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## ABSTRACT

Resilience refers to the capacity of a community, its members and the systems to respond to the significant disturbances to the social and physical environment created by large scale hazard activity in a manner that ensures the continuity of societal functions. A resilient society is able to draw upon its own individual, collective and institutional resources and competencies to cope with, adapt to, and develop from the demands, challenges and changes encountered before, during and after disaster. In this context, resilience comprises four general components:

1. Communities, their members, businesses and societal institutions must possess the resources (e.g., household emergency plans, business continuity plans) required to confront the issues encountered prior to (e.g., during warning phase of impending pandemic outbreak), during, and after the pandemic;
2. Communities, their members, businesses and societal institutions must possess the competencies and procedures (e.g., action coping, community competence, trained staff, disaster contingency management procedures) required to mobilize, organize and use these resources to confront the problems encountered and adapt to the reality created by a pandemic;
3. Because a pandemic will impact all levels of society, societal resilience will be a function of the capacity to integrate individual, community and societal resources to sustain societal capacity and provide the means to realize the change and growth potential that can accompany large-scale disaster; and
4. Mechanisms must be in place to ensure the sustained availability of these resources and the competencies required to use them over time and against a background of hazard quiescence and changing community membership, needs, goals and functions.

Because a pandemic will affect people and communities and societal functions, any model of resilience must accommodate the interdependencies between people, communities and societal institutions. Consequently, a generic multi-level model that accommodated the inter-relationship between these levels was developed to examine resilience to volcanic hazard consequences. The validity of the model was demonstrated when assessed using the volcanic impact scenario (Paton, 2007). This provided support for the utility of the model to act as a mechanism capable of assisting several aspects of natural hazard planning.

The benefits that accrue from a generic model include the development of a framework for evidence-based practice that can be used to make comparable assessments of resilience throughout the region. Planning activities can be expedited by the availability of a model that is capable of assessing resilience and guiding intervention and whose operation is independent of geography, location, or demographics. A generic model allows comparable assessments to be made across hazards (all hazards planning), demographic groups, and at different levels of analysis (e.g., ward, territorial authority, geographic area, region).

This confers upon the model the capability to be used to assess across levels of analysis and to integrate data to construct estimates of resilience in a range of contexts. With a common assessment and planning framework at their disposal, territorial, city and regional planners would be able to compare and contrast groups and regions and combine data from different groups or areas to construct a composite regional assessment.

The comparability afforded by a model of this nature is essential for the effective management of risk through facilitating resilience, for managing the effective distribution of limited resources to the areas which will benefit most (by using a common assessment method to assist intervention planning), and for response and recovery planning.

The development of a valid generic model allows for the use of an evidence-based approach to guide planning and intervention and provides city and regional planners with a common assessment framework to:

- assess resilience;
- identify aspects of personal and community competencies that will benefit from their development;
- facilitate resource allocation decisions; and
- monitor change in levels of resilience and its predictors over time.

A generic model transfers responsibility for translating model variables into practical intervention strategies to community members, representatives of wards/community groups, and to agencies with responsibility for facilitating community development outcomes through community engagement.

The transfer of responsibility for intervention planning and delivery to communities and community agencies is consistent with the tenets of resilience and is fundamental to the development of resilience and its sustained availability. A need to devolve authority to local levels derives from the fact that communities differ with regard to their specific mix of demographics, their hazard history, existing levels of resilience and vulnerability, and the resources they have available. Intervention strategies will facilitate the development of the community resources (e.g., knowledge, skills, collective competencies) required to effectively cope with and adapt to hazard consequences.

Given that interaction between these factors will determine the most appropriate strategy for the development of resilience, intervention strategies must accommodate the fact that the nature of these interactions will differ from one community to another. This makes it difficult to organise a central planning process for intervention development and delivery. However, a generic framework provides the means to identify the factors (e.g., positive outcome expectancy, community participation) that intervention strategies will target. It provides guidelines for local initiatives with the specific change strategy being developed at this level. While not defining the specific content of an intervention strategy, a generic model provides the means of the central coordination of strategies, the evaluation of intervention effectiveness and, by using the feedback from this process, informs future planning decisions.

Even though the goal is the same (e.g., increase positive outcome expectancy or community participation etc.), community diversity (e.g., hazard history, risk, demographics, stage of development) means that the strategies used to promote change in predictors and resilience must be tailored to the specific characteristics and needs of each community. For example, differences in baseline levels of hazard knowledge, opportunities for community participation and the groups (e.g., Rotary, religious congregations, social groups) available to be targeted for intervention will influence both the factors that need to be targeted in a given community and determine the most appropriate way to develop each factor within each community.

Devolving responsibility for the translation of the model into intervention strategies capable of facilitating local change increases the likelihood that intervention will be consistent with the needs, goals, expectations and competencies of each community. Local representatives are best placed to make these choices. The transfer of responsibility for making choices about managing change to those closest to the issue, and to those who are most affected by the change, can also contribute to a more cost-effective use of resources. It also ensures that the resources provided meet local needs, and that the process builds commitment to sustaining resilience over time and against a backdrop of changing community membership and needs. This is particularly important given that it is impossible to predict when a pandemic may strike and any gains in resilience must be sustained over an indefinite period.

While the validity of the model was demonstrated when tested against the volcanic scenario (Paton, 2007), a stringent test of the validity of the model requires that it is examined against another hazard. Consequently, the objectives of the present report are twofold. The first is to provide evidence of the validity of the model when tested against a second hazard and with a different sample of Auckland residents. For this, a pandemic scenario was selected. The second objective is to use the analysis of the model to examine Auckland's resilience in the event of a pandemic.

