Disaster Intelligence-Methods for the Wellington Region for use after

a Natural Disaster:

An Appendix to the Regional Public Health

Emergency Management Plan
Aim of Disaster Intelligence

Following a natural disaster, there is a concurrent increase in social and health needs, and deterioration in the infrastructure and the systems needed to respond to those needs. Governmental and relief organisations are faced with the task of prioritising and delivering services to the affected population.

In the Wellington region an earthquake is the event with the potential to cause significant damage and disruption.

The purpose of emergency management is to collect subjective and objective information in order to measure damage and identify those basic needs of the affected population that require immediate response. The process comprises describing the
extent of the emergency, the measurement of its current and potential future impact, the assessment of the existing response and immediate additional needs, and to recommend priority action.

Decision-making will be aided by the availability of relevant health information. However, immediately after an event, the information may not be readily available, and for data that is available or sought, compromise may be needed with respect to its completeness and comprehensiveness, in conjunction with the timeliness of its availability.

Community surveying and surveillance of communities form part of the process of need identification. The health information collected needs to be shared with other agencies, in order to aid the effective co-ordination of the disaster response.

**Summary**

The value of rapid needs assessments has been demonstrated from the experience after earthquakes and hurricanes. Basic living and health care needs have been identified; the data has then been used across agencies responsible for the response, and has informed decision-making.

World Health Organisation protocols indicate the multiple sources of information that should be used to help enlighten a situation; with the use of four main forms of data:

- Review of existing information
- Visual inspection of the affected area
- Interviews with key informants
- Rapid surveys

It has been acknowledged that there are significant resource requirements for the performance of a survey. The use of the appropriate resources needed for a survey
should be balanced against alternative demands on those resources, judged in the light of the information deficit.

The potential sampling methods for surveys are simple random sampling, systematic sampling and cluster sampling. The simple random sampling is the ideal, but not a feasible method in the circumstances post event. Cluster sampling has been used widely, and refined over time, and successfully applied after natural disasters. Systematic sampling is more appropriately applied to a smaller area of interest, where some demography is known.

The selection of geographical areas to be surveyed depends on the distribution of areas damaged, and the presence of information gaps relevant to decision-making process. Consideration should be given to preferentially assessing populations known to be less resilient, and so to be more vulnerable after a significant event, though age or pre-existing poverty.

The data collected on previous occasions after earthquakes and hurricanes has been consistent: including basic household demographics, nature of injuries and acute illness, pre-existing illness and medication needs, and access to basic living needs. The questionnaire template attached to this document, is predominantly based upon the one utilised after the earthquake at Izmit, Turkey in 1999.

Prior disasters have shown significant impacts on access to basic utilities, medical care and pharmaceuticals. After earthquakes the loss of amenities has not been complete, but variable; presumably a reflection on the energy of the earthquake, local geography and infrastructure quality prior to the event.

In response to a natural disaster the setting up of surveillance system is a recognised component of the information gathering systems, and its purpose is to guide actions of public health importance.

Objectives of the surveillance system include:
- Monitor a population's health and identify its immediate and long-term priority health needs
- Follow disease trends for early detection of outbreaks
- Assist in planning and implementation of health programmes
- Evaluate coverage and effectiveness of programme interventions

Emergency Departments, emergency shelters, and health care facilities set up in response to the event have been utilised as part of the surveillance system after hurricanes in the USA.

Syndromic surveillance is the recommended method, and refers to relying on clinical case features that are discernible before confirmed diagnoses are made. It has been shown that syndrome classifications show overall good agreement with discharge diagnosis from Emergency Departments.

It is intended that the data collection form to be used will be in paper format. The form has been developed by the Disaster Surveillance Work Group of the Centers for Disease Control and Prevention. The form collects aggregated tally data rather than individualised data that have been sufficient to fulfil the system's objectives. The use of paper forms by CDC is based on experience with logistical issues with the use of PDA and laptop computers: insufficient numbers, lack of electricity and need for IT support.

