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Three decades of hospital epidemiology and the challenge of integrating Health Surveillance: reflections from a case study

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Abstract *This study proposes a reflection on the uses and future prospects of hospital-based health surveillance based on the account of a pioneering experience in hospital epidemiology, the epidemiology service at the Hospital Federal dos Servidores do Estado - HFSE, which served as the basis for the creation of epidemiologic surveillance units in municipal and state hospitals in Rio de Janeiro, Brazil. The epidemiology service has combined epidemiological surveillance, continuing education, in-service training, research, and health service evaluation since 1986. The service is part of the national epidemiological surveillance network and was responsible for the notification of 55,747 cases between 1986 and 2016, most of which were the result of active search. The integration of various levels of health surveillance and health care makes classical control activities more agile and provides instruments for measuring. The important role played by the service in human resources training is evident in the training of 1,835 medical interns and 78 residents up to 2016. In addition, this experience has served as the basis for the implantation of several other hospital epidemiological surveillance units. Current challenges include the promotion of effective communication and coordination among the other health surveillance committees.*

Key words *Epidemiological Surveillance, Public Health Surveillance, Epidemiological Surveillance services, Epidemiology, Health evaluation*

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Introduction

Although Epidemiological Surveillance (ES) is one of the oldest known types of health monitoring, the active participation of hospitals in this process is rather more recent, dating back to the 1980s[1-10]. The importance of the participation of hospitals in Epidemiological Surveillance networks is already acknowledged[4-9]. Hospitals are an integral part of health systems, serving as important gateways for the treatment of monitored diseases. However, they require a huge amount of resources and face a string of challenges, including the accumulation of data that often fails to be transformed into information that can be readily used to inform decision making[4,11]. Traditionally, the surveillance of hospital-acquired infections has been touted as one of the most important components of health care in this context. However, the overall role of hospital epidemiology has been the subject of growing discussion[4,11]. One of Brazil's pioneering experiences in this respect is the *Hospital Federal dos Servidores do Estado* – HFSE in Rio de Janeiro. Since 1986, the hospital's epidemiology service has combined Epidemiological Surveillance, continuing education, research into clinical epidemiology, and epidemiology applied to health service evaluation. Furthermore, it was the first hospital epidemiology service to belong to the long-extinguished *Instituto Nacional de Assistência Médica e Previdência Social* - INAMPS. The experience gained from implementing this service served as the basis for creating Epidemiological Surveillance units in municipal hospitals in Rio de Janeiro and contributed to the development of hospital surveillance units within the state health system[7,8,12-14].

Ministerial Order (Ministry of Health) Nº 2.529 of 23 November 2004 created the Hospital-based Epidemiological Surveillance Subsystem (*Subsistema de Vigilância Epidemiológica em Âmbito Hospitalar*) and the National Network of Referral Hospitals (*Rede Nacional de Hospitais de Referência* - RNHR), with the associated Hospital Epidemiology Nuclei (*Núcleos Hospitalares de Epidemiologia* - NHEs)[15]. Apart from promoting an integrated National Epidemiological Surveillance System (*Sistema Nacional de Vigilância Epidemiológica*), the ministerial order promotes effective integration across bodies such as the Hospital-acquired Infection Control Committee (*Comissão de Controle de Infecção Hospitalar* - CCIH), the Health-Hospital Risk Department (*Gerência de Risco Sanitário-Hospitalar*), and Death Review Committee (*Comissão de Revisão de Óbitos*), among others. The system was later reshaped, leading to the creation of the Network of Hospital-based Epidemiological Surveillance of National Interest (*Rede de Vigilância Epidemiológica Hospitalar de Interesse Nacional* - REVEH), overseen by the Health Surveillance Secretariat (*Secretaria de Vigilância em Saúde* - SVS), which falls under the auspices of the Ministry of Health[16].

Hospital-based Epidemiological Surveillance (HES) aims to detect communicable diseases and health problems of national, state and international concern in a timely manner, and describe patterns of disease in strategic regions of the country. HES is performed in hospitals that act as sentinel units within the REVEH. In 2015, the RNHR was made up of 233 hospital-based Epidemiological Surveillance units distributed across the country, including the HFSE[17,18]. The creation of these units led to an increase in the sensitivity and capacity of the Epidemiological Surveillance system[7]. Given that hospitals are the gateway of various unusual and emerging diseases, the inclusion of this type of health facility into the Epidemiological Surveillance system represents an important advance.

The following aspects of hospital-based Health Surveillance are particularly worth highlighting: the need for multidisciplinary health teams; the importance of health information systems; planning, guidance, monitoring, and evaluation; and the role of epidemiology as a key tool for managing the information produced by the various committees involved in Health Surveillance[5-9].

The HFSE is a federal general teaching hospital that has been developing Epidemiological Surveillance activities since 1986 and has actively participated in the above process over the last three decades. In light of the above, this study aims to chronicle this pioneering experience and reflect on its results, difficulties, and future prospects in the context of the hospital's continued commitment to the coordination and integration of hospital-based Health Surveillance work practices in conjunction with the Unified Health System.

Methodology

This study chronicles the implementation of the HFSE's epidemiology service, drawing on a review of relevant legislation, official and technical documents produced by the service, and articles

and abstracts published in indexed and nonindexed journals. A statistical analysis of the data generated by Epidemiological Surveillance was also conducted using the following information systems: the Notifiable Diseases Information System (*Sistema de Informação de Agravos de Notificação* - SINAN), which is the official system of the National Epidemiological Surveillance System; and the local mandatory notification system, initially developed by the service using the statistical software Epi-6 and then updated to the Epi Info version for Windows. The authors actively participated in the creation and implementation of the service and their experience is included in the analysis.