## **KEYWORDS**

resilience, pandemic, preparedness

## **PART ONE**

### **1.0 VALIDATING THE RESILIENCE MODEL**

#### **1.1 Scenario selection**

The assessment of resilience must take place in a context in which the potential demands associated with hazards must, at the time of data collection, be the same for all participants. Only when this condition is satisfied is it possible to develop a model that can be generalised to the Auckland population as a whole. The inherent uncertainty regarding the timing, location, and distribution of pandemic hazard consequences, and the possibility for multiple clusters to emerge at the same time in different locations makes a pandemic scenario an appropriate one for this validation study.

These characteristics ensure that, at the time of data collection, risk is comparable for all residents irrespective of their specific location. This is an important caveat when developing models of resilience. Equality in risk distribution (at least with regard to the probability of exposure to pandemic hazards) requires comparable levels of adaptive capacity in all citizens of Auckland. This makes the differences between responses more meaningful and interpretable within a model. The infrequent nature of pandemic hazard activity, the complexity of consequences it poses for people and the need to rely on expert sources for information on protective measures renders a pandemic scenario an appropriate one for investigating resilience. The selection of this scenario, and the conduct of a survey to replicate the validity of the model, was essential to test the following objectives:

- a) Conduct a test to validate the model (developed using the volcanic hazard resilience model);
- b) Provide evidence for the all-hazards capability of the model; and
- c) Examine the contribution of variables that were, due to sampling problems in phase one, rendered marginal in the previous analysis.

#### **1.2 Variable selection**

For this validation study, the variables selected were those identified in the volcanic resilience model. The principle objective of Phase Two of the project was to validate the model by testing its predictive utility for a very different hazard from that used to develop the original model. The model comprises individual and community characteristics and processes that are, potentially, amenable to change through public education programmes based on community engagement principles. As a result, the variables modelled can be incorporated within risk management and pandemic (and other) hazard planning process in ways that afford opportunities to make choices regarding the availability of the individual, community and societal factors that influence resilience.

## **2.0 SURVEY QUESTIONNAIRE ITEMS**

In this section, information on the source of the variables included in the questionnaire is presented. Details of the variables and their sources can be found in Paton (2007). The variables modelled were:

**Action Coping**

**Outcome Expectancy**

**Empowerment**

**Community Participation**

**Articulating Problems**

**Trust (general and specific)**

**Intentions**

**Individual and Community Readiness**

A series of questions (see Appendix 1) regarding household and community readiness for a pandemic was compiled from World Health Organization and New Zealand Ministry of Health sources.

## **3.0 DATA COLLECTION**

These variables were compiled into a questionnaire, which was administered to a random sample of 400 households by telephone in July/August 2006. A telephone survey is the most appropriate medium through which to collect data, particularly with regard to the nature and level of peoples' preparedness and knowledge. Compared with postal surveys, telephone surveys provide more accurate insights into peoples' attitudes and knowledge.

## **4.0 MODEL COMPARISON**

The pandemic model is depicted in Figure 1. The model was a good fit to the data, with this model accounting for 32% of the variance on intentions to develop pandemic resilience. Comparison with the volcanic resilience model (Figure 2) reveals that the two models are fundamentally very similar. The variables identified in the volcanic analysis (Figure 2) and their inter-relationships, support the validity of the model as a mechanism that can assist all-hazards planning.

A secondary goal of this work was to determine whether one variable, Action Coping (AC), whose role in the volcanic analysis was marginal (possibly as a result of a sampling error that resulted from the survey company's inclusion of an inappropriate response category), had a significant role as a predictor of resilience. The role of AC was confirmed (Figure 1). While not having a direct influence on Intentions, its action was mediated by Community Participation (CP).

The data provides strong support for the validity of the model and its capability of use within an all-hazards environment. Some differences were apparent, but they do not alter the theoretical integrity of the model. These changes and their implications are discussed in this section.

The ability of AC to predict CP is consistent with the theoretical model from which the model is derived. With AC, the content reflects people's general disposition to confront problems. It is possible that this relationship would have been identified in the volcanic model analysis had the full complement of responses been available.

The relationship between Articulating Problems (AP) and Trust was not supported in the pandemic model. However, a direct relationship between Positive Outcome Expectancy (POE) and Trust was evident in the pandemic model, but was not identified in its volcanic counterpart.

This may reflect differences in how people form and act on beliefs regarding the feasibility of mitigating pandemic hazard consequences (captured by POE). For example, the more recent coverage of pandemic issues in the media and the provision of preparedness information from health agencies, may have increased pandemic knowledge (relative to the less frequent coverage of volcanic hazard issues) resulting in POE circumventing, to some extent, the need for separate problem articulation when seeking information.

Furthermore, the knowledge and preparedness issues posed by a flu pandemic are simpler (e.g., people have some familiarity as a result of flu being an annual hazard) and generally easier to acquire, understand and implement than their volcanic counterparts. However, this was not true for all respondents. This was illustrated by the fact that the core POE – AP – Empowerment – Trust pathway remains highly influential in the model (Figure 1).

The remaining missing pathway was that describing the relationship between Negative Outcome Expectancy (NOE) and CP. One tentative explanation for this reiterates the earlier point regarding differences between volcanic and pandemic hazards with respect to the information available. A major function of community discussion about hazards is to formulate estimates of risk. The more extensive coverage of pandemic issues may have meant that those citizens who formed negative Outcome Expectancy beliefs were less reliant on other sources to confirm their risk beliefs. Consequently, the path was not present.