The type of data to be collected has been previously sufficient to inform resource allocation and determine public information messages. Outbreak detection will be done using a combination the *Early Aberration Reporting System* and manual assessment of the data.

Further detail is available in *Disaster Intelligence* available at F:\Programmes\Medical Team\Emergency Needs Assessment and in hard copy in the Regional Public Health library.
1. Rapid Community Needs Assessment

1.1. Introduction

There are multiple agencies involved in the response to a natural disaster, each a potential source of data for illuminating the situation. A rapid community needs assessment survey is a means to add to the information producing process, filling gaps, that are not amenable to being filled by other means.

It will be the responsibility of Regional Public Health (RPH) to co-ordinate the implementation of a rapid community needs assessment at the time of a natural disaster.

Immediately after a major earthquake the disruption will mean that the necessary requirements will not be available. After the Chi-Chi earthquake in Taiwan, a rapid community needs assessment was performed on Day 5, and on Day 10 after the earthquake in Izmit, Turkey.

Immediately after a major earthquake the necessary requirements to perform a rapid community needs assessment will not be available. It is estimated that communication to outside of the region will be possible on approximately Day 3 after the event, with the availability of satellite-based systems. Communication may be through the WebEOC system.

As local resources are expected to be disrupted, it is not envisaged that staff of Regional Public Health will perform all the necessary tasks of the process. It is expected that some resources and specialised skills of organisations outside of the Wellington region will be utilised. The Emergency Management Team in the Ministry of Health will determine the availability of the specialist support through its networks. The request from regional Public Health should be made through the Civil Defence Emergency Management (CDEM) structure of the disaster response.
The decision whether to proceed with the community rapid needs assessment will depend on its expected benefits in the context of the situation, the feasibility at the point in time, the of availability of resources and alternative competing need for those resources. Given the realities of the situation, the aim is to collect the best information feasible to make important and timely recommendations to the decision making process.

The rapid community needs assessment may be repeated to evaluate the effectiveness of interventions and to respond to changing circumstances.

1.2. Determination of available resources

In order to complete the rapid community needs assessment, a variety of resources will need to be available to a greater or lesser extent locally or at a distance:

- communication-facilities between RPH base, field operators and the CDEM command, and to facilities outside of the region
- access to computer systems-Geographic Information Systems(GIS) and other software,
- paper-based or preferably network access to forms and data
- personnel for survey data collection and computer systems use
- means of transport in order for personnel to reach areas to be surveyed
- resources for data entry and analysis

1.3. Determination of areas to be surveyed

The choice of an area or areas to be surveyed will be informed by available background information regarding the size of the event, and the geographical distribution of the areas affected, as well as the quantity and quality of data currently available from other sources. This will help to inform where gaps in information exist.
In addition to the above, consideration should be given to the more vulnerable groups within the population, and whether it is necessary to give a higher priority to the ascertainment of their health needs. Material deprivation is measured with NZ Dep 2006, and presented as deciles 1-10; lowest to highest deprivation levels. Surface maps showing the NZ Deprivation 2006 Index are attached to this document. One for the Wellington region (Map 1), and a zoomed map, showing greater detail for Wellington, Porirua and the Hutt Valley (Map 2). A surface map showing the distribution of the population who identify as Maori is also attached (Map 4), as it is recognised that Maori experience worse health than non-Maori across all levels of deprivation. They are also available in PDF file format at F:\Programmes\Medical Team\.

A surface map showing the population for age group 65 and over by census area unit level are attached to this document (Map 3). The map presents the distribution in quintiles, and the legend shows the proportion of 65 and over by district health board. It shows the Wellington region and a zoomed window with greater detail for Wellington, Porirua and the Hutt Valley. It is also available in PDF file format at F:\Programmes\Medical Team\ Emergency Needs Assessment\Maps.

1.4. **Choice of sampling methods**

The options available are systematic sampling and cluster sampling.

Cluster sampling is the common method used after natural disasters to reliably produce representative survey results. The recommended sample size is twice that needed to obtain results by simple random selection, but is a more feasible method in emergency circumstances.