Results and discussion

Although it had been in operation since November 1986, the Epidemiology Service was officially inaugurated on 16 July 1987. Later, given the growing need to incorporate epidemiology into hospital activities, the service's administrative structure was created on 12 May 1988 by INAMPS Resolution N° 186/1.988[13]. It was the first hospital epidemiology service to belong to the former INAMPS network and possibly the first in Brazil to include activities that went beyond the ES of notifiable diseases. The service has played a pioneering role in the following areas: the discussion of epidemiology in the context of clinical practice; the integration of ES; continuing education and in-service training; clinical epidemiology research; service evaluation; and human resources training in the area of epidemiology with emphasis on hospital-based ES. The experience served as the basis for the creation of ES units in municipal hospitals and hospital surveillance units in Rio de Janeiro's state hospitals[7,8,12-14]. Following the creation of the Hospital-based Epidemiological Surveillance Subsystem and RNHR (Ministerial Order MS Nº 2.529/04)[15], the HFSE was nominated as a level II referral hospital on 24 February 2005. NHEs are one of the strategic Health Surveillance actions envisaged by the Ministerial Order MS Nº 1.378 of 9 July 2013, which defines roles and responsibilities and provides guidelines on the implementation and funding of Health Surveillance actions under the country's Health Surveillance systems[19]. The hospital-based surveillance system was later reshaped and the Ministerial Order Nº 48 of 20 January 2015, which enabled federal agencies to receive financial incentives for the implementation and maintenance of strategic public Health Surveillance actions, nominated the HFSE as a referral hospital within the REVEH[17].

The HFSE's epidemiology service falls under the Care Coordination Department (*Coordenação Assistencial*), formerly called the Medical Care Division (*Divisão Médico-Assistencial*), which integrates the hospital's range of diagnostic and therapeutic support services. The organizational chart contained in the original Ministerial Order included the departments shown in Figure 1, with the respective management and intermediate care posts (*Direção e Assistência Intermediária* - DAI). Although these departments were maintained after federal government restructuring, functional allowances were suspended. In addition, the service is also part of the Hospital-based Health Surveillance Nucleus (*Núcleo de Vigilância Hospitalar* - PT/HSE/MS Nº 337/05 and Nº 274/07), which also integrates the CCIH, Risk Management (*Gerência de Risco*), Deaths Review Committee (*Comissão de Revisão de Óbitos*), Medical Records Review Committee (*Comissão de Revisão de Prontuários*), Workers' Health Service (*Serviço de Saúde do Trabalhador*), and Waste Management (*Gerência de Resíduos*)[20]. A major challenge is achieving integration with the Nucleus for Patient Safety (*Núcleo de Segurança do Paciente* - NSP).

The implementation of NHEs in the states of São Paulo, Rio de Janeiro, Pernambuco, and Paraná is well described in the literature[7-10,19,21]. Problems related to physical structure and human resources are cited in the four states. With respect to physical structure, Rio de Janeiro emphasized problems related to information technology equipment[19]. A study of 39 hospitals in São Paulo's referral network considered the physical structure of the NHEs to be satisfactory, despite the fact that the room was shared in 47% of cases, generally with the CCIH. The units' position in the organizational hierarchy varies, falling under the medical department in 65.4% of cases[7].

The eight units belonging to Pernambuco's referral network were evaluated on two occasions (2004[8] and 2008[9]), each with differing results. Considerable improvements were reported in two NHEs associated with increased spending on equipment and furniture and consumables[9]. Seven of the eight NHEs were coordinated by doctors and one was coordinated by a nurse. An evaluation of the implementation of ten NHEs in the State of Paraná conducted by the SVS identified staffing shortfalls in five units, problems

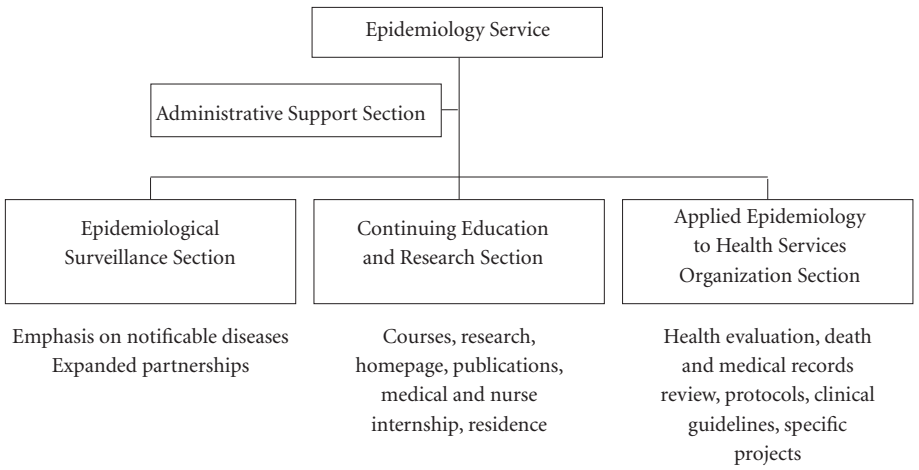

Figure 1. Organizational chart of the Epidemiology Service, which falls under the Care Coordination Department (Coordenação Assistencial) of the Hospital Federal dos Servidores do Estado - HFSE.

relating to physical space in three, and that three had been deactivated[21].

