

# The use of hospital-based nurses for the surveillance of potential disease outbreaks

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**Objective** To study a novel surveillance system introduced in Mpumalanga Province, a rural area in the north-east of South Africa, in an attempt to address deficiencies in the system of notification for infectious conditions that have the potential for causing outbreaks.

**Methods** Hospital-based infection control nurses in all of Mpumalanga's 32 public and private hospitals were trained to recognize, report, and respond to nine clinical syndromes that require immediate action. Sustainability of the system was assured through a schedule of regular training and networking, and by providing feedback to the nurses. The system was evaluated by formal review of hospital records, evidence of the effective containment of a cholera outbreak, and assessment of the speed and appropriateness of responses to other syndromes.

**Findings** Rapid detection, reporting and response to six imported cholera cases resulted in effective containment, with only 19 proven secondary cholera cases, during the two-year review period. No secondary cases followed detection and prompt response to 14 patients with meningococcal disease. By the end of the first year of implementation, all facilities were providing weekly zero-reports on the nine syndromes before the designated time. Formal hospital record review for cases of acute flaccid paralysis endorsed the value of the system.

**Conclusion** The primary goal of an outbreak surveillance system is to ensure timely recognition of syndromes requiring an immediate response. Infection control nurses in Mpumalanga hospitals have excelled in timely weekly zero-reporting, participation at monthly training and feedback sessions, detection of priority clinical syndromes, and prompt appropriate response. This review provides support for the role of hospital-based nurses as valuable sentinel surveillance agents providing timely data for action.

**Keywords:** nursing staff, hospital; sentinel surveillance; disease outbreaks, prevention and control; disease notification, methods; disease, syndrome; cholera, epidemiology; meningococcal infections, epidemiology; paralysis, epidemiology; South Africa.

**Mots clés:** personnel infirmier hospitalier; surveillance sentinelle; lutte contre les épidémies; notification des maladies, méthodes; syndrome; choléra, épidémiologie; méningococcies, épidémiologie; paralysie, épidémiologie; Afrique du Sud.

**Palabras clave:** personal de enfermería en hospital, utilización; vigilancia de guardia; brotes de enfermedades, prevención y control; notificación de enfermedad, métodos; síndrome; cólera, epidemiología; infecciones meningocócicas, epidemiología; parálisis, epidemiología; Sudáfrica.

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## Introduction

South Africa's system of notification for medical conditions shares the limitations described in other

countries, including underreporting, the use of complex forms, lack of awareness among health workers of the extensive list of notifiable conditions, and a sluggish and complex notification process (1–3). For the effective containment of an outbreak to occur, cases of infectious diseases must be recognized and reported promptly to those responsible for prevention and control activities (4). This is particularly important in under-resourced regions where delays in raising the alarm — caused by ill-informed health staff, circuitous administrative pathways, and inadequate postal services — may cause vulnerable communities to suffer multiple generations of disease along with the concomitant unnecessary morbidity, death, panic, and loss of credibility of the public health system.

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Proof that poliomyelitis has been eliminated in individual regions or countries currently depends upon the ability of local surveillance systems to detect and exclude poliomyelitis in the approximately 1 case of acute flaccid paralysis expected to occur annually among 100 000 people aged less than 15 years (5). Failure to detect this level of acute flaccid paralysis may indicate an inadequate surveillance system.

Mpumalanga Province is a predominantly rural area in north-eastern South Africa. The population of about 3 million is particularly vulnerable to importation of diseases endemic in neighbouring countries, such as Mozambique and Swaziland, because the province provides large-scale informal employment opportunities, particularly in agriculture. Medical care for the majority of the province's population is provided by the public health sector, which consists of 300 fixed and mobile clinics, and 26 state hospitals (Fig. 1). Private general practitioners and six private hospitals complement these services. There are 11 full-time infection control nurses and 21 part-time nurses in the 32 hospitals.

