Medical surveillance of multinational peacekeepers deployed in support of the United Nations Mission in Haiti, June–October 1995

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Background
Multinational peacekeepers, both military and civilian, often deploy to areas of the world where significant health threats are endemic and host country public health systems are inadequate. Medical surveillance of deployed personnel enables leaders to better direct health care resources to prevent and treat casualties. Over a 5-month period, June to October 1995, a medical surveillance system (MSS) was implemented in support of the United Nations Mission in Haiti (UNMIH). Information obtained from this system as well as lessons learned from its implementation and management may help decrease casualty rates during future multinational missions.

Methods
Over 90% of UNMIH personnel (80% military from over 11 countries and 20% civilian from over 70 countries) stationed throughout Haiti participated in the MSS. A weekly standardized reporting form included the number of new outpatient visits by disease and non-battle injury (DNBI) category and number of personnel supported by each participating UN medical treatment facility (MTF). Previously, medical reporting consisted of simple counts of patient visits without distinguishing between new and follow-up visits. Weekly incidence rates were determined and trends compared within and among reporting sites. The diagnoses and numbers of inpatient cases per week were only monitored at the 86th Combat Support Hospital, the facility with the most sophisticated level of health care available to UN personnel.

Results
The overall outpatient DNBI incidence rate ranged from 9.2% to 13% of supported UN personnel/week. Of the 14 outpatient diagnostic categories, the three categories consistently with the highest rates included orthopaedic/injury (1.6–2.5%), dermatology (1.3–2.2%), and respiratory (0.9–2.2%) of supported UN personnel/week. The most common inpatient discharge diagnoses included suspected dengue fever (22.3%), gastro-enteritis (15%), and other febrile illness (13.5%). Of the 249 patients who presented with a febrile illness, 79 (32%) had serological evidence of recent dengue infection. Surveillance results helped lead to interventions that addressed issues related to field sanitation, potable water, food preparation and vector control.

Conclusions
Despite hurdles associated with distance, language, and communications, the MSS was a practical and effective tool for UNMIH force protection. UN requirements for standardized medical surveillance during deployments should be...
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Materials and Methods

Background

The UNMIH began in March 1995 after a US-led multinational force (MNF) helped to return President Aristide to office in Haiti 6 months earlier. As described in UN Security Council Resolution No. 940, the UNMIH’s mandate was ‘to assist the democratic government of Haiti in fulfilling its responsibilities in connection with sustaining a secure and stable environment, protecting international personnel and key installations, the professionalization of the Haitian Armed Forces, the creation of a separate police force, and the establishment of an environment conducive to the organization of free and fair elections.’

To accomplish these objectives, UNMIH personnel were strategically located throughout Haiti.

From June to October 1995, the UNMIH force was comprised of military contingents from 11 countries as well as civilians from over 70 countries. Approximately 80% of the 8000 UNMIH personnel were military, predominantly from Bangladesh, Canada, Caricom nations (Caribbean Community and Common Market e.g. Antigua and Barbuda, the Bahamas, Barbados, Belize, Guyana, Jamaica, and Trinidad and Tobago), Djibouti, Guatemala, Honduras, India, Nepal, the Netherlands, Pakistan and the US. The remaining personnel (20%) were civilians who worked with local law enforcement, as human rights monitors, or in UN administrative positions. UNMIH forces were primarily stationed in the capital, Port-au-Prince, and in Haiti’s other major cities. Living conditions differed among UNMIH personnel, as military units typically lived in contingent-specific camps while civilians lived in local Haitian neighbourhoods.

A health threat assessment of Haiti and the common causes of morbidity during deployments were incorporated in UNMIH health support plans and policies. For example, UN vaccination policy required that prior to deployment, the vaccination records of all incoming personnel were checked for, and if indicated, individuals were vaccinated against hepatitis B, tetanus, typhoid fever, poliomyelitis and yellow fever. Administration of immunoglobulin or vaccine to prevent hepatitis A was mandatory. Personnel were given weekly prophylaxis (chloroquine) against malaria. UNMIH guidelines to prevent casualties due to dengue, diarrhoea, HIV and other infectious diseases, as well as heat and other conditions, were distributed to commanders and supervisors for dissemination.

