

9 LIMITATIONS OF THE SURVEY

9.1 *Prevalence estimates*

In prevalence surveys a cross sectional approach is adopted which is biased towards identifying HAI of longer duration. From a methodological aspect the main limitation in measuring prevalence lies in the application of specified definitions, including HAI case definitions in identifying patients with HAI. Data collectors were trained in the identification of patients with HAI and had easy access to CDC case definitions. Their validity of case reporting was monitored. They were limited to a certain extent however by the availability of information recorded in the many patient records including case notes, nursing records, prescribing records. The extent of microbiological investigation as well as the availability of reports of these and other investigations to data collectors at the time of the survey will also have affected the completeness and accuracy of the HAI diagnosis. An element of subjectivity does enter into the diagnosis of HAI, which had been present for days before the date of the survey. However the well documented protocol, the extensive training of data collectors, ongoing monitoring of performance and validation of data collection will have minimised the potential for bias.

It was not intended to undertake an analysis of intrinsic risk factors for HAI in this survey and these data were not collected. Data will become available from ISD on discharge diagnoses in the future, which will be used in further analyses. Data on extrinsic risk factors such as the presence or absence at the time of the survey of interventions such as peripheral and central venous catheters, urinary catheters and mechanical ventilation were collected and may be utilised in further analyses. However the absence of a specified intervention on the day of the survey may not accurately represent the facts, as catheters and other invasive devices could have been removed prior to the date of the survey. Data on the duration of exposure to specified interventions, which give a more accurate measure of risk, were not collected- this would require an incidence study.

9.2 *LOS estimates*

Estimates of additional LOS due to HAI are biased by the fact that longer stay patients are overrepresented in the sample and HAI of longer duration are more likely to be counted within a prevalence survey. Prevalence surveys therefore overestimate the LOS of all patients but this overestimation is greater for those patients with HAI.

The prevalence approach used the whole dataset but the approach to sampling created problems by over-representing the patients with a long length of stay. This can be illustrated by thinking about a 10-bedded ward: eight beds are occupied by patients who stay for one whole year, while, the other two beds have a different patient every day. At any given point, there will be 8 patients each with an average stay of 365 days and 2 patients with an average stay of 1 day, so the overall average would be 292 days (8x365 plus 2x1, all divided by 10). However, the calculation of national statistics would look across the whole year so there would be 730 patients with a stay of 1 day plus 8 patients with a stay of 365 days the average stay would be 4.9 days. This illustrates the problem with 'snapshot' approach in that it 'over-represents' patients who stay in hospital for a long time.

A specific limitation of this survey was that due to its size (numbers of acute hospitals and patients) only limited data were collected to adjust crude measures of LOS for factors other than HAI. Other smaller studies, or studies where patient data sets are available for study retrospectively have collected information on a range of indicator variables of risk of long inpatient stay such as: severity of illness, number of diagnoses, conditions arising in hospital, interventions etc. Information was available only on age group and specialty of admission as indicators of underlying illnesses, which might lead to increased LOS independently of HAI and also increase the risk of HAI due to prolonged inpatient stay. Data are awaited on discharge diagnosis/diagnoses which, when available, will be used in further analyses.

9.3 Outbreaks

Average costs have been used and it may be that actual costs of certain HAI exceed the average .e.g. the costs of outbreak have not been included and need to be considered.

One major MRSA outbreak in England was estimated to cost in excess of £400 000 in direct costs alone, excluding those costs associated with increased LOS, additional prescribing, and those arising from staff absence due to infection, or litigation (79).

Further additional costs associated with an outbreak may be those of adverse publicity resulting in loss of confidence in the hospital by the public and significant use of staff time in terms of managing this.

9.4 Economic analyses

The major limitation of the economic analysis is that there is no way to relate the prevalence found in this survey to the incidence of HAI throughout a calendar year.

Since the data required to use the formulae described in the literature (46) to convert prevalence to incidence a rough conversion approach has been to multiply the prevalent patients by the total number of patients who are treated in Scotland within a year. It is acknowledged that this is likely to be an over estimate of the true number of incident cases.

