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Socio-economic Variables as Indicators of Preparedness Level in Cyclone Events

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1.0 Introduction

Disasters can occur at any time of day or year in any country across the globe and have the potential to destroy the lives of all those standing in its path if they are not properly prepared for. The Emergency Risk Management Applications Guide of 2000 defines preparedness as "measures to ensure that communities and services are capable of coping with the effects of emergencies". There are several factors that influence a person's preparedness when it comes to disasters. Three of these factors are income, education level and resident status, namely if they have been living in the area for an extended period of time or if they are a relatively new migrant to the area. People with different socio-economic characteristics perceive, prepare for, and respond to disaster situations differently. The effects of disasters are also varied according to the above mentioned socio-economic indicators during periods of response, recovery and reconstruction (Fothergill and Peek, 2004). Rhodes (2003) argues that preparedness is measured through both a social and physical context. It should include a level of awareness, planning, knowledge, preparation and psychological readiness. The following study measures preparedness in residents living in cyclone prone areas by analysing responses to survey questions regarding natural hazards. These responses will be correlated with socio-economic factors to determine relationships between the chosen variables and natural hazard preparedness.

1.1 Aims and Objectives

The aim of this study is to determine what impact socio-economic indicators such as income, education and resident status have on the preparedness level of those in disaster situations, particularly cyclone events.

2.0 Literature Review

2.1 Preparedness

The literature defining preparedness in relation to natural hazards indicates two forms- physical and psychological (Evans *et al*., 2004). It is believed that there are differences in preparedness based on these forms. Here, psychological preparedness, namely knowledge

and awareness of one's surroundings, provides a level of preparedness that may be more valuable than physical preparations because they are mentally ready. On the other hand, physical preparations including storing food and water, securing loose objects and developing an emergency evacuation plan, have life saving potential through established harm prevention and evacuation strategies (Evans *et al*., 2004). This study focuses on physical preparedness and how different socio-economic variables influence the level of preparedness attained by residents of cyclone-prone areas.

2.2 Education

The first variable focused on in this study relating to level of preparedness is education. In general, it is accepted that natural hazard preparedness increases with education when it comes to planning for hazards, engaging in hazard mitigation and basic survival of a hazard event (Haulihan *et al*., 2000). There are several reasons for this including lack of understanding of the issues and dangers of the potential hazards, lack of knowledge regarding specific hazard behaviours and preparation techniques, and inability to comprehend warnings given by officials, especially through misunderstood language used in briefings or newscasts. Mack and Baker (1961) found that residents with low-education levels were less likely than individuals with moderate to high education levels to view warning signals as valid. They were, therefore, less likely to prepare for the potential disaster because they did not believe it was necessary to. In addition to this, Turner *et al*. (1986) found that education combats the belief that events are fixed in advance so that human beings are powerless to change them and instead fosters preparedness, but only until the point of entering college.

2.3 Income

Income is another factor that shares a relationship with preparedness and vulnerability. Studies show that those in a higher income category are less vulnerable and more prepared than those in a lower income group (King, 2000). Higher income households have more access to supportive items such as radios, televisions, usually live in more protected areas, and have access to cars in order to evacuate without assistance. Palm and Carroll (1998)

showed that income level allowed for some of the more costly mitigation measures such as purchasing insurance and building homes with stronger, cyclone withstanding materials. Lower income populations, however, are more vulnerable to disasters because they have fewer resources, less car access which means they require more assistance to evacuate and they usually live in less protected areas (King, 2000). Poorer populations also lack adequate resources to purchase natural hazard insurance which means the rebuilding and recovery process will be more difficult (Fothergill and Peek, 2004) It is also pointed out that people living in poverty are less likely to follow through with preparations necessary for mitigating the effects of hazards because they lack a sense of personal control over potential outcomes (Vaughan, 1995).

2.4 Resident Status

Studies show that elderly people are extremely aware of the hazards of their surroundings and are capable of looking after themselves due to their familiarity with their environment, yet many younger people may be new migrants to the area and do not know what preparations to make (King, 2001). The data collected pertaining to age in this study categorises residents as either “over 18” or “under 18” and, therefore; is not a useful indicator for our purposes. Instead, resident status will be used as it gives details as to how long people have lived in the study area which is far more useful and just as indicative of preparedness level for this study.

Research also shows that community members who feel an attachment to their surroundings as well as a sense of place are more likely to get involved in happenings within the community (Evans *et al*., 2004). This results in residents attending more town council meetings, being aware of the issues involving their community and being more prepared for events that could potentially affect them (Marsh and Buckle, 2001). The longer a person lives in a certain area the more likely they are to develop a sense of belonging and a feeling of attachment to their surroundings than someone who has just moved in. It is also more likely that they will grow to learn the types of hazards that affect them by living there and are, therefore; more likely to be prepared for whatever may strike. This type of awareness and involvement within communities creates resilience and resilient communities are more

likely to deal with adverse events such as cyclones in a more productive and successful manner (Evans et al, 2004). A positive correlation, therefore, exists between resident status (how long a person has lived in the natural hazard prone area) and preparedness. This relationship will be tested in the following study.