Caution has been expressed in the use of random selection methods in earthquakes, as there can be great variation in the degree to which areas are affected, so that a random sampling approach may leave more seriously damaged areas overlooked, and underestimate the overall damage.
The systematic sampling method may be appropriate when the geographic area is smaller.

The calculation used for the sample size required in order to estimate the population value of a proportion assumed an accuracy within 10%, 95% confidence intervals, and assumes the population proportion is 50%. The calculation gives the largest, most conservative sample size.

A description of the methodology for sample size calculation is attached (Sheet 1), and also available at F:\Programmes\Medical Team\Emergency Needs Assessment\Information

1.4.1. Systematic Sampling

The area will be well defined and its composition known. A random start point is chosen and then thereafter every $n^{th}$ household. This will also allow a smaller sample size to be used, as the cluster effect removed, and the method is closer to simple random sampling. So, using the same parameters as before, the sample size required will be 100 rather 210.

1.4.2. Cluster Sampling Method

The process of using this sampling method will be outlined for two alternative scenarios:

A-Computer systems are available to give access to files on the Regional Public Health network, and availability of software programmes; a spreadsheet (Microsoft Excel), a Geographic Information System (GIS), and word processor (Microsoft Word).

B Computer systems are not available, and manual paper based methods are used with access to pre-prepared maps with defined census areas units shown.
A Computer systems are available

The following is written assuming that the process would be performed locally. However, it is reasonable to expect that with sufficient communications outside of the affected region, some of the tasks could be performed “off-site”, as the software programmes and census data are widely available.

1 The initial step is to define the geographical area that is to be surveyed. The clusters to be sampled within the defined area are the meshblocks used in the production of the census. The database of meshblock numbers is available as a Microsoft Excel file: Meshblocks. This is available at F:\Programmes\Medical Team\ Emergency Needs Assessment\Information

2 Selection of clusters

The method requires the random selection of 30 clusters. This is done within Microsoft Excel, using the method outlined in the document attached (Sheet 2), which is also available at F:\Programmes\Medical Team\ Emergency Needs Assessment\Information

The data file is opened with the Excel programme. The meshblocks for the geographic area of interest are selected by using the filter function.

(Highlight a cell with data. Go to Toolbar-Data-Filter-Auto filter)
The columns reading from left to right are the meshblock identify code (MB06), the usually resident number of households (Households2006) the Census Area Unit, (CAU) code (AU06), the CAU name, the Territorial Authority name, and the District Health Board (DHB) name.

Then the area of interest can be selected using the drop down menus of the columns for territorial authority or district health board. The selection will limit the CAUs and associated meshblocks.
This data can then be highlighted (click on cell with data and keyboard Ctrl A, or click top, and most left cell, and then copy and paste into a new sheet.)
Then, using the data in the new sheet, *Excel* can be used to randomly select 30 meshblocks, and their codes, with the RAND function.

Initially, 2 columns are inserted to the right of the meshblock column, and in the first column a random number for each meshblock between 0 and 1 is generated with the RAND function, and the result multiplied by 100 for ease of use.

The formula is then copied into all the cells in the column, and the generated numbers copied and pasted into the adjacent column with the paste special function, as the RAND function will continue to re-run, and the original data will be replaced.
The pasted random numbers can then be sorted in ascending order and the first 30 rows used to select the meshblocks.
The number of households can be seen for each selected meshblock. If there is concern that the number of households is too low, say zero, which may be the real value, then an alternative can be chosen. It would be the next in the list, that is, number 31. An alternative approach is to decide to use the adjacent meshblock to that chosen. This decision may be made with the help of checking its position with the Geographical Information System (GIS) software first.

The Geographical Information System (GIS) software is then utilised to highlight the selected meshblocks, a map produced and printed and the centre of the meshblock identified as the starting point for field workers.

B Computer systems are not available

This paper based manual system will only be used if access to the appropriate computer facilities is not available within RPH or through access to the facilities and skills of outside institutions.

