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A sentinel network of microbiological laboratories as a tool for surveillance of infectious diseases in Belgium

D. WALCKIERS[1], A. STROOBANT[1], E. YOURASSOWSKY[2], J. LION[1] AND R. CORNELIS[1]

[1] *Institute of Hygiene and Epidemiology, Wytsmanstreet 14, 1050 Brussels, Belgium*

[2] *Brugmann Hospital, Pl. Van Gehuchten 4, 1020 Brussels, Belgium*

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SUMMARY

In the development of a surveillance programme for infectious diseases in Belgium, a national network of microbiological laboratories has been responsible, since February 1983, for the weekly registration of certain pathogenic agents. Thus, the main epidemiological features of a selected number of infections in Belgium can be characterized.

INTRODUCTION

Lack of information about the epidemiology of infectious diseases in Belgium led to the setting up, in February 1983, of a new nationwide surveillance system of infectious diseases. A national laboratory reporting system gathers epidemiological data about a selected number of micro-organisms [1–3]. Other countries in Europe have also developed laboratory-based surveillance systems but the development of such a system based essentially on voluntary reporting from private laboratories is unusual and presents special problems of organization in a country with a liberal health system. This paper describes the surveillance system and makes an evaluation of 7 years' activity.

THE SYSTEM

Organization

In Belgium, 397 laboratories each directed by a clinical biologist are currently licensed for bacteriology: 211 became involved in 1982 and 75 others at the beginning of 1985. The principles of the reporting system are: (1) the participating laboratories, called *sentinel laboratories*, are directed by a clinical biologist; (2) registration is voluntary and unpaid; (3) the reporting is anonymous and on a weekly basis; (4) feedback information is produced in the form of analysed data which are disseminated by means of 3-monthly and annual reports.

Isolates may be forwarded by sentinel laboratories to reference laboratories for special investigations such as typing and subtyping. The relationship between sentinel laboratories, reference laboratories and the Section of Epidemiology of

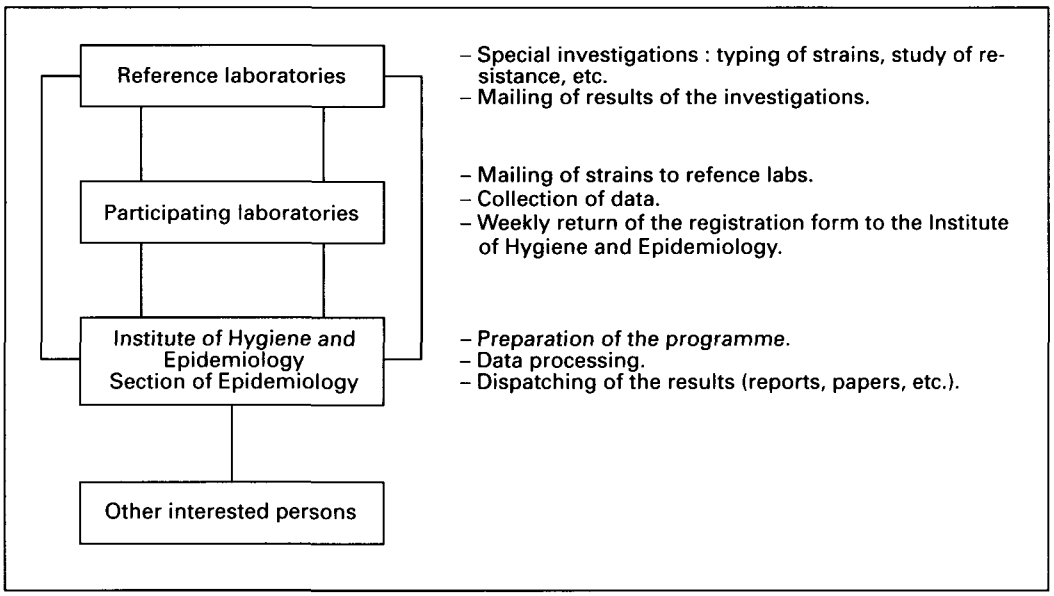

Fig. 1. Organization of the surveillance system of infectious diseases through a network of microbiological laboratories.

the Institute of Hygiene and Epidemiology is shown in Fig. 1. The Section of Epidemiology is responsible for the recording and processing of data and the regular dissemination of information to all who require it.

Methods

A study group composed of clinical biologists and epidemiologists selects the micro-organisms to be registered. A limited number only are selected so that the registration process does not overburden the administrative work of the laboratories. Each year organisms to be registered are reviewed and the list revised.

Each laboratory is free to use its own isolation methods. Serological evidence as diagnostic of some infections was included for the first time in 1985.

