TABLE 2

Laboratory scientists' attitude towards introduction of electronic to the local health department (n=466), Germany, 2004

Scientists' attitude	N	%
Urgently necessary	43	9
Good idea	301	65
Neutral	29	6
Unnecessary	66	14
Problematic	27	6

Discussion

Almost 90% of the laboratories studied reported notifying infectious organisms to the local health department within 24 hours. This enables timely surveillance and rapid intervention if necessary. The benefit comes at a reasonable cost: for more than 75% of the laboratories, disease reporting creates an additional workload of no more than 1 hour per week.

More than 66% of the participants would favour electronic reporting formats instead of the currently prevailing paperwork. Elsewhere, electronic reporting has been shown to be faster [5], less labour-intensive [6] and more complete [7] than traditional disease reporting. On the other hand, 33% of the laboratories in this survey do not use any laboratory software, and those that do are working with more than 60 different products. In the light of this heavily fragmented market, a uniform electronic reporting format is rather illusory in the near future. Past experience in Germany has shown that legislators are reluctant to impose standards regulating data transfer formats between healthcare providers and local health departments. Pilot projects with selected software manufacturers may be the way forward to promote national standards of electronic disease reporting and to catch up with European countries like the United Kingdom [8], the Netherlands [6] or Sweden [9], where such systems are already in place.

This was the first survey among German laboratories relating to practical implications of the Infektionsschutzgesetz. The survey response and the lack of non-responder data do not allow any safe assumptions as to the representativeness of the participating laboratories. It could be argued that laboratories with a keen interest in surveillance would have been more likely to participate in this study and might therefore have been overrepresented. As a result, we would have overestimated German laboratories' reporting compliance and enthusiasm for electronic reporting formats. The observed diversity of software products, however, would have probably been even more pronounced if all laboratories had participated.

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ORIGINAL ARTICLES

Surveillance report

ELECTRONIC REPORTING IMPROVES TIMELINESS AND COMPLETENESS OF INFECTIOUS DISEASE NOTIFICATION, THE NETHERLANDS, 2003

M Ward[1,2], P Brandsema[2], E van Straten[2], A Bosman[2]

In 2002, the internet based reporting system OSIRIS was introduced in the Netherlands and by the end of that year had fully replaced the paper-based reporting system. The objectives of OSIRIS were to improve timeliness and completeness of surveillance data on infectious diseases reported from regional to national level.

We compared the timeliness of infectious diseases reported by the conventional paper-based system in 2001 with those reported by OSIRIS in 2003. Two distict types of delay were compared: (1) total delay: defined as time between sympton onset and reporting at national level and (2) central delay: defined as time between regional and national reporting. Median delays between both systems were compared using the Wilcoxon Rank Sum-Test. We also compared electronic reports received via OSIRIS in 2003 to those received through the conventional system for 2001 for completeness of specific data fields. The Fisher exact test and the Mantel-Haenzel test with Yates correction were used to determine the significance of proportions of completed data fields in each system.

Results showed the median central delay was significantly reduced for all diseases in OSIRIS compared to conventional reporting system. Overall, the median central delay was reduced from 10 days (interquartile range 4) in 2001 to 1 day (interquartile range 1) in 2003. Except for cases of malaria, the total delay, from symptom

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onset to national reporting, was also significantly reduced. In addition, OSIRIS records contained more complete information than conventional records. In total, in 2003, 92.3% of data field examined were complete compared with 81.3% in 2001.
This study documents the benefits of electronic reporting of infectious disease surveillance data in terms of improved timeliness and completeness.