One pathway was represented in the pandemic model, but not in the volcanic model. A negative relationship was evident between CP and Trust. It is important to interpret this finding in relation to the CP – Empowerment – Trust pathway (Figure 1). The negative relationship between CP and Trust reinforces the importance of Empowerment as a predictor of levels of Trust when planning public pandemic education. This is discussed in more detail below.

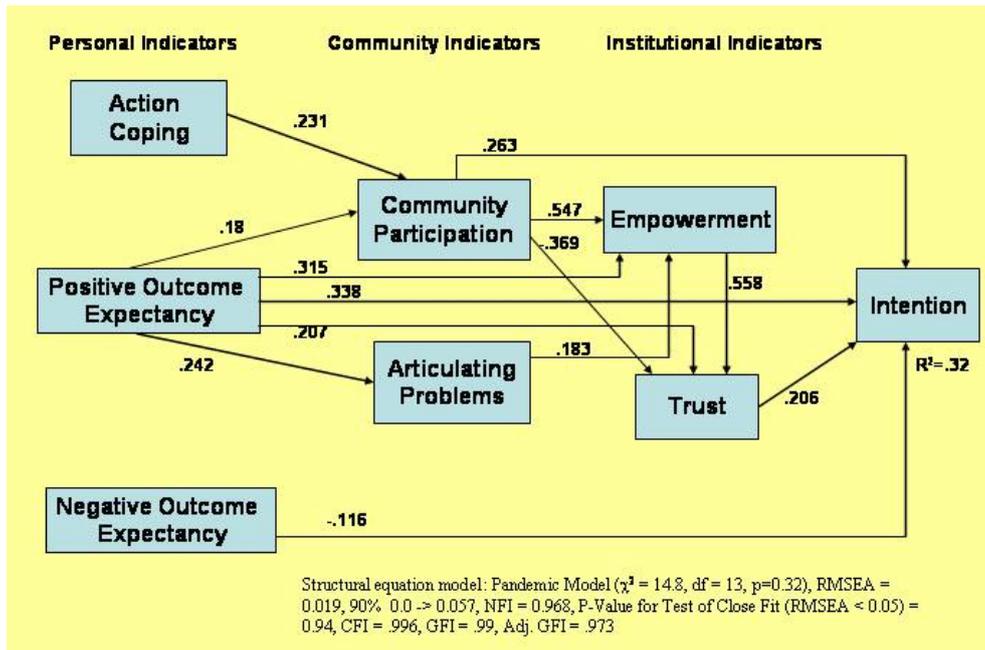


Figure 1 Pandemic Model

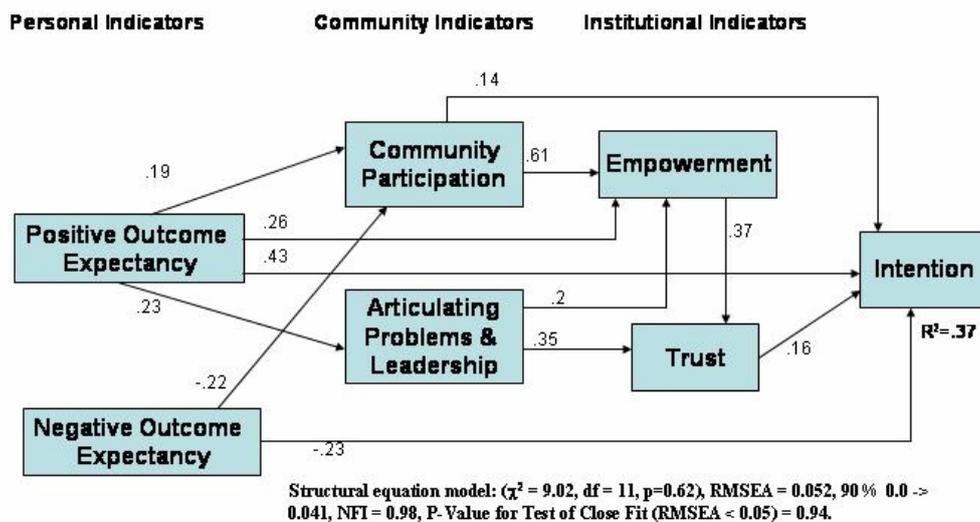


Figure 2 Volcanic model

The analysis of the resilience model using a pandemic scenario, which presents respondents with a very different hazard to that described for the volcanic scenario, provides support for the validity of the model for predicting community resilience. It also reinforces its value as a planning tool within an all-hazards framework. With regard to the latter, the remainder of this report focuses on the analysis of Auckland's current pandemic resilience potential and on identifying its implications for intervention.

## PART TWO

### 5.0 COMMUNITY PANDEMIC RESILIENCE AND READINESS

#### 5.1 Current Levels of Resilience and Readiness

The level of pandemic resilience in Auckland is a function of the degree to which people adopt measures that increase their ability to cope with, and adapt to, pandemic hazard consequences. A list of such measures and the frequency with which they have been adopted is described in Table 1. The mean number of readiness measures adopted is listed in the final row of Table 2.

The list of measures contained in Table 1 is a sub-sample of the items that comprised those used in the questionnaire. While all the items in the original preparedness scale (Appendix 1) can play a role in estimating people's capacity to adapt to the consequences of a pandemic event, the use of a curtailed list (Table 1) is essential from the perspective of testing a model of resilience. Before proceeding to discuss the contents and their relationship with pandemic resilience, the rationale for the selection of a sub-sample of items (Table 1) for use in model testing is outlined.