1 The initial step is to define the geographical area that is to be surveyed.
The clusters to be sampled within the defined area are the Census Area Units, or divisions of the CAUs

2 Selection of clusters

The method requires the random selection of 30 clusters. This is to be done using pre-prepared maps that are available in the emergency resource cupboard in the meeting room on Level 1 of Regional Public Health. These maps collectively cover the Wellington region, and delineate CAUs. The CAUs for the geographical area for surveying are identified. The sampling method needs at least 100 clusters from which to take the sample of 30. So the selected CAUs should be divided each into sufficient equal parts in order to achieve this total. The use of smaller individual clusters for sampling reduces the variance of the sample results and so gives better summary statistics.
The clusters should then be numbered and the required 30 chosen randomly using a random number table with instructions, (Sheet 3) attached to this document and available on the RPH network at F:\Programmes\Medical Team\Emergency Needs Assessment\Information

The centre of the chosen cluster should then be determined and its position indicated by comparison with appropriate road map, such as a *Wise* Wellington map available amongst the emergency resources in the operation room. The exact starting point can then be decided.

1.5. **Data collection**

The survey teams should be briefed prior to going to the field regarding the use of the questionnaire, and the selection of households as outlined below. The public information leaflets should be available, as should forms to record specific households that have needs that require referral onto relief services.

The questionnaire template is attached (Form 1) and is also available at F:\Programmes\Medical Team\Emergency Needs Assessment\Form. It is in *Microsoft Word* format. It is formatted with commonly required information, but should be edited prior to use, to add or delete questions, as deemed appropriate at the time of preparation.

The survey teams must be transported to the determined starting point within the cluster, with either maps supplied as print outs from the GIS software, or using pre-existing maps, with the start point communicated. The maps should show roads and other important features to aid navigation.

Within each cluster seven households are selected for data collection. The survey team is to go to the central point on the cluster area, and the direction of travel is determined by the toss of a coin; following the direction indicated by the line of a pre-determined feature on the coin. The team then proceeds to the first occupied household. An adult member of the household is to be interviewed. Subsequent
households are chosen by travelling in the same direction to the next occupied
dwelling. If a dwelling has multiple households then one is randomly selected, and the
next household located in the next dwelling. If dwellings come to an end in the pre-
determined direction then the team turns in a 90-degree direction clockwise, until the
next group of households are found. If there are insufficient occupied households in
the selected cluster, the team should travel into the adjacent meshblock in order to
achieve the required number of households for surveying.

The interview teams should comprise at least two people, with preferably at least one
having local knowledge. Suitably skilled professionals would be public health
officers, environmental health officers, communicable disease nurses and health
promoters: those familiar with surveys and communication.

Completion of this sampling should then give completed data from 210 households. It
gives a representative summary for the sampled population, and the sample size is
considered large enough to account for the increased variance inherent in the cluster
sampling design, for common conditions.

The teams should also carry information packs to distribute to the locals at the time, to
aid communication. This would have the added benefit of improving the profile of the
emergency response.
The teams should also have means of recording specifically identified needs of
households that require referral to appropriate relief agencies.

The survey teams should also record other observations outside the parameters of the
questionnaire, that they consider important and should communicate this at the time
of data transfer.
1.6. Analysis

The data will be collected on paper forms, and will need to be collated and analysed. The paper format will require entry into an electronic data format, and simple analysis with the results presented as proportions of the total sample for responses.

The software programme used for this analysis will not be specified, as the personnel allocated with task will best decide the appropriate approach within their experience. The requirements may be fulfilled by Epi-Info (http://www.cdc.gov/epiinfo/), or other statistical software. The former will also allow a data entry form to be produced from the questionnaire template through its “Make View” function.

Data collection and analysis will need to proceed as outlined above. It is presumed that there will be inadequate resources with RPH and the affected region to devote time to data entry and analysis. It is expected that the forms and data will be sent out of the region to undergo data entry and analysis, and for the results to be sent to the responsible officer at RPH and shared with the CIMS group for attention and action.
2. Surveillance

2.1. Introduction

As part of the intelligence gathering process after a natural disaster, consideration should be given to the implementation of a surveillance system. The system will aim to provide information on health care use and need to aid resource management, and to provide a means of outbreak detection.

