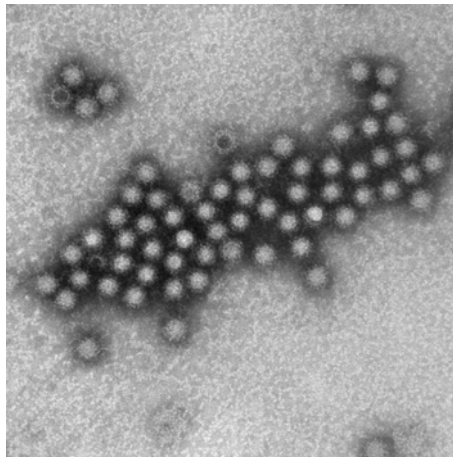


*Second Report of the Health Protection Agency.*

## Hospital Norovirus Outbreak Reporting



### Summary findings

- In January 2009 the HPA in conjunction with the Infection Prevention Society launched a voluntary National scheme for reporting outbreaks of suspected and confirmed norovirus outbreaks occurring in Acute Trusts within the NHS in England. The purpose of the reporting scheme is to document trends and characterise the risks and impacts associated with reported outbreaks.
- In the first year, January 2009 – December 2009 (outbreaks reported by 22 January 2010):
  - 713 outbreaks were reported;
  - 7153 patients and 2142 staff were affected;
  - Seventy one percent of outbreaks were lab confirmed;
  - Eighty two percent involved some type of ward closure.
- From these data and using laboratory data from five laboratories, we estimated the true level of norovirus outbreaks in hospitals in England using capture – re-capture methods. This gives estimates for all Trusts in England for the year 2009. Approximately:
  - 2332 outbreaks occurred;
  - 24551 patients were affected;
  - 7834 staff were affected;
  - 15027 days of ward closure were incurred;
  - 47644 bed days were lost.

## Background

In January 2009 the Health Protection Agency in collaboration with the Infection Prevention Society set up a dedicated voluntary reporting system for recording outbreaks of norovirus occurring in hospitals in England. Outbreaks need not be laboratory confirmed; an outbreak definition based on clinical presentation of disease is used for outbreaks where laboratory confirmation of norovirus infection was not available. Infection control staff, located at Trusts in England, enter data on outbreaks as they occur using a secure web enabled reporting form: <http://www.hpa-bioinformatics.org.uk/noroOBK/> into a custom designed database. This provides real time data on outbreaks in participating Trusts in England. It is intended to be useful for Trusts, Health Protection Agency staff in Regional Offices and Health Protection Units for monitoring trends, risk factors and impacts of outbreaks during the year. The first report produced after the scheme had been operational for six months showed that in that time 350 outbreaks had been reported; affecting over 3500 patients and 980 staff members. Reporting is voluntary and therefore some under-ascertainment will occur. Using capture re-capture methods, using laboratory reports alongside hospital reported outbreaks we estimated the true number of outbreaks for the year (from July 2008 to June 2009) was 2241. This report updates the six month report with data gathered on outbreaks reported to have occurred from the beginning of January to the end of December 2009. The report was compiled on outbreaks reported by 22 January 2010.

## Outbreak Definition

The database works with field-tested case and outbreak definitions. Cases are defined as suspected or confirmed as follows:

### A suspected case of norovirus:

- a) Vomiting: Two or more episodes of vomiting of suspected infectious cause\* occurring in a 24 hour period
- b) Diarrhoea: Two or more loose stools in a 24 hour period\*
- c) Diarrhoea and vomiting: One or more episodes of both symptoms occurring within a 24 hour period \*

\*not associated with prescribed drugs or treatments and not associated with reaction to anaesthetic or an underlying medical condition or existing illness.

### A confirmed case of norovirus:

a,b or c above with microbiological confirmation

### Norovirus outbreaks:

**Suspected outbreak:** two or more cases, as defined above, occurring in a functional care unit within the hospital without laboratory confirmation.

**Confirmed outbreak:** as above with laboratory confirmation

Reporters are asked to report both suspected and laboratory confirmed norovirus outbreaks. In the absence of laboratory confirmation, the following criteria act as an indicator of a norovirus outbreak:

- average duration of illness of 12 to 60 hours
- average incubation period of 24 to 48 hours
- more than 50% of people with vomiting, and
- no bacterial agent found.