3.0 Study Area

The area used in this study consists of Railway Estate and South Townsville, two suburbs of Townsville located on the northeast coast of Queensland, Australia (Figure 1). The combined population of the two communities consists of roughly 5,300 residents as of the 2001 census. Located in the tropics, Railways Estate and South Townsville are characterised by a wet season (November to March) consisting of high humidity and heavy rain with maximum and minimum temperatures averaging 31°C and 24°C respectively and a dry season (April to October) consisting of maximum and minimum temperatures averaging 25°C and 13°C respectively.

Both communities are located in an area prone to high intensity tropical storms and cyclones which bring a combination of heavy rain, wind, floods and storm surges on the coastal fringe. Water logging, erosion, sediment deposits and potentially life-threatening conditions are problems associated with cyclones. Railway Estate and South Townsville were last involved in a natural hazard situation back in January 1998 when ex-Cyclone Syd moved down from the gulf as a rain depression and brought with it over 700mm of rain in 24 hours (Bureau of Meteorology, 2002). Due to their location in a hazard prone area as well as their recent confrontation with a cyclone event, these communities make an excellent study area for research regarding socio-economic variables and natural hazard preparedness.

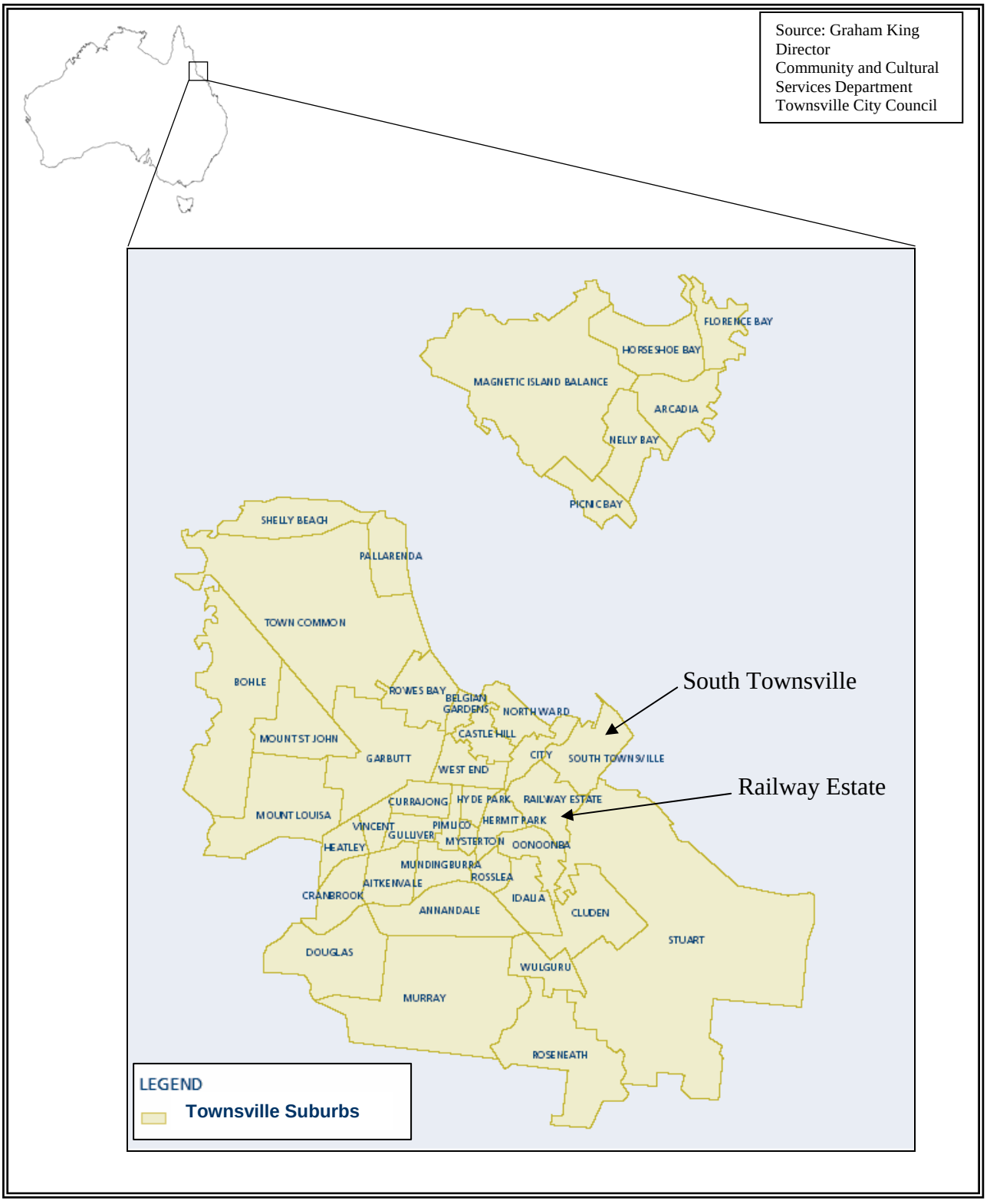

Figure 1. Study Area Location Map

4.0 Methods

Research regarding how education level, income and resident status affect ones preparedness was carried out using 2003 survey data consisting of 100 questions regarding cyclones and storm surge from Railway Estate. A total of 80 people returned the survey. Answers returned from residents were recorded in an SPSS database. SPSS was then used to construct various tables showing the correlations between three sets of data: education and preparedness, income and preparedness and resident status and preparedness. Five questions about disaster preparedness were selected from the survey and compared alongside the three variables- annual household income, education level and amount of time the survey takers have been living in the Townsville area.