The initiation of a surveillance system will be dependant upon assessment at the time on its need and the resources that are available, and well as the competing needs for those resources. The timing of its initiation will depend upon these factors. Surveillance was initiated after Chi-Chi earthquake in Taiwan after Day 7, progressively over the first seven days in Thailand after the 2004 tsunami, and from Day 8 after Hurricane Katrina.

2.2. Methodology for surveillance

2.2.1. Sites

The surveillance system will incorporate centres providing healthcare. It is presumed that this will potentially include hospital emergency departments, primary care accident and medical centres, and pre-existing primary care centres that are continuing to function, as well as medical centres set up directly in response to the natural disaster.

The greater number of sites participating improves the representativeness of the data, as well as its effectiveness with greater geographical coverage.

The benefits of having a larger number of participating sites will have to be balanced against the resources required to maintain them in the system and the specific geographical distribution of sites in relation to the population affected by the disaster.
2.2.2. Syndromic surveillance

Syndromic surveillance will be the method used in preference to using specific diagnostic categories or laboratory investigations. The suggested syndromes categories are based on previous experience and ones that are correlated with diseases with risk of outbreaks in the Wellington region. The main syndromes of interest for outbreak monitoring are gastrointestinal disease, respiratory disease (including pneumonia), jaundice, meningitis, and unexplained pyrexia.

2.2.3. Healthcare Utilisation

The other healthcare categories that will be collected represent the profile of injuries and illnesses that are the reason for attendance at medical facilities. This will describe the ongoing utilisation of health care services, and inform resource management. The broad categories of healthcare utilisation are injuries, chronic disease management, obstetric and gynaecology and mental health presentation.

2.2.4. Data collection

The data collection tool will be a form adapted from one available from the Center for Disease Control, Atlanta, USA. It is a single page form that aggregates data from attendees at the healthcare provider. The form is completed by an individual clinician, and includes simple demographic data, and all reasons for attendance. It includes data for the site name and time of collection. Each site will need to aggregate data collected, and to report the overall data for a 24-hour period. It is suggested that the 24-hour period runs from 00-00 to 23.59 for each day. Sites will need to report by a determined time the following morning, with an alert system in place to alert the system to sites that have not reported by the deadline, so that they can be contacted.

The surveillance sites will need education in the use of the data collection tools and the means of communication to be employed for transfer of data. In order to assist the operation of the surveillance system, the basing of public health personnel at the sites will need consideration. The deployment of staff will enable the implementation of
the system, and liaison will encourage participation, and will help deal with problems related to the operation of the system. It may also reduce the burden of participation on the sites and so facilitate their co-operation, and allow resources to remain focused on their primary role. Benefit has been reported from the presence of personnel at sites through indirect communication of public health concerns from clinicians. For smaller health care providers it may be feasible for a public health worker to liaise with a group of sites to offer the equivalent support.

The tally data collection form is attached to this as Form 2 and is also in electronic version, found at network location F:\Programmes\Medical Team\Emergency Needs Assessment\Forms in Microsoft Word format.

Sites should report their data on a single report form, having added the individual data from each clinician. This is the tally report form (Form 3), which can also be found at F:\Programmes\Medical Team\Emergency Needs Assessment\Forms.

2.2.5. Communications

The system will be dependant upon the availability of viable a communication system. The aggregated site reports will need to sent, either by fax or e mail to a central collection centre.

The central organisation point will not necessarily need to be within the affected zone and there may be advantages for the central organisation point to be out of the affected region, in order to utilise outside resources, and free local resources for other tasks.
2.2.6. Data collation and analysis

The data has two functions:

- To provide descriptive information on the spectrum of health care utilisation, and to enable monitoring of this over time.
- To provide a warning flag for a possible outbreak of communicable disease requiring further investigation. This will be done with the EARS programme.

The data will need to be entered into an electronic format, and the data from the multiple sites will need to be amalgamated, with the site-specific identity of the data being maintained. The data being in aggregated form rather than at the individual level imposes limitations on its subsequent analysis.