The HFSE's epidemiology service has been part of the national VE network since its creation. The service is responsible for monitoring notifiable diseases in the hospital and liaises with other hospital-based Health Surveillance committees. It also coordinates the hospital's Preventive and Social Medicine Residency Program, practical training placement within the Multiprofessional Public Health Residency Program at the *Instituto de Estudos em Saúde Coletiva* - IESC of the Universidade Federal do Rio de Janeiro (UFRJ), and, up to December 2016, hospital epidemiology placements on the Public Health Internship Program at the *Universidade Estácio de Sá* (UNESA).

The hospital has six permanent staff employed by the federal government: two doctors, two nurses, a statistician, and nursing technician, two of which have doctorates and three of which have master's degrees. There are also two technicians, each with a degree, employed by the *Instituto Estadual de Infectologia São Sebastião* - IEISS and an outsourced administrator. There has been a significant reduction in medical staff, which reached a peak of seven doctors in the 1990s. The hospital also receives an average of one intern per term (six medical interns up to 2016 and, as from 2017, one nursing intern).

Staffing shortfalls are a frequently cited problem in the national literature on NHEs[8-10,19,21]. A general increase in the level of staff qualification was observed in Pernambuco between 2004 and 2008. This increase was not accompanied by an increase in the staffing levels.

Epidemiological surveillance actions

The service has the following aims in the area of Epidemiological Surveillance: to detect communicable diseases and health problems of national, state and international concern; describe patterns of disease; promote relevant control measures at hospital level; and act as a referral hospital unit for the REVEH, interacting with all hierarchical levels of municipal, state, and national VE. Integrated actions begin with interaction between the hospital and the Municipal Health Center and Health Surveillance Division (*Divisão de Vigilância em Saúde* - DVS) of the Coordinating Office of the Planning Area 1.0, of which the hospital is part. The service is responsible for monitoring notifiable diseases in the HFSE, which entails interaction with other hospital Health Surveillance bodies, particularly the CCIH, Risk Management, Deaths Review Committee, Workers' Health Service, and, more recently, the Nucleus for Patient Safety. The service

also participates in the surveillance of noncommunicable diseases, provides advisory support for research projects developed in the hospital, promotes the development and analysis of indicators to measure the quality of hospital services, and promotes training and refresher training in the area of epidemiology. The internships coordinated by the epidemiology service include an intense workload dedicated to ES, evaluation of the available information systems, and local health situation analysis. Residents and interns are involved in ES activities during in-service training.

Integration between the various levels of ES helps to optimize classical notifiable disease activities and also provides tools for measuring service delivery, thus contributing to the improvement of service quality. ES at hospital level is capable of generating and providing feedback on health care quality indicators. A brief of notifiable diseases is published on a quarterly basis and the hospital produces a six-monthly epidemiological bulletin, both of which are available on the hospital's website. These efforts to produce feedback are characteristic of the service, although their impact is difficult to measure. In Pernambuco, although the level of adherence of NHEs to best practices for the immediate notification of diseases was high, feedback was considered to be a weakness[8,9].

Figure 2 shows temporal trends in 55,747 notifications of notifiable diseases registered by the epidemiology service, illustrating the significant contribution of the service to ES in the State of Rio de Janeiro. A number of factors should be taken into account when analyzing this graph. The impact of arbovirus epidemics is high, beginning with dengue fever (1986, 1991, 2002, 2008) and, from 2015, Zika fever and chikungunya. Since 11 August 2005, when the hospital was included in the Hospital-based Epidemiological Surveillance Subsystem, there has been an increase in notifications, partly due to improvements in surveillance processes and the inclusion of new notifiable disease.

On 20 August 2012, the IEISS was integrated into the HFSE. The IEISS has played a leading role in the State of Rio de Janeiro in the provision of

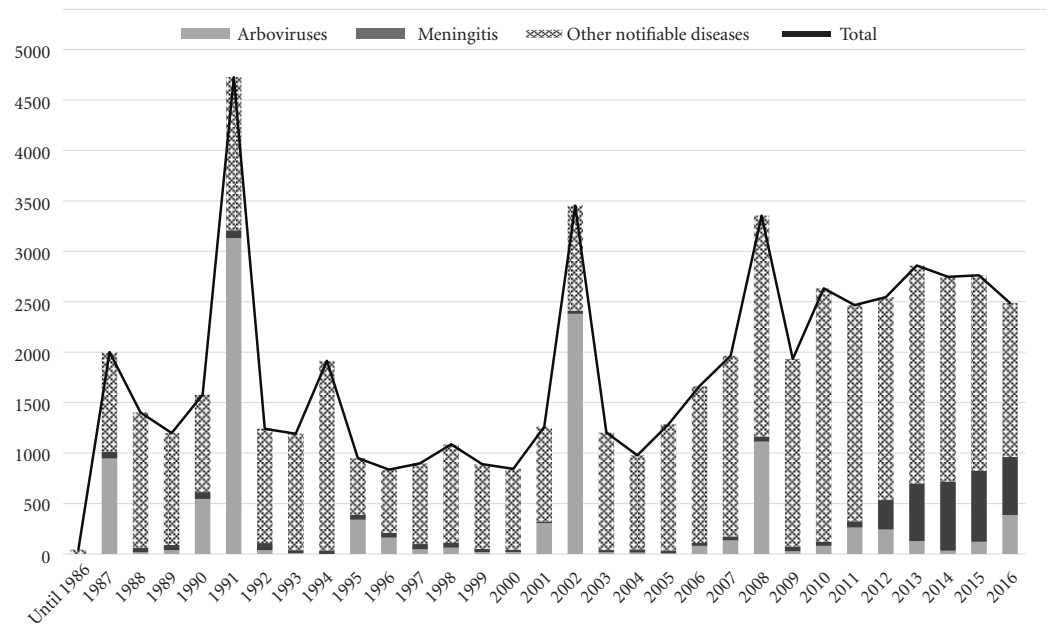

Figure 2. Temporal trends in 55,747 notifications of notifiable disease made by the Epidemiology Service. HFSE, Rio de Janeiro, 1986-2016.