Communicable Disease Control Coordinators in the district are senior nurses appointed to manage communicable disease control programmes in each of Mpumalanga's 16 health districts. Their responsibilities include responding to outbreaks of infectious diseases in the community and detecting cases of acute flaccid paralysis. However, in 1997 despite the training provided to all clinic staff, only 3 of the 11 cases of acute flaccid paralysis expected to occur in Mpumalanga Province were detected; this raised concerns that the public health surveillance system was inadequate. Additionally, recent responses to outbreaks of a number of infectious diseases, including infections with *Salmonella typhi* in 1993 and *Neisseria meningitidis* during 1996, in Mpumalanga and neighbouring provinces, were criticized as tardy (6, 7).

The object of this paper is to discuss the contribution that hospital-based infection control nurses have made to improving surveillance for infectious syndromes that require immediate response in Mpumalanga Province, South Africa.

## Methods

### Implementation of a surveillance system using hospital-based nurses

The critical findings of an appraisal of Mpumalanga's notification system by provincial staff and the apparent failure to reach the target for detecting cases of acute flaccid paralysis were extensively discussed with health workers, military logistics personnel, and both academic and field staff working in public health in a number of countries (8). This consultation resulted in a decision to develop and implement a system for the rapid, routine reporting of a limited number of infectious conditions that have the potential to cause outbreaks as a component of public health surveillance in Mpumalanga. Criteria utilized for

choosing the syndromes included: whether control depended on an urgent investigation and an immediate appropriate response, the severity of the condition, the potential for large populations to be affected, the objectives of national and international programmes, and the availability of effective control measures. Nine clinical syndromes were chosen for reporting, and simple case definitions were developed for each syndrome (Box 1). The nine syndromes chosen were: acute flaccid paralysis, profuse watery diarrhoea, an outbreak of diarrhoea, an outbreak of dysentery, measles, meningococcal disease, plague, viral haemorrhagic fevers, and yellow fever.

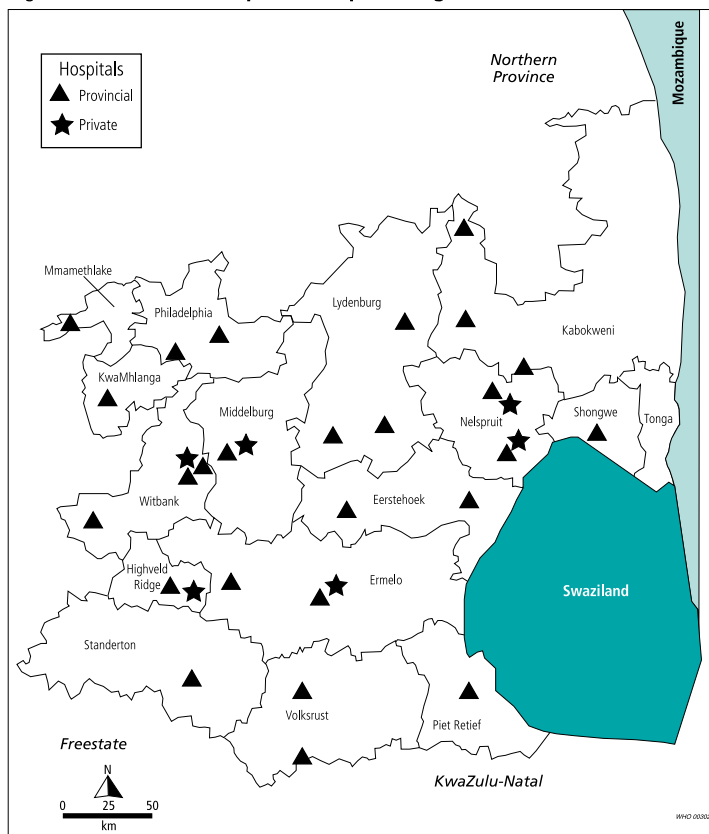
A user-oriented outbreak manual was produced. It provides a systematic approach to diagnosing each syndrome using a clinical case definition and includes the following: criteria for confirmation; an information box that gives details on standard responses (including infection control precautions) and initial therapy; discussion on the preparation of diagnostic specimens and community control strategies; lists of contact people. (A copy is available at <http://www.jcu.edu.au/school/sphtm/PHTM/links/outbreak.htm>) The manual was used as the template for in-depth training and periodic retraining of infection control nurses from both public and private hospitals for the nine syndromes and appropriate responses.

