Social Resilience and Climate Related Risks in Singapore:

Insights from a Case Study at Cambridge Road

FRS Working Paper 1

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1. Introduction

Some areas in Singapore are more prone than others to climate change-related risks. Coastal areas are exposed to rising sea levels, which will further accelerate in the future due to global warming, while other areas are vulnerable to flash floods caused by heavy rainfall. The frequency and intensity of such heavy rainfall will also accelerate as a consequence of global climate change (Taylor et al., 2013). Furthermore, rising temperatures and increased heat stress will lead to climate change-related impacts that directly affect Singapore. Rise in sea level and flash floods are threatening Singapore's physical infrastructure whereas heat directly affects its people. Given the high temperatures and humidity in Singapore, additional heat will reduce people's outdoor thermal comfort and affect their health and productivity. Both types of risks — those that have the potential to indirectly or directly reduce people's well-being — are relevant for Singapore. They both reduce the economic welfare and endanger the social glue within the society. This means that social resilience is at stake. Hence, it seems to be worthwhile thinking about measures to reduce the effects of climate change-related risks and to increase the level of social resilience.

Depending on which of the different climate change-related risks one focuses, the appropriate measures as well as the respective effects on social resilience will vary. In this study, in order not to inflate the degree of complexity, we focus on flash floods as a specific climate change-related risk. In Singapore, Cambridge Road is an area that has experienced floods during the last few decades due to its low-lying location. In order to protect the population, infrastructure-related interventions have been implemented and studies are conducted on the functioning of social networks during climate change-related incidents. The Centre for Liveable Cities (CLC) started an initiative to inform people living in the Cambridge Road area about potential climate change-related risks and measures that can help to avert flash floods and adapt to rising temperatures. A critical topic in this context is the 'community resilience' and the 'social resilience' of the respective neighbourhood. Do residents of the area support one another to cope effectively with the disasters that may occur? What are the key determinants ensuring such a support before, during and after a crisis event?

Community resilience is typically defined as the ability of a community to recover from external shocks by using its own physical, economic and social resources (Paton, Smith, & Johnston, 2000). From another perspective, community resilience is also seen as the 'ability of a community to stick together during a time of crisis' (Ganor & Ben-Lavy, 2003), or the ability not only to endure times of crises or recovery but also to prepare and plan, absorb, recover and adapt to actual or potential future disruptions (Cutter, Ash, & Emrich, 2014; Cutter, Burton, & Emrich, 2010; Cutter, 2016). Community resilience strongly relies on linking networks of adaptive capacities before, during and after a crisis or disruption (Joerin, J., et al., 2014; Burton, 2015). There are five key elements to community resilience: networking and social capital Cutter, 2016; Peacock, 2010; Aldrich, Oum, & Sawada, 2014); economic development (Bahadur, Ibrahim, & Tanner, 2010; Leach, 2013); institutional system (Adger et al., 2005; Brenkert & Malone, 2005; Folke et al., 2005; Adger, 2006); physical/infrastructure (Chang, McDaniels, & Beaubien, 2009; McDaniels et al., 2015); and environmental/ecological systems (Adger, 2006; Milman & Short, 2008). As an aspect of community resilience, the social resilience of groups and communities (Ainuddin, Routray, & Ainuddin, 2015; Kusumastuti et al., 2014); has received special attention (Ainuddin, Routray, & Ainuddin, 2015; Paton & McClure, 2013; Aldrich, 2012; Paton et al., 2014).

Social resilience refers to a social unit or a group coping collectively with any political, social or environmental changes (Adger, 2000; Friedland et al., 2005; Zhou et al., 2014). The degree of social resilience depends on the nature and strength of the relationships between people living in the respective area. Numerous studies have found that good connections between people — expressed by the support of one another, the sense of community, mutual trust, social engagement, social participation, etc., — enhance the ability of community members to cope well with crises. Hence, building and fostering these connections are important for the resilience of communities (Aldrich, 2012; Adger, 2000; Peacock et al., 2010; Sherrieb, Norris, & Galea, 2010; Kapucu, Hawkins, & Rivera, 2013; Parsons et al. 2016; Qasim et al., 2016). In addition, increasing the awareness of a community's competence (e.g., knowledge of local risks, learning from previous disasters) seems to help foster its resilience (Ainuddin, Routray, & Ainuddin, 2015). Knowing the social structure and demographic characteristics of the population could contribute to enhancing the population's resilience when coping with unexpected events (Scherzer, Lujala, & Rød, 2019).

To assess potential changes of resilience against climate change-related risks in the Cambridge Road area that are initiated by targeted interventions, researchers from FRS (Future Resilient Systems) together with members from CLC teamed up for a field study. The goal of this study was to assess whether information and activation events can improve the social resilience within a community. A further aim was to better understand the key factors determining the resilience of a community towards climate change-related risks. The respective analysis was based on a questionnaire, which aimed at identifying the respective degree of resilience (for details see Section 2). Overall, we collected 133 valid responses in five data collection sessions. The first two data collection sessions were arranged during two pop-up booth events organised by CLC and PiD (Participate in Design). The observations were collected from citizens from the area who attended the events on the 24 and 30 November 2019. A month before the pop-up booth events, CLC and PiD had worked with the People's Association (PA) to conduct an activating event at the side of the Tanjong Pagar GRC's tree-planting event on the 26 October. The last three data collection sessions were held after the activating and pop-up booth events, i.e., between 6 and 11 December 2019. In these three sessions, respondents who did not attend any of the event had to fill a questionnaire. (See Figure 1 for a timeline of the events and data collection periods).

The rest of this working paper is structured as follows: Section 2 describes the survey and our sample; Section 3 evaluates the results; and Section 4 concludes with a number of directions for future research as well as policy recommendations.

2. Survey and sample description

This survey study adopted a convenience sampling approach. The questionnaire was available in both English and Mandarin, and citizens could fill it either on their own or, if required, with the assistance of someone from the researchers' team. All questionnaires were completed between 24 November and 11 December 2019 (see Figure 1). The duration for completing the questionnaire was between 10 and 15 minutes. Each respondent received a S$10 voucher upon completing the survey.

