Using the Haddon Matrix to develop a general practice conceptual framework for pandemic planning

Lyn Clearihan, George Somers, Eastern Ranges Division of General Practice

Introduction

By its nature, a pandemic is a catastrophe, disrupting the structure and function of any community engulfed by it.1 Given our experiences with the influenza pandemics of 1918, 1957 and 1968, how ready is the world for another one? According to the World Health Organization’s (WHO) updated Influenza Preparedness plan, – not very; in spite of the fact that “ominous changes have been observed in the epidemiology of the disease in animals”.2

Antigenic shift of the H5N1 Influenza A virus is currently regarded as the likely source of the next influenza pandemic.3 This highly pathogenic viral subtype was isolated as the cause of the Hong Kong influenza epidemic in 1997, and in spite of that country’s massive culling of its poultry at the time4 the H5N1 appears to be “expanding its host and geographic range”.5 Since 2003, 49 countries have had confirmed cases of H5N1 in their bird populations with viral isolation from other mammalian species.6 As of the 16th of October 2006 there have been 256 confirmed human cases with 151 deaths, spread across ten countries.7 Human to human transmission is now presumed to have occurred between close contacts and WHO have warned that the threat posed is very real and likely to escalate with time due to the endemic nature of the H5N1 in poultry and the fact that domestic ducks can excrete large amounts of the virus without showing signs of illness2, thus increasing the risk of transmissibility to humans.

While evidence of the human pathogenicity of the Influenza A viruses is well established8 their behaviour is unpredictable. The degree of warning of an impending pandemic depends on whether the viruses antigenic shift results from a reassortment event, which could produce a sudden appearance of “cases with explosive spread”; or an adaptive mutation, which tends to occur in cluster outbreaks and may ‘buy time’ for containment measures and vaccination programs to limit global reach and impact.2

For the Asia–Pacific region there is heightened concern as the majority of confirmed deaths from Avian Influenza are from this area, with over a third of those from Indonesia. Based on experiences from previous epidemics9 an Australian estimate that uses a 25% strike rate, suggests that an influenza pandemic could produce 2.5–7.5 million ‘outpatient’ visits with a potential mortality rate of 13 000–44 000 people.10,11 This surge in demand is likely to quickly overwhelm all available health resources.

Within Australia there has been both a national and a state based response to the need for pandemic planning.10,12,13 Recognition of the place of general practice within the health sector response has however, been slow14 with State based communications centring on case identification procedures15 rather than point-of-care issues that are likely to engulf GPs. In reviewing the pandemic plans of nine countries in the Asia–Pacific area, of which Australia was one, Cokier and Mounier-Jack identified a number of generic weaknesses5 pertinent for general practice:

- “Operational responsibility remained somewhat unclear, especially at the local level.”
- “Most did not detail drug strategies or logistics for provision for antiviral drugs to the population…they did not clearly specify treatment or use of prophylactics.”
- “Most had poorly developed policies for vaccination of the population.”
- “Most relied on health care institutions for the treatment of influenza patients (notably special infectious diseases hospitals). Some designated specific facilities as hospitals for infectious diseases. Few developed the possibility of caring for patients at home.”
- “Many did not make adequate provision for the maintenance of essential services”.

Standing up for Rural Health: Learning from the past Action for the future
• “Strategic communication could prove critical during a pandemic, and needs to be improved in some countries.”

• “Several did not provide adequate operational procedures for key stakeholders during each phase of the pandemic.”

For general practice, a pandemic will demand expertise from the full spectrum of our skill base across all the dimensions in which we work. Our success in dealing with it, and indeed our survival may depend on how well prepared we are for the task.

In the 1960s William Haddon, a public health physician, addressed a similar problem of multi-dimensionality in the prevention and management of road vehicle trauma.16 His method of dealing with this was via a matrix approach, which has come to be known as the Haddon Matrix. It consists of four columns and three rows. The columns define four factors that may impact on the problem—nature of the host, nature of the agent, physical environment and socio-cultural environment. The rows define the time phases—pre-event, event, and post-event. Specific interventions can then be allocated to each cell of the grid depending on the needs determined by the nature of the factor at a particular phase of the event.

