Case Ascertainment in Active Paediatric Surveillance Systems

A report from the British Paediatric Surveillance Unit Ascertainment Group

Lynn R, Reading R on behalf of the BPSU Ascertainment Group

Word count
Summary: 134
Article text 2594

Lead Author:
Richard M. Lynn
Scientific Coordinator
British Paediatric Surveillance Unit
Royal College of Paediatrics
London WC1X 8SH
Richard.lynn@rcpch.ac.uk

Correspondence to
Richard Reading
Jenny Lind Department
Norfolk and Norwich University Hospital
Norwich NR4 7UY
Richard.reading@nnuh.nhs.uk
Members of the BPSU Ascertainment Group:
Adams N – Public Health England
Avis J – British Paediatric Surveillance Unit
Barker L – Leeds General Infirmary
Bedford H – Institute of Child Health, University College London
Eke H - University of Exeter Medical School
Foot B – British Ophthalmology Surveillance Unit
Francis K - National Surveillance of HIV in Pregnancy & Childhood
Hunter L - Royal College of Paediatrics and Child Health
Irwin A – British Paediatric Allergy Immunology and Infectious Disease Group
Janssens A - University of Exeter Medical School
Knowles R – Institute of Child Health, University College London
Ladhani S - Public Health England
Lynn RM – British Paediatric Surveillance Unit
Michie C – Royal National Orthopaedic Hospital
Oeser C - Public Health England
Peters H - National Surveillance of HIV in Pregnancy & Childhood
Philbin M – Royal College of Paediatrics and Child Health
Powell A – Addenbrookes Hospital, Cambridge
Reading R – British Paediatric Surveillance Unit
Samad L - Institute of Child Health, University College London
Simms I - Public Health England
Simpson M - Royal College of Paediatrics and Child Health
Stevens S – National Congenital Anomalies and Rare Disease Registration Service
Tookey P - Institute of Child Health, University College London
Verity C - Addenbrookes Hospital, Cambridge
te Water Naude J – Welsh Paediatric Surveillance Unit
Winstone AM - Addenbrookes Hospital, Cambridge
Wood R - NHS National Services Scotland, Information Services Division
Summary

The British Paediatric Surveillance Unit (BPSU) conducts surveillance of rare paediatric conditions using active, or prospective, case finding. The reliability of estimates of incidence, which is the primary outcome of public health importance, depends on ascertainment being as near complete as possible. This paper reviews evidence of the completeness of ascertainment in recent surveillance studies run through the BPSU. Ascertainment varied between 49% and 94% depending on the study. These are upper estimates. This was the basis of a discussion on barriers and facilitators of ascertainment which we have separated into factors related to the condition, factors related to the study methods, factors related to the study team and factors related to the surveillance system infrastructure. This leads to a series of recommendations to ensure continuing high levels of ascertainment in active surveillance studies.
Introduction

The British Paediatric Surveillance Unit (BPSU) is one of a number of surveillance systems (for example British Ophthalmological Surveillance Unit - BOSU, Child and Adolescent Psychiatric Surveillance System – CAPSS, and members of the International Network of Paediatric Surveillance Units - INoPSU) which use active, or prospective, case ascertainment in order to measure incidence. In 1986 the BPSU introduced the method of monthly cards sent to every consultant paediatrician in the UK and Republic of Ireland as a simple yet robust method of ascertaining incident cases of a limited number of uncommon conditions. Since its inception over 120 surveillance studies have been run through the BPSU with many important impacts on public health and clinical practice.[1] However, the ability to ascertain cases may have been affected by changes in clinical working patterns such as subspecialisation and less continuity of care; developments in BPSU methods particularly use of electronic communication; and changes in the regulatory environment surrounding research and data privacy. The potential impact of a surveillance studies often depends on the reliability of the estimate of incidence. For rare conditions this is sensitive to small changes in the number of cases which are ascertained. In this paper we first review available evidence on the levels of ascertainment in recent studies, next we describe barriers and facilitators, and go on to recommend measures to optimise ascertainment.