A system of weekly "zero reporting" by infection control nurses was also initiated. A specifically designed simple surveillance form listing the nine designated syndromes is faxed weekly to the provincial surveillance officer. If the zero report is not received by the agreed time the provincial surveillance officer phones the nurse whose report is missing. Ensuring close cooperation between the primary reporting agents (the nurses) and their district counterparts (the communicable disease control coordinators), who are primarily responsible for responding to community outbreaks, was facilitated by having both groups attend training sessions and other related activities together. This included accredited seminars on topics of mutual interest and training rounds on controlling infections in hospital. Monthly sessions have been conducted at a central point in the province for all infection control nurses during the past two years to provide feedback and training on surveillance and other topics requested by the nurses, thus providing mentoring for the team and allowing members to network and learn from colleagues' experiences.

### Reporting

Successful outbreak containment is the primary goal of the system. Fortunately many of the nine designated syndromes did not occur in Mpumalanga during the past 2 years. However, as indicators of progress we were able to examine the occurrence of cholera and meningococcal disease locally to assess the quality of reporting to the provincial communicable disease control unit and the success of containment.

Fig. 1. Distribution of hospitals in Mpumalanga, South Africa



Two additional measures were used to provide an objective indication of the surveillance system. Firstly, the completeness and timeliness of weekly zero reporting by the infection control nurses over a two-year period was analysed. Secondly, a comprehensive review of hospital records to identify cases of acute flaccid paralysis was conducted in each hospital during the last quarter of 1998 and in randomly selected hospitals during the last quarter of 1999.

## Results

### Cholera

Mozambique had a large-scale outbreak caused by the El Tor biotype of *Vibrio cholerae* O1 during late 1997, with more than 10 000 cases identified before the end of the year; the initial confirmation of cholera occurred in the city of Maputo on 13 August 1997. The epidemic peaked in Maputo Province in November, with more than 1000 cases notified each week.

The rural Lowveld region of Mpumalanga borders Maputo Province in the east, and a large number of economic migrants from Mozambique enter the region seeking employment. Many are recruited as casual labour on banana and sugar plantations. In 1998, a 20-year-old Mozambican man was the index case for a localized cholera outbreak in the Lowveld region. He arrived from Maputo on 23 February 1998 and found casual employment on a

banana plantation located on the northern bank of the Lomati River. He became ill and had profuse watery diarrhoea late on the night of his arrival and was discovered in shock and partially submerged in the river the next morning. After admission to Shongwe Hospital on 24 February he was successfully resuscitated, and *Vibrio cholerae* El Tor Ogawa O1 strain was isolated and cultured from a stool specimen. The infection control nurse at the hospital instituted appropriate control precautions in the hospital and notified the provincial communicable diseases control unit within hours of the index case being admitted.

Details of the immediate response to the outbreak, including clinical surveillance and active surveillance in the village communities downstream, have been described elsewhere (9). The response resulted in the early detection and confirmation of cholera cases in Phiva village, located on the southern bank of the Lomati River immediately downstream from the point where the index patient was found. Prompt detection allowed for urgent deployment of control measures that averted a larger outbreak, and only 19 additional cases were detected.

During the two-year period under review, an additional five cholera cases, of which four had been exposed to infection in Mozambique, were detected by three public hospitals and one private hospital in Mpumalanga. Rapid notification by infection control nurses in three cases, and by a specialist physician and the laboratory in the remaining cases, allowed appropriate institutional and community measures to be implemented, and no secondary cases occurred.

