

Surveillance reports

SENTINEL SURVEILLANCE: AN OPTION FOR SURVEILLANCE OF INFECTIOUS INTESTINAL DISEASE

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Sentinel surveillance systems offer advantages over passive surveillance which is known to have limitations due to incomplete reporting. Sentinel surveillance gathering data from selected sources was piloted as an option for surveillance of infectious intestinal disease (IID) in Malta. Between October 2004 and May 2005, 22 general practitioners (GPs) voluntarily participated in the study and reported on the number of IID cases (by age and sex) and all primary care encounters in their practice. The GPs' reporting activity lasted for 35 weeks, covering a total of 55,425 primary care encounters, of which 1.95% concerned IID. For every case reported via the routine passive notification system, seven cases would be picked up by this enhanced sentinel surveillance.

Introduction

Surveillance is fundamental for public health decision-making and subsequent action. Over the past few decades, communicable disease surveillance has undergone considerable development. The more commonly used passive surveillance systems, which rely on disease notifications from physicians and laboratories, are known to have limitations due to incomplete reporting [1]. One of the diseases most prone to under-reporting is infectious intestinal disease (IID). To date, the main source of data on IID in Malta has been the passive surveillance system in which doctors and medical diagnostic laboratories report cases to the national surveillance system. Mandatory reporting of cases of salmonellosis, campylobacteriosis, *Escherichia coli* infections, giardiasis, cryptosporidiosis and shigellosis is required from both medical practitioners and laboratories [2]. However, there is no obligation to report cases of IID when food is not the suspected source. As a result, the impact of this illness in terms of the frequency of IID in Malta is not known.

In 2004-2005, a cross-sectional age-stratified study on a random sample of 3,504 persons was performed, with the aim of determining the prevalence of IID at community level, [3,4]. This study estimated a period prevalence of 3.18% of persons suffering from IID in the 28 days prior to the interview and a rate of 0.42 (95% CI 0.09-0.77) episodes of IID per person per year [3,4]. However, such a study cannot be carried out over a long period of time due to limited economic and human resources [5]. Instead, a different form of surveillance is required to estimate the frequency of IID on a continuous basis. One option is sentinel surveillance – an active surveillance system that collects data from selected, targeted groups or networks of health-care providers created for specific purposes [6] and covering a subset of the population. These

active sentinel sites can be medical clinics, hospitals, emergency departments [7], health centres and/or general practitioners [8]. General practitioner (GP) sentinel networks are often used for surveillance of communicable diseases such as influenza [9-12], gastroenteritis [13,14] and other diseases [15-18].

In Malta, general practitioner sentinel surveillance of influenza has been underway for several years [19]. During the influenza season of October 2004 to May 2005, the sentinel surveillance of IID by participating GPs was introduced in addition to the ongoing sentinel surveillance of influenza.

Methods

Objectives of study

The main objectives of the sentinel surveillance study were:

- ▶ to estimate the proportion of primary care encounters with IID;
- ▶ to describe the epidemiology of IID at the GP level;
- ▶ to determine the magnitude of under-reporting of IID at the GP level;
- ▶ to pilot the introduction of sentinel surveillance as a form of active surveillance of IID in Malta.

Study design

The study was a cross-sectional sentinel active surveillance study involving a number of GPs who reported on IID cases in their practices. They were invited through the local journal of the College of Family Doctors and via personal encouragement to participate in a sentinel surveillance system for IID, influenza and vaccine preventable diseases. Of 1,302 doctors registered with the Malta Medical Council (Direct Communication: registrar of medical council, September 2005), approximately 300 (direct communication with Soler JK. Malta College of Family Physicians, September 2005) are GPs. Twenty-two GPs volunteered to take part in the study.

Case definition

A case of IID was defined as a person presenting with a new episode of acute IID, defined as at least three loose stools or vomiting in 24 hours or diarrhoea or vomiting with two or more additional symptoms in 24 hours. Additional symptoms included

abdominal cramps, abdominal pain, fever, nausea, blood in stool or mucus in stool.