Source: Sistema NC and local SINAN.

emergency treatment for infectious diseases and is historically recognized for its role in the treatment of meningitis in Rio de Janeiro, benefitting from a laboratory that specialized in the analysis of cerebrospinal fluid. In 1997, around two-thirds of cases of all types of meningitis notified to the Epidemiology Programs Coordination Office of the Department of Health of the Municipality of Rio de Janeiro were diagnosed and treated in the IEISS[22]. Problems associated with the relocation of the IEISS to the HFSE remain. There is a lack of effective integration between the two institutions, one of which is a state organization and the other federal. In terms of Epidemiological Surveillance, the notification and investigation process is unified and is the responsibility of the epidemiology service. The relocation of the IEISS[23] led to a significant increase in the number of notifications of meningitis in the hospital and changes in the clinical and epidemiological profile of reported cases of meningitis: there was a fivefold increase in the number of notifications of meningitis between 2011 (62 cases) and 2012 (301 cases), while the number of cases almost doubled between 2012 and 2013 (571 cases). The proportion of acute bacterial meningitis increased from 18.4% in 2011 to 40.7% in 2012. Since 2013, meningitis has accounted for around a quarter of all notifications made by the HFSE. Data made available on the website of the Department of Health of the Municipality of Rio de Janeiro[24] through the TABNET tabulator for confirmed cases of meningitis in the municipality show that the HFSE notifying unit accounted for 4.3% of 766 cases in 2011, 8.9% of 877 cases in 2012, and 25.2% of 610 cases in 2015. Therefore, around one quarter of the notifications of meningitis confirmed on the municipal Notifiable Disease Information System (*Sistema de Informação de Agravos de Notificação* – SINAN) originated from the actions of this service.

The epidemiology service also makes a significant contribution to Epidemiological Surveillance in the Municipality of Rio de Janeiro for other diseases: in 2015, the HFSE was responsible for the notification of 33.1% of 432 cases of HIV in pregnant women, 15% of 40 cases of leptospirosis, 6.7% of the 2,252 cases of infectious hepatitis, and 1.5% of the 7,965 cases of tuberculosis. In the same year, the HFSE was the notifying unit that reported the highest number of cases of meningitis, leptospirosis, and HIV in pregnant women in the municipality, the fifth highest number of cases of hepatitis, and the tenth largest of tuberculosis[24].

A study conducted in São Paulo shows the positive impact of NHEs on the reporting and investigation of notifiable disease at central level[7]. Notifications increased by 71.3% between 2006 and 2011; albeit not in a uniform manner, as the effectiveness of certain units may be improved. For example, 13.8% of the units did not investigate notified cases of meningitis. There has been an increase in closing capacity in notified cases of bacterial meningitis based on laboratory diagnosis since 2006, although the results were heterogeneous across NHEs. Another process that showed heterogeneous results across NHEs was the opportunity for notification, with some showing unsatisfactory results. As with the HFSE, dengue, viral hepatitis, meningitis, and AIDS were among the most notified diseases in São Paulo during the study period. The role played by NHEs in the response to new diseases is well documented in relation to the H1N1 influenza pandemic[7] and, more recently, in relation to the microcephaly epidemic linked to the Zika virus[25].

Figure 3 shows the distribution of the main notified diseases for the period 1986 to 2016 and for 2016 alone. The most commonly reported notifiable diseases between 1986 and 2016 were infectious hepatitis, tuberculosis, AIDS/HIV, and arboviruses (mainly dengue fever), while in 2016 they were meningitis, infectious hepatitis, tuberculosis, and arboviruses (including Zika, chikungunya, and rash in pregnant women). The main care departments at the time of notification were: the Infectious and Parasitic Diseases Service (*Serviço de Doenças Infecto-Parasitárias* - DIP), with 43.4% of cases (74.4% of which from care provided in the department linked to the former IEISS); the Maternal-Fetal Unit (*Unidade Materno-Fetal*), with 16.7%; pediatrics, with 7.5%; 24-hour outpatient clinic, with 7.2%; Workers' Health, with 6.4%; and pharmacy, with 5.7%. The type of care provided was emergency care (30.4%), outpatient (30.8%), admissions (34.4%), and ignored (4.4%).

Historically, hospital-based Epidemiological Surveillance has been based on the active search for cases, which requires a major effort on the part of epidemiology units to detect suspected cases in a timely manner. Up to 2005, over 90% of the notifications at the HFSE were the result of active search; less than 10% were spontaneous notifications. Of the 25,041 notified cases between 2006 and 2016, 23.6% were spontaneous notifications. The percentage of spontaneous notifications varied greatly as a result of awareness campaigns and adherence to partner ser-

