ORIGINAL ARTICLE

A pragmatic approach to timely disease surveillance in the emergency department

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Background: Computerised emergency department (ED) logs have been in use for more than 20 years. Despite this, public health authorities have failed to fully utilise this important surveillance tool.

Setting: Alice Ho Miu Ling Nethersole Hospital (AHNH) is a 500 bed community hospital with ED attendance of 350–400 patients a day in Hong Kong.

Intervention: After the introduction of an ED computerised management system across Hong Kong in 1997, AHNH monitored common presentations using standard statistical software. Deviations from average attendance frequency were reported to public authorities. Experience during 1999 and 2000 calendar years is reported.

Results: Apart from the usual seasonal variation in presentations such as respiratory tract infection and gastroenteritis, specific public health interventions appeared warranted in presentations related to dog bites, bee stings, rubella, hand foot and mouth, chicken pox, and scooter injuries.

Discussion: ED computer information systems should be an effective tool for disease surveillance. In communities where this is not the case, public health authorities should insist on timely access and reporting of ED attendance data.

Computerisation of emergency department (ED) attendance records has the potential to permit disease surveillance and rapid intervention by public health authorities. Computerised ED logs were introduced more than 20 years ago.^{1–3} Implementation has been slow across the emergency system and even when computerisation has occurred, the full potential has not been recognised. EDs complain that they have large numbers of patients, poor staffing, and frequently underdeveloped software and hardware. A number of EDs and regions have reported selective retrospective analysis of specific issues, for example injury surveillance^{4–12} and respiratory disease.¹³ This form of analysis requires considerable human resource and usually occurs months or even years after the patient attendance. The analyses often target a specific problem and sample a small number of hospitals. Preferably a surveillance system would alert authorities to trends or changes in disease patterns as they occur.

This report describes the successful implementation of a computerised ED clinical information system that permits timely and responsive intervention as potential public health issues arise.

METHODS

Setting

Alice Ho Miu Ling Nethersole Hospital (AHNH) is a 500 bed community hospital in the New Territories, Hong Kong, which opened in 1997. It serves a population of about 300 000 and has a daily ED census of 350–400 per day. There are a significant number of minor cases because of the under developed primary care network in Hong Kong.

Computer system

The ED computer system used in Hong Kong has been locally developed by the hospital authority. This system was first introduced in 1993 to Prince of Wales Hospital and a new module was added in 1997 (Clinical Management System). This new module was piloted in the AHNH. The new version included capturing of diagnosis coding, medication order, and specialty information. Bar code* technology was used for patient identification. The clinical data, including the scanned

patient medical record can be shared in 4000 clinical workstations in all public hospitals in Hong Kong through intranet technology.

Data input

Demographic data input is by clerical staff. Specific data like triage time, waiting time, discharge time, discharge destination, and other clinical data are captured by nursing staff. Doctors are responsible for capturing of diagnosis coding in International Classification of Disease version 9 (ICD-9) format, discharge medication, and discharge summary. Patient identification is helped by the use of Hong Kong Identity Card number (HKID), which is compulsory and unique for every patient in Hong Kong. Patient selection is done by the use of bar code scanning of the patient labels. Training sessions are organised to help the data quality. Moreover, about 100 common diagnosis codes for ED are grouped together in the computer program so as to facilitate data input from doctors. The doctors have over 99% compliance with diagnosis coding and this is closely monitored.

Intervention

Using standard database software, data were extracted from the ED database and arranged in a table according to the diagnostic groupings. Common and sentinel diagnosis were tracked over time. Average monthly attendance figures were calculated and when there was a greater than two standard deviation variance, a computer generated report was sent to key personnel (ED director and hospital authority officials) for necessary action.

Resources

The hardware consisted of a Pentium 300MHz IBM (computers developed by International Business Machines Corporation) compatible personal computer with 64M RAM and 10G

*Alphabet/number are represented by a pattern of wide and narrow bars. Barcode scanner can translate this pattern back to alphabet/number.

Figure 1 Attendance of upper respiratory tract infections in AHNH. AVG, average number of upper respiratory tract infections in 2000. +1 SD, 1 standard deviation more than average number in 2000. -1 SD, 1 standard deviation less than average number in 2000.

hard disk, a black and white laser printer was used to print the reports. The system software was Microsoft Windows 98. Microsoft Visual Fox-pro version 6.0 (database engine developed by Microsoft Corporation) was the application software for database engine and program development. The computer program written in Fox-pro language was developed by the researcher for grouping, sorting, and counting of the diagnosis coding in the database file. The final processed data file was imported into the software Microsoft Excel for calculation and graphical representation of the data.

RESULTS

Over the two year period 1999–2000, there was constant monitoring of common disease groups. The top two attendances for AHNH ED were upper respiratory infection and gastroenteritis and significant seasonal variation occurred in these disease groups (figs 1 and 2). As expected, upper respiratory tract infections incidence rose during winter and fell over summer. Gastroenteritis had a bimodal peak that corresponded to the summer holiday and winter periods. There are many potential reasons for this, however there are some customs that may contribute. People in Hong Kong tend to buy foods (especially cold drink with ice and chips) from illegal hawkers in the street during the summer time. In winter, people like to eat a “hot-pot” dinner, consisting of a pot of boiling soup and the whole family gathers around this hot-pot

Figure 2 Attendance of gastroenteritis in AHNH. AVG, average number of gastroenteritis in 2000. +1 SD, 1 standard deviation more than average number in 2000. -1 SD, 1 standard deviation less than average number in 2000.

Figure 3 Attendance of dog bites in AHNH. AVG, average number of dog bites in 2000. +1 SD, 1 standard deviation more than average number in 2000. -1 SD, 1 standard deviation less than average number in 2000.

for dinner. The raw meat is cooked by dipping into the boiling soup for one to two minutes. Sometimes the meat is not thoroughly cooked before consumption.