Figure 1: Timeline of events and data collection periods

The questionnaire consisted of four sections (see Appendix A). The first section served as an eligibility check. Respondents had to fulfil the eligibility conditions before continuing with the survey. Only adults over 21 years who were living in the area were eligible. The second section of the questionnaire consisted of a 'climate change awareness' block with the following indicators: information and knowledge about climate change, actionable knowledge, and intention to act (see Table 1 for a description of how these indicators were measured). In addition, respondents were asked for their concerns and motivation to engage for actions to cope with climate change impacts. The questionnaire's third section was focused on 'social capital', referring to the following indicators: community bonds, sense of community, trust, social participation, community engagement, collective efficacy, crisis preparedness and leadership. The last section of the questionnaire contained a standard set of demographic questions (i.e. gender, nationality, age, ethnicity, marital status and educational attainment, living arrangements) and socio-economic questions (i.e. employment status, monthly household income and saving for an emergency, health status and insurance).

Table 1 describes in detail the elements of the questionnaire's two main blocks (i.e., climate change awareness and social capital). Column (1) describes the indicators and variables within each block. Column (2) displays the number of questions we asked for each indicator or variable, respectively. Column (3) gives a brief definition of the contents we are interested relating to the indicators and variables; and Column (4) indicates the respective answering scales. In many cases, the responses were made on a 5-point Likert scale, ranging from 'strongly disagree' to 'strongly agree'. This metric was applied uniformly across all the indicators, to make the results comparable. Further variables are presented as multiple-option or 'yes'-'no' answers, where respondents would select the most relevant answer. Column (5) points to the relevant literature references in Section 5 of this paper. With these references, more detail and discussion on the relevance and potential scores of indicators and variables could be uncovered.

The indicators and variables were chosen based on an extensive literature study. For both blocks mentioned in Table 1, the most widely recognised and used indicators were used, and some of the further variables were adapted to the specific context investigated in the Cambridge Road area. For a more detailed analysis of social resilience and community resilience indicators, see Khoja and Schubert (Khoja & Schubert, 2020). The authors filtered 80 unique indicators for social resilience from the existing literature. The most widely used and recognised indicators to measure social resilience were identified and extracted for this study.

Table 1: Description of the climate change awareness and social capital indicators and variables

(1) Indicator/ variable	(2) No. of questions	(3) Description of contents	(4) Answering scale	(5) References
Block 1: Climate Change Awareness				
Indicators				
Information Knowledge	5	Level of knowledge and understanding of climate change-related risks	1-5 Likert scale	Cutter et al.,2014; Joerin et al.,2014; Kusumastuti et al., 2014; Khalili et al., 2015
Actionable Knowledge	6	Capability to prepare for future action	1-5 Likert scale	Cutter et al.,2014; Joerin et al.,2014; Kusumastuti et al., 2014; Khalili et al.,2015
Intention to Act	7	Actions and intentions to cope with climate change related risks	1-5 Likert scale	Cutter, 2016; Kwok et al., 2016
Further Variable				
Motivation	1	Motivation for actions to cope with climate change	Multiple options	Cutter, 2016; Kwok et al., 2016
Block 2: Social Capital				
Indicators				
Community Bonds	3	Extent to which community members help one another and work together to be prepared and recovery from crises	1-5 Likert scale	Khalili et al., 2015
Sense of Community	5	Feelings of sense of belonging and attachment to the community	1-5 Likert scale	Cutter et al., 2010
Trust	3	Trust within the community	1-5 Likert scale	Khalili et al., 2015; Ainuddin et al., 2015; Parsons et al, 2016
Social Participation	2	Degree of connectedness between social groups	1-5 Likert scale	Joerin et al., 2014; Burton, 2015
Community Engagement	4	Ability of community members to collaborate and empower their community	1-5 Likert scale	Khalili et al., 2015; Parsons et al., 2016
Collective Efficacy	2	Cooperation towards good community performance	1-5 Likert scale	Khalili et al.,2015
Crisis Preparedness	2	Community knowledge on how to behave in crisis situations	1-5 Likert scale	Joerin et al., 2014; Kusumastuti et al., 2014; Khalili et al., 2015; Kwok et al., 2016
Community Leadership	3	Perceived effectiveness of community leaders	1-5 Likert scale	Kusumastuti et al., 2014; Khalili et al., 2015; Parsons et al, 2016
Further Variables				
Social Networking	1	Existence of strong networking relationships	Multiple options	Ainuddin et al.,2015
Volunteerism	1	Engagement to assist vulnerable people	YES- NO	Joerin et al., 2014; Kusumastuti et al., 2014; Cutter, 2016; Parsons et al., 2016
Community Networks	3	Number of different types of social ties per community member	Multiple options	Maguire and Hagan, 2007
Support Groups - Normal Times	2	Helping behaviour within family, friends, neighbourhood, and wider social networks within the community in normal times	Multiple options	Kusumastuti et al., 2014; Khalili et al., 2015; Parsons et al., 2016
Support Groups - Crisis Times	1	Helping behavior within the family, friends, neighborhood, and also outside the community in crisis times	Multiple options	Kusumastuti et al., 2014; Khalili et al., 2015; Parsons et al., 2016

We obtained 133 completed questionnaires during the five data collection sessions. Among these 133 respondents, 10 had attended the tree-planting and a pop-up booth event, 44 had attended just a pop-up booth event and 79 did not attend any of these events (see Figure 2 for a sample description).