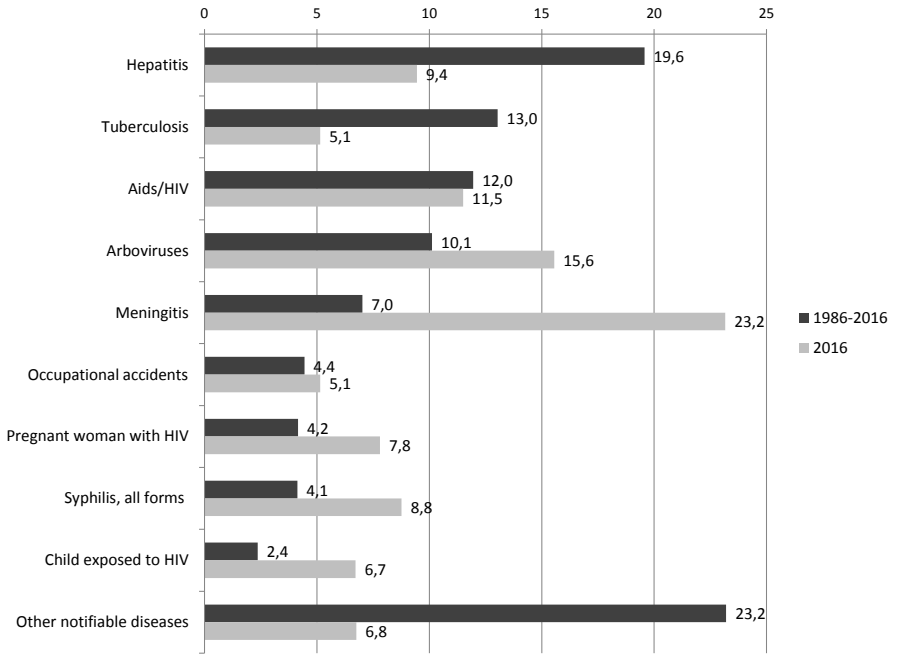

Figure 3. Distribution of notifications of notifiable diseases made by the Epidemiology Service by disease type. HFSE, Rio de Janeiro, 1986-2016 (n=55,747 notifications) and 2016 (n= 2,487 notifications).

Source: Sistema NC and local SINAN.

vices. The integration of the hospital into the Hospital-based Epidemiological Surveillance Subsystem on 11 August 2005 led to the review of routines and procedures, including those designed to speed up decision making regarding control measures, promotion of spontaneous notification, awareness campaigns, training for health professionals, and permanent education. Of the 1,557 notified cases in 2006, 31% were spontaneous notifications. The percentage of spontaneous notifications varied between 19.4% and 46.6% depending on the month, although no clear trend was observed. Financial incentives were used to produce educational material (posters, folders, and the Epidemiological Bulletin) about mandatory reporting of notifiable diseases and biosafety regulations. An awareness raising campaign was initiated on 26 February 2007 involving the following activities: daily visits to various hospital departments; direct contact with health professionals; bedside discussions about suspected cases; presentation and distribution of educational material at service and division meetings; and optimization of interfaces with other Health Surveillance committees[26]. To complement these activities, the epidemiology service maintains permanent contact with various departments and harnesses opportunities generated by investigated cases to clarify doubts and raise staff awareness. The campaign led to a significant increase in the percentage of spontaneous notifications in the same year: January - 26%, February – 42.6%, March – 43.2%, April – 44.5%, May – 46.7%, June – 59.5%. This growing trend was statistically significant ($r^2 = 0.81$; $p < 0.0001$) up to June, when the percentage of spontaneous notifications reached a record high. From then on, spontaneous notifications showed a decreasing trend, with the percentage falling to 35% in 2008. The mean and median of spontaneous notifications in 2016 were 18.8% and 15.1%, respectively. It is important to note the percentage of spontaneous notifications in area registered by services that are historically considered partner services:

hemotherapy - 100%, workers' health – 98.4%, Hospital Tuberculosis Control Program – 92.3%, and pediatrics – 41.6%.

Although the awareness raising strategies have had a positive impact on spontaneous notification, the following challenge remains: maintain and improve this level to facilitate the implementation of control measures in a timely manner. Working in partnership with other surveillance committees, such as the CCIH, risk management, and workers' health committees, is particularly desirable: 100% of cases of accidental exposure to fluids detected in the HFSE are spontaneously notified by the workers' health services via SINAN. To use tuberculostatic drugs it is necessary to fill out a SINAN investigation form, reducing the losses associated with the treatment of tuberculosis. In conjunction with these strategies, active search is the main pillar of case notification and investigation in the hospital.

Specific analyses are conducted on a systematic basis using the SINAN to assess information quality, the clinical and epidemiological profile of diseases, and health care quality. Examples of local health care quality indicators generated using the SINAN include: proportion of cases of meningitis of unknown etiology; proportion of cases of tuberculosis treated empirically; proportion of sputum smear-positive pulmonary tuberculosis cases; and provision of serologic testing for anti-HIV antibodies to tuberculosis patients. In the case of meningitis, hospital-based Epidemiological Surveillance was able to provide feedback to the services on care indicators, culminating in the discussion of routine diagnosis and treatment of meningitis together with the services involved[27]. Probabilistic relationship between databases was used to detect underreporting.

No mention was found of the participation of hospital epidemiology units in Epidemiological Surveillance in developed countries. The main component is surveillance of hospital-acquired infections[4,28-30].

ES information systems

The service works with two information systems: the SINAN and a system developed locally. The SINAN has been a useful tool for the evaluation of local services, especially in relation to the diagnosis and treatment of meningitis, tuberculosis, HIV/AIDS, and congenital syphilis. The SINAN was designed to be used locally with a view to rationalizing the data collection and transfer process, thus contributing to the decentralization of actions, services, and health system management[31,32]. However, it was only recently that the Municipality of Rio de Janeiro began the process of decentralizing data entry using its own system called SINAN-Rio, whereby date is entered online and exported by the DVS of the Health Coordinating Offices of the Programmatic Areas (*Coordenadorias de Saúde das Áreas Programáticas* - CAP) to the state SINAN. The system is currently decentralized for tuberculosis, non-serious workplace accidents, leprosy, pregnant women with HIV, pregnant women with syphilis, congenital syphilis, and syndromic surveillance de arboviruses. For other diseases, immediate notification is made using a digital form sent by email, while weekly notification is done using paper form. In these cases, data is entered at the DVS level and updates are informed using an electronic spreadsheet sent via email.