The reasoning behind this approach stems from the fact that people may record several items in the preparedness questionnaire for reasons other than it reflecting their deciding specifically to develop their capacity to cope with the consequences of a pandemic. For example, the questionnaire contained several items inquiring about food availability. In this sample, some 67% of respondents stated that they have food for a week. However, this response could reflect their regular shopping habits and not an action undertaken specifically to increase their resilience (e.g., they do not set aside food specifically for emergency use).

In contrast, a measure asking whether people are changing their shopping habits to gradually increase their emergency food supplies represents one that provides insights into the degree to which people are adopting actions that reflect their specifically preparing for a pandemic. For this measure, only 16% stated that they were building their food supply gradually.

The discrepancy between these scores (67% versus 16%) illustrates how measures that tap into routine behaviours (e.g., people shopping in bulk to meet their food needs for several days at a time) can lead to overestimating people's capacity to cope with the lack of food availability during a pandemic. If shopping habits have not changed, the potential for people to accumulate supplies during what may be a relatively short warning period (and one during which supermarket supplies are likely to be rapidly depleted) will place significant constraints on their capacity to adapt. The other measure taps into whether people are changing their shopping habits specifically to accumulate emergency supplies. As such, it provides a more representative measure against which the role of the predictors of adaptive capacity or resilience can be established.

Similar arguments can be made regarding several emergency kit items. For example, people could have a torch in case of power cuts, a battery radio because they like listening to it while

gardening, and spare batteries because they regularly use items for other reasons and so on. However, unless people have decided specifically to set these items aside within an emergency kit for use specifically in the event of an emergency, they do not provide an appropriate measure against which to evaluate predictors of resilience.

The same logic would apply to issues such as having school, work and health care contact details. While relevant for household pandemic planning, their presence could well reflect the utility of such information on a more regular basis.

**Table 1** Percentage adopting factors that reflect specific decisions to prepare for a flu pandemic

<b>Pandemic Preparedness Items</b>	<b>Have done this (%)</b>
Does your pandemic plan cover being isolated/remaining at home for up to four weeks?	<b>17</b>
Emergency water supplies (3 litres per person per day) for a week?	<b>14</b>
Does your plan include gradually building up emergency food supplies over the next few months (e.g., buying extra items each time you shop)?	<b>16</b>
Is there someone who could help with food and supplies if you and your household are ill?	<b>21</b>
Does your plan consider what you will do if a family member gets sick? E.g.,	
How you will care for them?	<b>8</b>
How you will isolate them?	<b>13</b>
If parents sick, who will look after the children?	<b>11</b>
If you need to move, do you have a bag with essentials packed?	<b>15</b>
What you will do if there is a death in the family?	<b>22</b>
Does your plan ensure that everyone know where important documents are located?	<b>8</b>
If you/your family were isolated or had to remain at home for more than a week, does your plan include:	
What you will do to keep occupied?	<b>12</b>
What would you do to keep the children entertained?	<b>16</b>
Does your plan include:	
Discussion with neighbours/friends/workmates to look out for each other?	<b>15</b>
Knowing the likely needs of elderly/infirm neighbours, those with disabilities single-parent families and what might be done to assist them ?	<b>14</b>
Discussion with the community groups that you are a member of about how to assist each other?	<b>29</b>
Have you planned for a reduction/loss of income if unable to work (e.g., need to stay at home to look after family) or workplace closes?	<b>13</b>
Have you planned for school/child care closure?	<b>23</b>

The inclusion of items in a preparedness scale that could be linked to decision processes that have little or nothing to do with developing a capacity to cope with or adapt to pandemic consequences will inflate estimates of the extent peoples' underlying reasoning leads them to decisions specifically to prepare. Using these items, it is impossible to separate outcomes that reflect routine behaviour from those that reflect a predisposition to develop an adaptive capacity for pandemic events. These items do not provide an appropriate basis for testing a model of adaptive capacity. Consequently, model development work focused on those items whose presence was indicative of a capacity to cope with and adapt to pandemic hazard consequences.

This should not be taken to imply that the items omitted from Table 1 (e.g., regarding food supply, torch, spare batteries etc.) have no role to play as influences on people's adaptive potential. However, if their presence reflects routine behaviour intended to meet immediate or short term needs, rather than decisions specifically taken to increase pandemic resilience, they must be excluded when testing the model. Furthermore, care must be taken when using measures that could reflect routine behaviour not to overestimate levels of readiness. Only by including measures that reflect decisions taken to increase capacity to cope with pandemic consequences is it possible to test a model of resilience and gauge current levels of Auckland's pandemic resilience. A key outcome of the model testing process is the provision of a means for assessing the nature and level of predictors. If predictor levels can be assessed, health agency planners responsible for public education can use these data to identify areas to which strategies can be directed (e.g., those with lower values).

From Table 2, it is evident that most variables are present at moderate to low levels. This is consistent with the moderate levels of intention and the generally low levels of adoption of readiness measures (Table 1). These data suggest that action is needed to increase levels of all factors. The exception is NOE (for which low scores are desirable). Because of their role as motivating factors, the low levels of AC and POE are particularly problematic and action to increase their levels should be prioritised. Intervention directed to increasing POE will be, given its significant direct and indirect influence on the development of resilience, particularly important. The final row in Table 2 lists the mean number of items adopted. These data reiterate the conclusions about low levels of preparedness reached on the basis of the data provided in Table 1.