Proportion of IID

The frequency of IID in this study was estimated as the proportion of IID in all primary care encounters. Each participating GP reported the number of cases presenting with IID as well as the total number of patient visits during each reporting week. The former was used as nominator and the latter as denominator in calculating the proportion of IID in the primary care encounters. To show changes in the number of reported IID over time, the actual number of IID cases seen by GPs was taken into consideration, rather than the proportion of IID cases in the primary care encounters, because a possible seasonal change in the overall number of primary care encounters (denominator) would bias the result.

Sentinel surveillance reporting

Participating GPs were provided with specific forms to report on cases with a new episode of IID seen in their practice, including patients seen during home visits. Zero reporting was implemented meaning that GPs submitted forms on a weekly basis even when IID cases were not recorded. Information on IID cases included age, sex, use of antibiotics and whether stool samples were requested for laboratory analysis. GPs also provided basic data (age and sex) on all patients seen over the same period for any condition, i.e. all primary care encounters in their practice. The forms were collected by a courier on a weekly basis and forwarded to the study coordinator.

Pilot study

A pilot study involving 10 GPs for a trial period of one week was performed in order to assess: a) the feasibility and b) the method of collecting and analysing the information. As a result, the questionnaire was finalised and some methodological and technical problems that had been identified during the pilot study were solved before the start of the larger study described in this paper.

Laboratory investigation

Laboratory investigation was attempted in order to confirm the clinical diagnosis, and to identify the aetiological agents responsible for IID at GP level. GPs were expected to ask the patients who fulfilled the case definition for IID to submit stool or vomitus samples (depending on the predominant symptoms) for analysis. Samples were analysed at the Public Health Laboratory in Malta for *Salmonella*, *Campylobacter*, *Shigella* and *Escherichia coli* and at the Virology Department of St. Luke's Hospital in Malta for rotavirus. Further testing for viral IID pathogens (norovirus and sapovirus) was performed at the Istituto Superiore di Sanita in Rome. Intestinal parasites were analysed by means of microscopic examination of fixed samples at St. Luke's Hospital laboratory in Malta.

Data processing

The data obtained from the reporting forms were entered in Statistical Package for Social Sciences Version 12 for Windows. The database and its back-up copy on CD were password-protected and stored in a safe place inaccessible to outsiders. After the data had been collected and the results of laboratory analyses had been communicated to the reporting GPs, all identifiable information was deleted from the database and the reporting GPs were identified only by a study identification number. Results were reported only

as aggregate totals, so that no individuals were identifiable (in line with the Data Protection Act, 2001 [20]).

Results

Between October 2004 and May 2005, 22 GPs from various parts of Malta participated in this study. They reported a total of 55,425 primary care encounters. Of these 1,082 met the case definition for IID. Hence the proportion of primary care encounters with IID during the study period was 0.02 (1.95%).

During the same period, the number of cases reported to the national passive surveillance system (Disease Surveillance Unit Database 2004, 2005) [19] was only 146. Hence, the enhanced sentinel surveillance system was able to pick up over seven times more cases than the routine reporting system.

TABLE

Number of cases of infectious intestinal disease (IID) per age group

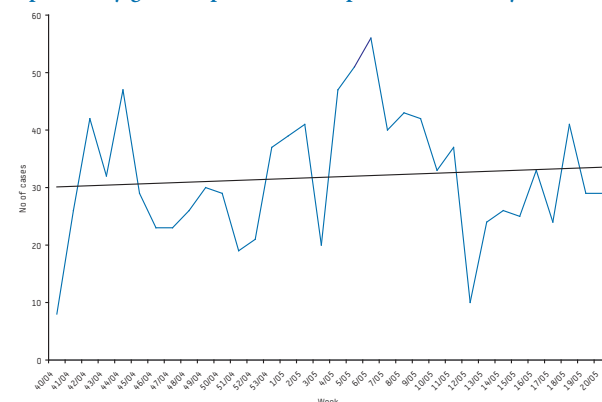
Age group (years)	Number of IID cases	Percentage of all IID cases
0-1	12	1.1
2-4	71	6.6
5-10	99	9.1
11-20	199	18.4
21-30	214	19.8
31-40	163	15.1
41-50	140	12.9
51-60	106	9.8
61-70	49	4.5
71-80	20	1.8
>81	9	0.8

Among the 1,082 cases, there were 533 males and 549 females. Persons aged between 11 and 30 years constituted 38.2% of the cases (Table).