The effective utilization of the SINAN allows the hospital to conduct a dynamic diagnosis of the occurrence of a notifiable disease and can provide important inputs for planning health care actions, defining intervention priorities, and evaluating the impact of interventions in specific geographic areas. Its systematic and decentralized use contributes to the democratization of information and means that registered health professionals have access to important information.

In accordance with the decentralization of the SUS, the SINAN-Rio was designed to be used in the most peripheral administrative units, i.e., health centers. Data is exported to the state SINAN-NET. However, the system lacks a tool that enables data exportation from the database to the level at which the data was entered. As such, the HFSE can consult individual forms online using the name or notification number, which is useful for identifying cases notified by other health centers, but is not able to access the database with its cases, which is important for diagnosis at hospital level. In this respect, as part of an agreement between the hospital and the DVS of the CAP1.0, the excel file of each disease is sent to the epidemiology service by email on a monthly basis.

Any evaluation of the impact of NHEs using the notifying unit informed in the SINAN is limited. If the case is treated by more than one health center, only the first notification unit is registered, which explains for example the greater number of notifications registered in the local database in comparison to the data made available at central level. With regard to meningitis for example, in 2015 the local SINAN database in the

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HFSE registered 656 confirmed cases and 43 that were ruled out, while the TABNET on the website of the municipal health department showed that there were only 154 confirmed cases notified by the HFSE[24].

Apart from the SINAN, the service maintains its own notification registry system. The system, known as *Sistema NC*, was developed using the statistical software Epi-6 and then updated to the Epi Info version for Windows. The system has a complementary database for HIV-related cases called *Arquivo Nominal*, also developed using Epi-6. The *Sistema NC* allows for more rapid and sensitive data consolidation and provides relevant data that is not available on the SINAN, such as the location of the case at the time of notification and the notifying department. A more detailed analysis of the disease profile is conducted using the SINAN.

Mexico's experience with reformulating and implementing its national Epidemiological Surveillance system raised a number of relevant points for Brazil: the selection of notifiable diseases with emphasis on relevant useful information for decision making; the need for one sole registry system; decentralization; and the need for human resources training[33]. The functions of NHEs in Brazil are defined by ministerial orders and include data entry in the SINAN[15-17]. However, the decentralization of data entry remains heterogeneous across units, as the experiences of Rio de Janeiro, including the HFSE, São Paulo, Pernambuco, and Paraná show[6-9,21]. In Rio de Janeiro, decentralization occurs through the SINAN-Rio, which does not encompass other municipalities. Therefore, decentralization to hospital level does not occur in these municipalities. A national article emphasizes the importance of an information management and dissemination policy, with investment to enhance human and material resources. It also draws attention to the "illusion" that automation on its own is the solution to information system problems[34].

Capacity building, human resources training, and continuing education

The history of the epidemiology service is deeply rooted in its vocation for human resources training and the pursuit of integration between the academic world and the service. The proposal for the creation of the department in the 1980s stemmed from the discussions of a preventive and social medicine resident from the UERJ who had passed in a public selection process as a doctor at the former INAMPS and was posted to the DIP service at the HFSE. The discussions initially envisaged an end of course study that ended up extending into the academy and service, including the board of directors and doctors of the HFSE, culminating in the creation of the former Epidemiology Service and CCIH, which initially shared the same physical space.

The important role played by the hospital in capacity building and human resources training is evident in the training of 1,835 medical interns and 78 residents up to 2016 (Figure 4) and in the fact that this experience has served as a basis for the implementation of various other hospital units since 1988.

Throughout its history, the service has offered 15 annual epidemiology courses for a total of 1,441 students, four courses on epidemiological methods applied to clinical settings, and two courses on Epidemiological Surveillance for secondary school students. The hospital has also organized three courses on Epi Info, provided advice on education in Rio de Janeiro and on the implementation of hospital epidemiology units at municipal, state and federal level. It has also maintained an impressive level of scientific output, with the production of 213 works presented in scientific congresses, 79 completed articles, and 130 abstracts published in indexed and nonindexed journals up to 2015.

Figure 4 shows the annual number of residents in areas related to public health and medical interns. Between 1998 and 2016, 17 residents (all doctors) participated in the HFSE's accredited Preventive and Social Medicine Program and 61 residents participated in the former Specialization in Public Health, currently called the Multiprofessional Public Health Residency Program, the result of an agreement between the hospital and IESC. The residents from the public health program had the following degrees: nursing - 18, nutrition - 14, psychology - 11, physiotherapy - 4, dentistry - 3, medicine - 2, veterinary medicine - 2, social services - 2, occupational therapy - 2, physical education - 1, statistics - 1, and public health - 1. In the 1990s the service also offered internships for infectology residents.