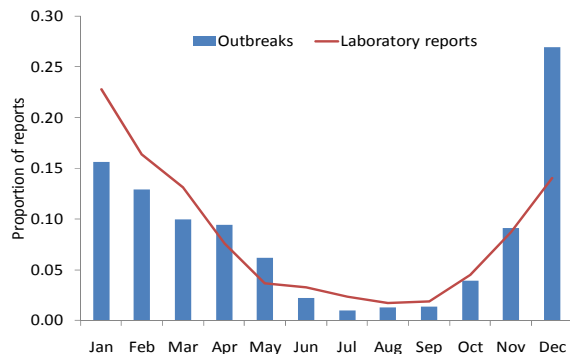
Outbreak are considered to be over if no new cases arise after seven days after the last case was considered to be symptom free.

## Results

### Outbreak pattern

From January to December 2009 713 suspected and confirmed norovirus outbreaks were reported by 73 Trusts in England. Eight non-acute trusts (Community or Mental Health Trusts) reported 33 outbreaks and 65 Acute Trusts reported 680 outbreaks. Outbreaks declined from an initial peak in January with the fewest occurring in July and began to rise again from October to December (figure 1). Twenty seven percent of reported outbreaks in 2009 occurred in December.

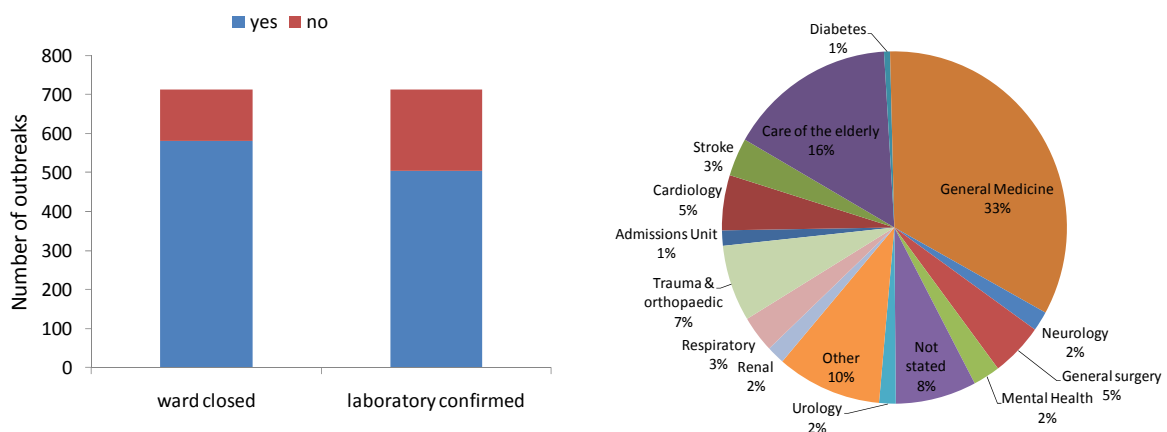
Figure 1. Proportion of all outbreak and laboratory reports by month of outbreak occurrence 2009



### Hospital impacts

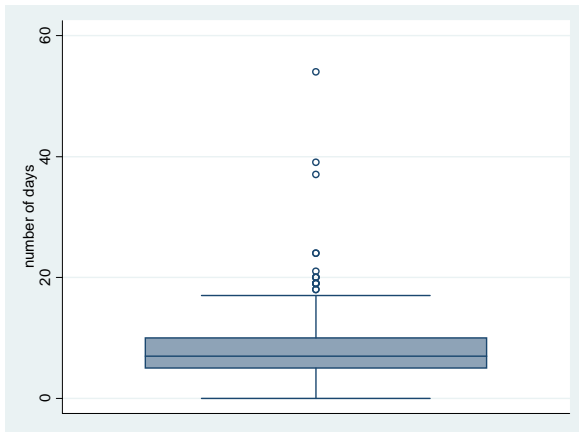
Eighty two percent of outbreaks (580) involved some form of ward closure or restriction on admissions to wards and 71% (503) of outbreaks were laboratory confirmed. Outbreaks affected a range of wards with general medical wards accounting for 33 percent of outbreaks and care of the elderly 16 percent (figure 2b)

Figure 2 a) proportion of outbreaks that involved ward closure and were laboratory confirmed b) wards affected.