**Table 2** Descriptive Statistics: Pandemic Scenario

	<b>N</b>	<b>Min</b>	<b>Max</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Ranking</b>
<b>Intention</b>	388	5.00	15.00	10.83	3.15	M
<b>Action Coping</b>	394	4.00	20.00	8.76	3.50	L
<b>Negative Outcome Expectancy</b>	389	4.00	20.00	13.76	3.21	M
<b>Positive Outcome Expectancy</b>	395	3.00	15.00	6.32	2.37	L
<b>Community Participation</b>	398	5.00	20.00	12.09	3.94	M
<b>Articulating Problems</b>	390	4.00	20.00	9.03	2.39	L
<b>Empowerment</b>	391	4.00	20.00	12.61	3.50	M
<b>Trust</b>	396	5.00	25.00	13.78	3.50	M
<b>Readiness Measures</b>	380	0.00	17.00	2.83	3.90	L

The responses in Tables 1 and 2 indicate that, overall, prevailing levels of adaptive mechanisms in Auckland are low. The most heavily subscribed item (Table 1) was 'discussion with the community groups that you are a member of about how to assist each other'. Some 29% stated having done this. At the other end of the scale, only 8% had planned what to do if a family member gets sick. The initial data highlights a need to develop the competencies and resources required to ensure a resilient response to a pandemic in Auckland. Households had adopted (Table 2), on average, 3 of the 17 recommended items in the curtailed list. No significant differences were found when comparing levels of preparedness by location (council area), age or ethnicity.

## 6.0 PREDICTING RESILIENCE

The variables selected for inclusion in the model were derived from the findings of the volcanic test. As in the earlier test, the selection of variables was driven by the pragmatic goal of ensuring that they represented factors amenable to change through a pandemic risk management process. Details of the variables and sources of measures can be found in Paton (2007).

The model proposed that resilience reflects the outcome of the interaction between variables at individual, community and societal levels (see Figure 3). At the individual level, the variables included were AC and two Outcome Expectancy variables (NOE and POE) and AC were modelled.

NOE taps into beliefs that a pandemic will be too destructive for personal action to make a difference. If people believe this, no further action is likely. POE taps into beliefs that personal preparation can help people cope with hazard consequences. AC measures the degree to which people are predisposed to confront problems, the more likely they are raise issues about pandemic risk and readiness with others in their community. If people believe it is possible to mitigate hazard consequences (POE) and are predisposed to act (AC) they are more likely to be motivated to develop their resilience.

People need specific knowledge and skills if they are to act on this belief. If people possess this knowledge themselves, this may be sufficient to guide their decision to formulate plans to act. However, because pandemics are rare, some people may not have this knowledge and will need to identify gaps in knowledge or expertise if they are to develop their adaptive capacity.

Consequently, to acquire the information and resources they need to reduce their uncertainty and guide their actions, the model proposes that people look first to other community members (CP) and subsequently to civic health or emergency planning agencies. The influence of health agencies was assessed in terms of whether or not the response of these agencies is perceived to empower community action. Variables were selected on the grounds of their potential to influence how people evaluate information under conditions of uncertainty.

Two community variables, CP and AP, were selected. Peoples' concept of environmental risk is influenced by others' views, as are the choices they make regarding how they might confront risk. In particular, people typically turn to those they believe share their values when faced with deciding how they might deal with uncertainty. Participating in activities with other community members provides access to information from others that will be consistent with one's values and expectations. This was assessed using a measure of CP.

While CP provides access to the collective knowledge and expertise within a community, this may not provide answers to all the issues people identify. Consequently, an additional step in the process may be required. The infrequent and complex nature of pandemic hazards increases people's need to rely, to some extent, on expert sources to acquire the information and resources they require to act. Under these circumstances, however, just knowing of a lack of, or gaps in, knowledge is not enough. If they are to interact effectively with civic agencies, community members must be able to articulate these needs and expectations into a set of questions (problem articulation) that can help reduce their uncertainty and guide their actions in ways that increases their resilience.

When faced with uncertainty, decisions regarding the quality of information received derive from the degree to which it is consistent with the needs and expectations of those seeking it. Being able to define information needs also facilitates more effective interaction with civic agencies. It is the consistency between people's expectations and the information received that helps people construct more accurate estimates of risk and reduces uncertainty. Community groups must be able to articulate their needs into a set of meaningful questions, the answers to which will reduce their uncertainty and provide direction for their actions. A measure of 'AP' was used to assess this aspect of community functioning.

Being able to formulate questions is one aspect of this process, whether action ensues is a function of the degree to which those being asked respond in ways that provide answers that meet community needs. Two factors relating to the quality of the relationship between community members and civic agencies were included in the model; Empowerment and Trust.

Realising the benefits of community problem-solving competence requires that civic agencies empower citizens and provide them with the resources, skills and information required by community members if they are to act to tackle problems that they deem important. A measure of Empowerment developed by Speer and Peterson (2000) was used here.

Once problems are articulated and resources/information sought, whether people decide to convert this into protective measures that will positively influence their adaptive capacity concerns whether they trust the source. The measure of social trust used was derived from an earlier study of earthquake preparedness. It was proposed that interaction between these variables predicts people's adaptive capacity. Adaptive Capacity was measured in two ways. Firstly, by the adoption of actual readiness measures that would increase people's ability to cope with, and adapt to, pandemic hazard consequences. An intermediate, Intentions, was also used.

The inclusion of a measure of Intentions is important in several respects. Firstly, with regard to the development of a generic model with all-hazards capability, the inclusion of 'intention' allows the model to be tested across other hazards. Because the factors that influence people's physical capacity to adapt will vary from hazard to hazard (e.g., the measures required for pandemic resilience will differ from those required to adapt to volcanic consequences) the inclusion of intentions, which is common to all hazards, allows comparison across hazards. Secondly, the inclusion of an intention measure means that capacity can be assessed even when actual levels of preparedness are low.