Reporting

All isolates from human patients are reported except those from repeat samples taken to monitor progress. The data are recorded on a special report form consisting of a single sheet of A4 paper. The number and the dates of the registration week are printed on each form together with a code number which is unique for each participant. The selected micro-organisms are listed on the forms. Recorded data include patient's age and sex, and for certain micro-organisms some other information such as occupation and travel abroad. The source of the specimen, diagnostic method used and whether sent to a reference laboratory are also recorded. The returns are made weekly and include nil returns. A Siemens BS-2000 computer is used to collate and process the information data.

The quarterly reports are sent to all participants, the Ministries of Public

Table 1. *Participation of laboratories to the surveillance programme*

Registration period	Participating laboratories	
	Number	% of licensed labs
31/01/1983–01/01/1984	101	25
02/01/1984–30/12/1984	114	28
31/12/1984–29/12/1985	159	40
30/12/1985–28/12/1986	154	38
29/12/1986–03/01/1988	150	37
04/01/1988–01/01/1989	139	34
02/01/1989–31/12/1989	139	35

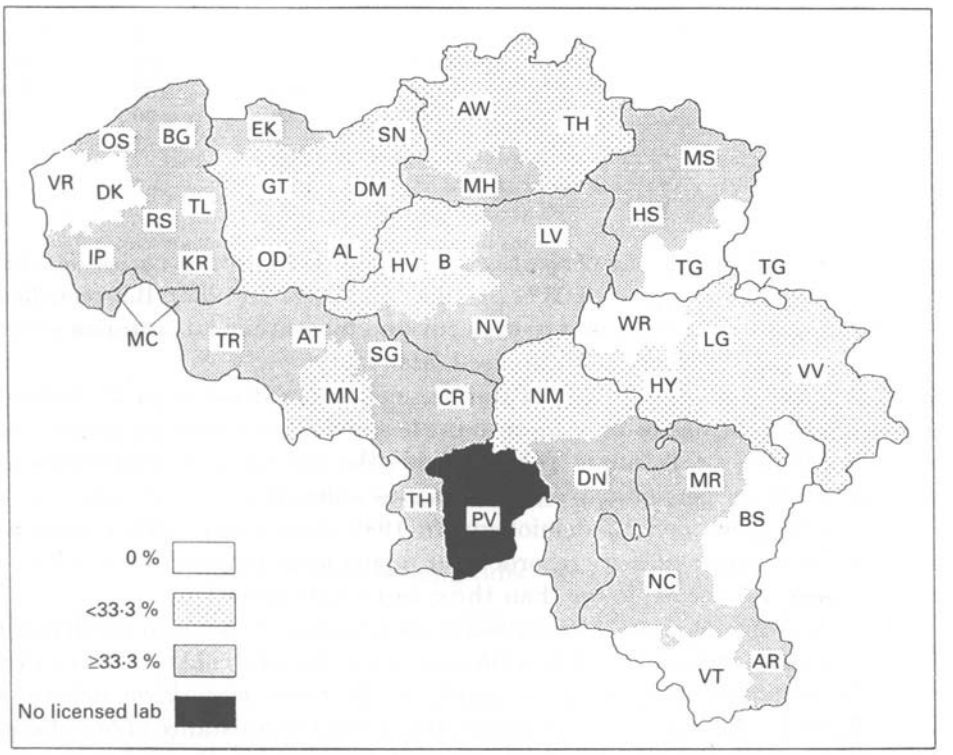

Fig. 2. Geographical distribution of sentinel laboratories according to district, expressed in percentage of laboratories licensed for bacteriology and directed by a clinical biologist: situation on 31 December 1989.

Health, Faculties of Medicine, professional organizations, the medical press and other interested parties. A detailed report is made at the end of each year and is sent to the same persons.

EVALUATION OF THE FIRST 7 YEARS OF SURVEILLANCE

Table 1 shows the number of sentinel laboratories in each year. 25% of licensed laboratories participated in 1983, 40% in 1985, but only 35% in 1989.

Fifty-five percent of all licensed laboratories are hospital laboratories. Among

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Table 2. *Regularity of participation of the laboratories*

	1983 weeks	1984 weeks	1985 weeks	
	5 to 52	1 to 52	1 to 13*	14 to 52
Number of participating laboratories	101	114	111	159
Minimum number/week	81	93	100	133
Maximum number/week	99	106	106	146
Regularity (%)	94	88	91	91
	1986 weeks	1987 weeks	1988 weeks	1989 weeks
	1 to 52	1 to 53	1 to 52	1 to 52
Number of participating laboratories	154	150	139	139
Minimum number/week	135	45†	116	118
Maximum number/week	150	143	132	134
Regularity (%)	94	88	90	92

* 75 other laboratories were contacted.
† Week number 53.

the sentinel laboratories, the percentage of hospital laboratories varies, according to the year considered, between 68% (in 1986) and 77% (in 1983). Between 35 and 37 of the 43 districts in the country were covered by sentinel laboratories over the years. In one district there is no licensed laboratory.