Methods

The surveillance system used by the BPSU is illustrated in figure 1. Every month all substantive paediatricians (i.e. consultant and associate specialists) are
requested to report whether they have seen a new case of any of the conditions currently under surveillance. In order to measure compliance they are also requested to report if they have seen no cases. Initially postcards were sent and returned by mail but in 2011 electronic reporting was introduced and postcards were completely phased out by 2015. The study team for each condition is notified of all case reports and issues a clinical questionnaire to the reporting paediatrician. The studies are run by research teams independent of the BPSU.

Lists of current post-holders are updated from multiple sources e.g. Royal College of Paediatrics and Child Health (RCPCH) member lists, recipients of Certificates of Completion of Training, self-registration from college members. <Insert figure 1>

This paper is based on data presented and discussed at a meeting on ascertainment hosted by the BPSU in June 2017. Participants were invited if they were involved in Surveillance Unit management (including other units such as BOSU and CAPSS) or they had run studies through the BPSU or other paediatric surveillance units. We selected particularly those involved in multiple studies or long-running studies. We have listed those attending in the authorship list. A number of the participants are reporting paediatricians themselves.

The discussion between workshop participants was structured round a series of questions which we have summarised into themes. The agenda for the meeting, including formal presentations and discussion questions, is listed in web appendix 1.
What is the scale of (under)ascertainment

Completeness of reporting

Over 3500 e-cards are sent each month. The monthly average response rate of over 90% did not change over the period when electronic reporting was introduced (see table in web appendix 2). Return rates of clinical questionnaires range from 80% to 95% between studies.

Multiple sources of ascertainment

Using multiple sources for ascertainment is a means for both monitoring and improving ascertainment. A review in 2006 found that 38/59 (64%) of BPSU studies used additional sources, with some studies using several sources.[2] More recent data is shown in Table 1.

<Insert Table 1>

Studies using additional reporting sources include the study on elevated lead in children which ascertained cases from the BPSU, the Supra-regional Assay Service Trace Elements laboratories and the health protection teams of the five national public health organisations.[3] All of these sources should have had complete ascertainment. Seventy per cent was obtained through the BPSU, 65% through the laboratories and 40% through the public health organisations.
Several studies have used multiple data sources because paediatricians would not be expected to know all cases and hence BPSU ascertainment would be low. These include the National Surveillance of HIV in Pregnancy and Childhood (NSHPC) which uses parallel reporting systems to collect data from obstetric and paediatric units throughout UK and Ireland as well as the BPSU (http://www.ucl.ac.uk/nshpc). Long-established networks and the ability to link data about cases have resulted in a high level of ascertainment. The study on severe visual impairment was run by the BPSU and BOSU, while a study on Young People with attention deficit hyperactivity disorder (ADHD) in transition to adult services (CATCh-uS) was run with CAPSS.[4 5]

Comparison with lab-based infectious disease surveillance data

A number of studies of infectious disease or their complications have also used lab-based databases. These record bacterial isolates but few clinical details. Lab-based data can be used to backtrack to clinicians for clinical data if appropriate permissions and data confidentiality arrangements are complied with.

The study on Invasive Group B Streptococcal disease in infants found around 50% were picked up by the BPSU reporting system.[6] The remaining cases were reported through a network of lab-based systems covering the five countries. However, after backtracking and intensive case finding, it was possible to obtain clinical information from reporting paediatricians on 84% of cases.
Higher rates of ascertainment from the BPSU reports were found in the most recent study on Haemolytic Uraemic Syndrome,[7] and the study on Acute Infectious Hepatitis in Hospitalised Children.[8]

Comparisons with lab-based non-infection screening or biochemistry data

In a study on congenital adrenal hyperplasia with both lab based and BPSU case notifications, only 8 out of 144 cases were not reported through the BPSU. This study actively sought cases by backtracking from lab reports from the 12 biochemistry laboratories that carry out the assays in the countries covered by the study.[9]