## 7.0 MODEL ANALYSIS

The model describes the development of Adaptive Capacity as a process which commences with the variables on the left side of Figure 3 (i.e., with factors that motivate people to act). The arrows linking the variables indicate the direction (commencing with Outcome Expectancy) of the causal relationships between variables identified by the analysis. The numbers adjacent to each arrow indicate the strength of the relationship (from 0 - no relationship to 1 - perfect relationship). A minus sign indicates an inverse relationship between variables.

The analysis (Figure 3) supports the validity of the model as a predictor of the role of social and societal influences on pandemic resilience. All paths shown are significant. The data provided a good fit for the model. The Goodness-of-Fit statistics are:  $\chi^2 = 14.8$ ,  $df = 13$ ,  $p=0.32$ ),  $RMSEA = 0.02$ ,  $NFI = 0.97$ ,  $GFI = 0.99$ .

In structural equation modelling, the objective is to find non-significant differences between the predicted and actual model. This is measured by the Chi Squared ( $\chi^2$ ) statistic. The smaller the  $\chi^2$  value, the better the fit of the actual model. The non-significant value obtained

here (14.8) indicates that the actual model is a close fit to the hypothesised model. This is supported by the other measures described here (e.g., the Goodness-of-Fit Index (GFI) can range from 0 (poor fit) to 1 (perfect fit) – a value of 0.99 indicates a good fit). The model accounted for 32% of the variance in intention to prepare for pandemic hazards. Overall, all measures of fit indicate that the model is a good fit to the data. The results support the utility of the model as a device to assist understanding of how personal, community and institutional factors interact to influence levels of resilience.

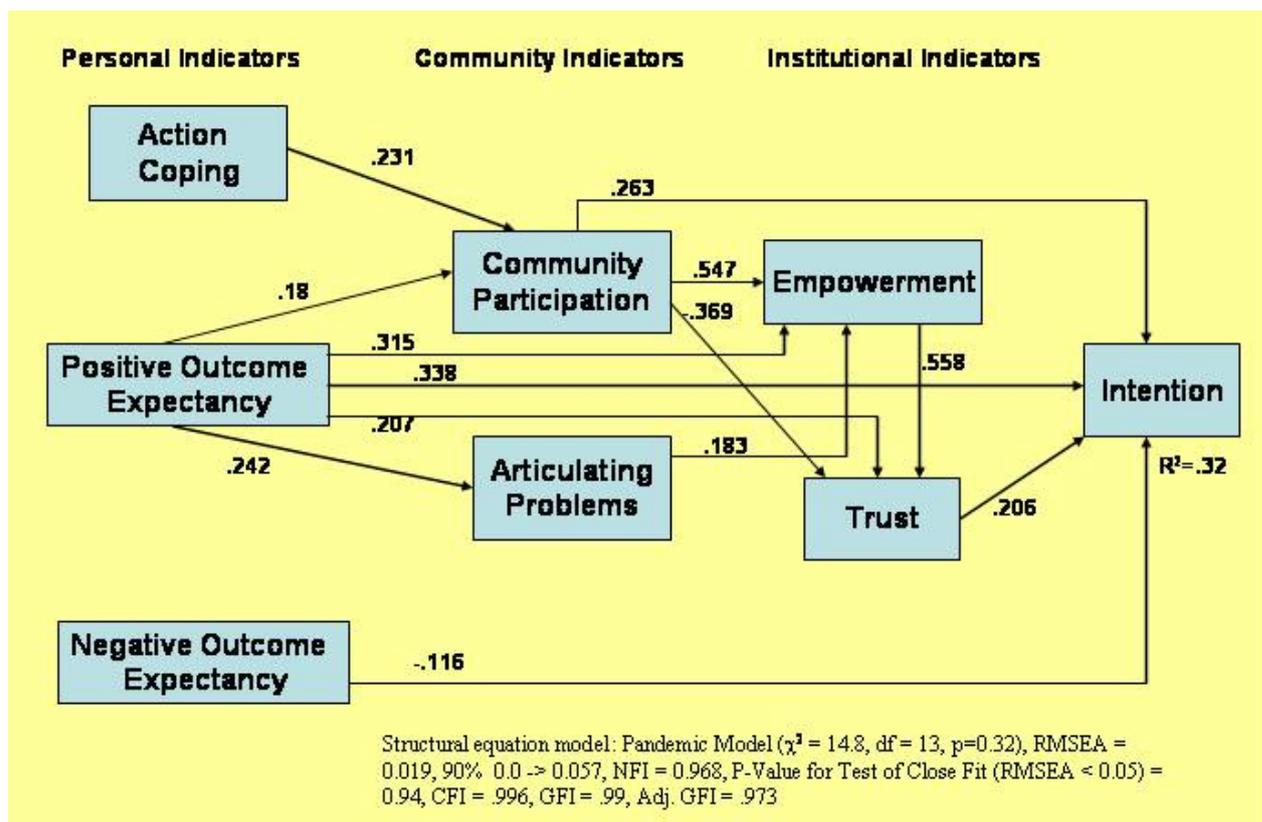


Figure 3 Pandemic Resilience Model

## 8.0 DISCUSSION AND CONCLUSION

In this section, each component of the model and its implications for pandemic resilience is discussed. It commenced with a review of the role of the motivating factors, NOE, POE and AC.