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Key words: completeness, infectious diseases, surveillance, timeliness

Introduction

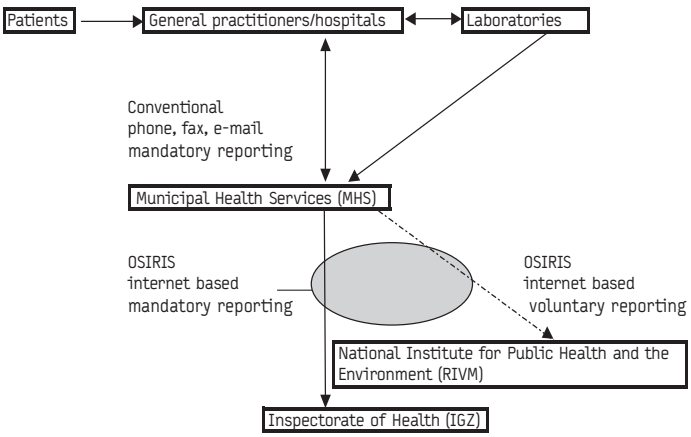
The primary purpose of reporting specific infectious diseases is to trigger an appropriate public health response so that further illness can be prevented [1]. However, to be effective such reporting must be timely and accurate. While electronic data transmission is likely to be more timely than conventional paper based systems, evidence for this on a national level is scarce [2]. We studied the effect of internet based reporting on reporting delays and data quality of notifiable infectious diseases in The Netherlands.

In The Netherlands, medical physicians and microbiological laboratories are required, by law, to notify the Gemeentelijke Geneeskundige Dienst (GGD, municipal health services) of patients diagnosed with notifiable infectious diseases. The GGD are the regional authorities responsible for receiving preliminary notifications so that immediate control measures can be initiated. The GGD are required by law to send summaries of these reports as soon as possible to the Chief Medical Officer (CMO) at the Inspectorate of Healthcare (IGZ). There is voluntary reporting of surveillance data to the National Institute for Public Health and the Environment (RIVM). Before 2002, reporting from the GGD was paper-based and involved two different processes for reporting to IGZ and RIVM.

The internet-based reporting system OSIRIS, developed in the RIVM, was introduced in the Netherlands in 2002. Therefore, at regional level, as a result of this web-based system, mandatory and voluntary reporting (to IGZ and RIVM) merged into a single process. By December 2002 all 38 GGD in the Netherlands used the internet as the sole means of notifying infectious diseases to the CMO at IGZ and the RIVM. Physicians and laboratory staff continued to use paper, fax and e-mail to send their notifications to the GGD [Figure 1].

Figure 1

Schematic of information flow for disease reporting in The Netherlands



Authorised users at the GGD, IGZ and RIVM have password-protected access to the system. OSIRIS makes preliminary reports available to both the IGZ and RIVM for early warning of significant adverse events. However, the GGD can continually update information until the report is finalised.

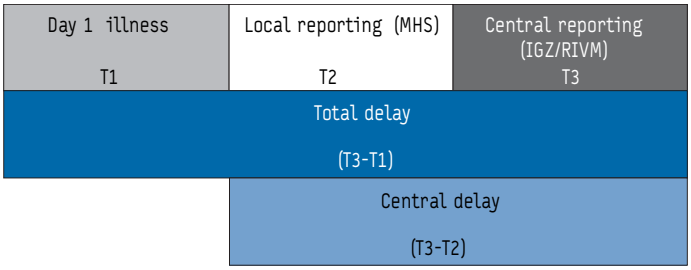
Methods

We compared diseases reported by the conventional paper-based system for 2001 with diseases reported by OSIRIS for 2003. The study was confined to diseases with a minimum of 100 cases reported for each study year (tuberculosis notifications were excluded from the analysis, as the data collection logistics for this disease are substantially different from other notifiable conditions).

To determine the timeliness of the surveillance systems, three separate time points were defined. T1 was defined as the first day of illness as entered into common fields in both the conventional reporting system and OSIRIS. T2 was defined as the date that illness was reported to the GGD. T3 was defined as the date that illness was first reported to the IGZ/RIVM. Two distinct types of delays were compared in both systems [Figure 2]. Total delay was defined as the time lapsed between the onset of symptoms and reporting of illness at a national level: T3- T1. Central delay was defined as the difference between T3 and T2 and represented how much sooner or later the electronic system identified notifiable diseases than the paper-based system. If a date required for calculation of a specific delay was missing only that specific delay (and not the total case) was excluded from analysis. To increase the validity of our results we corrected the data, where appropriate, for digit attraction. The presence of digit attraction was confirmed by analysing illness onset/notifications by frequency table of calendar date of onset (i.e.1-31). Records with a calendar date of onset/notification that occurred more frequently than the expected average were excluded from further analysis.