In contrast, a study by the same team on congenital hypothyroidism had lower initial ascertainment (see figure 2).[10] After removal of errors and duplicates, 427 cases were reported to the BPSU through the electronic reporting card system. In 67 of these a clinical questionnaire was not submitted (i.e. the questionnaire return rate was 84%). At the same time there were 704 cases reported through the labs with abnormal screening results. Twenty-eight of these were not able to be traced further. Thus the initial ascertainment rate through the BPSU would have been 52% (i.e. (22 +338)/(22 + 338 + 338)). Further intensive case finding and, in some cases, collecting only minimal data resulted in useful data being available on 698 of 739 (94%) case reports. The remaining 41 cases with no clinical data were 13 BPSU reports where no questionnaire was completed and 28 lab reports with no traceable clinician.

Insert figure 2 here
Capture-recapture analyses

Capture-recapture analysis is a means of estimating a total population from two independent samples so potentially could be used to measure the true incidence of a condition where there is under-ascertainment in the different data sources. A review in 2006 showed that 6 out of 38 BPSU studies which used more than one data source carried out capture-recapture analyses.[2] A more recent study of vaccine associated intussusception used the BPSU and Hospital Episode Statistics (HES) as separate data sources.[11] In total 200 cases were confirmed, 163 via the BPSU (i.e. ascertainment calculated at 86%). When subjected to capture-recapture analysis a presumed total population of 233 cases was estimated (giving a final BPSU ascertainment rate of 70%).

Capture-recapture analyses depend on six basic assumptions of which two, homogeneity and independence, are rarely met in BPSU studies (see Table 2). Failure to meet these criteria makes capture-recapture analysis unsuitable for estimating true ascertainment.

What factors are barriers and facilitators to ascertainment?

Factors related to the condition under study

Clinical and public health importance
Paediatricians are more likely to recall and report conditions in which the clinical relevance or public health importance is clear and relates to their day-to-day work. Put simply, paediatricians must find the condition noteworthy.

**Case definition**

Conditions need to be recognised by reporting paediatricians, many of whom may be unfamiliar with the specific condition. This requires a precise case definition. The surveillance case definition needs to be highly sensitive to ensure that all cases are recognised and reported. The study team then apply an analytic case definition which needs to be highly specific.

**Reporting burden**

The burden on reporting paediatricians needs to be manageable. Studies with a high reporting burden, particularly when this falls on a limited number of clinicians or subspecialties, have found that ascertainment may suffer. Some studies have resolved this by specific arrangements for data collection with high reporting units. Studies which are likely to place a heavy burden on reporting clinicians are requested to propose a procedure to alleviate this burden.

**Concerns over data disclosure and confidentiality**

Some clinicians have been reluctant to report cases because they have concerns about data confidentiality or disclosure of identifying information, particularly when the condition under study is sensitive or has a high public profile. There have been misunderstandings by local R&D departments about which data may
be reported and released. All these issues though are covered by the governance approvals required before surveillance commences.

Factors related to the study methods

Data sources

Multiple sources of data should always be considered unless the condition is exclusively seen by paediatricians (or the reporting clinicians for other surveillance systems). These data sources may be used in different ways; as alternative sources of ascertainment, as a complement to primary surveillance, for example by back-tracking from lab reports to trace clinicians who may not have reported the case initially, or, rarely, as independent data sources for capture-recapture analyses.

Questionnaire design

Clinical questionnaires are more likely to be completed if the questionnaire is concise and the questions are focused on answering the study objectives. Questionnaire length needs to be limited and the study objectives restricted to those with clinical or public health relevance. A detailed data analysis plan is an effective means of ensuring that each item in the questionnaire will provide useful and analysable information. (see https://www.rcpch.ac.uk/resources/applying-bpsu-run-study-orange-card-reporting-scheme for advice on producing a data analysis plan)

Where initial questionnaires were not completed, even with reminders, the congenital hypothyroidism study used a reduced questionnaire with limited data
enabling partial analysis of some key study objectives (e.g. to exclude false positive reports from screening labs and to confirm initial treatment).[10]

Factors related to the study team

Engagement of reporting paediatricians

Study teams can enhance interest by providing feedback to reporting clinicians and dissemination of findings in conferences and academic publications. For example, the Progressive Intellectual and Neurological Deterioration study offers diagnostic support to clinicians reporting a case, the NSHPC fosters links with respondents by regular feedback and updates on study news and publications, and the NSHPC and the CATCh-uS studies offer certificates for completion of study questionnaires.