### 8.1 Negative Outcome Expectancy

NOE (people believe that pandemic consequences are so severe or threatening as to render personal actions futile) predicted a reduction in the likelihood that people would formulate resilience intentions (Figure 3). If people hold NOE beliefs, they are unlikely to decide to develop their adaptive capacity. The mean score (Table 2) for this variable was 14, indicating its presence in this sample at moderate levels. Intervention strategies should be designed to reduce levels of this variable.

The fact that this factor had an independent role in the pandemic model (Figure 3) means that risk management programmes must neutralise this belief before commencing activities designed to increase resilience. Its presence effectively indicates that a portion of the Auckland population is particularly vulnerable in the event of a pandemic. Its presence also means that the management of NOE should be prioritised for intervention within the planning process and, at least in the short term, that it be accommodated within residual risk estimates within the pandemic planning process.

## **8.2 Positive Outcome Expectancy**

POE (i.e., people believe that preparing for pandemics can be beneficial and achievable) had a direct influence on intentions (Figure 3). This indicates that, for some people, a strong belief in the capacity of personal action to mitigate risk is sufficient for them to develop intentions to develop their adaptive capacity. A mean score of 6 (Table 2) indicates its presence at low levels in this sample. In addition to it being an important motivating factor, the fact that, as outlined earlier, it has both direct and indirect influences on resilience means that this factor should be targeted as a high priority for intervention.

However, the fact that POE had an indirect influence that was mediated by CP and AP indicates that some people require more information before deciding to develop their adaptive capacity. For this, they turn to the members of their community. Thus, in the absence of sufficient personal knowledge to manage one's risk, positive outcome expectancy beliefs prompt people to interact with others to fill the gaps in their knowledge.

## **8.3 Action Coping**

AC had no direct influence on resilience. Its influence was mediated by its relationship with CP (Figure 3). That is, the more people are predisposed to confront problems, the more likely they are raise issues about pandemic risk and readiness with others in their community. A mean score of 9 (Table 2) indicates its presence at low levels in this sample. Intervention should be designed to increase levels of AC.

## **8.4 Community Participation**

Confirmation of the role of CP in the model reflects the important contribution that social interaction with those who share similar beliefs and values has in the process of developing resilience. This was evident in the small, but significant, direct relationship between participation and intentions (Figure 3). Thus, in some cases, information from one's community can provide sufficient clarity and guidance to support people making decisions to prepare. However, the strong relationship between participation and Empowerment (Figure 2) also supports the contention that, when confronting infrequent, complex pandemic issues, communities may not always be in a position to meet the needs of their members. When this happens, people look to civic agencies to fill gaps in their knowledge. The analysis also provided support for the role of 'AP' in the development of resilience, and supports the argument that an ability to formulate one's needs into a coherent form or set of questions has a role to play in predicting resilience. A mean score of 12 (Table 2) indicates its presence at moderate levels in this sample. Intervention designed to change levels of this variable must

focus on increasing levels of discussion of pandemic issues in ways that mobilise household and community risk management.

An important outcome in the pandemic analysis was the finding of a significant negative relationship between CP and Trust (Figure 3). This observation emphasises the important role played by Empowerment in the process of facilitating the development of social resilience. This negative relationship suggests that, in the absence of perceived Empowerment (i.e., if people do not believe that civic agencies have responded in ways that meet their needs), trust in the source is reduced. This will act to constrain the development of resilience. This has longer term implications for the quality of the relationship between community members and the civic agencies that they rely on for expert information and advice.

The relationship between developing and losing trust has been described as asymmetric. This reflects the fact that trust can be easily lost if people perceive their relationship with health agencies as one that neglects or fails to meet their needs. In the context of being in the early stages of the process of developing pandemic resilience, this observation takes on added significance. It suggests that some members of these communities do not perceive themselves as being empowered by their relationship with health agencies. This can be interpreted in ways that lead to a loss of trust in agency sources. This outcome is more likely when public education relies on the dissemination of general information (which is more likely to fail to meet the needs of some sectors of the community). This could make future intervention a considerably more challenging proposition. Given the ease with which trust asymmetries can arise, it is important that attention be directed to sustaining the positive elements of this relationship through the development of pandemic risk management strategies that adopt community engagement principles designed to actively empower community members (see below).

## **8.5 Articulating Problems**

CP provides the social context within which collective knowledge can be accessed and risk management needs formulated through discussion with others with similar values and interests. However, if gaps in knowledge remain, being able to articulate these gaps into questions allows community members to represent their needs to civic emergency/health agencies. The ability to formulate questions also plays an important role in their evaluating whether the response they get from an expert source (e.g., health agency) is meaningful for them and is capable of assisting people's risk management planning. This is indicated by the relationship between AP and Empowerment (Figure 3). It is the relationship between being able to articulate problems and getting meaningful (empowering) responses that ensures that information providers contribute to the development of community resilience.

A mean level of 9 (Table 2) indicates its presence at low levels in this sample. Intervention targeted at increasing levels of this competence should include both increasing hazard knowledge and the problems solving skills of community members.

## 8.6 Empowerment

The prediction that the relationship between participation, the ability to AP and Preparedness would be mediated by Empowerment and Trust was supported (Figure 3). Empowerment strategies help people exercise some control over their risk management decisions. The links between CP and AP and Empowerment (Figure 3) indicates a relationship between community members and civic agencies that emphasises meeting community needs and expectations plays a significant role in the development of resilience.

A mean score of 13 (Table 2) indicates its presence at moderate levels. Because Empowerment is influenced by prevailing levels of CP and AP, strategies for building this component of the model must be developed in ways that include the complementary development of CP and AP.