Three levels of health care support were available to UNMIH personnel. The US Army’s 86th Combat Support Hospital (CSH) from Fort Campbell, Kentucky, provided Level III care in Port-au-Prince. A Level III medical treatment facility (MTF) can provide evaluation (e.g. laboratory, radiology) and treatment services beyond the two echelons of care below it; specifically,

Keywords

Medical surveillance, international health, Haiti, United Nations’ peacekeepers, military medicine

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Peacekeeping missions involve the deployment of multinational military and civilian personnel to areas of the world where community life has been seriously disrupted. As local communities stabilize and recover, foreign peacekeepers must adjust to new surroundings where concomitant health risks (e.g. civil unrest, infectious agents and environmental hazards) are often beyond those encountered by the ordinary traveller. In these settings, effective casualty prevention and treatment services are vital components of mission success.

Active medical surveillance can provide commanders with evidence-based health information for force protection. Surveillance is ‘the ongoing systematic collection, analysis, and interpretation of health data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those who need to know. The final link in the surveillance chain is the application of these data to prevention and control. A surveillance system includes a functional capacity for data collection, analysis, and dissemination linked to public health programs.’

Although military contingents from different countries typically monitor the health of their own troops, different data elements and data collection methods during multinational field operations make overall analysis and interpretation of surveillance data difficult. A standardized medical surveillance system (MSS) during multinational field operations is a practical necessity. With such an MSS, morbidity experience can be more accurately monitored and compared over time within a contingent, among different contingents, or with other similarly deployed forces.

Current medical reporting requirements of the United Nations (UN), which has experience in leading 38 peacekeeping operations over the last 50 years, include a monthly count of the number of personnel treated per field location by set diagnostic category. Routine counts may be sufficient for planning and managing health care services, but the collection of both the number of personnel treated per field location by set diagnostic category. Routine counts may be sufficient for planning and managing health care services, but the collection of both the number of personnel treated per field location by set diagnostic category. Routine counts may be sufficient for planning and managing health care services, but the collection of both

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developed and implemented. Furthermore, planners should recognize that if ongoing medical surveillance and related responses are to be effective, personnel should be trained prior to deployment and resources dedicated to a sustained effort in theatre.
up to 30 days of inpatient care as well as multi-specialty care in the areas of resuscitative surgery, anesthesiology and intensive care. Additional US Army detachments (e.g. medical logistics, combat stress control, preventive medicine and veterinary medicine) formed a task force with the 86th CSH to support all UNMIH MTF in Haiti. The US also staffed Level II MTF (sick call and 72-hour hold) at three sites distant from the capital. Each military contingent was responsible for operating its own Level I MTF (sick call and 24-hour hold). UNMIH personnel were instructed to seek care at the nearest MTF. Patients who required more sophisticated care were referred to the next appropriate level of care and patients who needed care beyond Level III capabilities were evacuated by air to a medical centre in Miami, Florida. Several local Haitian physicians were contracted to provide specialty consultations (e.g. ophthalmology and radiology). UNMIH peacekeepers that were no longer medically fit to perform their duties were repatriated to their home country.

The UNMIH Medical Surveillance System

The UNMIH MSS implemented by 86th CSH staff was in accordance with deployment surveillance guidelines issued by the US military’s Joint Chiefs of Staff. Although the MSS had been initiated soon after the US-led MNF entered Haiti in 1994, there was a break in its operation during the first 3 months of the UNMIH (March to May 1995). The Commander of the 86th CSH, who also served as the UNMIH’s Senior Medical Officer, strongly believed in the value of deployment medical surveillance and directed the system’s use by all UNMIH MTF. The 86th CSH’s preventive medicine officer was responsible for the surveillance system’s re-introduction and operation. Senior contingent health care staffs were presented with an overview of MSS and discussions were held regarding its contingent-specific implementation. For example, several contingents operated more than one Level I MTF; in these cases, one MTF was assigned responsibility for collecting and forwarding the entire contingent’s surveillance data. In almost all cases, MTF only had to make minor changes in their current medical surveillance practices to use the MSS.