Figure 2

Timeline for reporting notifiable infectious diseases in The Netherlands



Median delays were calculated and expressed with an interquartile range. Median delays between both systems were compared using the Wilcoxon Rank Sum-Test. Also, electronic reports were compared with those received through the conventional reporting system for completeness of specific data fields. For our study, completeness was defined as the proportion of selected data fields completed in each surveillance system. This analysis was confined to five selected conditions: legionellosis, bacillary dysentery, hepatitis A, pertussis and malaria. These diseases were selected for data quality evaluation as they represented different categories of notifiable diseases in the Netherlands: vaccine preventable diseases, enteric infection, respiratory infection, laboratory-notified infection and travel-associated infection. The Fisher exact test and the Mantel-Haenszel test with Yates correction was used to determine the significance of two proportions. Data was analysed using Epi Info ™ version 6.04c, SAS version 8.2 and MS Excel 97 ®.

Results

Nine diseases with more than 100 cases reported in 2001 and 2003 were included in the study: bacillary dysentery, hepatitis A, hepatitis B, hepatitis C, legionellosis, malaria, meningococcal disease, pertussis and foodborne outbreaks.

Digit attraction was only evident for first day of illness (T1). Thus, we corrected total delay, for digit attraction (T3-T1). We excluded all cases with illness date of onset on 1,5,10,15,20,25 and 30 as these dates were more frequently recorded than expected if illness onset was equally likely on all days. Correction for digit attraction resulted in a decrease in the estimated total delay (T3-T1) for all person-based infections in 2001 and 2003. (There was no correction for digit attraction for hepatitis B and hepatitis C as less than one in five patients with these illnesses had a recorded date illness onset).

Between 2001 and 2003 the central delay for all nine diseases was significantly reduced

[Figure 3]. Overall, the central delay was reduced from a median value of 10 days (interquartile range 4) in 2001 to 1 day (interquartile range 1) in 2003. Except for malaria, the total delay (T3-T1) was also significantly reduced for diseases studied [Table 1].

Table 1

Median total and central delay, interquartile range and statistical significance for notifiable infectious diseases in The Netherlands, 2001 and 2003

Condition	Total delay: T3-T1 (IR)†			Central delay: T3-T2 (IR)†		
	2001	2003	P *	2001	2003	P *
Dysentery	29 (23)	19 (12)	0.001	10 (11)	1(4)	0.001
Legionella	20 (33)	11 (22)	0.001	8 (9)	1(3)	0.001
Meningococcal disease	11 (10)	5 (6)	0.001	7 (8)	0 (3)	0.001
Malaria	12 (26)	13 (20)	NS**	10 (35)	2 (4)	0.05
Hepatitis A	22 (16)	12 (13)	0.001	8 (9)	1 (3)	0.001
Hepatitis C	NA	NA	0.001	10 (16)	3 (13)	0.001
Hepatitis B	NA	NA	0.001	16 (27)	2 (8)	0.001
Pertussis	60 (33)	51 (33)	0.001	9 (6)	1 (26)	0.001
Food borne infections	30 (22)	18 (19)	0.001	14(12)	3 (9)	0.001

