	2.287205465	QEUH	Environmental BSI
2021	6	1	349	2.865329513	Intercept + Linear	2.245895637	QEUH	Environmental BSI
2021	7	5	527	9.487666034	Intercept + Linear	2.206628918	QEUH	Environmental BSI
2021	8	0	533	0	Intercept + Linear	2.166774405	QEUH	Environmental BSI
2021	9	3	511	5.870841487	Intercept + Linear	2.127639715	QEUH	Environmental BSI
2021	10	1	325	3.076923077	Intercept + Linear	2.090440554	QEUH	Environmental BSI
2021	11	0	376	0	Intercept + Linear	2.05268455	QEUH	Environmental BSI
2021	12	0	350	0	Intercept + Linear	2.016795888	QEUH	Environmental BSI
2022	1	2	390	5.128205128	Intercept + Linear	1.98037	QEUH	Environmental BSI
2022	2	0	157	0	Intercept + Linear	1.94460201	QEUH	Environmental BSI
2018	10	3	733	4.092769441	Intercept + Linear + Smooth	3.979728231	QEUH	Environmental BSI
2018	11	1	692	1.445086705	Intercept + Linear + Smooth	3.907836734	QEUH	Environmental BSI
2018	12	1	436	2.293577982	Intercept + Linear + Smooth	3.839500973	QEUH	Environmental BSI
2019	1	3	394	7.614213198	Intercept + Linear + Smooth	3.770142152	QEUH	Environmental BSI
2019	2	1	575	1.739130435	Intercept + Linear + Smooth	3.70203568	QEUH	Environmental BSI
2019	3	4	440	9.090909091	Intercept + Linear + Smooth	3.641577652	QEUH	Environmental BSI
2019	4	1	605	1.652892562	Intercept + Linear + Smooth	3.575792291	QEUH	Environmental BSI
2019	5	2	529	3.780718336	Intercept + Linear + Smooth	3.513260167	QEUH	Environmental BSI
2019	6	3	292	10.2739726	Intercept + Linear + Smooth	3.44979168	QEUH	Environmental BSI
2019	7	3	579	5.18134715	Intercept + Linear + Smooth	3.38946206	QEUH	Environmental BSI
2019	8	1	288	3.472222222	Intercept + Linear + Smooth	3.328229409	QEUH	Environmental BSI
2019	9	3	406	7.389162562	Intercept + Linear + Smooth	3.268103055	QEUH	Environmental BSI
2019	10	1	322	3.105590062	Intercept + Linear + Smooth	3.210951083	QEUH	Environmental BSI

2019	11	2	668	2.994011976	Intercept + Linear + Smooth	3.152944581	QEUH	Environmental BSI
2019	12	0	623	0	Intercept + Linear + Smooth	3.097808227	QEUH	Environmental BSI
2020	1	0	501	0	Intercept + Linear + Smooth	3.041848046	QEUH	Environmental BSI
2020	2	0	424	0	Intercept + Linear + Smooth	2.98704901	QEUH	Environmental BSI
2020	3	1	431	2.320185615	Intercept + Linear + Smooth	2.936680844	QEUH	Environmental BSI
2020	4	1	192	5.208333333	Intercept + Linear + Smooth	2.883779288	QEUH	Environmental BSI
2020	5	0	277	0	Intercept + Linear + Smooth	2.833493145	QEUH	Environmental BSI
2020	6	1	250	4	Intercept + Linear + Smooth	2.782453202	QEUH	Environmental BSI
2020	7	1	483	2.070393375	Intercept + Linear + Smooth	2.733936556	QEUH	Environmental BSI
2020	8	0	335	0	Intercept + Linear + Smooth	2.684692554	QEUH	Environmental BSI
2020	9	3	438	6.849315068	Intercept + Linear + Smooth	2.636336818	QEUH	Environmental BSI
2020	10	1	300	3.333333333	Intercept + Linear + Smooth	2.590371563	QEUH	Environmental BSI
2020	11	1	379	2.638522427	Intercept + Linear + Smooth	2.543717129	QEUH	Environmental BSI
2020	12	0	380	0	Intercept + Linear + Smooth	2.499369123	QEUH	Environmental BSI
2021	1	0	390	0	Intercept + Linear + Smooth	2.454356277	QEUH	Environmental BSI
2021	2	0	316	0	Intercept + Linear + Smooth	2.410035454	QEUH	Environmental BSI
2021	3	0	557	0	Intercept + Linear + Smooth	2.370693192	QEUH	Environmental BSI
2021	4	1	444	2.252252252	Intercept + Linear + Smooth	2.327885543	QEUH	Environmental BSI
2021	5	0	501	0	Intercept + Linear + Smooth	2.287195899	QEUH	Environmental BSI
2021	6	1	349	2.865329513	Intercept + Linear + Smooth	2.245897763	QEUH	Environmental BSI
2021	7	5	527	9.487666034	Intercept + Linear + Smooth	2.206642457	QEUH	Environmental BSI
2021	8	0	533	0	Intercept + Linear + Smooth	2.166799593	QEUH	Environmental BSI
2021	9	3	511	5.870841487	Intercept + Linear + Smooth	2.127676254	QEUH	Environmental BSI
2021	10	1	325	3.076923077	Intercept + Linear + Smooth	2.09048772	QEUH	Environmental BSI
2021	11	0	376	0	Intercept + Linear + Smooth	2.052742332	QEUH	Environmental BSI
2021	12	0	350	0	Intercept + Linear + Smooth	2.016863622	QEUH	Environmental BSI
2022	1	2	390	5.128205128	Intercept + Linear + Smooth	1.98044768	QEUH	Environmental BSI
2022	2	0	157	0	Intercept + Linear + Smooth	1.944689254	QEUH	Environmental BSI

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays	Hospital	Organism
2015	6	0	487	0	Intercept + Linear	1.945636449	QEUH	Environmental BSI
2015	7	0	386	0	Intercept + Linear	1.966078749	QEUH	Environmental BSI
2015	8	0	621	0	Intercept + Linear	1.987428125	QEUH	Environmental BSI
2015	9	0	481	0	Intercept + Linear	2.009009331	QEUH	Environmental BSI
2015	10	1	530	1.886792453	Intercept + Linear	2.030117473	QEUH	Environmental BSI
2015	11	0	791	0	Intercept + Linear	2.052162237	QEUH	Environmental BSI
2015	12	1	501	1.996007984	Intercept + Linear	2.073723776	QEUH	Environmental BSI
2016	1	0	435	0	Intercept + Linear	2.096242054	QEUH	Environmental BSI
2016	2	0	550	0	Intercept + Linear	2.118942327	QEUH	Environmental BSI
2016	3	1	364	2.747252747	Intercept + Linear	2.140400558	QEUH	Environmental BSI
2016	4	0	664	0	Intercept + Linear	2.163579025	QEUH	Environmental BSI
2016	5	1	801	1.248439451	Intercept + Linear	2.186248757	QEUH	Environmental BSI
2016	6	3	549	5.464480874	Intercept + Linear	2.209923715	QEUH	Environmental BSI
2016	7	2	563	3.552397869	Intercept + Linear	2.233079041	QEUH	Environmental BSI
2016	8	3	565	5.309734513	Intercept + Linear	2.257261126	QEUH	Environmental BSI
2016	9	1	546	1.831501832	Intercept + Linear	2.281705079	QEUH	Environmental BSI
2016	10	4	428	9.345794393	Intercept + Linear	2.305612522	QEUH	Environmental BSI
2016	11	3	879	3.412969283	Intercept + Linear	2.330580074	QEUH	Environmental BSI
2016	12	4	640	6.25	Intercept + Linear	2.354999624	QEUH	Environmental BSI
2017	1	4	867	4.61361015	Intercept + Linear	2.380501991	QEUH	Environmental BSI
2017	2	3	599	5.008347245	Intercept + Linear	2.406351531	QEUH	Environmental BSI
2017	3	2	648	3.086419753	Intercept + Linear	2.429940684	QEUH	Environmental BSI
2017	4	5	983	5.08646999	Intercept + Linear	2.456327073	QEUH	Environmental BSI
2017	5	5	838	5.966587112	Intercept + Linear	2.482135067	QEUH	Environmental BSI
2017	6	3	632	4.746835443	Intercept + Linear	2.509088227	QEUH	Environmental BSI
2017	7	5	658	7.598784195	Intercept + Linear	2.535450569	QEUH	Environmental BSI
2017	8	5	617	8.103727715	Intercept + Linear	2.562982675	QEUH	Environmental BSI
2017	9	5	779	6.418485237	Intercept + Linear	2.590813748	QEUH	Environmental BSI
2017	10	4	624	6.41025641	Intercept + Linear	2.618034759	QEUH	Environmental BSI
2017	11	6	608	9.868421053	Intercept + Linear	2.646463635	QEUH	Environmental BSI
2017	12	3	664	4.518072289	Intercept + Linear	2.674269345	QEUH	Environmental BSI
2018	1	2	792	2.525252525	Intercept + Linear	2.703308864	QEUH	Environmental BSI
2018	2	1	525	1.904761905	Intercept + Linear	2.73266372	QEUH	Environmental BSI
2018	3	9	534	16.85393258	Intercept + Linear	2.759451669	QEUH	Environmental BSI
2018	4	4	426	9.389671362	Intercept + Linear	2.789416172	QEUH	Environmental BSI
2018	5	10	764	13.08900524	Intercept + Linear	2.818723847	QEUH	Environmental BSI
2018	6	6	526	11.40684411	Intercept + Linear	2.849331978	QEUH	Environmental BSI
2018	7	1	461	2.169197397	Intercept + Linear	2.879269173	QEUH	Environmental BSI
2018	8	4	576	6.944444444	Intercept + Linear	2.910534757	QEUH	Environmental BSI
2018	9	5	461	10.84598698	Intercept + Linear	2.94213985	QEUH	Environmental BSI
2018	10	3	733	4.092769441	Intercept + Linear	2.973052154	QEUH	Environmental BSI
2018	11	1	692	1.445086705	Intercept + Linear	3.005336115	QEUH	Environmental BSI
2018	12	1	436	2.293577982	Intercept + Linear	3.036912405	QEUH	Environmental BSI
2019	1	3	394	7.614213198	Intercept + Linear	3.069889815	QEUH	Environmental BSI
2019	2	1	575	1.739130435	Intercept + Linear	3.103225323	QEUH	Environmental BSI
2019	3	4	440	9.090909091	Intercept + Linear	3.133645839	QEUH	Environmental BSI
2019	4	1	605	1.652892562	Intercept + Linear	3.167673664	QEUH	Environmental BSI
2019	5	2	529	3.780718336	Intercept + Linear	3.200955593	QEUH	Environmental BSI
2019	6	3	292	10.2739726	Intercept + Linear	3.235714326	QEUH	Environmental BSI
2019	7	3	579	5.18134715	Intercept + Linear	3.26971114	QEUH	Environmental BSI
2019	8	1	288	3.472222222	Intercept + Linear	3.30521648	QEUH	Environmental BSI
2019	9	3	406	7.389162562	Intercept + Linear	3.341107367	QEUH	Environmental BSI
2019	10	1	322	3.105590062	Intercept + Linear	3.376211519	QEUH	Environmental BSI
2019	11	2	668	2.994011976	Intercept + Linear	3.412873331	QEUH	Environmental BSI