The biases mentioned as limitations of prevalence surveys and of LOS estimates particularly the fact that prevalence surveys overestimate LOS and the limitations of data collection will also affect the economic analyses of the cost of additional bed days. The gold standard reference for calculating costs of additional days due to HAI is the incidence study by Plowman (3) in which the costs were derived directly case by case is a very detailed and therefore costly methodological approach.

For the current survey an indirect method was used and assumptions had to be made to obtain the costs, based on Scottish Health Care Costs 2006, which were applied in the calculations. Calculations of the costs of additional bed days due to HAI, overall and by specialty, have been based on an assumption that the relevant costs are those for laboratory tests, pharmacy and nursing care only. Even with this assumption costs may be overestimated, as later days in a hospital stay are usually cheaper than earlier ones. The use of estimates of additional bed days based on a LOS analysis of patients with and without HAI with only very short hospital stays may compensate to some extent for the above two noted limitations.

9.5 *Limitations to using antimicrobial prescribing as a test for HAI*

Prevalence surveys only record the status of inpatients at the time of survey. Inpatients will not necessarily have the same status throughout their hospital stay.

It is important to note that during this survey the units of time recorded were days. Information was not included on time of admission and time of administration of first antimicrobial. It is important to note that 48 hours is 2 days and therefore could be anywhere between 36 and 50 hours after admission.

A number of inpatients may have been started on an antimicrobial on or before admission and then subsequent microbiological reports could suggest that a more appropriate therapy should be used and therefore changed prescription. These inpatients may appear to have been prescribed antimicrobials 48 hours or more after admission, but would not all necessarily have a HAI.

Prevalence surveys do not record all the antimicrobial therapies inpatients have been prescribed during their stay in hospital; only the antimicrobials the inpatients were prescribed at the time of the survey.

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11 RECOMMENDATIONS FOR FUTURE WORK

11.1 Objective 1

- Further analyses needs to be undertaken on the burden study component of the study (at specialty level) to look at other factors that may affect prevalence of HAI.

11.2 Objective 2

- Further work is required to analyse the prevalence data with the ISD ICD10 data which would provide information on co-morbidities and allow a more detailed logistic regression analysis to be undertaken.

11.3 Objective 3

- In order to generate the most accurate estimate of the cost of additional stay two things would be desirable:
 - A cohort study of people admitted to hospital that allows incidence to be estimated – if the costs in different specialties are of interest (e.g. haematology, oncology) this should be taken into account in designing the sampling framework
 - A more accurate estimate of the cost of added days of stay related to an infection
- However these would require costly and time consuming studies. It is recommended that the prevalence survey data are re-analysed using ISD discharge data including information on the patients' disease classification (ICD-10) when available which would allow a more specific comparison of patients with and without HAI.

11.4 Objective 4

- An incidence study of HAI and antimicrobial prescription as a proxy indicator should be carried out.

11.5 Objective 5

- Further work is needed in another study to examine the relationship between prevalence and incidence in more detail.

11.6 Objective 6

- Targeted incidence surveillance should be carried out on: Surgical site infection; *Clostridium difficile*; CAUTI (Catheter Associated Urinary Tract Infection), Vascular catheter infections, *Staphylococcus aureus* bacteraemia
- Antimicrobial prescribing should be monitored in Scotland
- Repeated prevalence surveys should be considered for specific specialties (elderly care, medicine), hospitals with small bed numbers where targeted incidence surveillance is of limited value, as a cost effective means of measuring the impact of interventions over time (utilising at least 3 surveys pre and post intervention (69))

11.7 Objective 7

- HPS should focus with NHS boards on targeting interventions where there is the most potential for prevention of HAI. These would be: care and maintenance of devices such as urinary catheters, vascular catheters (peripheral and central) and mechanical ventilation, surgical site infection (pre, peri and post op care), those practices which prevent transmission of infection such as hand hygiene and those practices which prevent and control antimicrobial resistance such as prudent prescribing of antimicrobials.
- Surveillance in settings outside hospitals should be considered in order to establish the burden and focus on required interventions for the prevention of HAI in these settings.

11.8 Objective 8

- Future national prevalence surveys in Scotland should use the methodology described in this study.

11.9 Objective 9

- Continued targeted local prevalence should be supported by HPS.

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