Personal contact

Personal contact with reporting clinicians or their secretaries may be more effective than letters, or emails. Clinical questionnaires should be dispatched within days of the case being reported and queries from reporting clinicians responded to rapidly. An offer to complete a clinical questionnaire over the phone is more likely to result in useful data than simply resending the questionnaire. These approaches would all be permitted under the research governance, ethical and confidentiality regulations.

Administration

The administrative burden of a study is often underestimated. Those studies which have committed enough administrative support have generally had higher
rates of completed clinical questionnaires, which will result in more accurate ascertainment.

Factors related to the surveillance system infrastructure

Maintaining the reporting database

Return of the monthly report card from clinicians above 90% and of clinical questionnaires above 80% are minimal rates accepted by the BPSU. If these fall lower then active steps of ensuring accuracy of the database of clinicians, and chasing up individual clinicians are necessary. Return rates of the monthly card increased after electronic reporting was introduced (Table 1).

Electronic reporting

Although the response to the electronic monthly report remains high, there is no facility for clinicians who report a case being able to record a local identifier (e.g. Hospital number) with the case report. Study teams and reporting clinicians both feel this to be a significant weakness of the move to electronic reporting. This has now been addressed by sending an aide memoir straight back to the clinician after reporting a case. In addition, study teams which use an electronic questionnaire can reduce the time period between reporting a case and completing a questionnaire.

Electronic clinical questionnaires

Electronic forms for online data collection have been found to be efficient and acceptable to respondents. The BPSU currently recommends electronic data collection, particularly where data is transmitted and stored securely. Eventually
we aim to establish a data platform to allow secure processing as well as the collection of all data through one portal (a “safe haven”).

Dealing with the changing regulatory environment

Changing research governance requirements, ethical frameworks and confidentiality and data privacy arrangements within the five countries covered by the BPSU have created a complex regulatory environment which in some cases has resulted in apparent incompatibilities. This has threatened the continuing operation of surveillance as a whole, but even within the limited aspects of case ascertainment, data privacy arrangements which prohibit potentially identifiable data from leaving the country it was collected in have jeopardised identification of duplicate reports of the same case.

Conclusions

Estimates of ascertainment from recent BPSU-associated studies range from 49 to 94%. The changing technological, regulatory and health service environments have presented opportunities to improve ascertainment and data accuracy, but also thrown up new barriers which could not have been predicted when the systems were set up. Nevertheless, the bulk of work undertaken by the surveillance systems still revolves around ensuring a high response rate of the monthly reports, ensuring clinicians complete questionnaires on cases they have reported, and developing and refining case definitions during the setting up of surveillance studies.
Limitations and generalisability

Estimates of ascertainment depend on comparison of imperfectly ascertained sources of data. The true level may be lower than we have calculated. However, capture-recapture analyses, where justified, support our estimates. The facilitators and barriers to ascertainment are based on opinions of an informed group but are not subject to any confirmatory evidence.

The factors which influence ascertainment depend on the methods of the surveillance system. They may not be applicable to other surveillance units either in the UK or internationally. However we included members of other UK surveillance units in our group and personal communications within INoPSU suggests similar issues are recognised elsewhere.

Recommendations

Recommendations arising from the group are collated in the box which will be used in assessing future BPSU studies and which may be useful for other surveillance systems in the UK and worldwide. Other types of health service research and evaluation may also find some of these recommendations helpful.

Case ascertainment is always likely to be incomplete so reported estimates of incidence would be better described as “minimal incidence”. We continue to recommend the use of complementary data sources wherever possible. Using these to support intensive case finding and back-tracking is a more productive
approach than simply using them as alternative sources of ascertainment.