The five questions used to determine level of preparedness are listed as follows according to the question number used in the original survey:

- Question 51: Have you and other members of this household discussed an evacuation plan?
- Question 67: Do you already have a cyclone emergency supply kit packed and prepared for this household?
- Question 69: Are this household's valuables, important documents, irreplaceable items and mementos located together where they can be readily found if necessary?
- Question 74: Have you cleaned up your yard and removed any objects that could potentially become missiles in the event of a cyclone or severe storm?
- Question 90: Are you insured for cyclone damage?

The questions regarding disaster preparedness were analysed twice. The first analysis involved each individual preparedness question being cross-tabulated with the main variable then the five preparedness categories were combined into one group which is known as "preparedness" and again cross-tabulated with the main variable. Percentages were calculated from this last data set.

Tabulation of frequencies and contingency tables were generated in SPSS. The calculation of percentages and graphing of the frequencies was done in Excel. The frequency of "yes" answers was plotted in contingency tables along with the variables of education level,

income and resident status. The combination of the five preparedness questions makes up the criteria for how prepared each variable interval is. “Yes” answers to each preparedness question contributed positively to the conclusion that those people were prepared and were, therefore; the only answers analysed. Preparedness level increases as the number of “yes” answers increases. “No” answers, as well as questions in which residents did not respond to, were not graphed but were included in the individual answer percentages.

5.0 Results

The following figures provide frequency summaries of “yes” answers given to the individual questions regarding preparedness and specific variables (education, income, or resident status). Data graphed here comes from the contingency tables generated in SPSS. The complete tables are provided in Appendix A.

5.1 Level of Education and Preparedness

Figure 2 shows the frequencies of “yes” answers of the five questions regarding preparedness from the cyclone survey. University graduates gave the most “yes” answers to questions 67 (20 yes), 74 (20 yes), and 90 (18 yes) with secondary school graduates providing the second highest amount of “yes” answers to those questions (17, 19, and 12 respectively). Secondary school graduates gave the highest amount of “yes” answers to questions 51 (7 yes) and 69 (16 yes) with university graduates giving the second highest amount of “yes” answers (6 and 14 respectively). Residents with TAFE or primary school level education provided significantly fewer “yes” answers to all preparedness questions.