2019	12	0	623	0	Intercept + Linear	3.44873151	QEUH	Environmental BSI
2020	1	0	501	0	Intercept + Linear	3.486180807	QEUH	Environmental BSI
2020	2	0	424	0	Intercept + Linear	3.523932771	QEUH	Environmental BSI
2020	3	1	431	2.320185615	Intercept + Linear	3.559619143	QEUH	Environmental BSI
2020	4	1	192	5.208333333	Intercept + Linear	3.598166373	QEUH	Environmental BSI
2020	5	0	277	0	Intercept + Linear	3.635867546	QEUH	Environmental BSI
2020	6	1	250	4	Intercept + Linear	3.675240473	QEUH	Environmental BSI
2020	7	1	483	2.070393375	Intercept + Linear	3.713749219	QEUH	Environmental BSI
2020	8	0	335	0	Intercept + Linear	3.753965529	QEUH	Environmental BSI
2020	9	3	438	6.849315068	Intercept + Linear	3.794617342	QEUH	Environmental BSI
2020	10	1	300	3.333333333	Intercept + Linear	3.834376906	QEUH	Environmental BSI
2020	11	1	379	2.638522427	Intercept + Linear	3.875899497	QEUH	Environmental BSI
2020	12	0	380	0	Intercept + Linear	3.916510726	QEUH	Environmental BSI
2021	1	0	390	0	Intercept + Linear	3.958922746	QEUH	Environmental BSI
2021	2	0	316	0	Intercept + Linear	4.001912139	QEUH	Environmental BSI
2021	3	0	557	0	Intercept + Linear	4.041142366	QEUH	Environmental BSI
2021	4	1	444	2.252252252	Intercept + Linear	4.08502457	QEUH	Environmental BSI
2021	5	0	501	0	Intercept + Linear	4.127944868	QEUH	Environmental BSI
2021	6	1	349	2.865329513	Intercept + Linear	4.172769648	QEUH	Environmental BSI
2021	7	5	527	9.487666034	Intercept + Linear	4.216611861	QEUH	Environmental BSI
2021	8	0	533	0	Intercept + Linear	4.262399464	QEUH	Environmental BSI
2021	9	3	511	5.870841487	Intercept + Linear	4.308684268	QEUH	Environmental BSI
2021	10	1	325	3.076923077	Intercept + Linear	4.353954501	QEUH	Environmental BSI
2021	11	0	376	0	Intercept + Linear	4.401233489	QEUH	Environmental BSI
2021	12	0	350	0	Intercept + Linear	4.447476112	QEUH	Environmental BSI
2022	1	2	390	5.128205128	Intercept + Linear	4.495770638	QEUH	Environmental BSI
2022	2	0	157	0	Intercept + Linear	4.544589587	QEUH	Environmental BSI
2015	6	0	487	0	Intercept + Linear + Smooth	0.200434401	QEUH	Environmental BSI
2015	7	0	386	0	Intercept + Linear + Smooth	0.253001408	QEUH	Environmental BSI
2015	8	0	621	0	Intercept + Linear + Smooth	0.321612824	QEUH	Environmental BSI
2015	9	0	481	0	Intercept + Linear + Smooth	0.40825086	QEUH	Environmental BSI
2015	10	1	530	1.886792453	Intercept + Linear + Smooth	0.512971716	QEUH	Environmental BSI
2015	11	0	791	0	Intercept + Linear + Smooth	0.646961601	QEUH	Environmental BSI
2015	12	1	501	1.996007984	Intercept + Linear + Smooth	0.806137394	QEUH	Environmental BSI
2016	1	0	435	0	Intercept + Linear + Smooth	1.006342264	QEUH	Environmental BSI
2016	2	0	550	0	Intercept + Linear + Smooth	1.247317209	QEUH	Environmental BSI
2016	3	1	364	2.747252747	Intercept + Linear + Smooth	1.514054614	QEUH	Environmental BSI
2016	4	0	664	0	Intercept + Linear + Smooth	1.844799616	QEUH	Environmental BSI
2016	5	1	801	1.248439451	Intercept + Linear + Smooth	2.205864798	QEUH	Environmental BSI
2016	6	3	549	5.464480874	Intercept + Linear + Smooth	2.611442911	QEUH	Environmental BSI
2016	7	2	563	3.552397869	Intercept + Linear + Smooth	3.020111824	QEUH	Environmental BSI
2016	8	3	565	5.309734513	Intercept + Linear + Smooth	3.439384507	QEUH	Environmental BSI
2016	9	1	546	1.831501832	Intercept + Linear + Smooth	3.841641198	QEUH	Environmental BSI
2016	10	4	428	9.345794393	Intercept + Linear + Smooth	4.205019852	QEUH	Environmental BSI
2016	11	3	879	3.412969283	Intercept + Linear + Smooth	4.549942921	QEUH	Environmental BSI
2016	12	4	640	6.25	Intercept + Linear + Smooth	4.855316293	QEUH	Environmental BSI
2017	1	4	867	4.61361015	Intercept + Linear + Smooth	5.145641703	QEUH	Environmental BSI
2017	2	3	599	5.008347245	Intercept + Linear + Smooth	5.417839838	QEUH	Environmental BSI
2017	3	2	648	3.086419753	Intercept + Linear + Smooth	5.651482895	QEUH	Environmental BSI
2017	4	5	983	5.08646999	Intercept + Linear + Smooth	5.89899618	QEUH	Environmental BSI
2017	5	5	838	5.966587112	Intercept + Linear + Smooth	6.127345043	QEUH	Environmental BSI
2017	6	3	632	4.746835443	Intercept + Linear + Smooth	6.347600025	QEUH	Environmental BSI
2017	7	5	658	7.598784195	Intercept + Linear + Smooth	6.540988318	QEUH	Environmental BSI
2017	8	5	617	8.103727715	Intercept + Linear + Smooth	6.715315842	QEUH	Environmental BSI
2017	9	5	779	6.418485237	Intercept + Linear + Smooth	6.859112754	QEUH	Environmental BSI