Surveillance of rare conditions through the BPSU is a success story of modern paediatrics [1] and remains as relevant now as before. It is essential to continue monitoring ascertainment to demonstrate the robustness of the system and to justify the continued participation of paediatricians and healthcare organisations in surveillance of rare childhood conditions.
What is known about this subject

- Active disease surveillance depends on high case ascertainment
- The British Paediatric Surveillance Unit methods were designed to give high case ascertainment when set up in the 1980s
- Changing working patterns, technology and the healthcare environment may have affected case ascertainment in positive and negative ways

What this study adds

- Ascertainment levels remain high
- Factors related to the condition under study, the study methods, the study team, and the surveillance system can all affect ascertainment
- There are ways to optimise ascertainment by addressing these factors in study setup and surveillance system methods
References


5. Eke H, Ford T, Newlove-Delgado T, Price A, Young S, Ani C, Sayal K, Lynn R, Moli P, Janssens A. Transition between child and adult services for young people with Attention Deficit Hyperactivity Disorder (ADHD): findings from a British national surveillance study. BJPsych Accepted for publication


### Box: Recommendations for enhancing ascertainment

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Whose responsibility?</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure return rate of report cards remains above 90%</td>
<td>Surveillance system</td>
<td>Maintain accuracy in the database of reporting clinicians (deletion of those no longer clinically active and rapid inclusion of newly eligible clinicians)</td>
</tr>
<tr>
<td></td>
<td>Surveillance system</td>
<td>Consider ways of enhancing visibility and accessibility of report cards</td>
</tr>
<tr>
<td>Improve recognition and recollection of cases</td>
<td>Surveillance system</td>
<td>Enable an electronic link between a case report and identification for local clinicians</td>
</tr>
<tr>
<td></td>
<td>Study team – research methods</td>
<td>Ensure case definition is clear, simple, unequivocal and will capture all eligible cases</td>
</tr>
<tr>
<td>Ensure return rate of clinical questionnaires remains above 80% for each study</td>
<td>Study team – research methods</td>
<td>Consider the range of media for returning clinical questionnaires to include paper, electronic, email or telephone</td>
</tr>
<tr>
<td>Reduce reporting burden</td>
<td>Study team – research methods</td>
<td>Ensure questionnaire is designed only to collect the information which will meet the study objectives</td>
</tr>
<tr>
<td></td>
<td>Study team – research methods</td>
<td>Ensure questionnaire only requests information readily accessible in hospital notes</td>
</tr>
<tr>
<td></td>
<td>Study team – research methods</td>
<td>Ensure that all questions in questionnaire are covered in data analysis plan</td>
</tr>
<tr>
<td></td>
<td>Study team – research methods</td>
<td>Consider an abbreviated questionnaire for minimal data to meet primary study objectives only</td>
</tr>
<tr>
<td></td>
<td>Study team – research methods</td>
<td>Consider steps to reduce burden on high reporting centres or clinicians (eg supporting questionnaire completion)</td>
</tr>
<tr>
<td>Reduce bureaucratic and administrative blocks</td>
<td>Surveillance system</td>
<td>Attempt to negotiate compatible governance (research governance, ethics and data confidentiality) arrangements between the five countries covered by the BPSU</td>
</tr>
<tr>
<td></td>
<td>Study team – administration</td>
<td>Ensure sufficient administrative resources are dedicated to the study</td>
</tr>
<tr>
<td>Maximise sources of cases</td>
<td>Study team – research methods</td>
<td>Use multiple sources of data where appropriate if cases seen by different clinical specialties</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Study team – research methods</td>
<td>Use multiple sources of data for tracing clinicians, backtracking or checking surveillance numbers</td>
</tr>
<tr>
<td>Increase engagement of reporting clinicians</td>
<td>Study team – communications and administration</td>
<td>Use personal approach to reporting clinicians wherever possible.</td>
</tr>
<tr>
<td></td>
<td>Study team – research methods</td>
<td>Ensure the clinical and/or public health importance is clearly articulated</td>
</tr>
<tr>
<td></td>
<td>Study team – research methods</td>
<td>Consider pre-surveillance publicity to reporting clinicians</td>
</tr>
<tr>
<td></td>
<td>Study team – communications and administration</td>
<td>Rapid response to initial case reports to reporting clinician</td>
</tr>
<tr>
<td></td>
<td>Study team – communications</td>
<td>Ensure regular, timely and relevant feedback to individual reporting clinicians</td>
</tr>
<tr>
<td></td>
<td>Study team – communications</td>
<td>Ensure high profile dissemination of findings and results</td>
</tr>
</tbody>
</table>
### Table 1
Studies with data from multiple sources