Each contingent received a set of surveillance materials consisting of a daily patient (‘sick call’) log form, a weekly surveillance table divided by diagnostic categories and days of the week, and a disease and non-battle injury (DNBI) general information sheet. Health care providers were instructed to determine each patient’s diagnostic category based on the clinical evaluation at the end of the first encounter and to ignore diagnostic classifications based on the chief complaint. The outpatient diagnostic categories used for standardized, weekly reporting are shown in Table 1. To help minimize diagnostic misclassification, definitions for each diagnostic category were listed on the weekly surveillance form for quick reference by providers.

Each MTF designated staff who were responsible for extracting DNBI visits from the daily log form, grouping visits by day of the week and diagnostic categories, and totalling them weekly. Only the first patient visit with a new diagnosis was counted to avoid double counting. Referrals and subsequent patient visits were all recorded as follow-up visits. In addition, the weekly surveillance table contained space for listing reportable diseases that were required by the UN. The reporting week started each Sunday and ended the following Saturday. Each contingent’s weekly surveillance table was forwarded to the preventive medical officer in Port-au-Prince within the first 2 days of the new reporting week. A summary force surveillance report was returned to each contingent a few days later.

Most contingents were not accustomed to calculating incidence rates for diagnostic categories. Therefore, MSS training emphasized specifying initial versus repeat or follow-up patient

Table 1 Medical Surveillance System Diagnostic Categories—UNMIH (June–October, 1995)

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
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<tbody>
<tr>
<td>Heat injury</td>
<td>Any heat-related symptoms requiring treatment. Includes dehydration, heat cramps, heat exhaustion, heat stroke and sunburn.</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>Includes acute gastro-enteritis and dysentery. Focuses on infectious causes of diarrhoea.</td>
</tr>
<tr>
<td>Other gastro-intestinal (GI)</td>
<td>Includes nausea/vomiting without diarrhoea, GI bleeding, hemorrhoids, ulcers, constipation, oesophagitis and other non-infectious diagnoses related to the gastrointestinal tract.</td>
</tr>
<tr>
<td>Dermatological</td>
<td>All skin conditions presenting for medical evaluation. Includes fungal or bacterial infections, cellulitis, heat rash, blisters, dermatitis caused by inflamed insect bites. Includes hair and nail problems (ingrown toenails).</td>
</tr>
<tr>
<td>Respiratory</td>
<td>All upper and lower respiratory complaints. Includes URI, pharyngitis, rhinitis, allergic rhinitis, bronchitis, pneumonia, cough, bronchospasms, wheezing, asthma, and any other allergic or infectious respiratory complaint. Also includes secondary complications of respiratory symptoms, such as otitis media and sinusitis.</td>
</tr>
<tr>
<td>Unexplained fever</td>
<td>Temperature of 100.5°F or greater, or history of chills and fever without other associated illness (such as fever with dysentery, which would be classified as GI). This category is an initial screening method for malaria, dengue fever, etc.</td>
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<tr>
<td>Sexually transmitted diseases</td>
<td>Includes chlamydia, genital herpes, pelvic inflammatory disease and venereal warts.</td>
</tr>
<tr>
<td>Substance abuse</td>
<td>Abuse of alcohol, illegal drugs including marijuana, medication.</td>
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<tr>
<td>Other medical condition</td>
<td>Additional non-trauma problems such as chest pain, hypertension; headaches, convulsions, syncope, hepatitis; urogenital illnesses not associated with sexually transmitted disease; internal conditions (e.g. rule out appendicitis), chicken pox, pregnancy.</td>
</tr>
<tr>
<td>Orthopaedic/injury</td>
<td>All musculoskeletal and soft tissue complaints. Includes fractures, sprains, lacerations, abrasions, contusions, dislocations, muscle pulls, and closed head injury or other acute injuries (except eye injury). Also includes chronic musculoskeletal conditions such as tendinitis, bursitis and sciatica.</td>
</tr>
<tr>
<td>Bites/stings</td>
<td>All bites, stings or envenomation by animals. Does not include inflamed insect bites, but does include bee and scorpion stings.</td>
</tr>
<tr>
<td>Ophthalmic</td>
<td>Conjunctivitis, corneal abrasions, foreign bodies, solar/laser eye trauma.</td>
</tr>
<tr>
<td>Dental</td>
<td>Dental injury, disease or condition requiring care by a dentist.</td>
</tr>
<tr>
<td>Psychiatric</td>
<td>Depression, situational reactions, anxiety, neuroses, psychotic reactions, suicide attempt.</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>All other complaints presenting to sick call not fitting above categories, including prescription refills, physical exams, shaving profile, lab tests and follow-up visits.</td>
</tr>
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</table>
visits by diagnostic category and accurately quantifying the weekly average population served by each MTF. For Level II and III MTF with area support responsibilities, all units that were supported for ‘sick call’ were considered supported units for DNBI reporting purposes. Several contingents found incidence rates useful and began incorporating them into their own command health report (along with a copy of the weekly UNMIH surveillance report).