Barnett et al recognised the benefit of using this approach as an ‘all hazards response model’ after the American September 11 attacks in 2001, “as it reduces the need to create a complex family of situation-specific preparedness and response activities”.17 They have since demonstrated the utility of the matrix in relation to pandemic planning for avian influenza. They claimed that “by compartmentalising an injury into dimensions of time and contributing factors, the matrix can break a complex problem into more manageable segments”. This enables the refinement of the problem and the development of targeted interventions or policies.18

While our desired outcome was to assist local GPs to prepare for a potential influenza pandemic by developing individual practice action plans, our overall goal was broader than this. Our twofold aim was:

• To develop a strategic framework, targeted to local issues, that could form the basis of a generic model that could be adapted for other disaster situations, and

• To enhance the capacity of the region to respond to, and integrate effectively with, State and National pandemic plans.

The purpose of this article is to describe how we used the Haddon matrix to address these aims.

Method

Locality

The Eastern Ranges General Practice Association (ERGPA) is a Victorian Division of General Practice located in the Dandenong Ranges to the east of Melbourne. The Division has approximately 200 GP members, servicing a population of some 195 000 people. It covers a large geographic area encompassing practices designated RRMA 1 to RRMA 5. Community and individual practice needs within our area vary greatly. While the region is included in the Victorian State Emergency Plan and has good emergency services coverage, GPs are not generally encouraged to become involved in these.19 Similarly the hospitals servicing the region have their own emergency plans but these do not routinely include the general practice community in their planning or execution.

Study participants

The Eastern Ranges Emergency Task Force consists of five general practitioners, two females and three males; a female pharmacist; the division’s CEO to assist with strategic planning, and a project officer. Two of the GPs have experience in disaster management, one has further training in infectious diseases and two have further training in emergency care. All are active GPs and four of the five have experience in teaching and administration.
The process of a structured approach to local planning

Initial meetings in October 2005 involved brainstorming the issues and problems from a local perspective, using three broad domains—practice issues, community issues and organisational issues. These discussions “yield(ed) a wide variety of options”. The committee was also cognisant of the considerable planning and preparation occurring at an international and national level, and wanted to use existing data and information as much as possible while keeping our planning focused and relevant for local GPs.

Our technique for identifying individual cells in the matrix involved the construction of two generic clinical scenarios (see box 1) and imposing the matrix over these helped us identify key issues.

Having identified issues of major concern, the next step was to organise these into items that either required action or further debate and discussion, using the Haddon Matrix (see Table 1). Adapting this for a general practice framework required the addition of a third dimension in conjunction with those of a time dimension (involving the phases of the pandemic) and a space dimension (the specific factors that impact on a pandemic) that allows the incorporation of the various general practice areas of operation—clinical, community and broad organisational into the model.

Existing disaster plans refer to the Pre-event phase as prevention and preparation phases; the Event phase as the response phase and the Post-Event phase as the recovery phase. Prevention was regarded as stretching across all three time dimensions, as efforts to prevent extension of the event need to continue irrespective of the phase of the disaster being dealt with.

Results

Over the last twelve months the committee has meet approximately every six weeks to action items from the matrix and to work on extending the conceptual model. Our adaptation of the Haddon matrix is outlined in Table 1.

Each cell in the matrix represents either an action point or an identified problem that requires further assessment, resource identification or discussion. A number of cells have sub-cells buried within them, for example the cell that sits at the intersection of socio-cultural factor with community issues in the Pre-event phase is—‘consider continuity of local essential services and communication networks’—to action this item requires several steps including initial identification of the source of these facilities and then developing links with them. There are a number of these complex points and they are marked with the symbol: ∅

It will be noted from Table 1 that most of the conceptual and practical issues to date fall into the Pre-Event stage, with prime concerns centred around increasing surveillance; improving seasonal influenza and pneumococcal immunisation; developing clinical protocols for both patients and staff in the event of exposure to the influenza virus; improving communication networks both within the practice, between practices and with the community, plus developing a business continuity plan that incorporates ethical and legal issues for practitioners. In relation to the Event itself the focus is anticipated to swing between the issues of containment of spread and minimisation of damage caused by the virus. Post event recovery is vital to reduce the possibility of a second and even third wave after the initial 6–8 weeks of the pandemic; thus it was presupposed that the focus of health care may again change to mass vaccination programs; practice restructuring and resurrection of ‘normal’ medical care, and the provision of psychological support for staff; patients and their families who were affected by the pandemic.