Total sample size =133

n=79

n=44

n=10

● "No event" group: Did not attend any event (59.4%)

● "One event" group: Attended only the pop-up booth (33.08%)

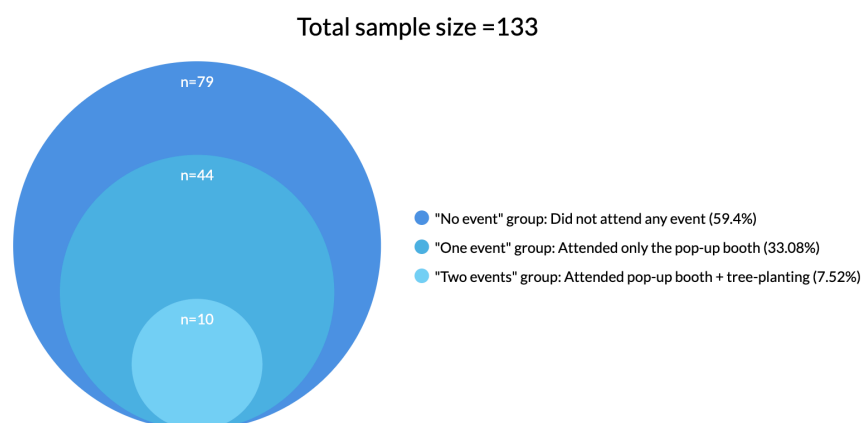● "Two events" group: Attended pop-up booth + tree-planting (7.52%)

Figure 2: Total sample size and sub-groups

Table 2 shows the demographic and socio-economic characteristics of the respondents, while Figure 3 offers a brief overview of the most relevant characteristics. As we do not have the demographic and socio-economic profile of all citizens in the Cambridge Road area, we are unable to determine to what degree our sample is representative of the community.

Overall, the respondents presented the following characteristics:

- Gender and age: Our sample had slightly more men (56%) than women (41%). On average, the respondents were 54 years old and had lived in the community for 26.6 years.

- Nationality and ethnicity: 77% of our respondents were Singaporeans, 10% came from other Asian countries and 13% were from European countries. Those of Chinese ethnicity comprised 80% of the respondents, followed by 11% that were Indian and 2% that were Malay, respectively.

- Family structure (marital status, presence of children in the household): More than 50% of the respondents were married and 35% were single. Of the respondents, 44% had no children while the rest (56%) had on average two children per household.

- Education and employment status: Overall, 44% of our respondents attained Secondary School education or lower, 22% had a Nitec or a A-Level Diploma, and 30% a university degree. In terms of employment, more than 50% of all respondents were employed and 27% said they were retired.

- Economic status (income and savings): Income-wise, 40.54% of the respondents reported an income that was below $2,000 income per month; 21.62% had a monthly income between $2,000 and $3,999; 14.41% between $4,000 and $5,999; and 14.41% indicated an income between $6,000 and $9,999. Only 9.01% of respondents earned an income of $10,000 and above. More than 70% of our respondents have savings in case of emergencies.

- Dwelling (type of dwelling, ownership and partnerships): In terms of dwelling, 56% of the respondents lived in relatively large properties (25% in HDB 3-room flats and 31% in HDB 4-room flats), while 80% of the all respondents owned or co-owned the property in which they lived. Those that lived with a spouse or with a spouse and children comprised 46% of the respondents; 15% of respondents lived alone; and 14% lived with their parents. Those

that lived with different groups of people made up 25% of the respondents. Among those, 12% lived with parents and children; 5% lived with friends; 3% lived with children and grandchildren; 3% lived with partners and or other relatives; and 2% lived with only their children.

- Health status and insurance coverage: More than 60% of our respondents described their health status as excellent, very good or good; 23% indicated that their health status was fair; and 5% indicated a poor health status. When it came to insurance coverage, 65% of the respondents reported having different insurance coverage. Specifically, 47 of the 133 respondents reported having health insurance, 13 persons had life insurance, 12 had housing insurance, and nine had accident insurance.

Table 2: Sample description — demographic and socio-economic characteristics

	Number of respondents	Percentage of respondents
Gender		
Female	54	41.22
Male	74	56.49
Age		
20-29	9	9.57
30-39	13	13.83
40-49	16	17.02
50-59	18	19.15
60-69	19	20.21
70-79	16	17.02
80-89	3	3.19
Ethnicity		
Chinese	105	79.55
Malay	3	2.27
Indian	14	10.61
Other	10	7.58
Presence of children in the household		
No	58	44.27
Yes	73	55.73
Education		
Primary & below	15	11.45
Secondary	43	32.82
Nitec/Higher Nitec	5	3.82
A Levels / Diploma	25	19.08
Bachelors	29	22.14
Postgraduate	10	7.63
Other	3	2.29
Employment situation		
Employed (full/part time)	69	52.27
Unemployed	11	8.34
Retired	35	26.52
Homemaker	10	7.58
Other	7	5.30
Dwelling type		
HDB 1-Room	13	9.92
HDB 2-Room	8	6.11
HDB 3-Room	33	25.19
HDB 4-Room	41	31.3
HDB 5-Room or Executive flat	19	14.5
Condominium or Private flat	12	9.16
Landed property	5	3.82

Note: Three respondents preferred not to disclose their gender; one respondent preferred not to disclose their level of education.
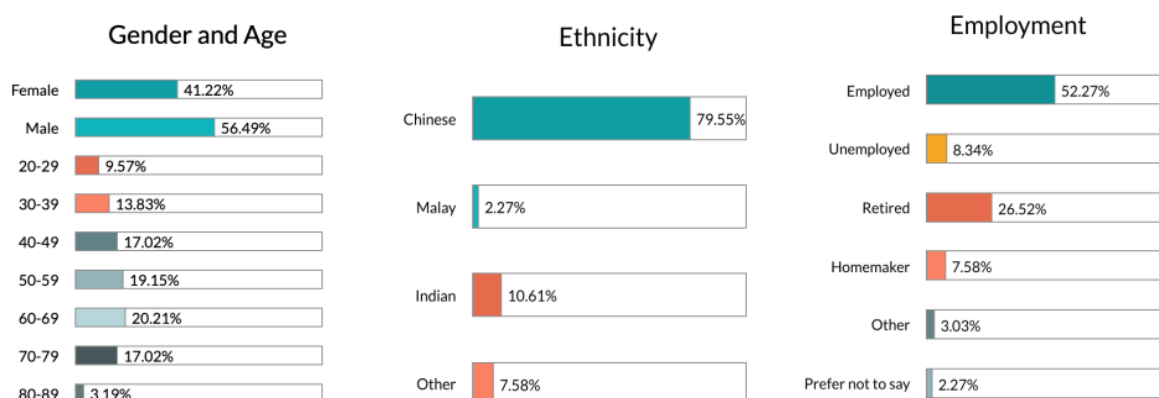
Figure 3: Summary of the most relevant demographic and socio-economic characteristics

3. Analysis of the survey data

3.1 Reliability Analysis

As a first step in our analysis we measured the reliability of the survey data for 'climate change awareness' and 'social capital' using Cronbach's alpha. The reliability statistics for each of the indicators from the questionnaire are summarised in Table 3.