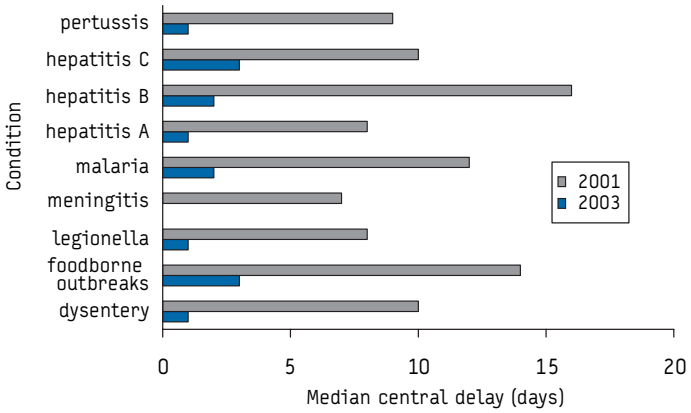
† IR: Interquartile range

* P value of difference calculated using Wilcoxon Rank Sum-Test

** P = 0.5

Figure 3

Median central delay for nine notifiable conditions by conventional (2001) and electronic (2003) reporting, The Netherlands



Electronic reports contained more complete information on variables common to both conventional and electronic reporting formats. In 26 of 36 data fields studied, those completed electronically contained significantly more information ($p<0.05$). Overall, in 2003, 91.3% of examined data fields were complete in comparison with 82.3% in 2001 [Table 2].

Table 2

Field completion rates for reports received by electronic (2003) and conventional (2001) reporting systems for five notifiable infectious diseases, The Netherlands

	% of electronic reports with complete field (2003)	% of paper reports with complete field (2001)	P value
Dysentery	n=267	n=346	
Post code	92.1	82.4	<0.001
Year of birth or age	100.0	99.4	0.5 (F)
Deceased	96.3	82.7	<0.001
Hospitalised	96.3	80.1	<0.001
How diagnosis made	98.9	80.1	0.1(F)
Isolated case	97.8	95.0	0.05(F)
Infection acquired abroad	100.0	81.1	<0.001
Legionella	n=222	n=182	
Post code	87.8	72.5	<0.001
Year of birth or age	100.0	100.0	NA‡
Deceased	98.2	76.9	<0.001
Hospitalised	99.1	72.5	<0.001
How diagnosis made	100.0	96.7	<0.05 (F)
Isolated case	100.0	74.2	<0.001
Malaria	n=356	n=569	
Post code	68.3	41.1	<0.001
Year of birth or age	100.0	98.9	<0.001
Deceased	78.9	53.1	0.40
Hospitalised	70.5	52.4	<0.001
How diagnosis made	47.8	39.5	<0.05
Isolated case	91.6	46.4	<0.001
Infection acquired abroad	96.3	100.0	<0.001
Pertussis	n=2701	n=6986	
Post code	82.7	85.2	<0.05
Year of birth or age	100.0	100.0	NA‡
Deceased	93.2	83.5	<0.001
Hospitalised	90.2	81.1	<0.001
How diagnosis made	96.9	76.6	<0.001
Isolated case	95.3	83.9	<0.001
Vaccination status	98.3	97.9	0.28
Hepatitis A	n=375	n=701	
Post code	88.0	75.7	<0.001
Year of birth or age	100.0	100.0	NA‡
Deceased	97.1	74.8	<0.001
Hospitalised	97.6	74.3	<0.001
How diagnosis made	97.9	64.3	<0.001
Isolated case	64.5	75.5	<0.001
Infection acquired abroad	89.9	99.0	<0.05
Vaccination status	89.9	75.5	<0.001

N reported number

F Fisher exact test

NA not applicable

Discussion

To our knowledge, this is the first report comparing electronic and conventional reporting of infectious disease surveillance data on a national basis. Electronic reports were received at the national level significantly quicker than conventional reports for the nine diseases studied. This improved timeliness was not detrimental to data quality as electronic reports also contained more complete information than conventional reports. Similar results have previously been reported for electronically notifiable disease reporting from clinical laboratories [3,4].