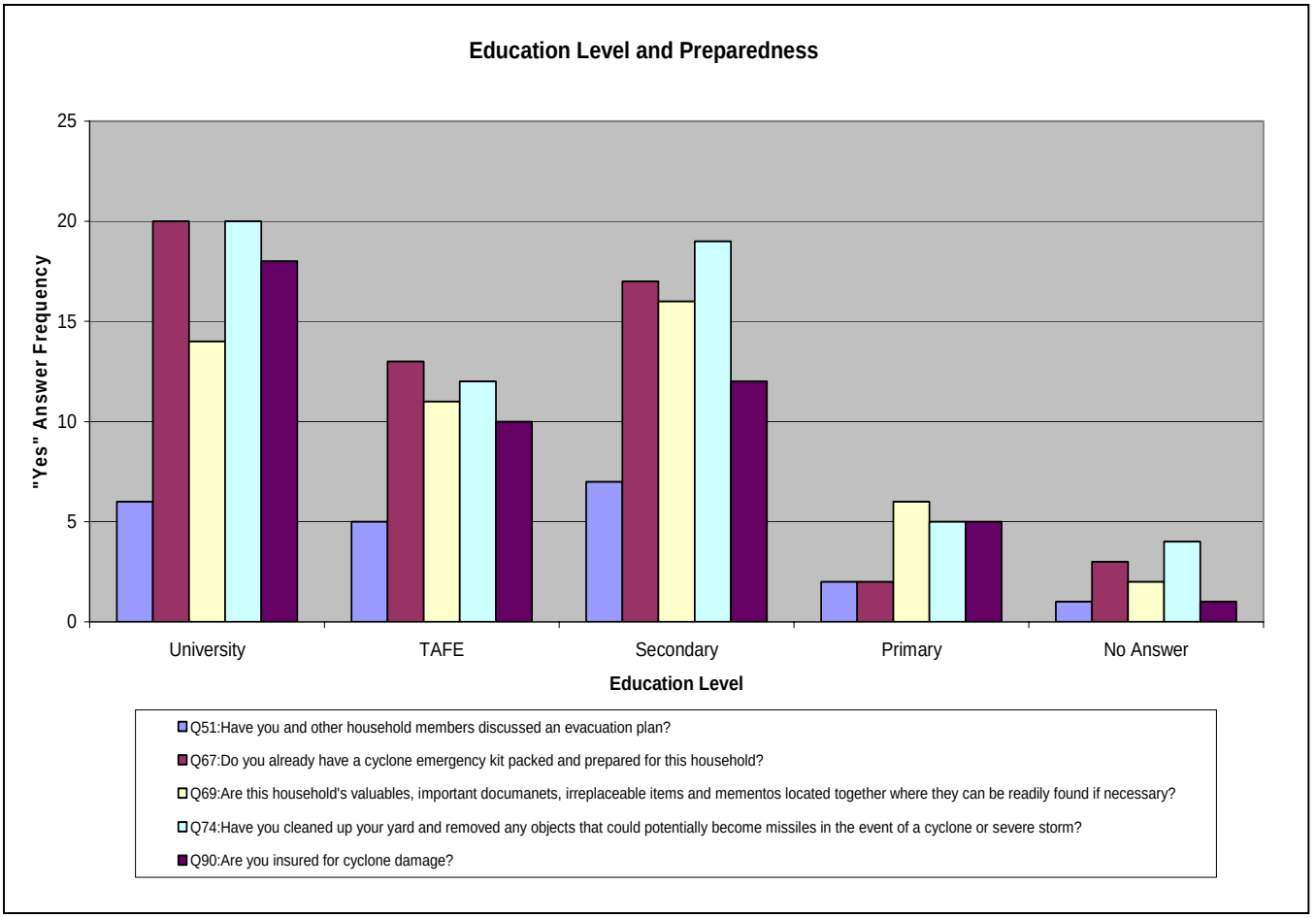

Figure 2. Education Level and Preparedness

Table 1 summarises the total amount of answers for all five preparedness questions. The percentage of preparedness value was calculated using only the total "yes" answers in comparison to all questions asked regarding preparedness. The cross-tabulation frequency results as well as the preparedness percentage calculations show that those residents whose highest level of completed education is university are the most prepared for a cyclone. University graduates showed the highest level of preparedness at 19.50%, secondary school graduates came in second with 17.75% preparedness, TAFE graduates came in third with 12.75% preparedness and primary school graduates had the lowest level of preparedness at 5%.

		What is the Highest Level of Education Achieved by Anyone in the Household?					
		University	TAFE	Secondary	Primary	No Answer	Total
Preparedness	Total Yes	78	51	71	20	11	231
	Total No	45	27	38	10	9	129
	Total No Answer	12	2	11	0	15	40
Total Answers		135	80	120	30	35	400
Total Preparedness (%)		19.50%	12.75%	17.75%	5.00%	2.75%	57.75%

Table 1. Total Preparedness within Each Education Level Category

5.2 Annual Household Income and Preparedness

Frequency of "yes" answers across the annual household income intervals was much more comparable than the results for the education variable. Results regarding income are incomplete because 18 out of 80 people didn't answer the survey question about how much their household earned in annual wages. Conclusions do not, however, include those people who did not answer the question regarding income. Figure 3 shows that households making $50,001-75,000 per year had the highest frequency of "yes" answers to question 51 (7 yes) and tied for the highest on questions 67 (13 yes) and 90 (12 yes). The frequency of "yes" answers remains fairly consistent in income levels below the $75,000 mark. "Yes" answers decrease dramatically in income intervals above $75,000 compared to those below that interval.