In general, a reliability analysis focuses on measuring the degree of internal consistency and quality of the indicators used in a survey (Pallant, 2013). Hence, we tested whether the indicators in the two relevant blocks, i.e., 'climate change awareness' and 'social capital', gave us a Cronbach's alpha higher than 0.7, where 0.7 is typically seen as a lower boundary for acceptance (Schervish, 1987) For all alpha values above this threshold, we can assume that the questions considered for a particular indicator are internally consistent and offer a good explanatory quality of that indicator.

Table 3: Reliability statistics for measure of climate change awareness and social capital

Block	Indicator	Cronbach's alpha	Number of questions
Climate Change Awareness	Information Knowledge	0.80	3
	Actionable Knowledge	0.74	4
	Intention to Act	0.71	6
Social Capital	Community Bonds	0.74	3
	Sense of Community	0.81	3
	Trust	0.78	3
	Social Participation	0.55	2
	Community Engagement	0.73	4
	Collective Efficacy	0.92	2
	Crisis Preparedness	0.86	2
	Community Leadership	0.80	3

For the indicators in the 'climate change awareness' block, Cronbach's alpha coefficients were 0.80 for 'information knowledge', 0.74 for 'actionable knowledge' and 0.74 for 'intention to act', suggesting acceptable internal consistency between the items of each of these indicators. The 'social capital' block also had high Cronbach's Alpha coefficients for all of its indicators, with the only exception of 'social participation'. Indeed, the Cronbach's alpha coefficient for this

indicator was 0.55 — this is less than the minimum for acceptance that is 0.7. This suggests that our questions explain each of the 'social capital' indicators in a good and consistent way, except for 'social participation'. Therefore, we decided to exclude this indicator in the further analysis.

In order to control for the consistency in the answers of our respondents, we had included two reverse questions in the 'sense of community' indicator. This indicator hence contained three main questions and two reverse questions, making a total of five questions. We applied the reliability analysis separately for all five questions and calculated Cronbach's alpha coefficient for the 'sense of community' indicator. Our results suggest that our respondents were consistent and attentive when compiling the survey.

3.2 Descriptive Statistics and Econometric Analysis of the Cambridge Road Citizens' Data

In the eligibility section of our survey, we asked respondents whether they had attended the tree-planting event in the Cambridge Road area on 26 October 2019 and the pop-up booth event on 24 and 30 November 2019. As mentioned, we found that 10 people attended both events (i.e., pop-up booth and tree-planting events), 44 people attended just the pop-up booth event, and 79 people did not attend any of the events (see Figure 2). Therefore, we decided to divide our sample in three groups for analytical purposes: 'No event' group (i.e., those who did not attend any event); 'one event' group (i.e., those who attended only the pop-up booth event) and the 'two event' group (i.e., those who attended the pop-up booth and the tree-planting events). This allowed us to study whether an increase in the number of events attended was linked to different measured social resilience scores.

Our questionnaire was designed such that each of the respondents gave a specific score to each of the individual indicators (variables) in the 'climate change awareness' block and in the 'social capital' block of the questionnaire (see Table 1). Summing up the scores delivered an aggregate score for the two blocks and for the entire survey. The range of scores was set such that higher scores represented a higher degree of social resilience.

Table 4 reports the summary statistics for the above-mentioned three groups of respondents (i.e., no event, one event, two events). The table shows the total score for the entire survey as well as the average scores for each block and each indicator. We ran Mann Whitney Wilcoxon tests on the independent observations (from the different respondents) to test for significant differences across the three groups of respondents.

The first column displays the average score of the respondents in the 'no event' group (our benchmark) for the whole survey, for each block (i.e., climate change awareness and social capital) and for each indicator. The same is displayed in Column (2) for the respondents in the 'one event' group and Column (3) for the respondents in the 'two events' group. The first part of Table 4 shows the results of the entire survey ('total score'). The second part shows the results per block of questions ('climate change awareness' and 'social capital') and the third part shows the results for the different indicators in these blocks.

Table 4: Mean score of the whole survey, by block (i.e., social capital and climate change) and by indicator per group

(1) 'No event'	(2)	(3)

		'One event': pop-up booth event attendance only	'Two events': pop-up booth and tree-planting events attendance
	n=79	n=44	n=10
Total Score	3.67	3.67	4.00**
	(0.50)	(0.95)	(0.46)
By Block			
Climate Change Awareness	3.88	3.94	4.03**
	(0.61)	(1.13)	(0.61)
Social Capital	3.71	3.65	4.17***
	(0.67)	(0.95)	(0.56)
By Indicator			
From the Climate Change Awareness Block:			
Information Knowledge	3.87	4.08	4.17
	(0.97)	(1.23)	(1.23)
Intention to Act	3.77	3.82	3.90
	(0.61)	(1.10)	(1.10)
Actionable Knowledge	4.00	4.03	4.13
	(0.69)	(1.19)	(1.19)
From the Social Capital Block:			
Community Bond	3.64	3.44	3.88
	(0.86)	(0.84)	(0.99)
Sense of Community	4.25	4.25	4.62***
	(0.87)	(0.63)	(1.10)
Trust	3.91	3.91	4.25*
	(0.86)	(0.65)	(1.06)
Community Engagement	3.29	3.24	4.08***
	(0.81)	(0.72)	(1.20)
Collective Efficacy	4.18	4.19	4.40
	(0.84)	(0.82)	(1.10)
Crisis Preparedness	3.40	3.23	3.8
	(1.08)	(0.98)	(1.18)
Leadership	3.44	3.44	4.15***
	(1.00)	(0.97)	(0.85)

Column (1) presents the results for 'no event' group. Column (2) displays results of the 'one event'; Column (3) show results for the 'two events' group. Standard deviations are displayed in parentheses. Asterisks indicate significance level from Mann Whitney Wilcoxon tests run on independent observations (respondents) to confirm differences with the 'no event' group: * 90% significance; ** 95% significance; *** 99% significance.