### Meningococcal disease

Fourteen cases of meningococcal disease were identified in Mpumalanga Province during the two-year period. All but one were notified to the provincial communicable disease control unit within 48 hours. The remaining patient was a coal miner treated in a hospital at the mine; the treating physician notified the National Department of Health after four days. An inquiry found that adequate control measures had been implemented in six of the eight cases detected in 1998 and in all six of the cases in 1999.

### Zero reporting

The completeness of the submission of weekly zero reports steadily increased during the first year after implementation. Reporting increased from an average of 24 (75%) of hospitals providing completed zero reports before the designated time in the first quarter of 1998 to 32 (100%) hospitals providing timely reports by the end of the first quarter of 1999. During the first quarter of 1998, 12 (38%) hospitals provided less than 80% of their reports on time, whereas by the end of that year all reports were received by the designated time. Complete and timely reporting was sustained throughout 1999.

**Box 1. Syndromes designated for immediate reporting and response by hospital-based infection control nurses in Mpumalanga Province, South Africa**

Clinical syndrome	Case definition
• Acute flaccid paralysis (poliomyelitis)	• Any case of acute flaccid paralysis, including Guillain–Barré syndrome, in a child <15 years of age for which no other cause is apparent or a patient of any age diagnosed as having poliomyelitis by a medical officer
• Profuse watery diarrhoea (cholera)	• Sudden onset of profuse, painless, watery stools with rapid dehydration in a patient $\geq 5$ years of age
• Diarrhoea outbreak	• More than 10 cases of diarrhoea that can be linked by place, person, and time
• Dysentery outbreak	• More than 10 cases of diarrhoea with visible blood in the stool that can be linked by place, person, and time
• Measles	• Acute onset of febrile disease with non-blistering, generalized skin rash and either coryza, conjunctivitis, or cough
• Meningococcal disease	• Sudden onset of fever, intense headache, and stiff neck with or without a petechial rash
• Plague	• A febrile disease with suppurative lymph glands in the groin
• Viral haemorrhagic fevers	• Acute onset of febrile disease with haemorrhaging from skin and mucosal tissue
• Yellow fever	• A viral haemorrhagic fever accompanied by jaundice

### Review of hospital records on acute flaccid paralysis

Despite an increase in the detection of acute flaccid paralysis, only 7 of the 11 cases expected for 1998 were detected using the new system. To investigate this apparently low reporting rate a detailed review of records was conducted in each hospital during the last quarter of 1998 by a team led by the provincial surveillance officer, with external audit provided by officials from the national Expanded Programme on Immunization (EPI). The review identified 41 cases in which EPI keywords indicative of a possible diagnosis of acute flaccid paralysis were present in the diagnosis made at admission during the preceding 20 months (January 1997 to August 1998 inclusive).

Six cases meeting the case definition for acute flaccid paralysis that were not reported by the infection control nurse surveillance system were detected during the review of admission histories and clinical notes. Two of these cases did not qualify for notification: in one child the weakness was due to a pathological fracture of the humerus and the other child had signs of raised intracranial pressure. Two

cases of Guillain–Barré syndrome were missed during 1997 when the reporting system was not in place. The two cases missed during 1998 had complicating circumstances that made it difficult to apply the case definition. One was a case of transient post-ictal paralysis occurring after a generalized seizure in a patient known to have epilepsy, and the admission diagnosis in the remaining case was suspected Perthes disease.

Opportunistic reviews for missed cases of acute flaccid paralysis were conducted in hospitals throughout Mpumalanga during October and November 1999 to review admissions notes from 1 January 1999 to the date of the visit, and no missed cases were found (10).

### Discussion

The primary goal of an outbreak surveillance system is to ensure timely recognition of syndromes requiring an immediate response (11, 12). Although a belated response to an outbreak may have some value — in delineating strategies to prevent future outbreaks, providing additional insights into a specific disease, evaluating existing prevention strategies, teaching epidemiology, or addressing public concerns — surveillance without timely action may result in large numbers of additional cases, spread of disease, and allow for selection of more virulent pathogens (13, 14).