In-service training on the residency programs offers the opportunity to promote interfaces between the hospital's various Health Surveillance committees and departments, since the residents spend time in various departments. A major challenge currently facing the service is to promote communication and coordination with the other committees that make up the NVH and

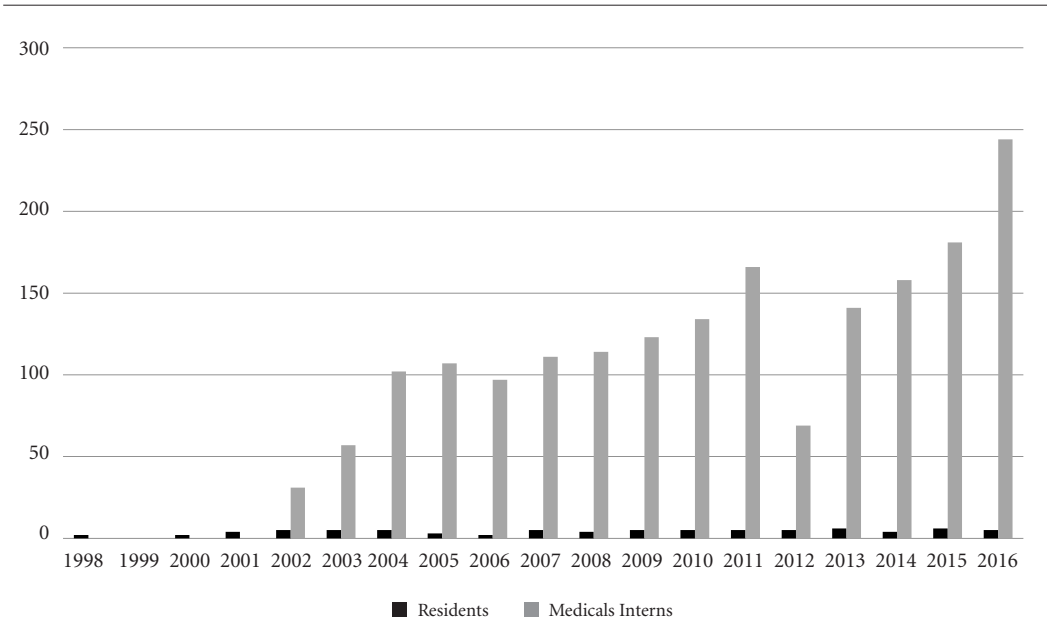

Figure 4. Annual number of residents (Preventive and Social Medicine Residency Program and Multiprofessional Public Health Residency Program)[a] and medical interns[b] placed in the Epidemiology Service, 1998 to 2016.

[a] Of the 78 residents, 17 are from the Preventive and Social Medicine Residency Program/HFSE and 61 from the Multiprofessional Public Health Residency Program (IESC/UFRJ agreement). [b] Interns from HFSE/UNESA agreement, public health basic area.

NSP with a view to establishing an integrated multidisciplinary Health Surveillance setting.

The integration of a placement in hospital epidemiology from a medical internship in public health with the daily activities of the epidemiology service of a federal hospital was particularly successful. The service offered placements in hospital epidemiology as part of the medical internship program of the Faculty of Medicine of the *Universidade Estácio de Sá*, through an agreement between the hospital and the university. The program operated between November 2002 and November 2016 as part of the syllabus of the public health internship program. The internship consisted of between 40 hours (one week) and 160 hours (four weeks) of work experience. The program was attended by 1,835 interns up to the second semester of 2016. The variation in working hours was determined mainly by the increase in number of students and internal limitations. The students participated in a multidisciplinary team in all activities, with emphasis on ES, mandatory reporting of notifiable diseases, epidemiological investigation of cases treated in the hospital, control measures, use of national information systems, development of research skills applied to a group study of a hospital-level health problem, integrating ES, database management, and service assessment. As part of the study, students were required to prepare a seminar which served as the basis for evaluation. A total of 599 works were produced up to 2015, which generated 25 presentations in congresses (15 national and one international), four awards, six completed articles, and 11 published abstracts. The integration between internships and service is mutually beneficial, favoring collective professional development, particularly in the case of the four-week period. Despite the success of the program, the increase in number of students and discussions surrounding the new curriculum led to its interruption in 2017. In 2016, the service began to offer a placement in Epidemiological Surveillance as part of a nursing internship.

NHEs are regarded as important centers of training and capacity building in Epidemiological Surveillance. Twenty eight (71.8%) of the NHEs in São Paulo participate in education and research activities and 18 (46.2%) receive interns from degree programs and specialist courses.

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Like the HFSE, some units, such as the *Instituto Emilio Ribas* and Unicamp unit, have been offering internships in the area of Epidemiological Surveillance for several years[7]. Some NHEs in São Paulo and Paraná state that they offer internships for medical and/or nursing students[7,21]. However, we were unable to find any reports of experience with internships in the literature.

Hospital-based Health Surveillance Units: developing strategies for integrated Health Surveillance

The concept of hospital-based Health Surveillance has received considerable attention in the context of the various practices of Health Surveillance that exist today in hospital settings, which go beyond Epidemiological Surveillance and surveillance of hospital-acquired infections. Certain studies show that hospital-based Health Surveillance is developed in a fragmented manner in Brazilian institutions, with little integration between the various committees[3,4]. There is a growing perception between health professionals involved in Health Surveillance of the need for a new model of Health Surveillance. The lessons learned from the integration of Health Surveillance through the structure of the NVH in hospital units belonging to Rio de Janeiro's state network[14] brings a new perspective to this discussion encompassing four committees: Epidemiological Surveillance, control of hospital-acquired infections, review of medical records, and review of deaths. Subsequently, the HFSE proposed an alteration to this proposal, creating the NVH/HFSE, which also includes the Department of Health-Hospital Risk (*Gerência de Risco Sanitário-Hospitalar*), the Workers' Health Service, and the Environment/Waster Management Committee[20] (Figure 5).