<table>
<thead>
<tr>
<th>Study, years of data collection and reference</th>
<th>Source of alternative data</th>
<th>Initial BPSU ascertainment</th>
<th>Proportion of cases with paediatric information after case tracing</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>National HIV Surveillance and Childhood Data collected since 1986 – years considered here 2012 - 2017 <a href="http://www.ucl.ac.uk/nshpc">www.ucl.ac.uk/nshpc</a> Unpublished data supplied by Peters H.</td>
<td>The surveillance has established relationships with named contacts at paediatric and obstetric units across the UK and Ireland. Paediatricians may report through the BPSU or directly to the surveillance team.</td>
<td>By the end of 2017, for years of birth 2012 – 2015, cases ascertained directly through BPSU were 1364/4490 (30.4%)</td>
<td>90% (see comments for explanation of this proportion)</td>
<td>Cases are initially reported either through the BPSU (numbers given in initial ascertainment column), or directly from individual paediatric or obstetric units. Because of the long established links between NSHPC and individual units and clinicians which encourage direct reporting, these figures are not a reliable guide to BPSU ascertainment levels. Clinical information including paediatric data is eventually available for around 90% of all cases. It is not possible to give precise data as this information comes from several sources, through a variety of routes, at different times.</td>
</tr>
<tr>
<td>ADHD in transition (CATCH-U) 2015-6 Eke et al 2019 [5]</td>
<td>Child and Adolescent Psychiatry Surveillance</td>
<td>202/315 (62.3%) There was no overlap in</td>
<td>Of the final 315 cases reported, 202 were reported through BPSU and 113 through CAPSS. There were no cases reported through both systems. This indicates that no</td>
<td></td>
</tr>
<tr>
<td>System (CAPSS)</td>
<td>cases reported through both organisations (i.e. no cases were reported by both paediatricians and psychiatrists)</td>
<td>useful information can be obtained about ascertainment as both groups are likely to have been mutually exclusive. An evaluation of the CAPSS ascertainment using an alternative service based source of data suggested 18 of 76 (24%) eligible cases seen in the South London child psychiatric services were notified via CAPSS. (H Eke et al, [14])</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual Impairment and Blindness 2015-2016 Rahi J 2017[4]</td>
<td>British Ophthalmic Surveillance Unit (BOSU) 182/422 (43%)</td>
<td>The low ascertainment rate is due to ophthalmologists being the main secondary care doctor for the majority of these children. Of note, 139 (33%) cases were notified only through the BPSU illustrating the benefit of additional sources of ascertainment to the primary source (in this case BOSU)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Studies comparing BPSU ascertainment with lab based infectious disease databases</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuberculosis 2003-2005 Teo et al 2009 [15]</td>
<td>Enhanced Tuberculosis Surveillance scheme (ETS) covers England, Wales and Northern Ireland 320/557 (57%)</td>
<td>This study was designed to assess the quality of ascertainment in the ETS rather than the BPSU</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Invasive Group B Streptococcal disease 2014-2015</td>
<td>Microbiology laboratory notifications to 49% (numbers not available) 83% (657/856 paediatric and lab reports, 59/856)</td>
<td>The increase in proportion ascertained from paediatricians shows value of backtracking and intensive case tracing,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source</td>
<td>Case Reports</td>
<td>Hospital Episode Statistics</td>
<td>Case Reports Included</td>
<td>Notes</td>
</tr>
<tr>
<td>--------</td>
<td>--------------</td>
<td>----------------------------</td>
<td>-----------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Heath P 2016[6]</td>
<td>public health bodies in England, Scotland, Wales, Northern Ireland and Republic of Ireland</td>
<td></td>
<td>paediatric report only, 142/856 lab report only)</td>
<td></td>
</tr>
<tr>
<td>Intussception 2008-2009 Samad L et al 2016[11]</td>
<td>Hospital Episode Statistics</td>
<td>190/227 (84%)</td>
<td>Case reports included those notified by paediatric surgeons who were added to BPSU reporting for this study. A capture-recapture analysis calculated the total estimated incidence as 233 cases, which would bring the BPSU ascertainment rate down to 82%.</td>
<td></td>
</tr>
<tr>
<td>Acute hepatitis 2014-2015 Ladhani S, 2015 [8]</td>
<td>Laboratory reports to central public health organisations</td>
<td>72/84 (86%)</td>
<td>82/84 (98%)</td>
<td>The total number of cases includes those where no paediatric information was available but hospital admission was confirmed.</td>
</tr>
<tr>
<td>Escherichia coli (VTEC) through public health bodies of England, Scotland, Wales, Northern Ireland and the Republic of Ireland</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Congenital Syphilis 2010 – 2015 Simms I et al 2017 Simms I, 2014 [12 13]</td>
<td>Public Health bodies of England, Scotland, Wales, Northern Ireland and Republic of Ireland Laboratory reports. GUMCAD (Clinical Activity Dataset of GUM clinics)</td>
<td>13/15 (87%)</td>
<td>Although the final study identified 17 cases, the only published data on which ascertainment could be calculated were on the first 15 confirmed cases published in the BPSU Annual report 2013-2014</td>
<td></td>
</tr>
</tbody>
</table>
### Reporting by microbiologists directly to study