Discussion

General practitioners are in a unique position in terms of health care delivery, nested as they are within a given community setting. This places multi-dimensional demands on general practitioners that are not as applicable for other areas of health care delivery such as public health or hospital medicine. As their practice populations often turn to their local GPs for guidance, support and information on all
health care matters, we were cognisant of this in addressing the multi-level issues that GPs would have to address in an evolving influenza pandemic. For the committee this meant that the general practitioners role had to be considered on the multi-dimensional levels of the following:

- management of the disease process
- management of the patient with a disease
- management of the ill patient in the context of their family
- management of an affected family within the context of the practice community and society in general.

While general practitioners deal with these layers in their everyday work, the reality of a pandemic would be likely to place untold and possibly unsustainable burdens across all levels.

In addition to these clinical contexts we were very aware of the need for the general practitioner to be seen and acknowledged as an individual who also had a responsibility to themselves, their family and their staff. Experiences in dealing with Severe Acquired Respiratory Syndrome (SARS) demonstrated the risks for frontline health care workers in managing these highly pathogenic viruses. An evolving pandemic will place GPs very much on the frontline, forcing them to confront some very personal questions such as how best to care for our patients while simultaneously protecting our families, our staff and ourselves. This element has formed an important part of the matrix across all dimensions.

There was also one further area that needed to be addressed and emphasised if this plan was to address the full range of general practice concerns and that was general practice as a small business. In employing staff, GPs have both legal and ethical responsibilities to their staff within current industrial relations legislation. Consideration of staff employment contracts and stand-down procedures were an essential element in the preparation of any business to deal with an overwhelming natural disaster. General practice is no exception to this. In addition to this indemnity issues need to be clarified, especially if a general practitioner offered their services in other practice localities or environments. This also raised the issue of personal and practice safety especially in the light of civil disorganisation and unrest.

We encountered a number of problems in utilising the Haddon matrix to assist us in formulating the specific issues that surviving a pandemic raised: namely the complexity of the problems that needed to be considered from a general practice context. One method has already been highlighted — the use of a third dimension. Another was developing specifically appropriate action points in the current climate of uncertainty of not knowing when, where and how a pandemic will emerge. We also identified another deficit in the matrix in that it did not allow for identification of when an item had been actioned. A further modification by the addition of an action and date of completion column would help improve the connection between identifying an intervention and implementing it and further increase the practicality of the Matrix.

As the world is currently at the WHO Stage 3 of Pandemic Alert, the committee felt that effective and efficient response may well depend on timely application of practice protocols developed in the Pre-Event stage. In order to ensure this one of our prime concerns was to encourage and empower individual practices to develop protocols that are both appropriate for them and also consistent with national and state recommendations. Preparation for, and the development of a clear understanding about how to act on a practice level was in the committee’s judgement, crucial to managing well the other two time phases of the pandemic.

Working with the Haddon Matrix on all these issues has demonstrated its flexibility Further work and modification of the matrix is likely to increase its utility and user friendliness, allowing an extension of our current understanding of managing a pandemic in a general practice setting.
Conclusion

GPs broad skill base equips them to deal with multi-dimensional problems, making them ideally suited to take a proactive approach to developing ‘disaster’ plans for their practice and local communities. In the case of influenza pandemic planning, this exercise demonstrated to us that it was possible to address a global problem from a local and regional perspective. By taking a systematic approach based on the Haddon matrix a seemingly impossible array of tasks was broken into ‘bite sized’ problems. While we encountered some difficulties superimposing the complexities of general practice on the original Haddon matrix, these were not insurmountable. The geographic diversity of Australian communities makes local planning essential to ensure that plans remain relevant and applicable irrespective of practice locality or the intrinsic problems of a specific population. The reduced resources for rural and remote Australia make this need even more acute. Hopefully, avian influenza will mimic the swine fever ‘scare’ and never eventuate, but in the event that it does, this paper offers one approach for GPs to ensure their region is as well prepared as possible.

Box 1  Case scenarios

Case Scenario 1
Tim is a fit 18 year old boy who has been a patient at this practice since he was a young child. He has just returned from a backpacking trip to Thailand. His mother, who you know suffers with an anxiety disorder, brings him to see you as he developed a fever of 39.8 degrees since arriving home yesterday and woke this morning with a dry cough. He decided not to have his flu’ shot this year.

1  What is the likelihood this is avian influenza?
2  How should it be confirmed, who confirms it and how?
3  What precautions need to be taken?
4  What to tell, family, staff other patients?
5  What does this mean?