Inpatient information (e.g. discharge diagnosis and length of inpatient stay) was collected only for the 86th CSH since it was the sole Level III MTF in the theatre and patients who needed more complex inpatient evaluation or treatment beyond 1–3 days were always referred to it. In addition, a standard protocol for evaluating patients presenting to the 86th CSH with febrile illness was initiated based on the MNF’s experience with dengue infections.18,19 Serum specimens from these patients were transported from Haiti to laboratories in the US for dengue serological testing.20

**Results**

With up to 20 MTF reporting, the overall average UNMIH outpatient DNBI weekly incidence rate was 11.3% (range: 9.2–13.0%) of supported UN personnel/week over the 19 weeks of data collection (Figure 1). Incidence rates varied by contingent and location. For example, the overall average weekly incidence rate was 3.0% (range: 2.0–4.5%) for the Bangladesh contingent, 14.0% (range: 5.2–24.2%) for the Netherlands contingent, and 24.1% (range: 17.1–36.0%) for the 86th CSH. No temporal association was identified between a contingent’s overall incidence rates and the arrival of new personnel in Haiti.

Of the 14 outpatient diagnostic categories, the three with consistently highest average incidence rates were orthopaedic/injury, 1.9% (range: 1.6–2.5%); dermatology, 1.9% (range: 1.3–2.2%); and respiratory, 1.8% (range: 0.9–2.2%). The average weekly incidence rate for dental was 1.7% (range: 0.8–3.0%) and for diarrhoea, 0.9% (range: 0.6–1.4%). No visits for substance abuse were reported.

Of the 374 hospitalizations at the 86th CSH, the most common discharge diagnostic category (Table 2) was non-localized febrile illness, which included suspected dengue fever (22.3%).

![Figure 1 UNMIH weekly United Nations Mission in Haiti outpatient surveillance data, 11 June to 21 October 1995](image)

**Table 2** Total number of discharge diagnoses (n = 374) by category from the 86th Combat Support Hospital, United Nations Mission in Haiti, June to October, 1995

<table>
<thead>
<tr>
<th>Discharge Diagnostic Category</th>
<th>Total (%)</th>
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<tbody>
<tr>
<td>1. Non-localized febrile illness</td>
<td>134 (35.8)</td>
</tr>
<tr>
<td>2. Gastro-enteritis/diarrhoea (with/without fever)</td>
<td>56 (15.0)</td>
</tr>
<tr>
<td>3. Abdominal pain/surgery</td>
<td>24 (6.4)</td>
</tr>
<tr>
<td>4. Dental/oral</td>
<td>23 (6.1)</td>
</tr>
<tr>
<td>5. Orthopaedic</td>
<td>23 (6.1)</td>
</tr>
<tr>
<td>6. Skin/soft tissue infections</td>
<td>16 (4.3)</td>
</tr>
<tr>
<td>7. Pneumonia/bronchitis/sinusitis</td>
<td>11 (2.9)</td>
</tr>
<tr>
<td>8. Back/neck strain</td>
<td>9 (2.4)</td>
</tr>
<tr>
<td>9. Contusions</td>
<td>7 (1.9)</td>
</tr>
<tr>
<td>10. Gastro-intestinal bleed</td>
<td>6 (1.6)</td>
</tr>
<tr>
<td>11. Psychiatric</td>
<td>6 (1.6)</td>
</tr>
<tr>
<td>12. Urinary tract infections</td>
<td>4 (1.1)</td>
</tr>
<tr>
<td>13. Head injury</td>
<td>3 (0.8)</td>
</tr>
<tr>
<td>14. Other</td>
<td>52 (13.9)</td>
</tr>
</tbody>
</table>
and other febrile illnesses (13.5%). Gastro-enteritis accounted for 15% of discharge diagnoses. Examples of less common diagnoses included four patients with malaria (sensitive to chloroquine), four patients with acute hepatitis E virus infection, and one patient with an acute myocardial infarction. The duration of hospitalization averaged less than 5 days. The hospital's laboratory identified several clinically-important antibiotic-resistant diarrhoeal and urinary pathogens.22