Regarding the total result of our survey as shown in the first part of Table 4 ('total score'), the Mann Whitney Wilcoxon test results show that the mean scores are significantly higher in the 'two events' case (p=0.06) than in the 'no event' case. Furthermore, the scores for the 'two events' group were significantly higher than the ones for the 'one event' group (p< 0.01).

In the second part of Table 4, we display mean scores for the 'climate change awareness' and 'social capital' blocks. We find that the scores for the 'two events' group were significantly higher than the 'no events' (p=0.01 and p=0.07, respectively) and the 'one event' (p < 0.01 in both cases).

In the last part of Table 4, we explore the differences in mean scores across the different groups per indicator. We find that 'sense of community', 'trust', 'community engagement' and 'leadership' scores were significantly higher in the 'two events' than in the 'no event' group (p=0.03; 0.08; p < 0.01; p < 0.01 and p=0.04, respectively). We also find that 'two events' scores are higher than the ones for the 'one event' group for the same indicators (p < 0.01; p=0.04; p <0.01; p < 0.01 and p=0.04, respectively).

Stars report significance level from Wilcoxon Mann-Whitney tests run on independent observations (subjects) to confirm differences with the 'No event' group.
* 90% significance ** 95% significance *** 99% significance.
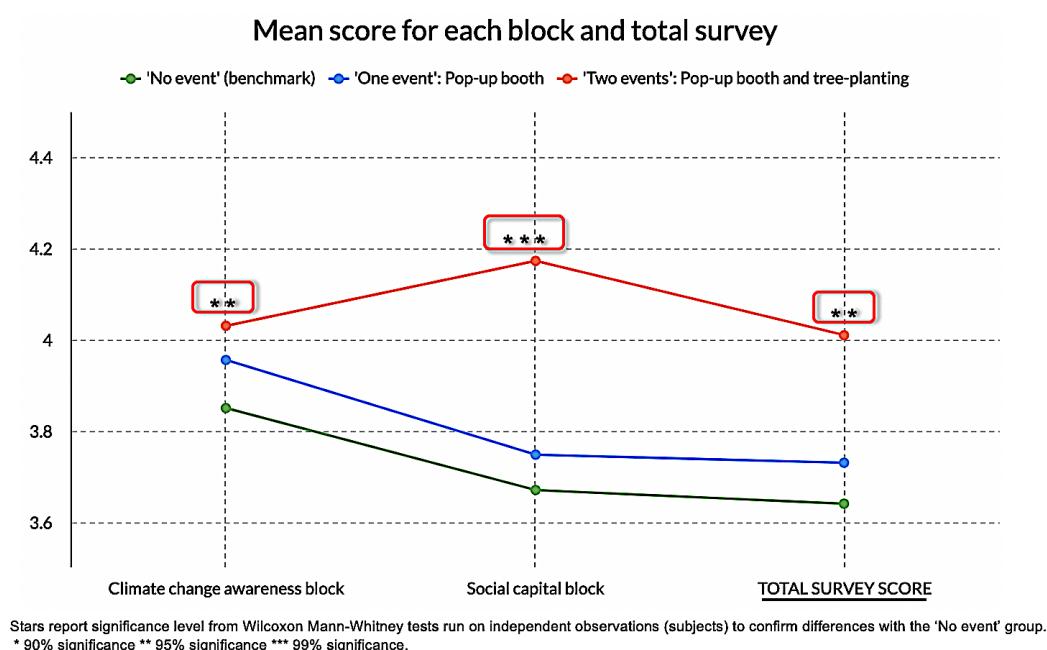
Figure 4: Aggregated means for the entire survey and for each block by group

Figure 4 displays the aggregated mean scores for the entire survey and for each of its block (i.e., climate change awareness and social capital). Consistent with Table 4, we observe that those that attended two events have a higher mean score of climate change awareness and social capital compared with those who did not attend any event and those who attended only one event. Interestingly, the highest difference is in the aggregated social capital indicators. We also see that the total score of respondents who attended two events is significantly higher than score of those who attended only one event or no event at all.