Only 14 out of 1,082 patients with IID (1.3%) were asked by their GP to submit stool samples for microbiological analysis, and only five actually did so. No pathogens were isolated from any of the samples.

FIGURE

Number of cases of infectious intestinal disease (IID) reported by general practitioners per week of study



The study was carried out between October 2004 and May 2005 (week 40 of 2004 to week 20 of 2005). As expected, during this period, there were minor fluctuations in the number of IID cases from week to week, with a peak in February-March. By plotting the linear line of the regression to the mean, an overall increase was noted as the warmer month of May approached (Figure).

Discussion

The proportion of primary care encounters with IID estimated in this study was 0.02 (1.95%). A patient-related factor associated with the number of cases was the patient's age. The number of cases was highest in the age groups between 11 and 30 years (Table). Several international studies have reported a higher rate of IID in the elderly and children [22]. This was not observed in our study. There was no sex difference in the number of IID cases either, whereas studies in other countries have demonstrated higher rates for women than men [23,24].

The absence of pathogens in samples from symptomatic cases can be explained mainly by the small number of samples obtained, the delay in taking the sample after the onset of symptoms, and prior antibiotic usage.

The study formed part of the sentinel surveillance for influenza. Hence, the period of study coincided with the influenza season between October and May, covering 35 weeks. There were minor fluctuations in the number of cases reported during this period of study; however, a continued surveillance system covering the whole year would be required in order to describe the seasonality of such illness.

Knowing the frequency of IID is essential to be able to target control measures. Ideally, in order to estimate incidence and prevalence rates, cohort or cross sectional studies are carried out respectively. Such studies, however, require considerable human and financial resources. Some countries have opted for sentinel surveillance as a continuous form of surveillance of specific diseases [25,26]. However, in order to calculate incidence or prevalence rates on the basis of sentinel surveillance data the exact size of the population covered is needed.

The main problem in Malta is that general practitioners do not have a defined patient population. Patients can refer to any GP they wish, both in private and public sector, and they can even consult different GPs for the same condition. Indeed, taking a second opinion is known to be common. There are no registers of GP's patient lists and even the number of patients seen by individual GPs is not known. There are other countries with the same problem. The Sentiweb system in France [14] extrapolates findings from the sentinel GPs to the total population of GPs in a given region, and uses the population data of that region as the denominator, the same being done on the national level, too. However, this system cannot be applied in Malta because of the differences between various GP practices due to which the population covered by participating GPs may not be representative of the population covered by the rest of GPs of Malta.

Another limiting factor is that most GPs do not keep electronic patient records, hence the list of patients that consult their GP at least once in a given year is not available. This information was used as a reliable denominator in the Belgian Intego register [21]. The Belgian study piloted a method which could be used as a proxy measure to determine the frequency of illness as a proportion of

the primary care encounters at GP level, rather than incidence or prevalence rates, in countries where the size of the population (denominator) is not known. One major drawback of using this method is that the proportion of IID obtained in our study cannot be compared to studies in other countries since the denominators used as the basis for the calculations are different. A solution for Malta and other countries with similar problems in determining the size of the population (denominator) would be the development of an electronic database record system for GPs which would facilitate an approach similar to the Intego register and comparisons between countries would be possible since the population denominator would be similar.