The performance of the surveillance system run by infection control nurses in containing outbreaks endorses its value, particularly if the recent history of cholera outbreaks in the area is considered. The introduction of cholera into the region in 1980 caused an estimated 30 000 cases, and in 1982 it resulted in an estimated 20 000 cases. Altogether, 3786 cases were confirmed by laboratory testing in 1980 and 7638 in 1982 (15). The absence of any proven secondary cases of meningococcal disease since the introduction of the surveillance system is also encouraging.

Sustainability is an important consideration. The monthly meetings of the team of infection control nurses for structured training (university accreditation is currently being sought), networking, and feedback is proving to be an important mechanism in ensuring sustainability. This approach also addresses the shortcoming highlighted by critical appraisal of the notification system — that is, health workers' reporting of notifiable conditions had in the past been affected negatively by the lack of feedback on the actions that had been taken as a result of their notification (8).

Zero reporting is the key element that shows that the surveillance system is active. The high levels of reporting over an extended period are heartening, providing a further indication of the sustainability of the system.

Our approach shares some characteristics with one recently used in the North Arcot district in Tamil

Nadu, India (16). The system there combined government and private sectors in enrolling every hospital, used sentinel laboratory surveillance and simple posted notification forms, and also used defined responses and regular feedback. Features shared by the two systems include the use of a limited list of priority conditions, syndromic case definitions, an action-oriented focus, and a mechanism for providing regular feedback to those who generated the surveillance data.

The non-specific nature of the clinical syndromes that characterize certain important infectious diseases makes it imperative that laboratory reporting is included as a key element of a functional surveillance system (17). Although this is not unusual in many other countries, it is a new concept in South Africa. Since January 1998 local public and private laboratories have been required to report the identification of designated pathogens to the provincial communicable disease control unit in Mpumalanga, and the cooperation of the laboratories has been excellent.

The expansion of the role of infection control nurses into surveillance has not been difficult to achieve. Surveillance of nosocomial infections and maintaining close contact with the laboratory, which is usually based in the same geographical location, are integral components of the routine functions of the infection control nurses. Most of the syndromes chosen for surveillance require specific infection control measures, and so nurses will be consulted and thus learn promptly of patients suspected of having notifiable diseases. The calm and determined approach that characterizes many of these nurses makes them ideal for performing the outbreak surveillance function.

The hospital-centred, syndromic approach that focuses on a limited number of important conditions has its weaknesses. The case definition of the syndromes has a high sensitivity and relatively low specificity despite the attendant commitment of resources for establishing a definitive diagnosis. This approach is justified if it is balanced against the public health importance of preventing the spread of the chosen conditions. The focus of the surveillance system on the hospital clearly results in a "tip of the iceberg" phenomenon. This is particularly obvious for measles, one of the conditions selected for surveillance, since very few cases of measles require hospital consultation or admission. However, for the majority of the remaining syndromes the severity or nature of the condition will lead to hospitalization.

Although the serious state of dysfunction of many public health surveillance systems has been attributed to dwindling health resources, it may also, at least in part, be blamed on the inflexibility of health systems, particularly those with a legislative basis, and the use of surveillance systems that are not action-oriented (18, 19).

In areas similar to Mpumalanga, the potential role of infection control nurses in hospitals as pivotal agents in the surveillance cycle should be exploited to provide timely "data for action". ■

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## Résumé

### Participation des infirmières hospitalières à la surveillance du risque de flambées épidémiques

**Objectif** Étudier un système de surveillance novateur dans la Province de Mpumalanga, zone rurale du nord-est de l'Afrique du Sud, pour chercher à remédier aux faiblesses du système sud-africain de notification des maladies infectieuses susceptibles d'être à l'origine de flambées épidémiques.