Figure 5 displays the aggregated mean scores per indicator and per group. Consistently with Table 4, we observe that for the most of the indicators the mean scores are higher for respondents who attended two events compared with those who did not attend any event or who attended only one event. It is also interesting to see, that for all three groups of respondents the indicators 'community engagement', 'crisis preparedness' as well as 'leadership' score relatively low. This could be due to scoring differences between different demographic or socio-economic groups and their different representation in our sample. Given the size of our sample, some of the demographic or socio-economic groups are too small to derive statistically reliable conclusions. Therefore, it seems important to collect more evidence to explain the above-mentioned differences and to have these differences in mind when designing futures measures to strengthen the social capital of the analysed community.
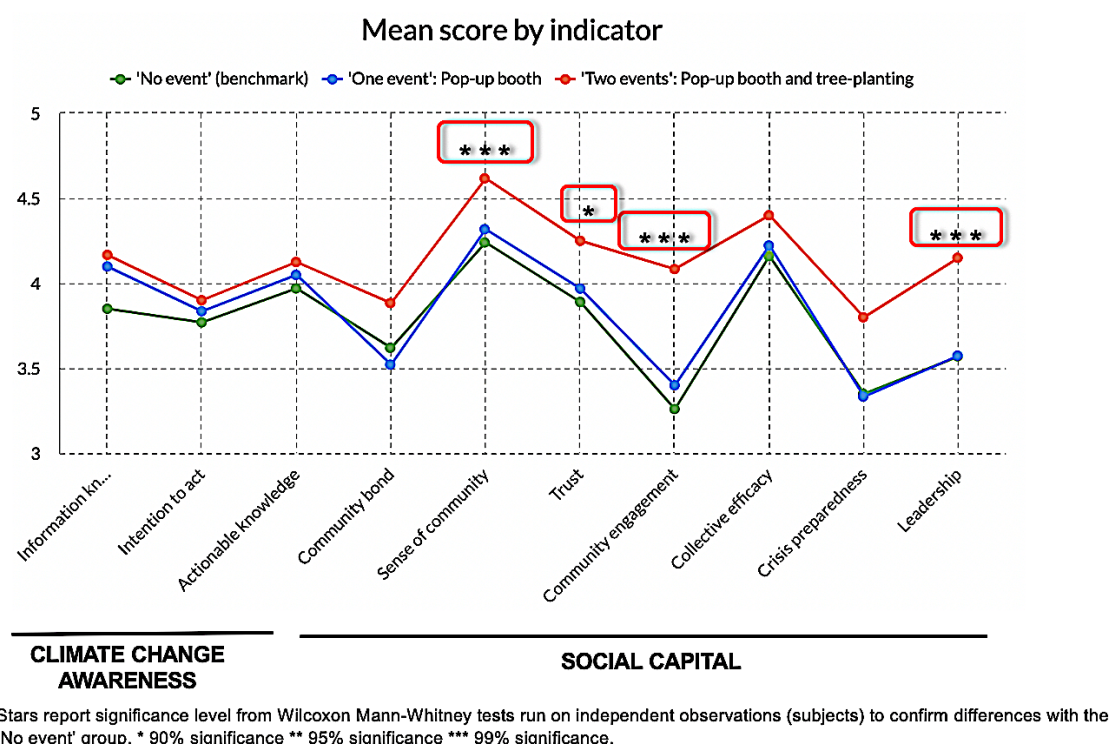
Figure 5: Aggregated means for each indicator by group

Table five presents the OLS (Ordinary Least Squares) estimations for analysing treatment effects for the 'one event' group compared to the 'no event' group (benchmark). OLS estimations give values to the unknown parameters of explanatory variables in a linear regression model. These parameter values indicate whether an explanatory variable has a positive or negative influence on the independent variable, and also whether the influence is big or small. In our analysis, the estimations are done on the levels of the entire survey, on each of the blocks and on each of the indicators. We compare the scores for the entire survey in Column (1); for each block in Columns (2) and (3) and for each indicator in Columns (4)–(13) between the 'one event' group and the 'no event' group. Furthermore, we compare the demographic and socio-economic scores between the two groups, considering different aggregation levels (entire survey, two blocks, or 10 indicators). The standard errors are clustered at the respondent level.

We added the same demographic and socio-economic control variables to all three models. We focused on few key variables such age, gender, ethnicity, education level, and dwelling type. In order to check for correlations between the control variables and to avoid multi-collinearity in our regressions, we performed Spearman tests across the demographic and socio-economic variables. We found low correlations across the variables (see Table 6). Because of the rather small size of our sample, we could not add more demographic and socio-economic controls to our regression in order not to lose too much explanatory power. In order to select the controls to use, we incorporated our controls one by one in our regressions. We kept adding as long as the fitness of our regressions improved. The combination of controls that gives the highest fitness in our regressions comprise gender, ethnicity, age, education,

and dwelling type. However, we will explore the relevance of these variables and of the rest of demographic and socio-economic characteristics in Tables 10 and 11 in Section 3.4.

Table 5: OLS estimations on differences between 'one event: pop-up booth' and 'no event', and treatment effects

VARIABLES	(1) Whole survey	(2) BLOCKS Climate Change Awareness	(3) Social Capital	(4) INDICATORS Information Knowledge	(5) Intention to Act	(6) Actionable Knowledge	(7) Community Bond	(8) Sense of Community	(9) Trust	(10) Community Engagement	(11) Collective Efficacy	(12) Crisis Preparedness	(13) Leadership
No event	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
One event: pop-up booth attendance	0.246***	0.280**	0.239*	0.401**	0.247**	0.264**	0.0905	0.149	0.222	0.327**	0.250*	0.238	0.372**
	(0.089)	(0.110)	(0.121)	(0.174)	(0.113)	(0.132)	(0.165)	(0.152)	(0.151)	(0.154)	(0.150)	(0.201)	(0.184)
Demographic and socio-economic controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Constant	3.841***	3.938***	3.958***	3.633***	4.15***	3.738***	4.362***	4.211***	3.994***	3.714***	4.440***	3.353***	3.651***
	(0.214)	(0.263)	(0.291)	(0.418)	(0.272)	(0.317)	(0.396)	(0.365)	(0.362)	(0.369)	(0.359)	(0.482)	(0.442)
Observations	124	124	124	124	124	124	124	124	124	124	124	124	124
R-squared	0.128	0.097	0.108	0.107	0.105	0.079	0.113	0.073	0.081	0.070	0.076	0.083	0.089

Standard errors clustered at respondent level in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 6: Results from the correlation tests across the demographic and socio-economic variables; Spearman's rho are reported

	Gender	Ethnicity	Age	Children	Education	Dwelling	Health status	Employment
Gender	1							
Ethnicity	0.0184	1						
Age	-0.1114	0.1961	1					
Children	0.0855	0.0924	-0.222	1				
Education	-0.0042	0.1602	0.3032	-0.3198	1			
Dwelling Type	-0.1783	0.0205	-0.0501	-0.0491	0.1728	1		
Health Status	0.022	-0.2202	-0.2007	-0.0084	-0.2836	0.064	1	
Employment	0.0565	0.032	-0.2457	0.0919	-0.0055	0.0777	-0.0218	1

The results from Table 5 show that respondents in the 'one event' group tended to indicate a significantly higher score than the ones in the 'no event' group. This clearly holds when we compare the two groups for the entire survey in Column (1) as well as for each of the blocks of the survey: climate change awareness and social capital in Columns (2) and (3). With respect to the specific indicators, we find significantly higher scores for the 'one event' group in the following indicators: information knowledge, intention to act, actionable knowledge, community engagement, collective efficacy and leadership. On the other hand, we also observe that the two groups were not significantly different with respect to community bonds, sense of community, trust, and crisis preparedness.