2017	10	4	624	6.41025641	Intercept + Linear + Smooth	6.966861599	QEUH	Environmental BSI
2017	11	6	608	9.868421053	Intercept + Linear + Smooth	7.044257139	QEUH	Environmental BSI
2017	12	3	664	4.518072289	Intercept + Linear + Smooth	7.085828996	QEUH	Environmental BSI
2018	1	2	792	2.525252525	Intercept + Linear + Smooth	7.094229348	QEUH	Environmental BSI
2018	2	1	525	1.904761905	Intercept + Linear + Smooth	7.065313915	QEUH	Environmental BSI
2018	3	9	534	16.85393258	Intercept + Linear + Smooth	7.004746567	QEUH	Environmental BSI
2018	4	4	426	9.389671362	Intercept + Linear + Smooth	6.898921869	QEUH	Environmental BSI
2018	5	10	764	13.08900524	Intercept + Linear + Smooth	6.758907568	QEUH	Environmental BSI
2018	6	6	526	11.40684411	Intercept + Linear + Smooth	6.579939516	QEUH	Environmental BSI
2018	7	1	461	2.169197397	Intercept + Linear + Smooth	6.381541636	QEUH	Environmental BSI
2018	8	4	576	6.944444444	Intercept + Linear + Smooth	6.158758749	QEUH	Environmental BSI
2018	9	5	461	10.84598698	Intercept + Linear + Smooth	5.92577746	QEUH	Environmental BSI
2018	10	3	733	4.092769441	Intercept + Linear + Smooth	5.697111525	QEUH	Environmental BSI
2018	11	1	692	1.445086705	Intercept + Linear + Smooth	5.4626797	QEUH	Environmental BSI
2018	12	1	436	2.293577982	Intercept + Linear + Smooth	5.241455495	QEUH	Environmental BSI
2019	1	3	394	7.614213198	Intercept + Linear + Smooth	5.020657647	QEUH	Environmental BSI
2019	2	1	575	1.739130435	Intercept + Linear + Smooth	4.808937954	QEUH	Environmental BSI
2019	3	4	440	9.090909091	Intercept + Linear + Smooth	4.625950412	QEUH	Environmental BSI
2019	4	1	605	1.652892562	Intercept + Linear + Smooth	4.432652084	QEUH	Environmental BSI
2019	5	2	529	3.780718336	Intercept + Linear + Smooth	4.254873623	QEUH	Environmental BSI
2019	6	3	292	10.2739726	Intercept + Linear + Smooth	4.080603285	QEUH	Environmental BSI
2019	7	3	579	5.18134715	Intercept + Linear + Smooth	3.92097771	QEUH	Environmental BSI
2019	8	1	288	3.472222222	Intercept + Linear + Smooth	3.765316297	QEUH	Environmental BSI
2019	9	3	406	7.389162562	Intercept + Linear + Smooth	3.619090197	QEUH	Environmental BSI
2019	10	1	322	3.105590062	Intercept + Linear + Smooth	3.486659807	QEUH	Environmental BSI
2019	11	2	668	2.994011976	Intercept + Linear + Smooth	3.359236476	QEUH	Environmental BSI
2019	12	0	623	0	Intercept + Linear + Smooth	3.244980418	QEUH	Environmental BSI
2020	1	0	501	0	Intercept + Linear + Smooth	3.136109706	QEUH	Environmental BSI
2020	2	0	424	0	Intercept + Linear + Smooth	3.036326717	QEUH	Environmental BSI
2020	3	1	431	2.320185615	Intercept + Linear + Smooth	2.950392327	QEUH	Environmental BSI
2020	4	1	192	5.208333333	Intercept + Linear + Smooth	2.865770876	QEUH	Environmental BSI
2020	5	0	277	0	Intercept + Linear + Smooth	2.790321062	QEUH	Environmental BSI
2020	6	1	250	4	Intercept + Linear + Smooth	2.718356672	QEUH	Environmental BSI
2020	7	1	483	2.070393375	Intercept + Linear + Smooth	2.653946894	QEUH	Environmental BSI
2020	8	0	335	0	Intercept + Linear + Smooth	2.592252586	QEUH	Environmental BSI
2020	9	3	438	6.849315068	Intercept + Linear + Smooth	2.534995185	QEUH	Environmental BSI
2020	10	1	300	3.333333333	Intercept + Linear + Smooth	2.483402622	QEUH	Environmental BSI
2020	11	1	379	2.638522427	Intercept + Linear + Smooth	2.433719517	QEUH	Environmental BSI
2020	12	0	380	0	Intercept + Linear + Smooth	2.388882522	QEUH	Environmental BSI
2021	1	0	390	0	Intercept + Linear + Smooth	2.34564953	QEUH	Environmental BSI
2021	2	0	316	0	Intercept + Linear + Smooth	2.305204123	QEUH	Environmental BSI
2021	3	0	557	0	Intercept + Linear + Smooth	2.270894568	QEUH	Environmental BSI
2021	4	1	444	2.252252252	Intercept + Linear + Smooth	2.2350443	QEUH	Environmental BSI
2021	5	0	501	0	Intercept + Linear + Smooth	2.202124186	QEUH	Environmental BSI
2021	6	1	349	2.865329513	Intercept + Linear + Smooth	2.169539071	QEUH	Environmental BSI
2021	7	5	527	9.487666034	Intercept + Linear + Smooth	2.139061445	QEUH	Environmental BSI
2021	8	0	533	0	Intercept + Linear + Smooth	2.108366492	QEUH	Environmental BSI
2021	9	3	511	5.870841487	Intercept + Linear + Smooth	2.078279253	QEUH	Environmental BSI
2021	10	1	325	3.076923077	Intercept + Linear + Smooth	2.049657085	QEUH	Environmental BSI
2021	11	0	376	0	Intercept + Linear + Smooth	2.020535491	QEUH	Environmental BSI
2021	12	0	350	0	Intercept + Linear + Smooth	1.992778406	QEUH	Environmental BSI
2022	1	2	390	5.128205128	Intercept + Linear + Smooth	1.96452279	QEUH	Environmental BSI
2022	2	0	157	0	Intercept + Linear + Smooth	1.936680714	QEUH	Environmental BSI

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays	Hospital	Organism
2008	1	8	934	8.565310493	Intercept + Linear	13.4592246	Yorkhill	Non-environmental BSI
2008	2	8	439	18.22323462	Intercept + Linear	13.45105047	Yorkhill	Non-environmental BSI
2008	3	11	953	11.54249738	Intercept + Linear	13.44340819	Yorkhill	Non-environmental BSI
2008	4	8	585	13.67521368	Intercept + Linear	13.43524366	Yorkhill	Non-environmental BSI
2008	5	13	379	34.30079156	Intercept + Linear	13.42734722	Yorkhill	Non-environmental BSI
2008	6	4	746	5.361930295	Intercept + Linear	13.41919245	Yorkhill	Non-environmental BSI
2008	7	20	767	26.0756193	Intercept + Linear	13.41130544	Yorkhill	Non-environmental BSI
2008	8	7	537	13.03538175	Intercept + Linear	13.40316041	Yorkhill	Non-environmental BSI
2008	9	8	646	12.38390093	Intercept + Linear	13.39502032	Yorkhill	Non-environmental BSI
2008	10	9	535	16.82242991	Intercept + Linear	13.38714753	Yorkhill	Non-environmental BSI
2008	11	5	484	10.33057851	Intercept + Linear	13.37901716	Yorkhill	Non-environmental BSI
2008	12	4	651	6.144393241	Intercept + Linear	13.37115377	Yorkhill	Non-environmental BSI
2009	1	12	633	18.95734597	Intercept + Linear	13.36303312	Yorkhill	Non-environmental BSI
2009	2	2	381	5.249343832	Intercept + Linear	13.35489518	Yorkhill	Non-environmental BSI
2009	3	7	799	8.760951189	Intercept + Linear	13.34754904	Yorkhill	Non-environmental BSI
2009	4	13	710	18.30985915	Intercept + Linear	13.33942052	Yorkhill	Non-environmental BSI
2009	5	6	583	10.2915952	Intercept + Linear	13.33155893	Yorkhill	Non-environmental BSI
2009	6	14	590	23.72881356	Intercept + Linear	13.32344015	Yorkhill	Non-environmental BSI
2009	7	5	778	6.426735219	Intercept + Linear	13.31558798	Yorkhill	Non-environmental BSI
2009	8	4	449	8.908685969	Intercept + Linear	13.30747893	Yorkhill	Non-environmental BSI
2009	9	11	638	17.24137931	Intercept + Linear	13.29937482	Yorkhill	Non-environmental BSI
2009	10	13	802	16.20947631	Intercept + Linear	13.29153683	Yorkhill	Non-environmental BSI
2009	11	12	465	25.80645161	Intercept + Linear	13.28344242	Yorkhill	Non-environmental BSI
2009	12	12	471	25.47770701	Intercept + Linear	13.27561382	Yorkhill	Non-environmental BSI
2010	1	3	505	5.940594059	Intercept + Linear	13.26752911	Yorkhill	Non-environmental BSI
2010	2	3	506	5.928853755	Intercept + Linear	13.25944933	Yorkhill	Non-environmental BSI
2010	3	7	481	14.55301455	Intercept + Linear	13.25215569	Yorkhill	Non-environmental BSI
2010	4	9	517	17.40812379	Intercept + Linear	13.24408527	Yorkhill	Non-environmental BSI
2010	5	6	719	8.344923505	Intercept + Linear	13.23627986	Yorkhill	Non-environmental BSI
2010	6	11	516	21.31782946	Intercept + Linear	13.22821911	Yorkhill	Non-environmental BSI
2010	7	9	397	22.67002519	Intercept + Linear	13.22042305	Yorkhill	Non-environmental BSI
2010	8	3	891	3.367003367	Intercept + Linear	13.21237196	Yorkhill	Non-environmental BSI
2010	9	3	566	5.300353357	Intercept + Linear	13.20432576	Yorkhill	Non-environmental BSI
2010	10	9	493	18.25557809	Intercept + Linear	13.19654379	Yorkhill	Non-environmental BSI
2010	11	7	769	9.102730819	Intercept + Linear	13.18850724	Yorkhill	Non-environmental BSI
2010	12	8	724	11.04972376	Intercept + Linear	13.18073459	Yorkhill	Non-environmental BSI
2011	1	8	615	13.00813008	Intercept + Linear	13.17270766	Yorkhill	Non-environmental BSI
2011	2	4	274	14.59854015	Intercept + Linear	13.16468562	Yorkhill	Non-environmental BSI
2011	3	9	570	15.78947368	Intercept + Linear	13.15744411	Yorkhill	Non-environmental BSI
2011	4	7	428	16.35514019	Intercept + Linear	13.14943136	Yorkhill	Non-environmental BSI
2011	5	11	562	19.57295374	Intercept + Linear	13.14168174	Yorkhill	Non-environmental BSI
2011	6	8	392	20.40816327	Intercept + Linear	13.1336786	Yorkhill	Non-environmental BSI
2011	7	3	453	6.622516556	Intercept + Linear	13.12593826	Yorkhill	Non-environmental BSI
2011	8	5	399	12.53132832	Intercept + Linear	13.1179447	Yorkhill	Non-environmental BSI
2011	9	4	505	7.920792079	Intercept + Linear	13.10995602	Yorkhill	Non-environmental BSI
2011	10	4	392	10.20408163	Intercept + Linear	13.10222966	Yorkhill	Non-environmental BSI
2011	11	9	479	18.78914405	Intercept + Linear	13.09425054	Yorkhill	Non-environmental BSI
2011	12	5	402	12.43781095	Intercept + Linear	13.08653344	Yorkhill	Non-environmental BSI
2012	1	5	670	7.462686567	Intercept + Linear	13.07856388	Yorkhill	Non-environmental BSI
2012	2	5	566	8.833922261	Intercept + Linear	13.07062093	Yorkhill	Non-environmental BSI
2012	3	6	954	6.289308176	Intercept + Linear	13.0631948	Yorkhill	Non-environmental BSI
2012	4	4	490	8.163265306	Intercept + Linear	13.05526118	Yorkhill	Non-environmental BSI
2012	5	6	994	6.036217304	Intercept + Linear	13.04758807	Yorkhill	Non-environmental BSI
2012	6	6	389	15.42416452	Intercept + Linear	13.03966393	Yorkhill	Non-environmental BSI
2012	7	8	492	16.2601626	Intercept + Linear	13.03199999	Yorkhill	Non-environmental BSI
2012	8	8	312	25.64102564	Intercept + Linear	13.02408532	Yorkhill	Non-environmental BSI