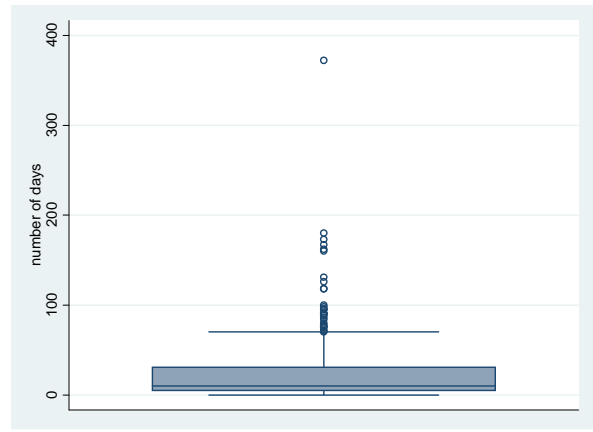


The reported outbreaks lasted for a total of 3816 days with each outbreak lasting on average 6.4 days (range 1 – 37 days) leading to a total of 4300 reported days of ward closure and on average wards were closed for 7.9 days (range 1 to 54 days). Ward closures led to 9415 reported bed days lost with each outbreak leading to an average of 25 bed days lost (range 0 – 372, median 10). Figure 4 shows a) the average and range of the length of ward closure and b) the number of bed days lost and c) the length of outbreaks.

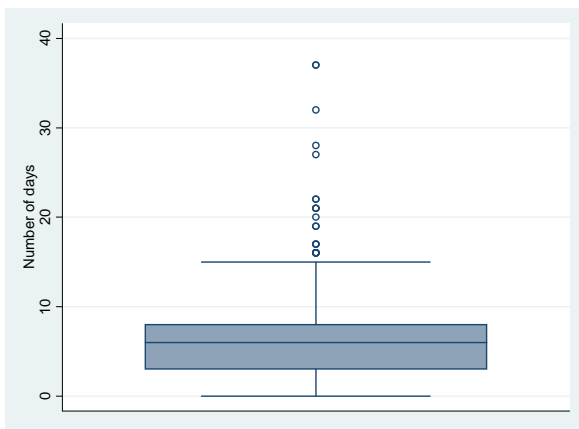
Figure 4 a) length of ward closures



b) number of bed days lost



c) length of outbreak



### Patient and staff cases

The reported outbreaks affected 7153 patients and 2142 staff. On average, each outbreak affected 10 patients (range 1 to 34) and three members of staff working on the affected wards (range 0 to 23) (figure 5).

Figure 5. Number of patients and staff affected during outbreaks

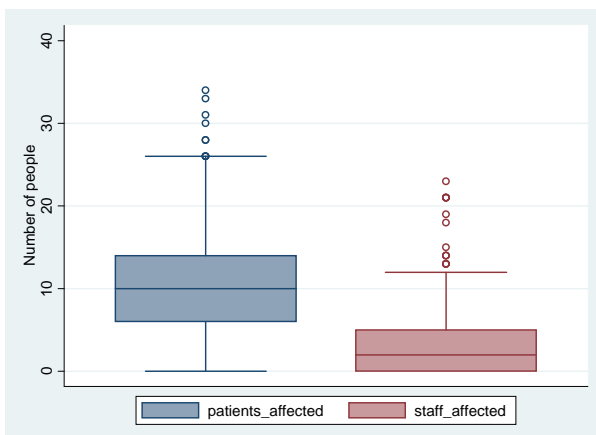


Table 1 characteristics of the reported outbreaks

	Outbreaks (n)	Total (median, IQR)	Mean	Max
Patients affected	679	7153 (10, 6-14)	10.53	34
Staff affected	637	2142 (2, 0-5)	3.36	23
Length of outbreak (days)	596	3816 (6, 3-8)	6.40	37
Length of ward closure (days)	547	4300 (7, 5-10)	7.86	54
Bed days lost	378	9418.5 (10, 5-31)	24.92	372
Reporting delay	469	-- (15, 7-31)	36.88	285