Result 1: Respondents who attended the pop-up booth had a higher aggregated mean score over all variables in the entire survey compared to the respondents who did not attend any event. In particular, they had significantly higher scores in the two distinctive blocks of the survey: climate change awareness and social capital. This result was particularly driven by the following specific indicators: the information knowledge, intention to act, actionable knowledge, community engagement, collective efficacy and sense of leadership. Attending one event did

not seem enough to trigger an increase in the level of trust, sense of community, community bond, and crisis preparedness, which of course was not surprising.

Table 7 displays the OLS estimations to analyse treatment effects for the 'two events' group compared to the 'no event' group which is the benchmark. Again, we compare the scores for the entire survey, for each of the blocks and for each of the single indicators. As in Table 5, the scores for the whole survey can be found in Column (1), those for the two blocks in Columns (2) and (3) and those for the 10 indicators in Columns (4)–(13), respectively. The standard errors are clustered at respondent level. Furthermore, we controlled for the demographic and socio-economic characteristics as indicated in Table 6. We observe from Table 7 that respondents from the 'two events' group had a higher score in the entire survey, in each of the blocks and in all the indicators compared with the 'no event' group.

Table 7: OLS estimations on differences between 'two events: pop-up booth and tree-planting event' and 'no event', and treatment effects

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
		BLOCKS		INDICATORS									
	Whole survey	Climate Change Awareness	Social Capital	Information Knowledge	Intention to Act	Actionable Knowledge	Community Bond	Sense of Community	Trust	Community Engagement	Collective Efficacy	Crisis Preparedness	Leadership
No event	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*
Two events: pop-up booth +tree-planting	0.656***	0.529**	0.777***	0.758**	0.415*	0.556**	0.502*	0.704**	0.695**	1.122***	0.588**	0.709*	0.923***
	(0.166)	(0.206)	(0.229)	(0.330)	(0.214)	(0.236)	(0.295)	(0.285)	(0.296)	(0.295)	(0.291)	(0.382)	(0.342)
Demographic and socio-economic controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Constant	3.718***	4.060***	3.690***	3.641***	4.343***	3.845***	4.196***	3.808***	3.904***	3.382***	4.189***	3.047***	3.338***
	(0.253)	(0.314)	(0.350)	(0.504)	(0.330)	(0.360)	(0.451)	(0.435)	(0.453)	(0.450)	(0.444)	(0.583)	(0.522)
Observations	86	86	86	86	85	86	86	86	86	86	86	86	86
R-squared	0.265	0.175	0.220	0.155	0.150	0.164	0.144	0.211	0.140	0.192	0.130	0.134	0.179

Standard errors clustered at respondent level in parentheses *** p<0.01, ** p<0.05, * p<0.1

Result 2: Respondents who attended the pop-up booth and the tree-planting event (i.e., 'two events') had a higher score in the entire survey, in each of the blocks and in all of the indicators compared to respondents who did not attend any of the events. Results 1 and 2 suggest that one event might have induces an increase in the scores of nearly all of the indicators while two events seemed to be necessary for an increase in the scores of trust, sense of community, community bonds, and crisis preparedness.

Finally, we tested whether the 'two events' group presented differences in scores compared to the 'one event' group. Table 8 presents the results of the OLS estimations to analyse treatment effects for the 'two events' group compared to the 'one event' group (benchmark) for the entire survey, each of the blocks, and each indicator separately. As in Table 5 and Table 7, Table 8 shows the scores for the entire survey in Column (1), for each block in Columns (2) and (3), and for each indicator in Columns (4)–(13), respectively. The standard errors are clustered at the respondent level.

We also controlled for the same demographic and socio-economic variables as in Table 5 and Table 7 (i.e. gender, ethnicity, age, education and dwelling type). Our results show that for the whole survey the 'two events' group has a higher score than the 'one event' group. The same holds for the two blocks, particularly for the social capital block. For the 'two events' group the coefficient of social capital is higher and more significant as shown in Column (3), compared to the one for the climate change awareness as shown in Column (2). Furthermore, with

respect to the different indicators (Columns (4)-(13)), we see that the 'two events' group presents a significantly higher score in the actionable knowledge, sense of community, trust, community engagement and leadership than the 'one event' group.

Table 8: OLS estimations on differences between 'two event: pop-up booth and tree-planting event' and 'one event: pop-up booth', and treatment effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
		BLOCKS		INDICATORS									
VARIABLES	Whole survey	Climate Change Awareness	Social Capital	Information Knowledge	Intention to Act	Actionable Knowledge	Community Bond	Sense of Community	Trust	Community Engagement	Collective Efficacy	Crisis Preparedness	Leadership
One event: pop-up booth attendance	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Two events: pop-up booth +tree planting	0.516***	0.387*	0.647***	0.487	0.290	0.455*	0.494	0.677***	0.588**	0.938***	0.375	0.521	0.704**
	(0.143)	(0.197)	(0.177)	(0.316)	(0.204)	(0.261)	(0.306)	(0.223)	(0.238)	(0.246)	(0.241)	(0.345)	(0.326)
Demographic and socio-economic controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Constant	4.021***	3.715***	4.359***	3.479***	4.080***	3.349***	4.222***	4.380***	4.202***	4.326***	4.969***	4.258***	4.358***
	(0.303)	(0.417)	(0.376)	(0.670)	(0.432)	(0.553)	(0.649)	(0.474)	(0.504)	(0.521)	(0.511)	(0.731)	(0.691)
Observations	52	52	52	52	52	52	52	52	52	52	52	52	52
R-squared	0.365	0.113	0.436	0.104	0.152	0.098	0.284	0.262	0.242	0.388	0.171	0.267	0.232

Standard errors clustered at respondent level in parentheses *** p<0.01, ** p<0.05, * p<0.1

Result 3: For the entire survey and for each of the blocks, respondents attending a pop-up booth and a tree-planting event have a higher aggregated mean score over all variables compared to those who attended only the pop-up booth event. Particularly for the social capital block, the 'two events' group scores significantly higher than the 'one event' group. This effect seems to be driven essentially by higher scores for the 'two events' group for variables like actionable knowledge, trust, sense of community, community engagement and leadership.