The improved timeliness was almost exclusively due to the reduction in reporting delay between the GGD and the national authorities. This reduced reporting delay can be attributed to OSIRIS as there was no other major change in work practices at GGD level that would have resulted in a reduced local reporting delay (T2-T1). In fact, using this system lead to an estimated 50% reductions in administrative workload in relation to reporting infectious diseases at GGD level [5]. Correction for digit attraction resulted in a reduction in the estimated total delay for bacillary dysentery, hepatitis A, legionellosis, malaria, meningococcal disease and pertussis in both study periods. This suggests that some patients tend to overestimate the time period during which they are ill by 'rounding-up' to the nearest convenient date. While correcting for this phenomenon is impractical in routine practice, time intervals should be measured in a consistent way to allow comparison between different outbreak detection reports and surveillance systems [6].

The noted improvement in data quality is also important as this availability of more complete information should enable national authorities to respond in a more timely and appropriate manner. While we only selected 7-8 data fields per disease as indicators of data quality the general superiority of electronic reports suggests that improved completeness is also likely in unexamined data fields.

A potential concern in comparisons such as this is variation in coding between the fields in the electronic and paper-based systems. However, in this study as we only selected variables that were equivalent on the hardcopy and the electronic surveillance forms, direct comparability was ensured. Also, before the introduction of the electronic system staff training, technical assistance was provided at local level to ensure any data entry and coding problems were identified and managed appropriately [5]. Another potential concern is that the relative benefits of electronic reporting in this study could be secondary to deterioration in the conventional system. As the transition from conventional to electronic reporting occurred mid-year in 2002 and we selected only years when one system functioned at GGD level, a decline in the conventional working process could not explain the improved reporting times in 2003. In addition, the consistency of our results for all nine conditions suggests that the improved reporting times are real.

OSIRIS has achieved its objectives. Data received at national level is more timely and of better quality than with conventional reporting. However, the primary purpose of surveillance is not merely speedy and complete transmission of data. Technologically innovative reporting systems, as OSIRIS, also need to be consistent with the purpose of disease reporting, that is, of translating information into action [1,7]. Thus, it must be a two-way communication process of information exchange between public health agencies and the clinical community. Even in this technologically advanced age, observations made by astute clinicians still remain important, in timely reporting of certain notifiable diseases [8]. In these instances, electronic surveillance systems help us verify suspicions of outbreaks as was recently observed in the Netherlands when action was taken as a result of the observed increased notifications of hepatitis A cases. This action was due to a combination of clinical observation and national notification by OSIRIS [9,10].

This study documented improved timeliness and completeness of national infectious disease surveillance data that has occurred as a result of the use of electronic communication.

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ORIGINAL ARTICLES

Surveillance report

HARMONISATION OF THE ACUTE RESPIRATORY INFECTION REPORTING SYSTEM IN THE CZECH REPUBLIC WITH THE EUROPEAN COMMUNITY NETWORKS

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Respiratory virus activity is detected in Europe each winter, yet the precise timing and size of this activity is highly unpredictable. The impact of influenza infection and/or acute respiratory infection in European countries is continuously monitored through a variety of surveillance systems. All of these sources of information are used to assess the nature and extent of activity of influenza and other respiratory viruses, and to offer guidance on the prevention and control of morbidity and mortality due to influenza at a local, national and international level.

The early warning system for a forthcoming influenza epidemic is mainly based on the use of a set of thresholds. In the Czech Republic, the acute respiratory infection (ARI) reporting system, with automated data processing, uses a statistical model for the early detection of unusual increased rates of the monitored indicators. The collected data consists of the number of ARI, the number of complications due to ARI and the population registered with the reporting general practitioners and paediatricians, all collected separately in five age groups. To improve the reporting system in the Czech Republic, clinical data on the weekly incidence of influenza-like illness (ILI) within the same population and the same age groups was started in January 2004. These data fit the European Commission's recently adopted ILI case definition and allows a better comparison of data with other countries in Europe, in particular those participating in EISS (European Influenza Surveillance Scheme).

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Key words: acute respiratory infection, early warning system, European Union, influenza surveillance.

Introduction

Information on the occurrence of infectious diseases is very important for maintaining public health in Europe. Every European country has its own national notification and surveillance system and legislation [1, 2]. National laboratories participate in many international surveillance programmes organised by the European Union, WHO and other organizations. Recently the Community