2012	9	5	542	9.225092251	Intercept + Linear	13.01617546	Yorkhill	Non-environmental BSI
2012	10	7	583	12.00686106	Intercept + Linear	13.00852532	Yorkhill	Non-environmental BSI
2012	11	4	467	8.565310493	Intercept + Linear	13.00062491	Yorkhill	Non-environmental BSI
2012	12	3	533	5.628517824	Intercept + Linear	12.99298392	Yorkhill	Non-environmental BSI
2013	1	5	434	11.52073733	Intercept + Linear	12.98509294	Yorkhill	Non-environmental BSI
2013	2	4	613	6.525285481	Intercept + Linear	12.97718516	Yorkhill	Non-environmental BSI
2013	3	8	560	14.28571429	Intercept + Linear	12.97004678	Yorkhill	Non-environmental BSI
2013	4	7	451	15.5210643	Intercept + Linear	12.96214816	Yorkhill	Non-environmental BSI
2013	5	6	552	10.86956522	Intercept + Linear	12.95450892	Yorkhill	Non-environmental BSI
2013	6	8	368	21.73913043	Intercept + Linear	12.94661976	Yorkhill	Non-environmental BSI
2013	7	2	244	8.196721311	Intercept + Linear	12.93898966	Yorkhill	Non-environmental BSI
2013	8	2	347	5.763688761	Intercept + Linear	12.93110996	Yorkhill	Non-environmental BSI
2013	9	13	357	36.41456583	Intercept + Linear	12.92323505	Yorkhill	Non-environmental BSI
2013	10	3	534	5.617977528	Intercept + Linear	12.91561874	Yorkhill	Non-environmental BSI
2013	11	2	509	3.929273084	Intercept + Linear	12.90775326	Yorkhill	Non-environmental BSI
2013	12	4	513	7.797270955	Intercept + Linear	12.90014607	Yorkhill	Non-environmental BSI
2014	1	5	533	9.380863039	Intercept + Linear	12.89229002	Yorkhill	Non-environmental BSI
2014	2	6	670	8.955223881	Intercept + Linear	12.88443875	Yorkhill	Non-environmental BSI
2014	3	10	384	26.04166667	Intercept + Linear	12.8773514	Yorkhill	Non-environmental BSI
2014	4	7	465	15.05376344	Intercept + Linear	12.86950923	Yorkhill	Non-environmental BSI
2014	5	9	560	16.07142857	Intercept + Linear	12.86192458	Yorkhill	Non-environmental BSI
2014	6	12	517	23.21083172	Intercept + Linear	12.8540918	Yorkhill	Non-environmental BSI
2014	7	3	360	8.333333333	Intercept + Linear	12.84651624	Yorkhill	Non-environmental BSI
2014	8	4	743	5.383580081	Intercept + Linear	12.83869285	Yorkhill	Non-environmental BSI
2014	9	7	348	20.11494253	Intercept + Linear	12.83087422	Yorkhill	Non-environmental BSI
2014	10	8	529	15.12287335	Intercept + Linear	12.82331234	Yorkhill	Non-environmental BSI
2014	11	4	519	7.707129094	Intercept + Linear	12.81550308	Yorkhill	Non-environmental BSI
2014	12	10	509	19.64636542	Intercept + Linear	12.80795026	Yorkhill	Non-environmental BSI
2015	1	8	730	10.95890411	Intercept + Linear	12.80015036	Yorkhill	Non-environmental BSI
2015	2	8	436	18.34862385	Intercept + Linear	12.7923552	Yorkhill	Non-environmental BSI
2015	3	10	525	19.04761905	Intercept + Linear	12.7853185	Yorkhill	Non-environmental BSI
2015	4	8	591	13.53637902	Intercept + Linear	12.77753237	Yorkhill	Non-environmental BSI
2015	5	6	347	17.29106628	Intercept + Linear	12.77000193	Yorkhill	Non-environmental BSI
2008	1	8	934	8.565310493	Intercept + Linear + Smooth	14.42711134	Yorkhill	Non-environmental BSI
2008	2	8	439	18.22323462	Intercept + Linear + Smooth	14.37762859	Yorkhill	Non-environmental BSI
2008	3	11	953	11.54249738	Intercept + Linear + Smooth	14.33148049	Yorkhill	Non-environmental BSI
2008	4	8	585	13.67521368	Intercept + Linear + Smooth	14.28229369	Yorkhill	Non-environmental BSI
2008	5	13	379	34.30079156	Intercept + Linear + Smooth	14.23482911	Yorkhill	Non-environmental BSI
2008	6	4	746	5.361930295	Intercept + Linear + Smooth	14.18591724	Yorkhill	Non-environmental BSI
2008	7	20	767	26.0756193	Intercept + Linear + Smooth	14.13871312	Yorkhill	Non-environmental BSI
2008	8	7	537	13.03538175	Intercept + Linear + Smooth	14.09007686	Yorkhill	Non-environmental BSI
2008	9	8	646	12.38390093	Intercept + Linear + Smooth	14.04159312	Yorkhill	Non-environmental BSI
2008	10	9	535	16.82242991	Intercept + Linear + Smooth	13.99483164	Yorkhill	Non-environmental BSI
2008	11	5	484	10.33057851	Intercept + Linear + Smooth	13.9466897	Yorkhill	Non-environmental BSI
2008	12	4	651	6.144393241	Intercept + Linear + Smooth	13.90028475	Yorkhill	Non-environmental BSI
2009	1	12	633	18.95734597	Intercept + Linear + Smooth	13.85253287	Yorkhill	Non-environmental BSI
2009	2	2	381	5.249343832	Intercept + Linear + Smooth	13.80486111	Yorkhill	Non-environmental BSI
2009	3	7	799	8.760951189	Intercept + Linear + Smooth	13.76198464	Yorkhill	Non-environmental BSI
2009	4	13	710	18.30985915	Intercept + Linear + Smooth	13.71471459	Yorkhill	Non-environmental BSI
2009	5	6	583	10.2915952	Intercept + Linear + Smooth	13.66916503	Yorkhill	Non-environmental BSI
2009	6	14	590	23.72881356	Intercept + Linear + Smooth	13.62229225	Yorkhill	Non-environmental BSI
2009	7	5	778	6.426735219	Intercept + Linear + Smooth	13.57711446	Yorkhill	Non-environmental BSI
2009	8	4	449	8.908685969	Intercept + Linear + Smooth	13.53061492	Yorkhill	Non-environmental BSI
2009	9	11	638	17.24137931	Intercept + Linear + Smooth	13.48429737	Yorkhill	Non-environmental BSI
2009	10	13	802	16.20947631	Intercept + Linear + Smooth	13.43964077	Yorkhill	Non-environmental BSI
2009	11	12	465	25.80645161	Intercept + Linear + Smooth	13.39366226	Yorkhill	Non-environmental BSI
2009	12	12	471	25.47770701	Intercept + Linear + Smooth	13.34933724	Yorkhill	Non-environmental BSI