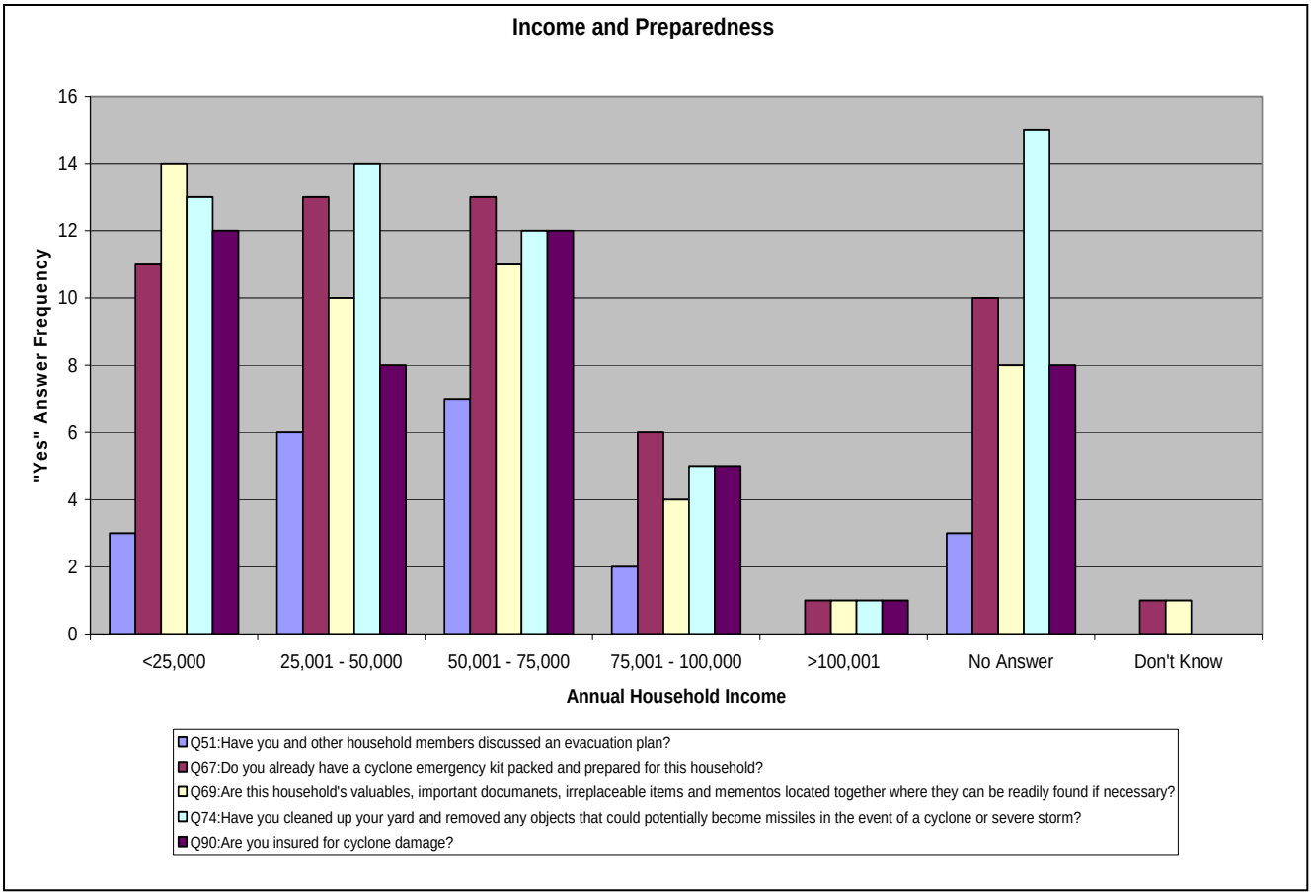

Figure 3. Income and Preparedness

Table 2 summarises preparedness within each income level interval. Preparedness percentages were very similar across the intervals and, similarly to Figure 3, a clear relationship between income level and preparedness could not be determined simply by looking at the graph. The highest percentages of preparedness belong to those income levels that fall below $75,000, and the income intervals above that show very low frequencies of "yes" answers, but the percentages of the last three intervals fall within 1% of each other and are, therefore; too similar to be significant. These results show that based on this study there is a negative relationship between income level and preparedness which goes against previous studies in which preparedness increased with income. Possible reasons for this could be that significant data was missing due to the large amount of residents who did not answer the question regarding their annual household income level.

		What is the Approximate Combined Income in This Household?							
		<25,000	25,001 - 50,000	50,001 - 75,000	75,001 - 100,000	>100,001	No Answer	Don't Know	Total
Preparedness	Yes	53	51	55	22	4	44	2	231
	No	26	30	28	17	1	24	3	129
	No Answer	11	4	2	1	0	22	0	40
Total Answers		90	85	85	40	5	90	5	400
Total Preparedness		13.25%	12.75%	13.75%	5.50%	1.00%	11.00%	0.50%	59.00%

Table 2. Total Preparedness within Each Income Interval

5.3 Resident Status and Preparedness

Figure 4 shows the frequencies of "yes" answers regarding resident status and preparedness. Results were mixed regarding this variable. The highest frequencies of "yes" answers were given either by residents who have lived in the Townsville area for less than 5 years or for more than 20 years. The lowest frequencies of "yes" answers were given by residents living in the Townsville area for 5-20 years. The highest number of "yes" answers were given by residents living in Townsville for more than 20 years for questions 51 (6 yes), 69 (19 yes), 74 (22 yes) and 90 (18 yes). Residents living in Townsville for less than 5 years gave the second highest frequency of "yes" answers for those questions (4, 16, 18, 13 respectively) and gave the highest number of "yes" answers for question 67 (20 yes).