Seventy-nine (32%) of 249 patients who presented to the 86th CSH with a febrile illness had serological evidence of recent dengue infection by demonstration of IgM.20,23 There was a higher percentage of cases among UNMIH civilians (38 cases, 3% of civilians) compared to military personnel (41 cases, 1% of soldiers). UNMIH civilians primarily lived in local Haitian communities without vector control services while most military personnel lived in contingent-specific garrison-like environments with vector control services available. Seventeen countries had at least one case of dengue and the greatest number of cases by country included: the US (20), Jordan (10), Pakistan (7), Nepal (7), Bangladesh (6), Canada (6) and France (5).

Forty-four (56%) of the patients with serologically-confirmed recent dengue infections completed a written questionnaire about their use of personal protection measures such as topical and clothing insect repellents, or bed nets to prevent insect bites. Thirty-two (73%) respondents reported insect bites daily or almost daily. Approximately half reported the use of insect repellents less than once per week or never, and a similar proportion indicated a lack of supervisor emphasis on the use of personal protection measures to prevent disease and nuisance bites.

Discussion

The experience of over 90% of deployed UNMIH personnel was captured by the UNMIH MSS within 3 weeks of its re-introduction. This level of compliance was possible because of the relative simplicity and practicality of the MSS itself and the support of senior health care personnel. Weekly force surveillance reports including results, interpretations, and suggestions for action were distributed not only to commanders and supervisors but also to those generating the raw data. Direct personal contact was made with specific reporting sites to discuss worry disease trends or rare events, and possible related actions. Despite successive weeks of relatively stable findings, interest in and contributions to the MSS remained strong. Fortunately, the smooth operation of the MSS was not tested in a more combative environment.

An average of 11.3% of UNMIH personnel presented to a MTF for a new condition each week. A similarly composed UN force, which was deployed for approximately one year to Namibia (1989),24 had an overall average incidence rate of 3.5 visits per person-year; by comparison, the rate for the UNMIH force was 5.9 visits per person-year or 70% higher. The difference in these rates is not too surprising, since even within the same force, DNBI rates often vary considerably due to factors such as geographical location, type of operation, time of year, and accessibility of medical services. Still, reasons for the relatively high overall average UNMIH incidence rate should be clarified. For example, the health screening and pre-deployment preparations among some of the contingents was undoubtedly inadequate,25 even though military and civilian personnel were expected to meet set health and fitness standards. Easy access to free MTF during a lengthy but stable UNMIH deployment may also have contributed to new patient visits. Since personal identifiers were not collected as part of MSS, there was no practical way to identify subgroups of patients who may have accounted for excessive MTF visits. Follow-up visits and miscellaneous visits (e.g. vaccinations, prescription refills and simple inquiries) were not included in the calculation of UNMIH incidence rates and therefore could not have artificially inflated the average. Further understanding of these issues should be incorporated into the medical planning of future multinational deployments.

The relatively high incidence rates associated with orthopaedic/injury, dermatology, and respiratory conditions reflected findings from other military deployments.26–30 Injuries due to exercise and sports activities accounted for the majority of visits in the orthopaedic/injury category. Outpatient visits for respiratory diseases were relatively low during the surveillance period which did not include the usually higher risk winter months. Although sporadic outbreaks of diarrhoea occurred, overall diarrhoeal rates were low, perhaps because of effective preventive medicine measures.31,32 The relatively high rate of dental visits reflected the availability of routine dental care for all UNMIH personnel; dental care was not restricted to emergency treatment only.33

The use of broad diagnostic categories such as ‘other medical condition’ was perhaps too vague and could have resulted in the loss of interesting or important information. For instance, 86th CSH staff treated 13 male soldiers who presented with prostatodynia,34 a chronic urologic problem that is often very difficult to resolve, and there were four cases of acute hepatitis E virus infection (also classified as an ‘other medical condition’) among peacekeepers.21 In response to the later finding, UNMIH medical personnel conducted a serosurvey of 981 UNMIH peacekeepers and Haitian civilians to estimate prevalences and susceptibilities to hepatitis E infections among them.35