There were several disease groups where public health interventions seemed warranted. It was observed that dog bites increased over a period of months (fig 3). In Hong Kong, bites are usually secondary to stray dogs. Civil authorities were informed and a campaign to round up stray dogs was implemented. After this, a large decrease in dog bites was noted. Bee stings were another example where intervention was warranted. In summer there is an increase in bee stings and our monitoring alerted civil authorities. A campaign to destroy excess hives was undertaken. The problem was controlled (fig 4), however a rise in bee stings occurred again the following summer.

Common infectious diseases such as rubella, hand-foot-mouth disease, chicken pox, and so on were also closely monitored. There was a sudden increase in incidence of hand-foot-mouth disease and chicken pox in 1999 (fig 5) and rubella in 2000 (fig 6), health authorities and media were informed. The increase in awareness and health education given by the health authority possibly helped to control the spread of these infectious diseases.

The introduction of a new toy sometimes causes injuries to children. When scooters became very popular in Hong Kong, 24 cases were reported within a month in our ED. Scooter

Figure 4 Attendance of bee stings in AHNH. AVG, average number of bee stings in 2000. +1 SD, 1 standard deviation more than average number in 2000. -1 SD, 1 standard deviation less than average number in 2000.

Figure 5 Attendance of infectious diseases in AHNH in 1999. Chicken pox and hand-foot-mouth (HFM).

Figure 6 Attendance of rubella in AHNH in 2000.

Figure 7 Scooter injuries reported by a local newspaper.

injuries were expected as many children did not have proper training in controlling this device and many of them played with scooters in the shopping mall. The increase in the number of scooter injuries was reported to the local district board and was quickly brought to the attention of the media. Nearly all newspapers and television stations made this a

news headline (fig 7). Training classes were organised and playing with scooters in shopping malls was prohibited.

DISCUSSION

This report describes the contemporaneous audit of a computerised ED log for public health purposes using statistical variation in diagnostic categories to highlight potential targets for intervention. A number of specific examples of the usefulness of these data have been given. Given the time period of the surveillance system, it is not possible to be certain whether the intervention was effective or whether the decreased incidence was attributable to seasonal or other factors. The methodology described here is in its infancy, however it is a simple, cost effective approach that has obvious potential benefits.

The examples given of simple community problems, such as dog bites and bee stings, are comparatively minor in terms of overall morbidity and mortality. However, they do show the potential power of these data. Extremely common problems such as gastroenteritis and upper respiratory tract infections are important because of the number of work days lost and patient volume effects on the system. Whether it is possible to reduce attendances (and incidence of disease) for these common problems by public health interventions is open to question. It is probable that public health interventions could reduce the bimodal peaks for gastroenteritis, including education about food preparation and strict adherence to regulations by street vendors. Certainly, the electronic ED surveillance would give feedback as to the usefulness of such interventions. During the study time period, no such interventions were trialled. The high level of upper respiratory tract infections presentations reflects the low threshold among Hong Kong people for attending EDs for minor complaints. Probably the biggest impact on these presentations will occur with the introduction of charging for ED attendances in the near future. The high prevalence and "discretionary" element to whether a patient actually attends for this complaint would make studying the impact of influenza vaccination or other initiatives very difficult.

There has been extensive discussion regarding the potential utility of EDs for disease surveillance. This has mostly focused on injury prevention.⁴⁻¹² The advent of computerised logs of ED attendance offers enormous potential benefits but this does not seem to have been realised. Many of the extensive surveillance systems in the US, such as "Emergency ID Net"¹⁴ are separate from the routine data collection of the emergency information system. The slow implementation of full computerisation, lack of staff time and training in EDs, inferior computer hardware and software, large patient numbers have all led to unreliable data input. Public health authorities have regarded the information available with some scepticism and have usually insisted that the inaccuracies are too great to result in useful data. Therefore, additional data input from paid data collectors is usually requested.

In regions where useful information from computerised ED attendance records is not available, strategies to improve quality of data input should be implemented. These include functional ED software, sufficient hardware, incorporation of attendance record into daily workflow, efficiency benefits for clinicians, regular data audit and feedback.

All states in Australia now have computerised ED attendance records, similar to Hong Kong. This is also the case in most EDs in the UK. The data quality is variable and central collection and collation of data occurs months after the event. Some states such as Victoria, have used the data for injury surveillance and planning of specific interventions.¹⁵ However, there has not been more generic use of the data for system wide disease surveillance on an ongoing basis. This public health tool has been under utilised. ED staff may improve data accuracy if they are aware that data input is monitored on a daily basis and acted upon. Presently the ED staff view this as

an administrative tool with very little benefit for them or their patients in timely, accurate data input.

Although it was not fully utilised in this study period, the ED computer system in Hong Kong also has the capacity to track cases across Hong Kong because of the common and unique HKID and hospital authority intranet. Thus, for example, a sudden rise in respiratory cases across a number of hospitals may be identified earlier and the source can be traced. There is also the potential to monitor disaster victim location and status in disaster management—the Disaster Management Module. In order not to overload a single hospital during a disaster, medical diversion at the incident site is practised. That is, victims of different grades of severity will be sent to different hospitals for treatment according to hospital capacity. No matter which ED the victims go to, if they belong to the same disaster group, their data will be merged into a single file. Therefore a complete set of updated information about all victims in different hospitals can be retrieved which is very useful for overall disaster management.

This report shows that with minimal additional resource, very important public health information can be monitored. The data collected are routine for all EDs with computerised attendance records. Extracting the information into a standard statistical package permits immediate recognition of any significant change in disease pattern. Public health practitioners should insist on access to timely and reliable ED data to assist in public health surveillance.

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