<p>| Studies comparing BPSU ascertainment with lab based non-infectious disease databases |
|---------------------------------|---------------------------------|---------------------------------|
| <strong>Congenital Adrenal Hyperplasia</strong>&lt;br&gt;2007-2009 Khalid 2012 [9] | Individual biochemistry laboratories which carries out diagnostic assays for CAH | 136/144 (94%) |
| This study involved intensive case tracing both ways – from laboratory reports to clinicians. The majority, but not all, laboratories carrying out relevant assays reported into the study. This study achieved 95% clinical questionnaire returns from all initial case reports which, along with case tracking from lab reports, suggests the ascertainment figure is reliable |
| <strong>Elevated blood lead in children</strong>&lt;br&gt;2010 – 2012 Ruggles R, et al. 2018 [3] | National Public Health Organisations (PHOs) Supra-regional Assay Service Trace Element Laboratories | 32/46 (70%) Of 46 confirmed cases 32 reported through BPSU, 32 reported via laboratories of which 19 were also reported through BPSU, and 19 reported |
| This study was run through PHE and involved the health protection teams in the public health organisations of each of the five countries. Theoretically each source should have been able to ascertain all cases although there were some cases reported by only one source. While ascertainment in the BPSU was 70%, it was 65% from the laboratories and 41% through the PHOs |</p>
<table>
<thead>
<tr>
<th>Congenital Hypothyroidism 2011-2012</th>
<th>Antenatal screening laboratories</th>
<th>through PHOs of which 13 were also reported to BPSU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowles R, 2014 [16] Knowles et al 2017 [10] Knowles et al. 2018 [17] and additional data supplied by Knowles</td>
<td>360/698 (52%)</td>
<td>698/739 (94%) Includes 13 initially reported to BPSU with no clinical questionnaire and not traceable to lab reports, and 28 reliable lab reports where the clinician was not traceable</td>
</tr>
<tr>
<td>This study enhanced the initial ascertainment by intensive tracing of paediatric clinicians from lab reports, and the use of a mini-questionnaire to confirm cases status from paediatricians where a full questionnaire was not submitted</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2