Created in 2005 to provide support to the senior management team, the function of the NVH is to coordinate Health Surveillance actions undertaken within the HFSE in conjunction with the SUS. It incorporates methods, techniques, and instruments from the area of epidemiology, planning, social sciences, and information technology, thus enabling the analysis of health situations to reorient Health Surveillance actions and services delivered by the operational units aimed at enhancing health care quality and the cost-benefit ratio of actions[20,32]. To this end, the unit promotes communication and coordination between the various hospital departments that have emerged throughout its history linked to different public health movements. The NVH

*PT/HSE/MS No 337/05 (BSE No 28/2005), republished PT/HSE Nº 274/07 (BSE Nº 23/2007).

Figure 5. Proposal for the Hospital-based Health Surveillance Unit at the HFSE.

Source: HSE[35].

is an advisory body to the senior management team, to which it is directly subordinated. The committees and departments that make up the NVH existed before it was created. The role of the unit is to facilitate integration between the different departments and ensure that Health Surveillance functions are carried out across multiple interfaces, while at the same time preserving the specificities of each area, including those related to compliance with current legislation.

Using participatory methods, the unit seeks to create a space that enables communication and coordination between various bodies whose function is to protect the health and safety of patients and staff, thus promoting the integration of different departments as a key element of quality improvement. A well organized and systematized Health Surveillance system that meets the demands set by current legislation constitutes an agile network of information capable of undertaking a reliable situational diagnosis and detecting sentinel events, thus actively contributing to the timely implementation of control measures and promoting a positive impact on health care management and quality.

This proposal is still being developed. Challenges include historic difficulties in integrating existing Health Surveillance actions and the implementation of new structures of hospital-based Health Surveillance, such as the NSP for example[36]. At least one study[4] discusses the integration of Health Surveillance in hospital settings based on Epidemiological Surveillance and control of hospital-acquired infections. Based on the views of professionals working in this area, the author shows that the limits imposed by the specificities of each type of surveillance and conflicts often related to the diverse range of backgrounds of these professionals are factors that contribute to a fragmented approach to Health Surveillance.

In November 2013, in compliance with Collegiate Board Resolution, ANVISA Nº 36 of 25 July 2013[36], which deals with patient health and safety, the HFSE's Nucleus for Patient Safety (*Núcleo de Segurança do Paciente* - NSP) was created. More recently, by order of the Department of Hospital Management (*Departamento de Gestão Hospitalar* - DGH) of the State of Rio de Janeiro, the Department of Hospital-based Health Surveillance (*Setor de Vigilância Hospitalar* - SVH) was created[37]. The SVH incorporates hospital epidemiology, control of hospital-acquired infections, risk management, waste management, and the NSP. This ministerial order, among other functions, defines participation in hospital-based Health Surveillance actions with the aim of optimizing intersectoral actions that may influence determinants of health and health outcomes. Thus, there is an array of ministerial orders that are not necessarily accompanied by effective actions. It is important to note that ministerial orders that deal with hospital-based Epidemiological Surveillance emphasize the importance of the interface between Epidemiological Surveillance and CCIH, risk management (hemovigilance, technovigilance, and pharmacovigilance), deaths surveillance, and workers' health, among others[15,19].

The HFSE emphasizes the importance of promoting communication and coordination between the actions undertaken by the different components of the NVH and NSP.

Final Considerations

During the three decades of its existence, the epidemiology service has maintained internal and external consistency, fulfilling its role as an Epidemiological Surveillance service integrated into the SUS, actively participating in the national REVEH, and playing a leading role in human resources training. The Epidemiological Surveillance routine is fully structured, the service if part of the REVEH, and plays an important role as a notifying unit within the municipality and the state as a whole. Despite efforts made to raise awareness regarding the importance of notification, the system still relies on active surveillance. The SINAN is useful at local level for evaluating services and the information generated has been discussed with the care services and used to orient decision making. The integration of information systems and their importance for hospital-based surveillance, the utilization of information in the evaluation of services and, above all, the role of epidemiology in human resources training and capacity building are vital issues that are systematically defended by the service.

The epidemiology service, through its Epidemiological Surveillance activities, maintains permanent contact with various departments and harnesses opportunities generated by cases to clarify doubts and raise staff awareness. The service has also been a catalyst for the development of the proposal for the NVH, which seeks to create a space that enables effective communication and coordination between the various bodies involved in Health Surveillance in the hospital and whose function is to protect the health of the

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patients and staff. A well organized and systematized Health Surveillance system that meets the demands set by current legislation constitutes an agile network of information capable of undertaking a reliable situational diagnosis and detecting sentinel events, thus actively contributing to the timely implementation of control measures and promoting a positive impact on health care management and quality.

Certain aspects of hospital-based Health Surveillance warrant highlighting: the need for multidisciplinary health teams; the importance of health information systems; planning, guidance, monitoring, and evaluation; and the role of epidemiology as a key tool for managing the information produced by the various committees involved in Health Surveillance. Based upon the experience of the HFSE, it is possible to reflect on the uses, limitations, and future prospects of Health Surveillance in a hospital unit that is part of the SUS, in which certain aspects of so-called academic knowledge are integrated into the health service routine and which persistently seeks to promote daily interaction between the various knowledges and technologies from the field of Health Surveillance with a view to strengthening the present to foster a stronger future, without forgetting its history.

Collaborations

CC Escosteguy participated in all stages, from the design, analysis and interpretation of data, writing and approval of the version to be sent. AGL Pereira and RA Medronho participated in the analysis and interpretation of data, critical review and approval of the version to be sent.

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