Fig. 2 depicts the distribution of the sentinel laboratories as on 31 December 1989: in 22 districts, one third or more of the licensed laboratories are participating in the surveillance programme. Table 2 shows the regularity of participation by year, expressed as percentages of laboratories submitting report forms to the Institute of Hygiene and Epidemiology. In 1989 details from 13007 cases were recorded. The number of cases recorded per report form ranges from 0 to 117. On 99% of the report forms, fewer than three cases were recorded.

Collected epidemiological information is used to detect trends in incidence and the identification of factors involved in infectious diseases control. For example, recent observations suggest that the number of *Neisseria gonorrhoeae* infections is falling (Table 3), that there is a significant increase in the resistance of *Streptococcus pneumoniae* to erythromycin (Table 4) and that group C meningococci are becoming more common (Table 5).

DISCUSSION

In order to complement the information from the statutorily notifiable diseases reporting system, a new surveillance system of infectious diseases was developed in Belgium in 1983. It is widely recognized that only a fraction of communicable disease cases are reported by the notifiable diseases reporting system [4]. The new surveillance system revealed that, for example, in 1984 only 33% of cases of gonorrhoea notified through the sentinel laboratories [5] and 31% of cases of malaria [6] were reported through the normal channels.

Table 3. Neisseria gonorrhoeae: *cases reported*

Period	Number of cases	Mean number of cases/ lab/year
31/01/1983–01/01/1984*	853	9·7
02/01/1984–30/12/1984*	883	8·8
31/12/1984–31/03/1985*	272	10·6
01/04/1985–29/12/1985†	943	9·1
30/12/1985–28/12/1986†	1202	8·3
29/12/1986–03/01/1988†	899	6·6
04/01/1988–01/01/1989†	517	4·1
02/01/1989–31/12/1989†	368	2·9

* Diagnosis based only on culture.
† Diagnosis based on culture or ELISA.

Table 4. Streptococcus pneumoniae: *antibiotic resistance*

Antibiotic	1983 ($N = 88$)	1984 ($N = 301$)	1985 ($N = 326$)	
Penicillin G	0 —	0 —	3 (1)*	
Tetracycline	12 (14)	48 (16)	52 (16)	
Chloramphenicol	1 (1)	10 (3)	10 (3)	
Erythromycin	not tested	not tested	not tested	
Antibiotic	**1986 ($N = 403$)**	**1987 ($N = 433$)**	**1988 ($N = 382$)**	**1989 ($N = 520$)**
Penicillin G	8 (2)	12 (3)	5 (1)	15 (3)
Tetracycline	66 (16)	73 (17)	40 (10)	87 (17)
Chloramphenicol	20 (5)	15 (3)	8 (2)	28 (5)
Erythromycin	21 (5)	36 (8)	44 (11)	64 (12)

* Numbers in parentheses are percentages.

Table 5. Neisseria meningitidis: *serogroup distribution*

Serogroup	1983	1984	1985	1986	1987	1988
A	2 (2·3)*	3 (3·7)	1 (1·0)	1 (1·3)	2 (3·2)	2 (2·4)
B	63 (73·2)	58 (71·6)	76 (76·8)	54 (70·1)	42 (66·6)	52 (61·9)
C	20 (23·2)	19 (23·4)	17 (17·2)	19 (24·7)	17 (27·0)	26 (30·9)
W 135	0 —	1 (1·2)	1 (1·0)	1 (1·3)	1 (1·6)	0 —
X	0 —	0 —	0 —	0 —	0 —	1 (1·2)
Y	0 —	0 —	0 —	0 —	1 (1·6)	2 (2·4)
Z	0 —	0 —	1 (1·0)	1 (1·3)	0 —	0 —
29 E	0 —	0 —	0 —	1 (1·3)	0 —	0 —
Non-typable	1 (1·2)	0 —	3 (3·0)	0 —	0 —	1 (1·2)
Total	86 (99·9)	81 (99·9)	99 (100·0)	77 (100·0)	63 (100·0)	84 (100·0)

* Numbers in parentheses are percentages.

However, while the statutorily notifiable diseases reporting system is confined to the reporting of specified infectious diseases, the laboratory-based surveillance system has provided information on other diseases, such as *Chlamydia trachomatis* and *campylobacter* infections, for which no epidemiological information has hitherto been available on a national scale [7, 8].

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The system has also generated epidemiological studies when the very high isolation rate of *Yersinia enterocolitica* notified through the sentinel laboratories led to a case-control study which related the finding to the consumption of raw pork [9].

Forwarding of strains to reference laboratories is encouraged. Useful data on the evolution of antimicrobial resistance [5] and the distribution of capsular types [2] has been obtained.