Assumptions required for Capture-Recapture analyses to be valid

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Every case has been diagnosed accurately by the two sources</td>
</tr>
<tr>
<td>2</td>
<td>Matching pairs must be identified reliably</td>
</tr>
<tr>
<td>3</td>
<td>Cases from each source are within the same time-space unit</td>
</tr>
<tr>
<td>4</td>
<td>The population under study is “closed”</td>
</tr>
<tr>
<td>5</td>
<td>Each case must have the same probability of being “caught” by each source: <strong>Homogeneity</strong></td>
</tr>
<tr>
<td>6</td>
<td>Ascertainment of each case by each of the two sources is <strong>independent</strong></td>
</tr>
</tbody>
</table>
Captions for Fig 1

Figure 1

BPSU active case ascertainment methods
Captions for Fig 2

Figure 2

Final status of reports in Congenital Hypothyroidism study

- **41 (13+28) cases** (3% of all reports that were not errors or duplicates) were excluded as we had insufficient data to confirm these were true cases

Data courtesy Dr Rachel Knowles
Programme for the meeting

Session 1
Active Case Ascertainment Surveillance Systems
- Review of BPSU processes – Lynn R
- Issues surround a heavy reporting condition – Verity C, Winstone AM

Discussion Questions
1) What simple steps can we take to improve the number of people responding to the initial case notification request (the monthly orange electronic card)?
2) Does electronic reporting bring any barriers or advantages to reporting?
3) What steps can we take to improve response to clinical questionnaires?
4) Does questionnaire design make a difference?

Session 2
Evidence of under ascertainment from BPSU studies
- Using the laboratory system – why is BPSU missing so many cases and problems of back tracking to clinicians – Ladhani S
- Laboratory surveillance to support BPSU case reporting – Knowles R

Discussion Questions
1) How can we ensure that once a case is notified, details are kept to enable clinicians to identify the case once the questionnaire arrives?
2) How can we facilitate back-tracking from lab reports to asking paediatricians for clinical details?
3) What are the research governance and patient confidentiality constraints to back tracking to access clinical data?
4) What advice should we give investigators to facilitate data
checking/back-tracking within ethical and patient confidentiality constraints?

Session 3
How to maximise ascertainment – collaboration between PSUs and multisource ascertainment
  How useful is capture recaptures analysis - Knowles R
  Multi source ascertainment: an HIV perspective’ Tookey P, Peters H

Discussion Questions
1) How do we overcome potential barriers and problems associated with multi-source ascertainment?
2) How to address the impact of volume of cases and reporting burden across different conditions/types of units
3) One clinical questionnaire or different ones for different PSUs?
4) Other possible external validations of ascertainment (e.g. HES, NCARDRS, neonatal and other speciality databases)?
5) How to address the impact of volume of cases and reporting burden across different conditions/types of units
6) How do we influence questionnaire design to maximise responses?
Web Appendix 2

Table
Rates of return of report card over period of transfer from paper to email response

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Card return rate</td>
<td><strong>93.1</strong></td>
<td><strong>91.4</strong></td>
<td><strong>93.3</strong></td>
<td><strong>95.3</strong></td>
<td><strong>94.1</strong></td>
<td><strong>94.3</strong></td>
<td><strong>94.2</strong></td>
</tr>
<tr>
<td>Proportion of respondents in receipt of the e-card</td>
<td>0%</td>
<td>15%</td>
<td>65%</td>
<td>77%</td>
<td>95%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

E-card system introduced in 2011
Case reporting-how it works

- Researchers
- Alternate source of data
- BPSU Office
- BPSU Orange card
- Paediatricians

Flow: Researchers → Alternate source of data → BPSU Orange card → Paediatricians → BPSU Office → Researchers
BPSU case-reports (n=427)

- 13 unconfirmed reports through the BPSU
- 22 confirmed BPSU reports with a negative screen result
- 338 confirmed BPSU reports that were matched to an independent laboratory report
- 338 confirmed screen positive reports for which a clinician retrospectively completed a questionnaire

Laboratory case-reports (n=704)

- 28 unconfirmed reports through laboratories