2010	1	3	505	5.940594059	Intercept + Linear + Smooth	13.3037306	Yorkhill	Non-environmental BSI
2010	2	3	506	5.928853755	Intercept + Linear + Smooth	13.25834692	Yorkhill	Non-environmental BSI
2010	3	7	481	14.55301455	Intercept + Linear + Smooth	13.21757228	Yorkhill	Non-environmental BSI
2010	4	9	517	17.40812379	Intercept + Linear + Smooth	13.17269776	Yorkhill	Non-environmental BSI
2010	5	6	719	8.344923505	Intercept + Linear + Smooth	13.1295676	Yorkhill	Non-environmental BSI
2010	6	11	516	21.31782946	Intercept + Linear + Smooth	13.0853361	Yorkhill	Non-environmental BSI
2010	7	9	397	22.67002519	Intercept + Linear + Smooth	13.04289301	Yorkhill	Non-environmental BSI
2010	8	3	891	3.367003367	Intercept + Linear + Smooth	12.99945534	Yorkhill	Non-environmental BSI
2010	9	3	566	5.300353357	Intercept + Linear + Smooth	12.95649088	Yorkhill	Non-environmental BSI
2010	10	9	493	18.25557809	Intercept + Linear + Smooth	12.91540334	Yorkhill	Non-environmental BSI
2010	11	7	769	9.102730819	Intercept + Linear + Smooth	12.87349362	Yorkhill	Non-environmental BSI
2010	12	8	724	11.04972376	Intercept + Linear + Smooth	12.83349833	Yorkhill	Non-environmental BSI
2011	1	8	615	13.00813008	Intercept + Linear + Smooth	12.79278204	Yorkhill	Non-environmental BSI
2011	2	4	274	14.59854015	Intercept + Linear + Smooth	12.75272076	Yorkhill	Non-environmental BSI
2011	3	9	570	15.78947368	Intercept + Linear + Smooth	12.71712874	Yorkhill	Non-environmental BSI
2011	4	7	428	16.35514019	Intercept + Linear + Smooth	12.67841685	Yorkhill	Non-environmental BSI
2011	5	11	562	19.57295374	Intercept + Linear + Smooth	12.64170952	Yorkhill	Non-environmental BSI
2011	6	8	392	20.40816327	Intercept + Linear + Smooth	12.60463439	Yorkhill	Non-environmental BSI
2011	7	3	453	6.622516556	Intercept + Linear + Smooth	12.56968528	Yorkhill	Non-environmental BSI
2011	8	5	399	12.53132832	Intercept + Linear + Smooth	12.53466572	Yorkhill	Non-environmental BSI
2011	9	4	505	7.920792079	Intercept + Linear + Smooth	12.50090104	Yorkhill	Non-environmental BSI
2011	10	4	392	10.20408163	Intercept + Linear + Smooth	12.46957028	Yorkhill	Non-environmental BSI
2011	11	9	479	18.78914405	Intercept + Linear + Smooth	12.43874456	Yorkhill	Non-environmental BSI
2011	12	5	402	12.43781095	Intercept + Linear + Smooth	12.41059008	Yorkhill	Non-environmental BSI
2012	1	5	670	7.462686567	Intercept + Linear + Smooth	12.38342572	Yorkhill	Non-environmental BSI
2012	2	5	566	8.833922261	Intercept + Linear + Smooth	12.35849509	Yorkhill	Non-environmental BSI
2012	3	6	954	6.289308176	Intercept + Linear + Smooth	12.33732015	Yorkhill	Non-environmental BSI
2012	4	4	490	8.163265306	Intercept + Linear + Smooth	12.31717687	Yorkhill	Non-environmental BSI
2012	5	6	994	6.036217304	Intercept + Linear + Smooth	12.30028816	Yorkhill	Non-environmental BSI
2012	6	6	389	15.42416452	Intercept + Linear + Smooth	12.28568086	Yorkhill	Non-environmental BSI
2012	7	8	492	16.2601626	Intercept + Linear + Smooth	12.27443112	Yorkhill	Non-environmental BSI
2012	8	8	312	25.64102564	Intercept + Linear + Smooth	12.26592153	Yorkhill	Non-environmental BSI
2012	9	5	542	9.225092251	Intercept + Linear + Smooth	12.26075204	Yorkhill	Non-environmental BSI
2012	10	7	583	12.00686106	Intercept + Linear + Smooth	12.2591583	Yorkhill	Non-environmental BSI
2012	11	4	467	8.565310493	Intercept + Linear + Smooth	12.26127958	Yorkhill	Non-environmental BSI
2012	12	3	533	5.628517824	Intercept + Linear + Smooth	12.26721665	Yorkhill	Non-environmental BSI
2013	1	5	434	11.52073733	Intercept + Linear + Smooth	12.27761428	Yorkhill	Non-environmental BSI
2013	2	4	613	6.525285481	Intercept + Linear + Smooth	12.29258595	Yorkhill	Non-environmental BSI
2013	3	8	560	14.28571429	Intercept + Linear + Smooth	12.31014224	Yorkhill	Non-environmental BSI
2013	4	7	451	15.5210643	Intercept + Linear + Smooth	12.33416704	Yorkhill	Non-environmental BSI
2013	5	6	552	10.86956522	Intercept + Linear + Smooth	12.36209045	Yorkhill	Non-environmental BSI
2013	6	8	368	21.73913043	Intercept + Linear + Smooth	12.39586413	Yorkhill	Non-environmental BSI
2013	7	2	244	8.196721311	Intercept + Linear + Smooth	12.43341841	Yorkhill	Non-environmental BSI
2013	8	2	347	5.763688761	Intercept + Linear + Smooth	12.47738803	Yorkhill	Non-environmental BSI
2013	9	13	357	36.41456583	Intercept + Linear + Smooth	12.52677326	Yorkhill	Non-environmental BSI
2013	10	3	534	5.617977528	Intercept + Linear + Smooth	12.57992467	Yorkhill	Non-environmental BSI
2013	11	2	509	3.929273084	Intercept + Linear + Smooth	12.64058375	Yorkhill	Non-environmental BSI
2013	12	4	513	7.797270955	Intercept + Linear + Smooth	12.70494426	Yorkhill	Non-environmental BSI
2014	1	5	533	9.380863039	Intercept + Linear + Smooth	12.77737225	Yorkhill	Non-environmental BSI
2014	2	6	670	8.955223881	Intercept + Linear + Smooth	12.85561221	Yorkhill	Non-environmental BSI
2014	3	10	384	26.04166667	Intercept + Linear + Smooth	12.9309293	Yorkhill	Non-environmental BSI
2014	4	7	465	15.05376344	Intercept + Linear + Smooth	13.01907879	Yorkhill	Non-environmental BSI
2014	5	9	560	16.07142857	Intercept + Linear + Smooth	13.10878319	Yorkhill	Non-environmental BSI
2014	6	12	517	23.21083172	Intercept + Linear + Smooth	13.20565415	Yorkhill	Non-environmental BSI
2014	7	3	360	8.333333333	Intercept + Linear + Smooth	13.30326756	Yorkhill	Non-environmental BSI
2014	8	4	743	5.383580081	Intercept + Linear + Smooth	13.40802345	Yorkhill	Non-environmental BSI
2014	9	7	348	20.11494253	Intercept + Linear + Smooth	13.51654647	Yorkhill	Non-environmental BSI

2014	10	8	529	15.12287335	Intercept + Linear + Smooth	13.62489584	Yorkhill	Non-environmental BSI
2014	11	4	519	7.707129094	Intercept + Linear + Smooth	13.73999612	Yorkhill	Non-environmental BSI
2014	12	10	509	19.64636542	Intercept + Linear + Smooth	13.8540755	Yorkhill	Non-environmental BSI
2015	1	8	730	10.95890411	Intercept + Linear + Smooth	13.97435856	Yorkhill	Non-environmental BSI
2015	2	8	436	18.34862385	Intercept + Linear + Smooth	14.09671255	Yorkhill	Non-environmental BSI
2015	3	10	525	19.04761905	Intercept + Linear + Smooth	14.20869976	Yorkhill	Non-environmental BSI
2015	4	8	591	13.53637902	Intercept + Linear + Smooth	14.33405439	Yorkhill	Non-environmental BSI
2015	5	6	347	17.29106628	Intercept + Linear + Smooth	14.4566054	Yorkhill	Non-environmental BSI