### Laboratory reported outbreaks

In the first year four laboratories from the HPA Regional Microbiology Network (RMN) and one HPA collaborating centre in London reported investigating samples for 965 outbreaks of norovirus (table 2). The data from the laboratories are gathered in various ways either electronically (via a weekly download in a spreadsheet) or via fax or by telephoning the laboratory directly. Laboratory data do not have the same case definition or outbreak definition that applied to those in hospitals. The highest number of outbreaks were reported by the laboratories in Bristol (31%) and Manchester (28%).

Table 2 laboratory reported outbreak by HPA regional laboratory

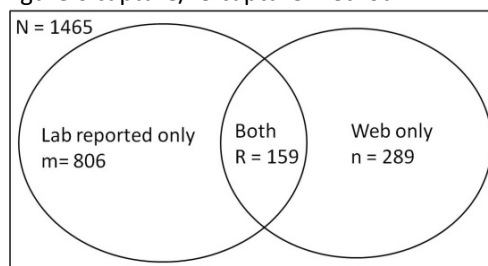
HPA regional laboratory	Number of outbreaks investigated
Bristol	296
Cambridge	147
Manchester	273
Southampton	171
University College Hospital, London <sup>†</sup>	78
Total	965

<sup>†</sup>HPA collaborating centre

### Estimating the true incidence.

Seventy-three trusts reported outbreaks (65 acute and 8 non-acute Trusts). This is only a proportion of the total number of Trusts in England, and therefore, the voluntary scheme does not currently provide a measure of the total number of hospital outbreaks. Outbreaks occurring in hospitals will inevitably involve sending samples to laboratories for confirmation. These laboratories are able to provide information on outbreaks that they have investigated that have not been included in the web based reporting scheme. The existence of these two sources of reporting allows us to estimate the true incidence of outbreaks using capture/re-capture methods through a matching reports from both reporting schemes. The capture /re-capture methods to calculate total number of outbreaks [Jan-Dec 09] was calculated as:  $N = n*m/R$  (figure 6). Where N is the total number of outbreak reports,  $n$  is the number of web only reported outbreaks (hospital reported) (554),  $m$  is the number of laboratory only reported outbreaks (806), and  $R$  is the number of outbreaks identified in both reporting systems (159). Only hospital outbreaks reported via web reporting from the same regions as the reporting laboratories were used to estimate under-reporting.

Figure 6 capture/re-capture method



Outbreaks were considered a match ( $R$ ) if they (a) occurred in the same Trust and (b) hospital, and (c) where the first date of onset of illness in the reported outbreak and the specimen dates were

within 14 days of each other and (d) did not have different ward names. However, the ward name was often missing from the laboratory data, therefore, if criteria (a)-(c) were met and ward name was missing from the laboratory data, the outbreaks were still considered a match. This gave a large  $R$ , and therefore a conservative estimate of the total number of outbreaks ( $N$ ). The reporting ratio was then calculated as  $(N-n+R)/(n+R) = 2.27$ .

## Estimated impact

Extrapolating the data from the capture/re-capture method we estimated that for each reported outbreak there were another 2.3 outbreaks, and therefore, 2300 norovirus outbreaks occurred in NHS Trusts in England in 2009. On average each outbreak affected ten patients, three staff and led to seven days of ward closure and 24 bed days lost (Table 3).

Table 3 estimated impact of norovirus based on reported outbreaks

			Reported outbreaks (n=713)	Non – Reported outbreaks (n = 1619)	Total
	n	mean	Jan-Dec 09 <sup>1</sup>	Jan-Dec 09 <sup>2</sup>	
Outbreaks	713		713	1619	2332
Patients affected	7153	10.53	7508	17043	24551
Staff affected	2142	3.36	2396	5438	7834
Outbreak duration	3816	6.4	4563	10359	14922
Days of ward closure <sup>3</sup>	4300	7.86	4595	10432	15027
Bed days lost <sup>3</sup>	9418	24.92	14570	33074	47644

1) adjusted for missing data by multiplying the reported number by the mean for that outcome:  $n(\text{reported outbreaks}) * (\text{mean outcome})$

2) adjusted for non reporting by multiplying the reported number by the mean for the outcome and the reporting ratio:  $n(\text{reported outbreaks}) * \text{mean}(\text{outcome}) * (\text{reporting ratio})^a$

3) Occurred in 82% of outbreaks

a) ratio of reported to non reported outbreaks =  $N-n+R/n+R = 2.27$ .