Case Scenario 2
Dr B works in a small town about 45kms east of the Melbourne GPO. She is the only full time doctor in the town, where she lives with her practice manager husband and their three small children. Two part time male doctors work with her and the practice employs three part time receptionists. Divisional news bulletins warned that four days ago clusters of confirmed Avian influenza cases had been reported in Indonesia and yesterday a patient in a Sydney hospital was confirmed as suffering with Avian influenza. Designated fever hospitals in Melbourne were activating their pandemic plans.

1  What are the key things that Dr B needs to address?
2  What vital aspects of preparation need to be actioned at this stage?
3  What should she be telling her patients, staff and family?
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<tr>
<th>GP domains</th>
<th>Host/human</th>
<th>Agent/vector</th>
<th>Physical environment</th>
<th>Socio-cultural environment</th>
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<tbody>
<tr>
<td>Pre-event (WHO phase 3 or below)</td>
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<tr>
<td><strong>Practice Issues</strong></td>
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<tr>
<td><strong>Clinical</strong></td>
<td>☀ Encourage early influenza and pneumococcal immunisation programs.</td>
<td>☀ Use division’s communication channels to keep practices updated about O/S travel advice re virus.</td>
<td>☇ Consider current patient flow within practice—room for patient isolation?</td>
<td>☇ Emphasise in handouts the need for doctor safety and self care.</td>
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<td>☇ Encourage the use of standard respiratory hygiene by all patients coming to practices.</td>
<td>☇ Divisional Project officer to monitor ‘official’ sites re viral activity eg WHO, CDC, Australian government.</td>
<td>☇ Individual practices to undertake stock take of supplies and likely needed supplies.</td>
<td>☇ Using best practice guidelines to reduce exposure risk for GPs, staff and GPs own family.</td>
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<td></td>
<td>☇ For doctors visiting ‘at risk’ localities, such as accommodation centres and nursing homes—develop plans for clinical care.</td>
<td>☇ Pharmacological treatment options—availability; accessibility; applicability.</td>
<td>☇ Practices to consider how they might ensure equity of access of medical care for all patients.</td>
<td>☇ Re-visiting practice policies re issues such as home visits—Does it need revising?</td>
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<td></td>
<td>☇ Provide each practice with at least one PPE kit for each doctor, plus information on how to use it.</td>
<td>☇ Develop patient information kits with advise re pharmacological and non-pharmacological management.</td>
<td>☇ Individual practices to consider their role in mass vaccination programs.</td>
<td>☇ Consider counselling options and support for staff exposed to virus</td>
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<td></td>
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<td></td>
<td>☇ Identify and monitor Information sources re vaccine development and availability</td>
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<td><strong>Organisational</strong></td>
<td>☇ Practice surveillance: recommend joining Influenza surveillance network.</td>
<td>☇ Practice surveillance: register of ‘at risk’ patients.</td>
<td>☇ Develop and distribute a practice poster advising patients with suspected avian influenza how to seek help from individual practice</td>
<td>☇ Develop a database of retired local doctors who may be prepared to work during a pandemic</td>
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<td></td>
<td>☇ Encourage intra–practice communication via practice newsletters to keep staff and patients informed</td>
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<td>☇ Develop database of local doctors willingness to continue working in a pandemic</td>
<td>☇ Run a mock disaster to test any protocols or plans</td>
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<tr>
<td><strong>Business</strong></td>
<td>☇ Develop staff protocols for working during a pandemic—issues of leave, sickness benefits.</td>
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<td>☇ Encourage every practice to develop a business continuity plan</td>
<td>☇ Encourage practice meetings to discuss effective ways for individual practices to deal with potential exposure</td>
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<td></td>
<td>☇ Individual doctors need to consider issues of medical indemnity, personal liability and disability insurance.</td>
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<tr>
<td><strong>Community Issues</strong></td>
<td>☇ Foster and build networks with local media outlets to enhance medical communication with local population.</td>
<td></td>
<td>☇ Consider local patient transport issues in the light of a pandemic.</td>
<td>☇ Consider ways of assisting continuity of local essential services and communication networks.</td>
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<tr>
<td><strong>General Organisational issues</strong></td>
<td>☇ Develop database of local health support staff, such as district nurses, pharmacists and allied health workers.</td>
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<td>☇ Consider the need for regional research on virus behaviour and effectiveness of protocols.</td>
<td>☇ Network with other relevant local bodies to enhance a GP voice in local planning.</td>
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### Factors