Year	Month	Count	Bed days	Rate/1000 beddays	Component	Fit/1000 beddays	Hospital	Organism
2015	6	10	487	20.5338809	Intercept + Linear	22.72342694	QEUH	Non-environmental BSI
2015	7	7	386	18.13471503	Intercept + Linear	22.33956807	QEUH	Non-environmental BSI
2015	8	7	621	11.27214171	Intercept + Linear	21.94972484	QEUH	Non-environmental BSI
2015	9	5	481	10.3950104	Intercept + Linear	21.56668468	QEUH	Non-environmental BSI
2015	10	10	530	18.86792453	Intercept + Linear	21.20236625	QEUH	Non-environmental BSI
2015	11	8	791	10.11378003	Intercept + Linear	20.8323681	QEUH	Non-environmental BSI
2015	12	6	501	11.9760479	Intercept + Linear	20.48045422	QEUH	Non-environmental BSI
2016	1	11	435	25.28735632	Intercept + Linear	20.12305401	QEUH	Non-environmental BSI
2016	2	6	550	10.90909091	Intercept + Linear	19.77284177	QEUH	Non-environmental BSI
2016	3	10	364	27.47252747	Intercept + Linear	19.45074374	QEUH	Non-environmental BSI
2016	4	9	664	13.55421687	Intercept + Linear	19.11223208	QEUH	Non-environmental BSI
2016	5	9	801	11.23595506	Intercept + Linear	18.7902505	QEUH	Non-environmental BSI
2016	6	5	549	9.107468124	Intercept + Linear	18.46323376	QEUH	Non-environmental BSI
2016	7	20	563	35.52397869	Intercept + Linear	18.15218578	QEUH	Non-environmental BSI
2016	8	5	565	8.849557522	Intercept + Linear	17.83627362	QEUH	Non-environmental BSI
2016	9	9	546	16.48351648	Intercept + Linear	17.52585944	QEUH	Non-environmental BSI
2016	10	5	428	11.68224299	Intercept + Linear	17.23060331	QEUH	Non-environmental BSI
2016	11	13	879	14.78953356	Intercept + Linear	16.93072994	QEUH	Non-environmental BSI
2016	12	10	640	15.625	Intercept + Linear	16.64549988	QEUH	Non-environmental BSI
2017	1	17	867	19.60784314	Intercept + Linear	16.35580937	QEUH	Non-environmental BSI
2017	2	19	599	31.71953255	Intercept + Linear	16.07038749	QEUH	Non-environmental BSI
2017	3	22	648	33.95061728	Intercept + Linear	15.81687064	QEUH	Non-environmental BSI
2017	4	23	983	23.39776195	Intercept + Linear	15.54085366	QEUH	Non-environmental BSI
2017	5	19	838	22.67303103	Intercept + Linear	15.27832748	QEUH	Non-environmental BSI
2017	6	21	632	33.2278481	Intercept + Linear	15.01170852	QEUH	Non-environmental BSI
2017	7	5	658	7.598784195	Intercept + Linear	14.758121	QEUH	Non-environmental BSI
2017	8	14	617	22.6904376	Intercept + Linear	14.50058005	QEUH	Non-environmental BSI
2017	9	11	779	14.12066752	Intercept + Linear	14.24753339	QEUH	Non-environmental BSI
2017	10	12	624	19.23076923	Intercept + Linear	14.00685482	QEUH	Non-environmental BSI
2017	11	14	608	23.02631579	Intercept + Linear	13.76242406	QEUH	Non-environmental BSI
2017	12	14	664	21.08433735	Intercept + Linear	13.52994026	QEUH	Non-environmental BSI
2018	1	10	792	12.62626263	Intercept + Linear	13.29383204	QEUH	Non-environmental BSI
2018	2	6	525	11.42857143	Intercept + Linear	13.0618441	QEUH	Non-environmental BSI
2018	3	16	534	29.96254682	Intercept + Linear	12.85578824	QEUH	Non-environmental BSI
2018	4	7	426	16.43192488	Intercept + Linear	12.63144451	QEUH	Non-environmental BSI
2018	5	8	764	10.47120419	Intercept + Linear	12.41806595	QEUH	Non-environmental BSI
2018	6	6	526	11.40684411	Intercept + Linear	12.20136082	QEUH	Non-environmental BSI
2018	7	2	461	4.338394794	Intercept + Linear	11.99524752	QEUH	Non-environmental BSI
2018	8	7	576	12.15277778	Intercept + Linear	11.78592091	QEUH	Non-environmental BSI
2018	9	7	461	15.18438178	Intercept + Linear	11.58024722	QEUH	Non-environmental BSI
2018	10	4	733	5.457025921	Intercept + Linear	11.38462617	QEUH	Non-environmental BSI
2018	11	8	692	11.56069364	Intercept + Linear	11.18595539	QEUH	Non-environmental BSI
2018	12	12	436	27.52293578	Intercept + Linear	10.99699497	QEUH	Non-environmental BSI
2019	1	2	394	5.076142132	Intercept + Linear	10.80508866	QEUH	Non-environmental BSI
2019	2	6	575	10.43478261	Intercept + Linear	10.61653127	QEUH	Non-environmental BSI
2019	3	7	440	15.90909091	Intercept + Linear	10.44905121	QEUH	Non-environmental BSI
2019	4	4	605	6.611570248	Intercept + Linear	10.26670695	QEUH	Non-environmental BSI
2019	5	7	529	13.23251418	Intercept + Linear	10.09327508	QEUH	Non-environmental BSI
2019	6	3	292	10.2739726	Intercept + Linear	9.917139398	QEUH	Non-environmental BSI
2019	7	4	579	6.908462867	Intercept + Linear	9.749612647	QEUH	Non-environmental BSI
2019	8	2	288	6.944444444	Intercept + Linear	9.579474151	QEUH	Non-environmental BSI
2019	9	6	406	14.77832512	Intercept + Linear	9.412304708	QEUH	Non-environmental BSI
2019	10	4	322	12.42236025	Intercept + Linear	9.253305951	QEUH	Non-environmental BSI
2019	11	4	668	5.988023952	Intercept + Linear	9.091828402	QEUH	Non-environmental BSI
2019	12	1	623	1.605136437	Intercept + Linear	8.938243339	QEUH	Non-environmental BSI
2020	1	4	501	7.984031936	Intercept + Linear	8.782263884	QEUH	Non-environmental BSI

2020	2	8	424	18.86792453	Intercept + Linear	8.629421465	QEUH	Non-environmental BSI
2020	3	2	431	4.64037123	Intercept + Linear	8.488848867	QEUH	Non-environmental BSI
2020	4	2	192	10.41666667	Intercept + Linear	8.341112906	QEUH	Non-environmental BSI
2020	5	2	277	7.220216606	Intercept + Linear	8.200591137	QEUH	Non-environmental BSI
2020	6	2	250	8	Intercept + Linear	8.057871879	QEUH	Non-environmental BSI
2020	7	2	483	4.140786749	Intercept + Linear	7.922121839	QEUH	Non-environmental BSI
2020	8	6	335	17.91044776	Intercept + Linear	7.784248931	QEUH	Non-environmental BSI
2020	9	3	438	6.849315068	Intercept + Linear	7.648775498	QEUH	Non-environmental BSI
2020	10	1	300	3.333333333	Intercept + Linear	7.519917457	QEUH	Non-environmental BSI
2020	11	3	379	7.915567282	Intercept + Linear	7.389044326	QEUH	Non-environmental BSI
2020	12	4	380	10.52631579	Intercept + Linear	7.264561947	QEUH	Non-environmental BSI
2021	1	1	390	2.564102564	Intercept + Linear	7.138132904	QEUH	Non-environmental BSI
2021	2	1	316	3.164556962	Intercept + Linear	7.013566807	QEUH	Non-environmental BSI
2021	3	2	557	3.590664273	Intercept + Linear	6.902924958	QEUH	Non-environmental BSI
2021	4	2	444	4.504504505	Intercept + Linear	6.782463427	QEUH	Non-environmental BSI
2021	5	4	501	7.984031936	Intercept + Linear	6.667889656	QEUH	Non-environmental BSI
2021	6	3	349	8.595988539	Intercept + Linear	6.551529677	QEUH	Non-environmental BSI
2021	7	1	527	1.897533207	Intercept + Linear	6.440856988	QEUH	Non-environmental BSI
2021	8	3	533	5.628517824	Intercept + Linear	6.328458911	QEUH	Non-environmental BSI
2021	9	3	511	5.870841487	Intercept + Linear	6.218022269	QEUH	Non-environmental BSI
2021	10	3	325	9.230769231	Intercept + Linear	6.112983404	QEUH	Non-environmental BSI
2021	11	4	376	10.63829787	Intercept + Linear	6.006306981	QEUH	Non-environmental BSI
2021	12	1	350	2.857142857	Intercept + Linear	5.904844547	QEUH	Non-environmental BSI
2022	1	2	390	5.128205128	Intercept + Linear	5.801800313	QEUH	Non-environmental BSI
2022	2	0	157	0	Intercept + Linear	5.700554283	QEUH	Non-environmental BSI
2015	6	10	487	20.5338809	Intercept + Linear + Smooth	14.53037881	QEUH	Non-environmental BSI
2015	7	7	386	18.13471503	Intercept + Linear + Smooth	14.76151882	QEUH	Non-environmental BSI
2015	8	7	621	11.27214171	Intercept + Linear + Smooth	15.00554244	QEUH	Non-environmental BSI
2015	9	5	481	10.3950104	Intercept + Linear + Smooth	15.25592474	QEUH	Non-environmental BSI
2015	10	10	530	18.86792453	Intercept + Linear + Smooth	15.50530544	QEUH	Non-environmental BSI
2015	11	8	791	10.11378003	Intercept + Linear + Smooth	15.7713254	QEUH	Non-environmental BSI
2015	12	6	501	11.9760479	Intercept + Linear + Smooth	16.03724847	QEUH	Non-environmental BSI
2016	1	11	435	25.28735632	Intercept + Linear + Smooth	16.32093118	QEUH	Non-environmental BSI
2016	2	6	550	10.90909091	Intercept + Linear + Smooth	16.61265001	QEUH	Non-environmental BSI
2016	3	10	364	27.47252747	Intercept + Linear + Smooth	16.89310362	QEUH	Non-environmental BSI
2016	4	9	664	13.55421687	Intercept + Linear + Smooth	17.2005611	QEUH	Non-environmental BSI
2016	5	9	801	11.23595506	Intercept + Linear + Smooth	17.50527449	QEUH	Non-environmental BSI
2016	6	5	549	9.107468124	Intercept + Linear + Smooth	17.8260333	QEUH	Non-environmental BSI
2016	7	20	563	35.52397869	Intercept + Linear + Smooth	18.13848081	QEUH	Non-environmental BSI
2016	8	5	565	8.849557522	Intercept + Linear + Smooth	18.45886049	QEUH	Non-environmental BSI
2016	9	9	546	16.48351648	Intercept + Linear + Smooth	18.77098943	QEUH	Non-environmental BSI
2016	10	5	428	11.68224299	Intercept + Linear + Smooth	19.05862276	QEUH	Non-environmental BSI
2016	11	13	879	14.78953356	Intercept + Linear + Smooth	19.33038918	QEUH	Non-environmental BSI
2016	12	10	640	15.625	Intercept + Linear + Smooth	19.55692323	QEUH	Non-environmental BSI
2017	1	17	867	19.60784314	Intercept + Linear + Smooth	19.7380379	QEUH	Non-environmental BSI
2017	2	19	599	31.71953255	Intercept + Linear + Smooth	19.84888706	QEUH	Non-environmental BSI
2017	3	22	648	33.95061728	Intercept + Linear + Smooth	19.87859992	QEUH	Non-environmental BSI
2017	4	23	983	23.39776195	Intercept + Linear + Smooth	19.82768625	QEUH	Non-environmental BSI
2017	5	19	838	22.67303103	Intercept + Linear + Smooth	19.69480708	QEUH	Non-environmental BSI
2017	6	21	632	33.2278481	Intercept + Linear + Smooth	19.47921827	QEUH	Non-environmental BSI
2017	7	5	658	7.598784195	Intercept + Linear + Smooth	19.20469908	QEUH	Non-environmental BSI
2017	8	14	617	22.6904376	Intercept + Linear + Smooth	18.86564296	QEUH	Non-environmental BSI
2017	9	11	779	14.12066752	Intercept + Linear + Smooth	18.48272535	QEUH	Non-environmental BSI
2017	10	12	624	19.23076923	Intercept + Linear + Smooth	18.08011521	QEUH	Non-environmental BSI
2017	11	14	608	23.02631579	Intercept + Linear + Smooth	17.64007542	QEUH	Non-environmental BSI
2017	12	14	664	21.08433735	Intercept + Linear + Smooth	17.19860931	QEUH	Non-environmental BSI
2018	1	10	792	12.62626263	Intercept + Linear + Smooth	16.733416	QEUH	Non-environmental BSI