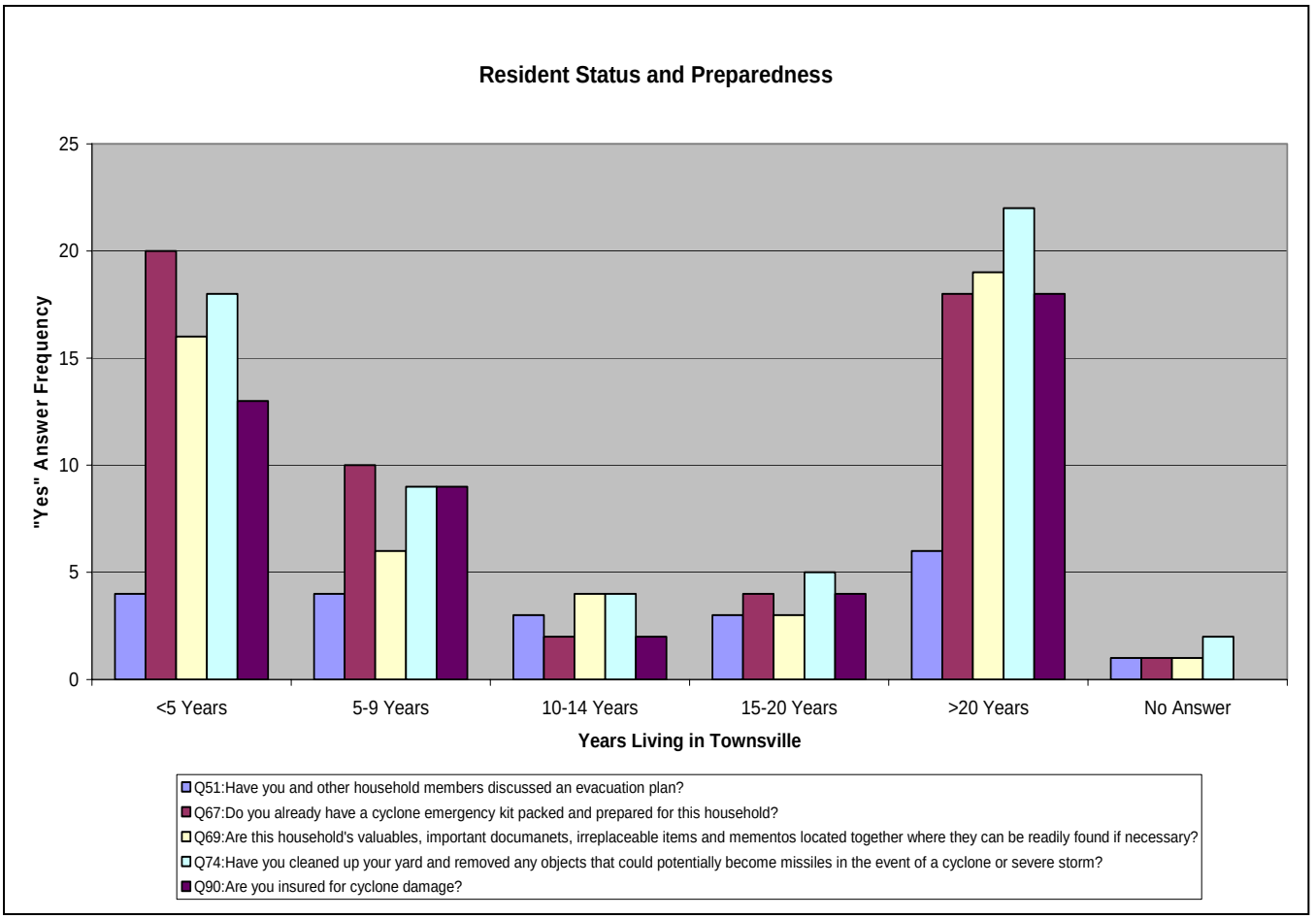

Figure 4. Resident Status and Preparedness

Table 3 summarises the combined answers for all five preparedness questions. Results show that those residents who have lived in the Townsville area for longer than 20 years are the most prepared at 20.75% followed by those who have only lived in the area for less than five years at 17.75%. These values are significantly higher than the other three categories. Those living in Townsville for 5-9 years show low preparation levels of 9.50% followed by those living in the area for 15-20 years at 4.75% and finally those who have lived in the area for 10-14 years at 3.75%. Those residents who did not answer were not included in the analysis.

		How Long Have You Lived in Townsville?						Total
		<5 Years	5-9 Years	10-14 Years	15-20 Years	>20 Years	No Answer	
Preparedness	Yes	71	38	15	19	83	5	231
	No	51	21	7	5	43	2	129
	No Answer	13	1	3	1	9	13	40
Total Answers		135	60	25	25	135	20	400
Total Preparedness (%)		17.75%	9.50%	3.75%	4.75%	20.75%	1.25%	57.75%

Table 3. Total Preparedness within Each Resident Status Interval

6.0 Analysis

In addition to the tabulation of frequencies and percentages of the survey data in SPSS, correlation analysis was performed on the data regarding the three variables as well as the five preparedness questions in order to back up and strengthen the relationships between the variables. To do this, the Pearson's product moment correlation coefficient (r) was calculated in Excel. Pearson's is a numeric measure of the strength of the linear relationship between two variables. Results range inclusively from -1.0 to 1.0 and reflect either a positive (between 0 and 1) or negative (between 0 and -1) correlation between the chosen variables depending on the calculated value. For our purposes here, there are three sets of tested variables: education and preparedness, income and preparedness and resident status and preparedness. Further conclusions regarding relationships among variables were based on these statistics.

Analysis shows the strongest relationship between income level and preparedness
(r = -0.878), which is high, although the correlation is a negative one which means that preparedness actually decreased with an increase in income level. We recall in Section 5.3 that frequencies for the lowest three income level intervals (incomes below $75,000) were significantly higher than those above $75,000.

Relationships between the other two variables and preparedness were positive, but mixed in strength. The correlation between education and preparedness turned out a Pearson's coefficient of 0.603. This shows a fairly high relationship which is in keeping with the

results from the cross-tabulation of the original data. This high and positive correlation supports the relationship that preparedness increases as with an increase in education level.