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<td>⊡ Foster and enhance inter-practice communication through Divisional communication channels.</td>
<td>⌀ Foster inter-practice support networks for clinical care of patients in the event of a pandemic.</td>
<td>⌀ Liaise with government and hospital bodies to link in with relevant pandemic plans.</td>
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### Event (WHO phase 4 or above)

#### Practices

- **Clinical**
  - ⊡ Action protocols for practice triage of patients with suspect disease.
  - ⊡ Action protocols for case identification and disease containment.
  - ⌀ Action practice policy in regard to what point closure of the practice is regarded as essential.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.
  - ⊡ Foster and enhance inter-practice communication through Divisional communication channels.
  - ⊡ Foster inter-practice support networks for clinical care of patients in the event of a pandemic.
  - ⌀ Liaise with government and hospital bodies to link in with relevant pandemic plans.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.

- **Organisational**
  - ⊡ Action triage plan for dealing with patients with co-morbidity and chronic ill health.
  - ⌀ Action protocols for case identification and disease containment.
  - ⌀ Action practice policy in regard to what point closure of the practice is regarded as essential.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.
  - ⊡ Action triage plan for dealing with patients with co-morbidity and chronic ill health.
  - ⌀ Action protocols for case identification and disease containment.
  - ⌀ Action practice policy in regard to what point closure of the practice is regarded as essential.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.

- **Business**
  - ⌀ Implement stand down procedures for staff if practice needs to close
  - ⊡ Action protocols for case identification and disease containment.
  - ⌀ Action practice policy in regard to what point closure of the practice is regarded as essential.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.

- **Community issues**
  - ⊡ Issues of home isolation for patients will require protocols for managing health care needs
  - ⌀ Action protocols for case identification and disease containment.
  - ⌀ Action practice policy in regard to what point closure of the practice is regarded as essential.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.

- **General Organisational issues**
  - ⊡ Consider developing other means of health care delivery, such as telephone triage
  - ⊡ Action protocols for case identification and disease containment.
  - ⌀ Action practice policy in regard to what point closure of the practice is regarded as essential.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.

### Post-Event (between waves and after pandemic)

- ⊡ Re-assess practice resources and capacity
  - ⊡ Action protocols for case identification and disease containment.
  - ⌀ Action practice policy in regard to what point closure of the practice is regarded as essential.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.

- ⌀ Assess practice viability for staff and resources
  - ⊡ Action protocols for case identification and disease containment.
  - ⌀ Action practice policy in regard to what point closure of the practice is regarded as essential.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.

- ⊡ Ongoing vaccination program to reduce impact of second wave
  - ⊡ Action protocols for case identification and disease containment.
  - ⌀ Action practice policy in regard to what point closure of the practice is regarded as essential.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.

- ⊡ Consider practice safety issues before re-opening
  - ⊡ Action protocols for case identification and disease containment.
  - ⌀ Action practice policy in regard to what point closure of the practice is regarded as essential.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.

- ⌀ Need to re-establish usual medical care procedures
  - ⊡ Action protocols for case identification and disease containment.
  - ⌀ Action practice policy in regard to what point closure of the practice is regarded as essential.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.

- ⌀ Use division's communication channels to keep doctors updated.
  - ⊡ Action protocols for case identification and disease containment.
  - ⌀ Action practice policy in regard to what point closure of the practice is regarded as essential.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.
  - ⌀ Consider the need for psychological and clinical support for staff in the event of practice closure.

### Notes
- ⊡ Action point
- ⌀ Policy or planning point that needs either further discussion or information before
References

20. Rosser WW. Approach to diagnosis by primary care clinicians and specialists: is there a difference? The journal of Family Practice 1996;42(2):139–144.


**Presenter**

Lyn Clearihan has been a principal in the Mt Evelyn Medical Surgery for the past 25 years. During that time an interest in medical writing and editing has meant that Lyn was Deputy Medical Editor of the *Australian Family Physician* from 1989 to 1995 and its medical editor from 1995 to 2001. She is currently a co-editor of the *Asia Pacific Family Medicine* journal. Lyn is also an examiner for the FRACGP and a member of the Women’s Committee in general practice of the RACGP, and has been a part-time senior lecturer for the Department of General Practice for the past four years. Over the past 12 months Lyn has chaired the Eastern Ranges Division of General Practice’s Avian Influenza Pandemic Planning Committee.