## Virology

The Virus Reference Department (VRD) at CfI analyse samples sent from outbreaks to monitor the strains of norovirus causing outbreaks. Some data are available from outbreaks occurring in December 2009 and early January 2010. The commonest strain causing outbreaks was genotype II.4.

Table 4 genotypes identified in outbreaks reported to VRD

Region	Norovirus Genotyping Result							Total
	GI-4	GI-6	GII-1	GII-3	GII-4	GII-6	GII-7	
East					22			22
East Midlands					0			0
London					11	1	1	13
North East					5			5
North West				2	28	3		33
South East					25			25
South West			2	1	32	1		36
West Midlands					0			0
Yorkshire & Humberside	2	2	2	2	26	5	2	41
Total	2	2	4	5	149	10	3	175

Thirty-eight outbreaks reported to VRD could be linked to outbreaks reported on outbreak reporting system. Of these 18 were genotyped and all of these were genotype II.4.

## Summary

The norovirus outbreak reporting scheme has now been running for one year. This reporting scheme uses standardised case and outbreak definitions allowing for meaningful comparisons over time. An outbreak need not be laboratory confirmed and suspected outbreaks are also reported, using standardised definitions of an outbreak based on clinical symptoms. This scheme focuses on outbreaks that occur in hospitals and gather data on how this affects units in terms of operational difficulty. As in the previous report this shows that norovirus has a considerable operational impact on hospitals. Norovirus activity peaks during the winter months and this is reflected in the number of reported outbreaks in the web reporting system during these months and the laboratory reports. The reporting scheme is voluntary and it is unlikely that all trusts reporting outbreaks report all of their outbreaks not only is it the case that not all Trusts choose to participate but also what is not clear is how many of those trusts who do not report outbreaks do not experience any norovirus outbreaks at all. In the light of this uncertainty, we use data from the laboratories as a second source and estimate the true number of outbreaks and, therefore, the impact on hospitals within the NHS in England. There are other sources of reported outbreaks of norovirus but these also have unpredictable variations in the levels reporting. Reports from laboratories is less likely to be so varied. Estimates in the previous report used data from only six months from January to June. This required using laboratory data from the six months prior to when reporting began to estimate annual figures. In this update, we have been able to use data reported for the whole year. The two reports have estimated similar figures for the burden of norovirus in hospitals within the NHS in England.

The reporting scheme highlights how important norovirus is in terms of burden of disease in hospital patients. The clear winter seasonality shown by the reported outbreaks emphasises how much of a burden it is to hospitals trying to cope with ward closures at a time when bed pressures are already high. Not only do affected hospitals have to close wards to help control outbreaks they are hit doubly by the loss of staff that become sick during the outbreaks. Whilst the reporting scheme does not record for how long staff members are off sick we have previously estimated the total number of working days lost to sickness due to norovirus. Assuming that staff work 5/7 days in a week and illness lasts 48 hours and staff should remain off until 48 hours after symptoms decline this would mean staff would normally be absent for 2.86 working days. The total number of staff estimated to have been affected by norovirus outbreaks is 7834, which would equate to  $(2.86 \times 7834)$  22405 working days lost due to staff sickness.

The Virus Reference Department aims to increase the number of samples obtained from outbreaks reported to the scheme. In this way, it will be possible to determine the diversity of strains reported in outbreaks and linking this to epidemiological data may allow assessment of whether some strains are more likely to cause larger outbreaks.

The scheme has been running for one year and we are now able to estimate the burden of norovirus outbreaks on hospitals by using capture/re-capture analysis. Reports are being received from more Trusts in England and as more data are gathered, the estimates will become even more robust.