The relationship between resident status and preparedness produced a Pearson's coefficient of 0.338. Although this is a positive relationship it is fairly low in strength. This is due to the fact that the answers were split between those residents living in the Townsville area for less than five years and those living in the area for more than 20 years. Due to the weak relationship between these two variables, it is noted that although there seems to be a relationship between resident status and preparedness for cyclone and disaster events, the exact relationship is unclear.

7.0 Discussion

Results for this study show that although there is a strong relationship between income and preparedness (although negative) and education level and preparedness (high and positive), the relationship between resident status and preparedness is still unclear. Preparedness levels decreased as income levels increased in this study. Research shows that those residents with higher incomes tend to be more prepared due to their access to available resources, greater access to evacuation methods and live in more protected areas (King, 2000). Results of this study for this variable go against previous research. Reasons for this could be that lower income people have a stronger connection to the land and surrounding environment which enables them to better understand the dangers of cyclones and other natural disasters. This allows them to prepare better for these types of events when they come. Higher income level residents, on the other hand, have a tendency to be disconnected from the environment. They live in elevated areas above the hazard line and have not learned how to prepare for such events- physically or mentally. They instead rely on government officials and disaster managers to prepare for them. In the event of a real emergency, this could truly be detrimental.

The relationship between education level and preparedness was consistent with previous research and showed a high and positive correlation. Those with higher education levels tend to understand the dangers and risks to their lives and property involved with the onset

of a storm and also understand the benefits of planning ahead to avoid personal and economic loss (Mack and Baker, 1961). They are, therefore; more likely to follow through with natural hazard preparations than those with lower education levels. This proved to be the case in this study.

The final relationship of the study dealt with resident status and preparedness. This proved a more difficult relationship to determine. Although the majority (20.75%) of "yes" answers were given by residents who have lived in Townsville for more than 20 years, those residents who have lived in Townsville for less than 5 years had equally large numbers of "yes" answers (17.75%). This shows that both groups are very prepared for a cyclone event which goes against research that people living in an area for a long time are more aware of the dangers and risks brought on by cyclones and are more aware of the necessary precautions one must take to protect themselves against harm and loss (Evans *et al*., 2004). Reasons for this could be that new residents have done research into the area they just moved into and learned that the area is cyclone prone. They are more likely to be proactive about cyclone preparedness in the early years they are living in an area. As time goes on, if a cyclone or storm event does not occur residents tend to become complacent. They stop taking the precautions they once did. The longer one resides in an area the more likely it is that a cyclone will eventually strike. If that happens, residents will once again begin the precautionary measures they once took. This cycle reoccurs as time passes. It is characteristic, then, that preparedness would be high in those residing in the area for less than five years, very low in those living in the area between 5 and 20 years and again very high in those living in the area for more than 20 years.

Considering that cyclone and most other natural disaster based research is opportunistic and that the last cyclone to hit the Townsville area was back in 2000, it is unclear if preparedness measured in this survey holds true or if it results are simply theoretically based on survey responses for this particular area. Unless there is current post-cyclone data to back up results of this study, preparedness levels can only be assumed. The true test of preparedness will come when a natural disaster actually strikes.

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Appendix A

Level of Education and Preparedness Contingency Tables

		What is the Highest Level of Education Achieved by Anyone in the Household?					
		University	TAFE	Secondary	Primary	No Answer	Total
Have you and other members of this household discussed an evacuation plan?	Yes	6	5	7	2	1	21
	No	20	11	14	4	2	51
	No Answer	1	0	3	0	4	8
Total		27	16	24	6	7	80

		What is the Highest Level of Education Achieved by Anyone in the Household?					
		University	TAFE	Secondary	Primary	No Answer	Total
Do you already have your cyclone emergency supply kit packed and prepared for this household?	Yes	20	13	17	2	3	55
	No	5	3	6	4	2	20
	No Answer	2	0	1	0	2	5
Total		27	16	24	6	7	80

		What is the Highest Level of Education Achieved by Anyone in the Household?					
		University	TAFE	Secondary	Primary	No Answer	Total
Are this household's valuables, important documents, irreplaceable items and mementos located together where they can be readily found if necessary?	Yes	14	11	16	6	2	49
	No	10	5	7	0	2	24
	No Answer	3	0	1	0	3	7
Total		27	16	24	6	7	80

		What is the Highest Level of Education Achieved by Anyone in the Household?					
		University	TAFE	Secondary	Primary	No Answer	Total
Have you cleaned up your yard and removed any objects that could potentially become missiles in the event of a cyclone or severe storm?	Yes	20	12	19	5	4	60
	No	4	4	3	1	1	13
	No Answer	3	0	2	0	2	7
Total		27	16	24	6	7	80

		What is the Highest Level of Education Achieved by Anyone in the Household?					
		University	TAFE	Secondary	Primary	No Answer	Total
Are you insured for cyclone damage?	Yes	18	10	12	5	1	46
	No	6	4	8	1	2	21
	No Answer	3	2	4	0	4	13
Total		27	16	24	6	7	80