Setting up sentinel surveillance is not an easy process. The problems in establishing such a system consist among others in connecting the practitioners to the sentinel system and in coordinating their work. Many GPs in Malta do not keep electronic patient records and hence computer reporting is not feasible. During our study, the reporting was done on paper and the forms were collected from GPs by a courier, increasing the human resources required to carry out this type of surveillance. Since the time available for an average consultation is short, GPs may have difficulties in accurately collecting and reporting information for surveillance purposes on a voluntary basis. It is vital that the forms used are simple and require as little time to fill in as possible, therefore in this study GPs were only asked to tick boxes in a questionnaire, rather than fill in data.

Our study highlighted also difficulties in making laboratory diagnosis for IID. It enrolled highly committed GPs and yet very few submitted stools for analysis. However, the GPs are at the best stage to perform testing since the patient is still symptomatic and hence the identification of pathogens is more feasible. Sentinel surveillance requires consistently high motivation for GPs throughout the entire period. This needs to be maintained by periodic visits from field staff, feedback on data collected, continued medical education meetings and publication of results [27]. In our study, GPs were given initial training and regular updates to ensure that the data being collected was comparable and of the best quality. However, since many doctors do not keep records of visits, validation of data was not possible.

GPs participated in the study on a voluntary basis, and therefore selection bias was inevitable. In order to ensure better representativity, the number of participating GPs should be increased. However, it is also important to make sure that sentinel GPs are easily accessible to surveillance staff.

Conclusion

The estimate of seven cases being reported by this sentinel system for every case notified to the national routine surveillance system confirms the high under-reporting of IID in Malta. Sentinel surveillance that relies on GPs commitment to notify is able to identify more cases than routine passive surveillance.

With appropriate electronic record systems at GP level, the sentinel surveillance would be more feasible and incidence rates could be estimated and compared with other countries.

The findings described here underline the important role that both private and public sector physicians can play in disease surveillance and in the advancement of our understanding about the patterns of common diseases in a population. Ongoing surveillance

conducted by sentinel physicians with appropriate coverage of the population is feasible and could make an important contribution to the surveillance and control of IID in the future.

Acknowledgements

Sentinel General Practitioners Collaborators, Malta: Attard L, Avendok T, Azzopardi A, Borg M, Borg S, Cassar C, Cordina M, Darmanin E, Debattista D, Farrugia S, Fenech F, Farrugia Randon S, Gauci J, Gauci S, Gauci T, Mallia P, Mamo J, Mercieca C, Micallef A, Sciortino P, Teeby Z, Zarb C; Christopher Barbara (St. Luke's Hospital Virology Department G'Mangia Malta); Staff at all laboratories who analysed the samples.