The MSS helped to stimulate timely public health actions. For example, the identification of several clusters of troops with dengue infections led contingent and force preventive medicine personnel to apply area insecticides and initiate mosquito breeding control measures in specific locations. The use of personal protection measures such as insect repellents and bed nets were further emphasized. Another example involved the contamination of bottled water supplies, which was thought to be the likely cause of an outbreak of diarrhoea (80 cases over one month, 9.4% of troops affected) among a UNMIH contingent in northern Haiti. The contaminating was using bottled water supplies that had not been tested or approved by UN preventive medicine personnel. The incidence of diarrhoea was closely monitored as bottled water samples at the site of the outbreak were frequently tested and more frequent inspections of the water bottling plant (in Port-au-Prince) were conducted. Additional training of dining hall personnel and availability of cleaning supplies to help improve sanitation at the contingent’s dining facilities may have also contributed to a decrease in the diarrhoea incidence rate to an acceptable baseline.36

No specific action levels were established to trigger further investigation of specific DNBI incidence rates or trends that were of particular concern. For example, a weekly diarrhoea
incidence rate above 0.2% might be set to initiate further investigation. Consideration should be given to the development of consistent methods for the interpretation of surveillance data and the initiation of directed responses including the institutionalization of epidemiological investigative capability.

With full command support, the UN should develop and implement standardized active medical surveillance during deployments. MSS such as the one described in this paper, EPINATO\(^{37}\) which has been used by NATO since 1996 in the Bosnian theatre, and others might each contribute valuable components towards a flexible system for use during UN or other multinational missions. Surveillance categories should be mutually exclusive and could be adapted from existing systems for the international classification of morbidity data.\(^{38,39}\) To address the needs of commanders and supervisors better, a non-effective rate (the percentage of personnel off duty for medical reasons) and an inpatient admissions rate such as the number of admissions/1000 personnel/week should be monitored.

To address the needs of commanders and supervisors better, a non-effective rate (the percentage of personnel off duty for medical reasons) and an inpatient admissions rate such as the number of admissions/1000 personnel/week should be monitored. Materials used as part of a standardized UN MSS should be available in at least English and French, the UN's official languages, and automated to facilitate ease of use.\(^{13}\) A mechanism to regularly check the quality of incoming data and to evaluate the surveillance system itself is essential.\(^{40}\) Medical surveillance skills must be taught and institutionalized prior to each contingent's deployment, and unit personnel should be encouraged to initiate local interventions based on their own surveillance.

Collection of additional types of data and links with host country surveillance systems should also be considered. During some large-scale deployments, simultaneous environmental surveillance can help guide public health efforts and perhaps lead to the formation of cohorts to assess the near- and long-term effects of potentially infectious or toxic exposures in theatre.\(^{41–43}\) Any MSS that is developed should, as much as possible, be consistent with each participating country's overall medical support strategy\(^{44}\) and compatible with expected, long-term, multinational, operational requirements.\(^{35}\) Finally, practical links between a UN MSS and host country surveillance systems must be made for the greatest mutual benefit. International standards such as those available for the surveillance of communicable diseases\(^{46}\) can provide a strong foundation for co-operation in this area.

Despite hurdles associated with distance, language, and communications, the MSS was a practical and effective tool in support of UNMIIH force protection. Surveillance results provided valuable epidemiological information, led to specific interventions to prevent further morbidity, and stimulated closer examination of concerning clinical situations. Developing a standardized MSS should enhance medical surveillance of future UN deployed forces and be of value to host country public health experts alike. Finally, planners should recognize that if ongoing medical surveillance and related responses are to be effective, designated personnel should be trained prior to deployment and adequate resources dedicated to a sustained effort in theatre.

**Acknowledgements**

The authors are grateful to the many individuals and organizations that contributed to the development of the surveillance methods used by the 86th CSH and UNMIIH personnel. Surveillance activities would not have been successful without the tremendous support provided by all of the participating UNMIIH units.

**References**