This laboratory reporting system facilitates inquiry into uncommon infections, such as neonatal septicaemia and meningitis. When such a case is registered, the nursing service of the hospital is contacted and a special detailed report form is completed.

Other countries in Europe have well-developed laboratory-based surveillance systems, but in the United Kingdom [10], for example, it is based on state organised services. In France, a network of hospital laboratories reporting bacterial strains isolated in blood cultures and cerebrospinal fluids was set up [11]. National reference laboratories were also established in this country [12]. The use of such a system based on voluntary and selective reporting by private (hospital and non-hospital) laboratories is perhaps unique in a country with a liberal organization of medical practice. In this system, the method of reporting has been kept very simple, and this clearly has encouraged compliance.

This system has, however, several limitations. It is for instance not possible to calculate incidence rates because of the lack of a denominator for the data though according to Thacker and colleagues [13], it is not essential to obtain complete counts of most diseases to undertake effective disease-control efforts. Temporal changes in the reported number of cases adequately reflect trends, and even incomplete disease reports can be analysed to detect outbreaks and to evaluate the impact of an intervention programme.

Problems encountered include a drop in participation, which can be linked with budgetary restrictions, and delays by laboratories in sending in reports. The system can, therefore, not be used as an early warning system. The current objective, however, is to develop a computerized system of fast accurate reporting to provide a sound basis for epidemiological studies of selected infectious diseases in Belgium. Surveillance data will be available in a format that can be used for rapid updating on disease trends and early identification of potentially significant situations.

Thus far the data collected have allowed the determination of some demographic characteristics of infected patients (age and sex distribution), the detection of disease trends, changes in antimicrobial sensitivity and the assessment of the effects of control measures.

About 90% of the report forms have been returned. Thus participation on a voluntary basis seems to be successful and is likely to be indicative of the current position throughout most of the country. Regular feedback of results to participants is essential for the success of the programme. Lastly, the surveillance system has enhanced the relationship between health authorities and microbiological laboratories, and encouraged more rapid and close cooperation when problems have arisen, or where reports suggest that closer scrutiny of particular situations would be advisable.

REFERENCES

1. Walckiers D, Van Casteren V, Stroobant A, Cornelis R. Surveillance van infectieziekten door laboratoria voor microbiologie. Tijdschr Geneeskd 1986; **42**: 191–200.
2. Walckiers D, Vandepitte J, Stroobant A, Cornelis R, Van Casteren V. Une nouvelle méthode de surveillance des maladies infectieuses en Belgique: le réseau 'vigie' de laboratoires de microbiologie. Méd Mal Infect 1986; **16**: 147–50.
3. Walckiers D, Wauters G, Stroobant A, Cornelis R, Van Casteren V. Surveillance des maladies infectieuses en Belgique par un réseau de laboratoires de microbiologie: principaux résultats de l'enregistrement 1984. Acta Clin Belg 1986; **41**: 260–7.
4. Marier R. The reporting of communicable diseases. Am J Epidemiol 1977; **105**: 587–90.
5. Walckiers D, Piot P, Stroobant A, Cornelis R, Lion J, Van Casteren V. Aspects épidémiologiques des infections à Neisseria gonorrhoeae en Belgique. Rev Epidém Santé Publ 1989; **37**: 7–12.
6. Walckiers D, Von Ros G, Stroobant A. Surveillance du paludisme en Belgique par un réseau de laboratoires de microbiologie. Ann Soc Belge Méd Trop 1986; **66**: 15–21.
7. Walckiers D, Piot P, Stroobant A, Cornelis R, Lion J, Van Casteren V. Aspects épidémiologiques des infections à Chlamydia trachomatis en Belgique. Acta Clin Belg 1988; **43**: 51–7.
8. Walckiers D, Lauwers S, Stroobant A, Cornelis R, Lion J, Van Casteren V. Aspects épidémiologiques des infections à Campylobacter en Belgique. Acta Clin Belg 1989; **44**: 10–16.
9. Tauxe RV, Vandepitte J, Wauters G, et al. Yersinia enterocolitica infections and pork: the missing link. Lancet 1987; **i**: 1129–32.
10. Galbraith NS, Young SEJ. Communicable disease control: the development of a laboratory associated national epidemiological service in England and Wales. Commun Med 1980; **2**: 135–43.
11. Goulet V. Etude du relevé des bactéries isolées dans les hémocultures et les liquides céphalorachidiens par les laboratoires d'hôpitaux publics français en 1983. Méd Mal Infect 1985; **6**: 342–50.
12. Hubert B. Les centres nationaux de référence. Bull Epidém Hebd 1987; **30**: 117–19.
13. Thacker SB, Choi K, Brachman PS. The surveillance of infectious diseases. JAMA 1983; **249**: 1181–5.