**Méthodes** Les infirmières associées à la lutte contre les maladies infectieuses dans les 32 hôpitaux publics et privés de Mpumalanga ont appris à reconnaître, déclarer et soigner neuf syndromes cliniques nécessitant des mesures urgentes. Pour assurer la pérennité du système, des cours réguliers et un maillage ont été programmés, et des informations sur les résultats obtenus ont été communiquées aux infirmières. L'évaluation du système a consisté en un examen minutieux des dossiers des hôpitaux et des données établissant la maîtrise effective d'une flambée de choléra, et en une évaluation de la rapidité et de la pertinence des mesures prises pour les autres syndromes.

**Résultats** Le dépistage, la notification et le traitement rapides de six cas de choléra importés a effectivement permis d'endiguer la flambée, 19 cas secondaires avérés de choléra seulement ayant été enregistrés pendant les deux années considérées. Aucun cas secondaire n'a été enregistré après le dépistage et le traitement rapide de 14 cas de méningococcies. Au terme de la première année de mise en œuvre, tous les établissements soumettaient des rapports hebdomadaires de notification zéro pour les neuf syndromes avant la date fixée. L'examen minutieux des dossiers des hôpitaux concernant les cas de paralysie flasque aiguë a établi l'utilité du système.

**Conclusion** Le principal objectif d'un système de surveillance des flambées épidémiques est d'assurer la reconnaissance en temps opportun des syndromes nécessitant des mesures immédiates. Les infirmières associées à la lutte contre les maladies infectieuses dans les hôpitaux de Mpumalanga ont accompli leurs tâches

de façon remarquable : présentation en temps opportun de rapports de notification zéro, participation à des séances mensuelles de formation et de communication des résultats, dépistage des syndromes cliniques prioritaires et application sans délai des mesures

nécessaires. Cet examen confirme que les infirmières hospitalières, en fournissant en temps opportun les données qui permettent de prendre les mesures voulues, sont de précieux agents de surveillance sentinelle.

## Resumen

### Participación de las enfermeras de hospital en la vigilancia de posibles brotes de enfermedades

**Objetivo** Estudiar un nuevo sistema de vigilancia introducido en la provincia de Mpumalanga, una zona rural del noreste de Sudáfrica, a fin de subsanar las deficiencias del sistema de notificación de las enfermedades infecciosas que encierran un alto riesgo de brotes.

**Métodos** Se capacitó a una serie de enfermeras de control nosocomial de infecciones de los 32 hospitales de Mpumalanga, públicos y privados, para que reconocieran y notificasen los casos de nueve síndromes clínicos que requieren medidas inmediatas, y para responder adecuadamente a los mismos. La sostenibilidad del sistema se aseguró implantando un programa de capacitación e interrelación regulares y proporcionando retroinformación a las enfermeras. El sistema se evaluó examinando formalmente las historias clínicas, analizando la eficacia de la contención de los brotes de cólera, y determinando la rapidez e idoneidad de las respuestas a otros síndromes.

**Resultados** La rápida detección y notificación de seis casos de cólera importados y la pronta respuesta a los mismos se tradujo en una contención eficaz, pues sólo se registraron 19 casos secundarios de cólera durante el periodo de examen de dos años. No se produjeron casos

secundarios tras la detección de 14 pacientes con infecciones meningocócicas y la rápida instauración consiguiente de tratamiento. Al término del primer año de aplicación, todos los servicios suministraban los informes de declaración de cero casos sobre los nueve síndromes dentro de los plazos establecidos. El estudio formal de las historias clínicas con miras a localizar los casos de parálisis flácida aguda potenció la utilidad del sistema.

**Conclusión** El objetivo principal de un sistema de vigilancia de brotes es asegurar que se reconozcan prontamente los síndromes que requieren una respuesta inmediata. Las enfermeras de control nosocomial de las infecciones de Mpumalanga se han distinguido por la puntual notificación cero semanal conseguida, por su participación en las reuniones mensuales de formación y retroinformación y por su capacidad para detectar los síndromes clínicos prioritarios y para responder rápida y eficazmente a ellos. El análisis aquí efectuado respalda el papel desempeñado por las enfermeras de hospital como valiosos agentes de vigilancia centinela capaces de suministrar prontamente datos para la acción.

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