Annual Household Income and Preparedness Contingency Tables

		What is the Approximate Combined Income in This Household? (Dollars per year)							
		<25,000	25,001 - 50,000	50,001 - 75,000	75,001 - 100,000	> 100,001	No Answer	Don't Know	Total
Have you and other members of this household discussed an evacuation plan?	Yes	3	6	7	2	0	3	0	21
	No	13	11	10	6	1	9	1	51
	No Answer	2	0	0	0	0	6	0	8
Total		18	17	17	8	1	18	1	80

		What is the Approximate Combined Income in This Household? (Dollars per year))							Total
		<25,000	25,001 - 50,000	50,001 - 75,000	75,001 - 100,000	>100,001	No Answer	Don't Know	
Do you already have your cyclone emergency supply kit packed and prepared for this household?	Yes	11	13	13	6	1	10	1	55
	No	5	3	4	2	0	6	0	20
	No Answer	2	1	0	0	0	2	0	5
Total		18	17	17	8	1	18	1	80

		What is the Approximate Combined Income in This Household? (Dollars per year)							Total
		<25,000	25,001 - 50,000	50,001 - 75,000	75,001 - 100,000	>100,001	No Answer	Don't Know	
Are this household's valuables, important documents, irreplaceable items and mementos located together where they can be readily found if necessary?	Yes	14	10	11	4	1	8	1	49
	No	2	6	6	4	0	6	0	24
	No Answer	2	1	0	0	0	4	0	7
Total		18	17	17	8	1	18	1	80

		What is the Approximate Combined Income in This Household? (Dollars per year)							Total
		<25,000	25,001 - 50,000	50,001 - 75,000	75,001 - 100,000	>100,001	No Answer	Don't Know	
Have you cleaned up your yard and removed any objects that could potentially become missiles in the event of a cyclone or severe storm?	Yes	13	14	12	5	1	15	0	60
	No	2	1	5	3	0	1	1	13
	No Answer	3	2	0	0	0	2	0	7
Total		18	17	17	8	1	18	1	80

		What is the Approximate Combined Income in This Household? (Dollars per year)							
		<25,000	25,001 - 50,000	50,001 - 75,000	75,001 - 100,000	>100,001	No Answer	Don't Know	Total
Have you cleaned up your yard and removed any objects that could potentially become missiles in the event of a cyclone or severe storm?	Yes	12	8	12	5	1	8	0	46
	No	4	9	3	2	0	2	1	21
	No Answer	2	0	2	1	0	8	0	13
Total		18	17	17	8	1	18	1	80

Resident Status and Preparedness Contingency Tables

		How Long Have You Lived in Townsville?						
		<5 Years	5-9 Years	10-14 Years	15-20 Years	>20 Years	No Answer	Total
Have you and other members of this household discussed an evacuation plan?	Yes	4	4	3	3	6	1	21
	No	22	8	1	2	18	0	51
	No Answer	1	0	1	0	3	3	8
Total		27	12	5	5	27	4	80

		How Long Have You Lived in Townsville?						
		<5 Years	5-9 Years	10-14 Years	15-20 Years	>20 Years	No Answer	Total
Do you already have your cyclone emergency supply kit packed and prepared for this household?	Yes	20	10	2	4	18	1	55
	No	5	2	3	1	8	1	20
	No Answer	2	0	0	0	1	2	5
Total		27	12	5	5	27	4	80

		How Long Have You Lived in Townsville?						Total
		<5 Years	5-9 Years	10-14 Years	15-20 Years	>20 Years	No Answer	
Are this household's valuables, important documents, irreplaceable items and mementos located together where they can be readily found if necessary?	Yes	16	6	4	3	19	1	49
	No	8	6	1	2	7	0	24
	No Answer	3	0	0	0	1	3	7
Total		27	12	5	5	27	4	80

		How Long Have You Lived in Townsville?						Total
		<5 Years	5-9 Years	10-14 Years	15-20 Years	>20 Years	No Answer	
Have you cleaned up your yard and removed any objects that could potentially become missiles in the event of a cyclone or severe storm?	Yes	18	9	4	5	22	2	60
	No	5	3	1	0	4	0	13
	No Answer	4	0	0	0	1	2	7
Total		27	12	5	5	27	4	80

		How Long Have You Lived in Townsville?						Total
		<5 Years	5-9 Years	10-14 Years	15-20 Years	>20 Years	No Answer	
Are you insured for cyclone damage?	Yes	13	9	2	4	18	0	46
	No	11	2	1	0	6	1	21
	No Answer	3	1	2	1	3	3	13
Total		27	12	5	5	27	4	80

		How Long Have You Lived in Townsville?						Total
		<5 Years	5-9 Years	10-14 Years	15-20 Years	>20 Years	No Answer	
Preparedness	Yes	71	38	15	19	83	5	231
	No	51	21	7	5	43	2	129
	No Answer	13	1	3	1	9	13	40
Total Answers		135	60	25	25	135	20	400
Total Preparedness (%)		17.75%	9.50%	3.75%	4.75%	20.75%	1.25%	57.75%