References

- Wheeler JG, Sethi D, Cowden JM et al. Study of infectious intestinal disease in England; rates in the community presenting to general practice, and reported to national surveillance. *BMJ* 1999; 318:1046-50.
- Government Gazette Notice January 2004. Notification of infectious diseases under Public Health Act 2003. Malta Legal Acts.
- Gauci C, Gilles H, O'Brien S, et al. Challenges in identifying methodology to estimate the prevalence of Infectious Intestinal Disease in Malta. *Epidemiol Infect* 2006; 134:393-399.
- Gauci C, Gilles H, O'Brien S, et al. The magnitude and distribution of infectious intestinal disease in Malta: a population based study. *Epidemiol Infect*. Forthcoming. (Published on-line Jan 2007 at: <http://journals.cambridge.org/action/displayIssue?iid=197538>)
- Gauci C. Surveillance of Infectious Intestinal Disease in Malta. 2006. PhD Thesis University of Malta.
- Chitr Sitthi-Amom. Information systems and community diagnosis in developing countries. Oxford Textbook of Public Health, 2002.
- Brillman JC, Burr T, Forsword D, Joyce E, Picard R, Umland E. Modelling emergency department visit patterns for infectious disease complaints: results and application to disease surveillance. *BMC medical informatics and decision making* 2005;5:4. Available on line: <http://www.biomedcentral.com> (Accessed 18/8/05)
- Person N, O'Brien J, Thomas H, Ewings P, Gallier L, Bussey A. Collecting morbidity data in general practice: the Sommerset morbidity project. *BMJ* 1996;312:1517-1520.
- Broom AK, David WS. The Influenza Surveillance Programme in Western Australia, 2003. *Commun Dis Intell* 2004;28(2):169-74.
- Ansalidi F, Agaro P, Burgnich P, et al. Three year (1999-2002) of epidemiological and virological surveillance of influenza in North-East Italy. *Eur J Epidemiol* 2004; 19(9):885-890.
- Meijer A, Paget WJ, Meerhoff TJ et al. Epidemiological and virological assessment of influenza activity in Europe, during the 2004-2005 winter. *Euro Surveill* 2006;11 (5):111-118.
- Deckers JGM, Paget WJ, Scellevis FG et al. European primary care surveillance networks: their structure and operation. *Fam Pract* 2006; 23(2):151-158.
- De Wit MAS, MPG Koopmans, Kortberg LM, Van Leeuwen WJ, Bartelds AIM, Van Duynhoven YTHP. Gastroenteritis in Sentinel General Practices, the Netherlands. *Emerg Infect Dis* 2001;1:82-91.
- Sentiweb. Epidemiological situation in mainland France. Available at: <http://rhone.b3e.jussieu.fr> (Accessed 17/1/07)
- Defraye A, Sasse A. STI Surveillance by sentinel network of physicians in Belgium. *Acta Clin Belg* 2005;60(2):70-4.
- Trong-Neng Wu, Su-Fen Tsai, Shu-Fang Li, et al. Sentinel surveillance for Enterovirus 71, Taiwan 1998. *Emerg Infect Dis* 2000;5(3):1-4.
- Moran K, et al. Development and evaluation of a school-based sentinel surveillance system in South Korea. Abstract at 131st Annual meeting of APHA, 2003.
- Den Bruel AV, Bartholomeeusen S, Aetgeerts B et al. Serious infections in children: an incidence study in family practice. *BMC Fam Pract* 2006; 7:23.
- Disease Surveillance Unit website at: <http://www.health.gov.au/dsu>
- Data Protection Act, 2001. Malta Legal Acts. http://docs.justice.gov.mt/lom/legislation/english/leg/vol_13/chapt440.pdf
- Bartholomeeusen S, Kim CY, Mertens R et al. The denominator in general practice, a new approach from the Intego database. *Fam Pract* 2005 Aug;22(4):442-7.
- Guerrant RL, Hughes JM, Lima NL, Crane J. Diarrhoea in developed and developing countries: magnitude, special settings and aetiologies. *Rev Infect Dis* 1990;12:541-50.
- Palmer S, Houston H, Lervy B, Ribeiro D, Thomas P. Problems in the diagnosis of food borne infection in general practice. *Epidemiol Infect* 1996; 117 (3):479-84.
- Monto AS, Koopman JS, Longini IM, Isaacson RE. The Tecumseh Study. XII. Enteric agents in the community, 1976-1981. *J Infect Dis* 1983 Aug;148(2):284-91.
- Majowicz SE, Edge VL, Fazil A et al. Estimating the under-reporting rate for infectious gastrointestinal illness in Ontario. *Can J Public Health* 2005; 96(3):178-81.
- Desenclos JC, Rebiere I, Letrillard L et al. Diarrhoea-related morbidity and rotavirus infection in France. *Acta Paediatr Suppl* 1999 Jan; 88 (426)42-47.
- Jacob JT. Disease surveillance at district level: a model for developing countries. *Lancet* 1998; July 4.

Citation style for this article: Gauci C, Melillo Fenech T, Gilles H, O'Brien S, Stabile I, Calleja N, and al. Sentinel Surveillance: an option for surveillance of infectious intestinal disease. *Euro Surveill* 2007;12(4)[Epub ahead of print]. Available online: <http://www.eurosurveillance.org/em/v12n04/1204-227.asp>