## 8.7 Trust

Finally, as predicted, Trust mediated the relationship between Empowerment and AP and the development of resilience Intentions (Figure 3). These relationships support the view that the more citizens perceive their needs as having been met through their relationship with civic agencies, the more likely they are to trust them and the information they provide, and to use the information to formulate plans to manage their risk by developing a capacity to adapt to pandemic hazard consequences. A mean level of 14 (Table 2) indicates its presence at moderate levels in this sample. The development of Trust will flow from the changes to variables preceding it in the model, with POE, CP and Empowerment having a prominent role to play in this regard.

## 9.0 CONCLUSION

This project had two goals. The first was to test the validity of the model developed using the volcanic scenario. This was accomplished (Figures 1 & 2). The high level of comparability obtained when examining different hazards supports the ability of the model for use in an all-hazards environment.

The second goal was to examine the specific implications of the analysis for estimating the potential resilience of the Auckland population for a pandemic. Analysis of the model using the pandemic scenario confirmed that interaction between personal (POE and NOE), social (CP, collective problem solving) and civic factors (Empowerment, Trust) predicted people's decisions to develop resilience intentions. While people, communities and civic agencies make different contributions to this process, the model indicates that developing resilience as a component of an effective volcanic hazard risk management programme will only ensue when their respective roles are integrated. An important finding was that the relationship between civic emergency management agencies and communities is a significant component of the social context in which risk beliefs are forged and enacted, and one which involves more than just making information available. The model suggests that integrating risk management and community development activities in ways that develop these competencies (e.g., discussion of hazards, problem solving) and relationships (e.g., empowering) will increase the degree to which the model predicts the likelihood that people

will develop their adaptive capacities. When communities and emergency management agencies play complementary roles in the risk management process, community members levels of trust, satisfaction with communication, risk acceptance, willingness to take responsibility for their own safety, and commitment to developing sustained adaptive or resilient capacity to deal with hazard consequences will increase.

## **10.0 REFERENCES**

Paton, D. 2007. Measuring and monitoring resilience in Auckland, GNS Science Report 2007/18. 88p.

Speer, P.W., Peterson, N.A. 2000. Psychometric properties of an empowerment scale: Testing cognitive, emotional and behavioral domains. *Social Work Research*, 24, 109-118.

## APPENDIX 1 PANDEMIC PREPAREDNESS MEASURES

	Have done this	May do this	Will not do this
Does your pandemic plan cover possibly being isolated/remaining at home for up to four weeks?	3	2	1
Does your pandemic plan cover having food for at least a week for:			
Your family, others who might be with you and your pets?	3	2	1
Is this food in cans and packets and dried foods?	3	2	1
Emergency water supplies (3 litres per person per day) for a week?	3	2	1
Do you have alternate sources of cooking/heating, lighting?	3	2	1
Does your plan include gradually building up emergency food supplies over the next few months (e.g., buying extra items each time you shop)?	3	2	1
Is there someone who could help with food and supplies if you and your household are ill?	3	2	1
Does your plan include an emergency kit containing:			
Prescription medicines/monitoring equipment for four weeks?	3	2	1
Disinfectant or bleach?	3	2	1
Medicines for fever/headaches (e.g., paracetamol/ibuprofen)?	3	2	1
Thermometer?	3	2	1
Torch and spare batteries?	3	2	1
Portable radio and spare batteries?	3	2	1
Manual can opener?	3	2	1
Rubbish/bin bags?	3	2	1
Does your plan consider what you will do if a family member gets sick? E.g.,			
How you will care for them?	3	2	1
How you will isolate them?	3	2	1
If parents sick, who will look after the children?	3	2	1
If you need to move, do you have a bag with essentials packed?	3	2	1
What you will do if there is a death in the family?	3	2	1
Does your plan ensure that everyone know where important documents are located?	3	2	1
Are wills up to date?	3	2	1

	<b>Have done this</b>	<b>May do this</b>	<b>Will not do this</b>
Does your plan include important contact numbers, e.g.		<b>2</b>	<b>1</b>
Doctor, pharmacy, police?	<b>3</b>	<b>2</b>	<b>1</b>
Work, school, child care?	<b>3</b>	<b>2</b>	<b>1</b>
Does work/school/childcare know your contact details?	<b>3</b>	<b>2</b>	<b>1</b>
Neighbours?	<b>3</b>	<b>2</b>	<b>1</b>
Vet?	<b>3</b>	<b>2</b>	<b>1</b>
If you/your family were isolated or had to remain at home for more than a week, does your plan include:			
What you will do to keep occupied?	<b>3</b>	<b>2</b>	<b>1</b>
What would you do to keep the children entertained?	<b>3</b>	<b>2</b>	<b>1</b>
Does your plan include:			
Discussion with neighbours/friends/workmates to look out for each other?	<b>3</b>	<b>2</b>	<b>1</b>
Knowing the likely needs of elderly/infirm neighbours, those with disabilities single-parent families and what might be done to assist them?	<b>3</b>	<b>2</b>	<b>1</b>
Discussion with the community groups that you are a members of about how to assist each other?	<b>3</b>	<b>2</b>	<b>1</b>
If you have travel plans:			
Have you booked insurance (check coverage) in case the trip is cancelled?	<b>3</b>	<b>2</b>	<b>1</b>
If you go overseas, would have the funds to get home in an emergency?	<b>3</b>	<b>2</b>	<b>1</b>
Have you planned for a reduction/loss of income if unable to work (e.g., need to stay at home to look after family) or workplace closes?	<b>3</b>	<b>2</b>	<b>1</b>
Have you planned for school/child care closure?	<b>3</b>	<b>2</b>	<b>1</b>



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