It is expected that analysis will provide the following descriptive data by date:

- Count of total attendances, and presentation of proportion of first time versus follow-up.
- Count and proportion of attendances by gender, ethnicity and age group
- Description of reasons for attendance: total for injuries, mental health, chronic disease management and acute illness, and the proportion of each category of the whole.
- Descriptive analysis of the subgroups of the main categories: the specific types of injury, the specific chronic disease management diseases, and the subgroups of mental health problem presentations.
- The above descriptive analyses will be presented over time, either by day or by week
- The analyses will be presented as a single report for all sites, but also with the potential to assign the participating sites geographically or by type in order to give alternative and comparative analyses.

The way in which the data is managed electronically needs to be considered with a view to how it needs to be analysed subsequently. The choice of which software
programme to be used is not detailed here, but will be left to the choice of the individual or team who have responsibility at the time of operation. The following programmes may be considered:

- The use of database software, such as Microsoft Access. The database will manage the data more effectively; a data entry page can be designed to ensure reliable data entry. The analysis requirements can be programmed at the initial stages and allow for repeated analysis over time with ease. Access is capable of analysing the data to the requirements stipulated above. The results of the analysis can be exported to Excel in order to show the results graphically. It is also intended that the data will also be used for outbreak detection. In order for this to be done, some of the collected data needs to exported from the database in Excel format to be used by the Excel version of EARS as described below. This can be done with Access.

- An alternative is Microsoft Excel is a commonly available programme and suitable for data analysis and presentation of results, but will deal less well with the data management requirements because of the multiple sources of data. In order to enable reliable data entry, a data entry form will be needed. This can be done through Excel, but a more robust option may be to use the Epidata software (http://www.epidata.dk/). Also, because of the nature of the aggregated data, it may need transformation within Excel to allow analysis, and repeated daily analysis will less easily be accommodated.

- To those familiar with it use, Epi Info produced by the CDC (http://www.cdc.gov/epiinfo/), may be a viable alternative to consider.
The syndromic surveillance for the detection of outbreaks requires the use of data for the acute illness categories of

1. Fever (>38C)-unexplained
2. Gastrointestinal
3. Jaundice
4. Meningitis/encephalitis, suspected
5. Dermatological
6. Pneumonia, suspected
7. Respiratory (cough, wheezing, shortness of breath)

The data will be used with the Early Aberration Reporting System (EARS) to help in the detection of outbreaks.

The details of the EARS programme are available at http://emergency.cdc.gov/surveillance/ears/. The programme is available in Microsoft Excel format at the same site. The download includes detailed instructions for use.

The programme, and instructions is also available on the RPH network at F:\Programmes\Medical Team\Emergency Needs Assessment\EARS_X. The programme is also available to used within the SAS statistical programme.

In order to use the EARS programme the collated data for all the sites needs to be imported into the programme. As the Excel file with the data is updated each 24-hour period with new data, running of the EARS programme uses the new data set.

The flags of the system are three, the C1-MILD, C2-MEDIUM and C3- ULTRA methods that manipulate the data slightly different ways. Sensitivity increases from C1, to C2 to C3. The programme needs a minimum of 7 days data for C1, and 9 days for C2 and C3. Previous experience has utilised a 3 day moving average for initial analysis prior to the availability of seven days data. This will require access to specialist knowledge to be performed.

It will need to be considered whether EARS will only analyse the data as a complete dataset for all the sites involved in the surveillance or whether selective stratification will also be used, based upon geographical areas, in order to study selective areas independently.
It will be preferable for the site reports to be reviewed by a medical epidemiologist, or someone with similar skills, in conjunction with the EARS programme, as previous experience has shown a dual approach to be more sensitive in outbreak detection.

Triggers determined by EARS or by review by the medical epidemiologist will need appropriate investigation.

The reports of the both the healthcare utilisation and the outbreak detection analyses will then need to be communicated daily to the responsible public health team, through the available communication channels, and then to inform the Civil Defence Emergency Management structure.