2018	2	6	525	11.42857143	Intercept + Linear + Smooth	16.26509124	QEUH	Non-environmental BSI
2018	3	16	534	29.96254682	Intercept + Linear + Smooth	15.84374688	QEUH	Non-environmental BSI
2018	4	7	426	16.43192488	Intercept + Linear + Smooth	15.38316891	QEUH	Non-environmental BSI
2018	5	8	764	10.47120419	Intercept + Linear + Smooth	14.94675037	QEUH	Non-environmental BSI
2018	6	6	526	11.40684411	Intercept + Linear + Smooth	14.50813242	QEUH	Non-environmental BSI
2018	7	2	461	4.338394794	Intercept + Linear + Smooth	14.09730872	QEUH	Non-environmental BSI
2018	8	7	576	12.15277778	Intercept + Linear + Smooth	13.68791837	QEUH	Non-environmental BSI
2018	9	7	461	15.18438178	Intercept + Linear + Smooth	13.29380886	QEUH	Non-environmental BSI
2018	10	4	733	5.457025921	Intercept + Linear + Smooth	12.92660401	QEUH	Non-environmental BSI
2018	11	8	692	11.56069364	Intercept + Linear + Smooth	12.56104508	QEUH	Non-environmental BSI
2018	12	12	436	27.52293578	Intercept + Linear + Smooth	12.21995288	QEUH	Non-environmental BSI
2019	1	2	394	5.076142132	Intercept + Linear + Smooth	11.8799136	QEUH	Non-environmental BSI
2019	2	6	575	10.43478261	Intercept + Linear + Smooth	11.55188867	QEUH	Non-environmental BSI
2019	3	7	440	15.90909091	Intercept + Linear + Smooth	11.26551334	QEUH	Non-environmental BSI
2019	4	4	605	6.611570248	Intercept + Linear + Smooth	10.95901263	QEUH	Non-environmental BSI
2019	5	7	529	13.23251418	Intercept + Linear + Smooth	10.67255978	QEUH	Non-environmental BSI
2019	6	3	292	10.2739726	Intercept + Linear + Smooth	10.38663215	QEUH	Non-environmental BSI
2019	7	4	579	6.908462867	Intercept + Linear + Smooth	10.11926798	QEUH	Non-environmental BSI
2019	8	2	288	6.944444444	Intercept + Linear + Smooth	9.852209501	QEUH	Non-environmental BSI
2019	9	6	406	14.77832512	Intercept + Linear + Smooth	9.594094309	QEUH	Non-environmental BSI
2019	10	4	322	12.42236025	Intercept + Linear + Smooth	9.352425149	QEUH	Non-environmental BSI
2019	11	4	668	5.988023952	Intercept + Linear + Smooth	9.110703244	QEUH	Non-environmental BSI
2019	12	1	623	1.605136437	Intercept + Linear + Smooth	8.884174695	QEUH	Non-environmental BSI
2020	1	4	501	7.984031936	Intercept + Linear + Smooth	8.657376722	QEUH	Non-environmental BSI
2020	2	8	424	18.86792453	Intercept + Linear + Smooth	8.438140705	QEUH	Non-environmental BSI
2020	3	2	431	4.64037123	Intercept + Linear + Smooth	8.238948337	QEUH	Non-environmental BSI
2020	4	2	192	10.41666667	Intercept + Linear + Smooth	8.032003728	QEUH	Non-environmental BSI
2020	5	2	277	7.220216606	Intercept + Linear + Smooth	7.837357036	QEUH	Non-environmental BSI
2020	6	2	250	8	Intercept + Linear + Smooth	7.641774073	QEUH	Non-environmental BSI
2020	7	2	483	4.140786749	Intercept + Linear + Smooth	7.457646299	QEUH	Non-environmental BSI
2020	8	6	335	17.91044776	Intercept + Linear + Smooth	7.272484566	QEUH	Non-environmental BSI
2020	9	3	438	6.849315068	Intercept + Linear + Smooth	7.092317594	QEUH	Non-environmental BSI
2020	10	1	300	3.333333333	Intercept + Linear + Smooth	6.922557495	QEUH	Non-environmental BSI
2020	11	3	379	7.915567282	Intercept + Linear + Smooth	6.751755571	QEUH	Non-environmental BSI
2020	12	4	380	10.52631579	Intercept + Linear + Smooth	6.590813907	QEUH	Non-environmental BSI
2021	1	1	390	2.564102564	Intercept + Linear + Smooth	6.428889014	QEUH	Non-environmental BSI
2021	2	1	316	3.164556962	Intercept + Linear + Smooth	6.270874982	QEUH	Non-environmental BSI
2021	3	2	557	3.590664273	Intercept + Linear + Smooth	6.131785828	QEUH	Non-environmental BSI
2021	4	2	444	4.504504505	Intercept + Linear + Smooth	5.981685298	QEUH	Non-environmental BSI
2021	5	4	501	7.984031936	Intercept + Linear + Smooth	5.840174297	QEUH	Non-environmental BSI
2021	6	3	349	8.595988539	Intercept + Linear + Smooth	5.697658407	QEUH	Non-environmental BSI
2021	7	1	527	1.897533207	Intercept + Linear + Smooth	5.56319123	QEUH	Non-environmental BSI
2021	8	3	533	5.628517824	Intercept + Linear + Smooth	5.427672889	QEUH	Non-environmental BSI
2021	9	3	511	5.870841487	Intercept + Linear + Smooth	5.295509	QEUH	Non-environmental BSI
2021	10	3	325	9.230769231	Intercept + Linear + Smooth	5.170679346	QEUH	Non-environmental BSI
2021	11	4	376	10.63829787	Intercept + Linear + Smooth	5.044753027	QEUH	Non-environmental BSI
2021	12	1	350	2.857142857	Intercept + Linear + Smooth	4.925778411	QEUH	Non-environmental BSI
2022	1	2	390	5.128205128	Intercept + Linear + Smooth	4.80575333	QEUH	Non-environmental BSI
2022	2	0	157	0	Intercept + Linear + Smooth	4.688632814	QEUH	Non-environmental BSI

Scottish Hospitals Inquiry

Direction in respect of discussion
between Experts – Mr Sid Mookerjee & Dr Lydia Drumright
22 July 2025

Introduction

1. The Inquiry needs to understand the scale and significance of infection events within the paediatric haemato-oncology patient cohort within the Schiehallion Unit arising from micro-organisms that have the potential to be connected in some way to changes to the water and ventilation systems of that hospital and whether there was in fact an exceedance of infections in QEUH/RHC in the period 2016 to 2019.

2. The Inquiry has already considered a number of reports which consider that question in respect of the QEUH/RHC after June 2015 and heard a considerable amount of expert evidence on these issues. These reports are listed in the annex to this Direction. Chapters 7 and 8 of HAD Report provides new material on this issue. Mr Mookerjee, Dr Mumford and Ms Cairns have reviewed those parts of the HAD Report[1]. The Response document produced by the HAD authors on 20 July 2025 along with their response to HAD Questionnaire 2[2] ("the HAD Response document") contains in sections 2 and 5 additional and supplementary tables and figures that revisit tables and figures that were contained in the HAD Report.

3. The Inquiry has heard competing evidence from clinicians, microbiologists, data scientists, members of the IPC team and others of the perceived importance of (i) the move from Yorkhill to the RHC on 10 June 2015, (ii) the 'decant' of patients from Wards 2A and 2B to Wards 4B and 6A on 26 September 2018 and (iii) the opening of the refurbished Wards 2A and 2B in March 2022. Witnesses have given opinion evidence of the impact of these

[1] See Bundle 44, Volume 2, Documents 48, 79, 81 and 45.
[2] Bundle 44, Volume 5, Document 1, Page 4.

three events on the rates of infections amongst paediatric haemato-oncology patients. It is now necessary to for the Inquiry to have the tools to discuss the significance of these events and whether any effect of them can be seen in the data.

4. In the HAD Report separate linear fitted lines were provided for BSI rates for each of the two hospitals[3], but in the HAD Response document Dr Drumright has provided both GAM fit[4] Linear and Linear+Smooth components for BSI[5] and Aspergillus[6] rates only for the two hospitals combined. In order to provide material to discuss with skilled and expert witnesses in the Glasgow 4, Part 2 hearing the Inquiry needs to see if there is common ground between Dr Drumright and Mr Mookerjee on rates and trends of infections in the two hospitals and between these events.

5. In order to make efficient use of the time of the Glasgow 4, Part 2 hearing Dr Drumright and Mr Mookerjee are directed to jointly consider the questions set out in this Direction and if possible, to reach an agreed position on those questions. That joint consideration may take the form of a video call or calls between them, or an exchange of emails or a combination of both.

6. Following that joint consideration Dr Drumright and Mr Mookerjee are directed to prepare a statement for the Inquiry that sets out the answers to those questions on which they agree. Where they disagree, they should provide a summary of their reasons for disagreeing.

7. Dr Drumright and Mr Mookerjee should produce their response to this Direction by Monday 11 August 2019 at 09:00 BST.

8. What inferences can be properly drawn from their agreed answers will be subject of questions to them and other witnesses during the Glasgow 4, Part 2 hearing and therefore Dr Drumright and Mr Mookerjee should not express any view on the significance of their answers at this stage. Both Dr Drumright and

[3] Figures 21 and 22 (Bundle 44, Volume 1, Document 1, Pages 117 and 118).
[4] Bundle 44, Volume 5, Document 2, Page 44, para 2F.2 (albeit that her code is not provided).
[5] Bundle 44, Volume 5, Document 2, Pages 50,51, see Figures 2.F.3 and 2.F.4.
[6] Bundle 44, Volume 5, Document 2, Pages 77,80, see Figures 5C.3 and 5C.4.

Mr Mookerjee should expect to be asked about the use of generalised additive models (GAMs) and the software package used to answer these questions in the hearing.

Issue 1 - Aspergillus infections amongst paediatric haemato-oncology patients

9. The Inquiry has heard evidence that the ventilation system at the RHC was different from the ventilation system at Yorkhill, that patients moved into the RHC from Yorkhill on 10 June 2015 and that no changes were made to the ventilation system at the RHC outside of isolation rooms until the new Ward 2A and 2B opened in March 2022.

10. Two attempts have been made to calculate rates of Aspergillus infection amongst paediatric haemato-oncology patients at Yorkhill and RHC. These have resulted in in Table 3 and Figure 1 in Dr Mumford and Mr Mookerjee's review of Chapter 8[7] and Table 5C.1 of the HAD Response document[8]. Both attempts use whole months, and both rely on occupied bed day data that includes three years of data in 2005, 2006 and 2007 that has been imputed by Dr Drumright[9].

11. Notwithstanding the criticisms made of Dr Agrawal's approach by Ms Cairns in her Supplementary Report[10] the following questions should be answered using the rates of infection set out in Table 5C.1 of the HAD Response document.

Question 1

1(a) What was the overall rate of Aspergillus infection amongst paediatric haemato-oncology patients at Yorkhill over the whole period from January 2008 to May 2015?

1(b) During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

[7] Bundle 44, Volume 2, Document 81, Pages 1295,1296.
[8] Bundle 44, Volume 5, Document 2, Page 76.
[9] Bundle 44, Volume 5, Document 2, Page 32, para 2B.5.
[10] Bundle 44, Volume 3, Document 5, Page 222.

Question 2

2(a) What was the overall rate of Aspergillus infection amongst paediatric haemato-oncology patients at the RHC over the whole period from June 2015 to February 2022?

2(b) During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

Issue 2 – Potentially environmentally connected infections amongst paediatric haemato-oncology patients

12. The evidence before the Inquiry is that the domestic water system at the RHC was different from the domestic water system at Yorkhill, that patients moved into the RHC at Yorkhill on 10 June 2015, that by 13 March 2018 point of use filters (POUFs) had been fitted in Ward 2A and that on 26 September 2018 the paediatric haemato-oncology patient cohort within the Schiehallion Unit were moved from Wards 2A and 2B to Wards 4B and 6A. This cohort of patients was accommodated in Wards 4B and 6A until the new Ward 2A and 2B opened in March 2022.

13. As explained in the HAD Response document Dr Drumright has updated the tables of monthly incidence rates of BSI attributed to environmental organisms[11] and used that to produce Figure 2E.3. Figure 2E.3 appears to be a replacement for Figure 22[12] of the HAD Report. Figure 2.F.3[13] contains GAM fit linear and smooth components against incidence rates for BSI incidence rates attributed to environmental microorganisms among paediatric haematology-oncology patients in Yorkhill (Jan 2005-April 2015) and RHC at QEUH (May 2015-Dec 2025). A similar exercise was also carried out for non-environmental BSI in Figure 2.F.4 [14] albeit that no equivalent data table has been included. This latter exercise is addressed in Issue 3. These calculations use whole months and rely on occupied bed day data that

[11] Bundle 44, Volume 5, Document 2, Page 44, Table 2E.6.
[12] Bundle 44, Volume 1, Document 1, Page 118.
[13] Bundle 44, Volume 5, Document 2, Pages 48, 50 - Along with associated explanation at paras. 2F.11 to 2F.13.
[14] Bundle 44, Volume 5, Document 2, Pages 50, 51 - Associated explanation at paras. 2F.14 to 2F.16.

includes three years of data in 2005, 2006 and 2007 that has been imputed by Dr Drumright[15].

14. There is clearly a discussion to have with witnesses at Glasgow 4, Part 2 about whether anything significant arises (a) from differences in definition used by HAD to define environmental BSI and those used by HPS, Dr Kennedy and Dr Mumford and Mr Mookerjee and (b) the choice of numerator and denominator data and (c) whether it is legitimate to impute occupied bed days for 2005 to 2007, but in recognition that Dr Drumright is the only person to attempt to calculate BSI rates at Yorkhill from before 2013 the following questions should be answered using the rates of infection set out in Table 2E.6.

Question 3

3(a) What was overall BSI incidence rate attributed to environmental microorganisms among paediatric haematology-oncology patients in Yorkhill for the whole period from January 2008 to May 2015?

3(b) During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

Question 4

4(a) What was overall BSI incidence rate attributed to environmental microorganisms among paediatric haematology-oncology patients in the RHC for the whole period from June 2015 to the September 2018?

4(b) During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

[15] Bundle 44, Volume 5, Document 2, Page 32, para 2B.5.

Question 5

5(a) What was overall BSI incidence rate attributed to environmental microorganisms among paediatric haematology-oncology patients in the RHC for the whole period from October 2018 to February 2022?

4(b) During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

Question 6

6(a) What was overall BSI incidence rate attributed to environmental microorganisms among paediatric haematology-oncology patients in the RHC for the whole period from June 2015 to February 2022?

6(b) During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

Issue 3 - Potentially non-environmentally connected infections amongst paediatric haemato-oncology patients

15. For completeness a similar exercise should also be carried out for the underlying data for non-environmental BSI shown in Figure 2.F.4 [16] albeit that no equivalent data table has been included in the HAD Response document.

Question 7

7(a) What was overall BSI incidence rate attributed to non-environmental microorganisms among paediatric haematology-oncology patients in Yorkhill for the whole period from January 2008 to May 2015?

7(b) During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

[16] Bundle 44, Volume 5, Document 2, Pages 50, 51 - Associated explanation at paras. 2F.14 to 2F.16.

Question 8

8(a) What was overall BSI incidence rate attributed to non-environmental microorganisms among paediatric haematology-oncology patients in the RHC over the whole period from June 2015 to February 2022.

8(b) During that same period what were the GAM fit linear and linear + smooth components against monthly incidence rates?

Annex

1. The HPS Situational Assessment, Wards 2A/B, Royal Hospital for Children, NHS Greater Glasgow and Clyde (Bundle 7, Document 5, Page 194) and, in particular, Appendix 4 to that document (Bundle 7, Document 5, Page 205).

2. The HPS SBAR: To support NHS GGC IMT Mycobacterium chelonae cases and the Incidence of gram-negative bacteraemia in the paediatric haemato-oncology, September 2019 (Bundle 3, Document 16, Page 127).

3. Draft HPS Review of NHS GG&C Infection Outbreaks in the Paediatric Haemato-oncology Data October 2019 (Bundle 7, Document 6, Page 214)

4. HPS Review of NHS GG&C Infection Outbreaks in the Paediatric Haemato-oncology Data October 2019 - 29 November 2019 (Bundle 7, Document 7, Page 250).

5. Presentation by Kathleen Harvey-Wood and Dr Christine Peters: Bacteraemia rates and Resistance Paediatric Haemato-oncology 2014- 2018, 30 August 2018 (Bundle 27 Volume 6, Document 9, page 107).

6. Report by Dr Iain Kennedy: Descriptive Analysis of Trends in Bacteraemia Rates for Selected Gram-Negative Organisms, 1 October 2018 (Bundle 6, Document 27, page 95).

7. Draft report by C Peters and K Harvey-Wood: Bacteraemia rates and resistance patterns in paediatric haematology/oncology patients 2014- 2018, 10 October 2018 (Bundle 19, Document 19, Page 143).

8. Report by Dr Iain Kennedy: Descriptive analysis of trends in bacteraemia rates for selected gram-negative organisms, July 2019 (Bundle 6, Document 28, page 104)

9. Presentation by Dr Iain Kennedy and Jennifer Rodgers: Paediatric Haemato-oncology RHC – Summary of Data, September 2019 - Presented at IMT meeting of 20 September 2019 (Bundle 27, Volume 13, Document 13, Page 77)

10. Reports by Mr Mookerjee for the Glasgow 3 hearing:

    a. Quantitative Infection Link Report - 9 May 2024 (Bundle 21, Volume 1, Document 1, Page 3)

    b. Supplementary Report – 12 August 2024 (Bundle 21, Volume 1, Document 3, Page 71)

    c. An addendum to that report – 16 October 2024 (Bundle 21, Volume 1, Document 10, Page 767)

    d. Direction 5 response dated 11 July 20242852 (Bundle 21, Volume 5, Document 3, Page 104)

    e. A chart produced for the hearing day upon which he gave evidence (Bundle 27, Volume 18, Document 1)

SCOTTISH HOSPITALS INQUIRY

Bundle of documents for Oral hearings commencing from 19 August 2025 in relation to the Queen Elizabeth University Hospital and the Royal Hospital for Children, Glasgow

Bundle 44 Volume 7

Responses from Experts, (Mr Mookerjee & Dr Drumright) and Associated Documents