3.3 Profile of Cambridge Road Area Citizens

In addition to the three OLS regressions, we also analysed the effects of further variables that were included in the questionnaire (i.e., Q2–Q7; Q9; Q11–Q13; see Annex A for the entire questionnaire). Some of the most pronounced aspects and differences between persons who participated in the events and those who did not attend any event are reported in the Table 9.

Persons attending the events had received information on climate change principally from radio/television, newspapers, research institutions, national agencies, and NGOs. Persons not attending the events rely principally on newspapers.

People who attended the events were worried about heat, dry spells, heavy rainfalls and floods as well as haze. People who did not attend any event declared to be worried mainly about heavy rainfalls and floods. Hence, those who had attended at least one event seemed to have a higher level of awareness on climate change-related risks for the community than those who did not attended any event.

Further, we asked the respondents whether they had taken actions to cope with the impact of climate change. From the 'no event' group, 68% of the respondents gave a positive answer; from the 'two events' group, 85% of the respondents gave a positive answer.

Respondents were also asked for their motives to actively cope with the impacts of climate change. The 'no event' group respondents stated that they took action because they loved

Singapore and did not want to incur losses or damages to their possessions. Respondents who attended at least one event mentioned an additional motive: they took action because they felt concerned about the next generation and about their families. Hence, respondents who had attended at least one event seem to be more altruistic than those who did not attend any event.

Table 9: Summary of the explanatory variables included in the questionnaire

Profile of (no) attendees to the events		
	Attendees of the event(s)	No attendees
What climate change impact are you mainly worried about?	Heat, dry spells, heavy rainfalls and floods as well as haze	Heavy rainfalls and floods
Principal sources of information related to climate change	Radio/television, newspapers, research institutions, national agencies and NGOs	Newspapers
Do you take actions to cope with the impacts of climate change?	85% said 'yes'	68% said 'yes'
Why would you take action to cope with climate change impacts?	They felt concerned about the next generation and about their families	They love Singapore and did not want to incur losses or damages to their possessions
Where do you meet with other members of the community?	Community centres and Hawker centres	
With how many people do you talk about private matters and ask for help?	Talked to three to five members of the community about private matters and asked for help from only one or two of them	
To whom do you rely on during difficult times?	Family and friends	

Concerning social activities, our respondents said they met with other members of the community mainly in the hawker centre and in the community centre. Also, they declared that they usually talked with three to five members of the community about private matters and would ask for help from only one or two of them. Respondents also disclosed that they essentially rely on family and friends in difficult times.

3.4 The Relevance of Demographic and Socio-economic Characteristics

Before analysing the demographics and socio-economic characteristics as determinants for the scores of the whole survey, each block, and each indicator, we tested for correlations across the demographics and socio-economic characteristics. In order to check for correlations, we performed Spearman tests across the demographic and socio-economic variables. Table 6 displays the Spearman's rho for each combination across the variables. We observed no high correlations across the variables and proceeded with the respective regression analyses.

Table 10 shows OLS regressions of the scores for the entire survey in Column (1); the two blocks in Columns (2) and (3). Table 11 displays the OLS regressions with the scores for each of the 10 indicators in Columns (1) to (10) on all the demographic and socio-economic variables from Table 6. This analysis is based on the aggregated sample. Table 12 summarises our results from the demographic and socio-economic characteristics analysis of Tables 10 and 11.

Our results suggest that Indian respondents tended to score significantly more than Chinese respondents in the social capital block, which might due to significantly higher scores on the level of trust, community engagement and collective efficacy. The level of trust was significantly

higher for those who were 40–49 years old and 60–79 years old, compared to those who were between 80–89 years old. People between 60–69 years old also scored higher on collective efficacy than those between 80-89 years old. Respondents with children scored significantly higher in the 'climate change awareness' block and for the indicators of actionable knowledge and collective efficacy than those without children.

For the whole survey, the 'climate change awareness' block, and the indicators of information knowledge and intention to act, respondents who declared themselves to be in good health tended to score less than those who declared excellent health status.

In terms of employment, homemakers had a lower level of sense of community, trust, crisis preparedness, and leadership than those who were fully employed. Unemployed persons had a higher level of community engagement than those who were fully employed. This might be due to the unemployed having more free time to engage with the community.

Persons living in HDB 2-room apartments had a lower overall score in 'climate change awareness' than all others, and those who lived in HDB 5-room apartments or landed properties had a lower score on the intention to act than those living in HDB 1-room apartments.

Lastly, in terms of education, our results suggest that respondents who had Secondary School education or higher had more information knowledge than those who had Primary School education.

Table 10: OLS estimators for the whole survey, the two blocks, and the 10 indicators on the demographic and socio-economic characteristics

	(1)	(2)	(3)
		BLOCKS	
VARIABLES	Whole survey	Climate Change Awareness	Social Capital
Gender: Male	Ref	Ref	Ref
Female	-0.0736	-0.1000	-0.0369
	(0.106)	(0.137)	(0.141)
Ethnicity			
Chinese	Ref	Ref	Ref
Malay	0.172	0.400	-0.0273
	(0.328)	(0.422)	(0.434)
Indian	0.270	0.0656	0.427*
	(0.171)	(0.221)	(0.227)
Other	0.0138	0.0483	0.0164
	(0.197)	(0.254)	(0.261)
Age: 80-89	Ref	Ref	Ref
70-79	0.389	0.118	0.580
	(0.297)	(0.383)	(0.393)
60-69	0.455	0.361	0.563
	(0.300)	(0.387)	(0.397)
50-59	-0.0431	-0.0701	-0.0700
	(0.313)	(0.403)	(0.414)
40-49	0.248	-0.132	0.503
	(0.326)	(0.420)	(0.431)
30-39	0.265	0.308	0.285
	(0.330)	(0.425)	(0.436)
20-29	0.0942	-0.0825	0.153
	(0.344)	(0.443)	(0.455)
Presence of Children : No	Ref	Ref	Ref
Yes	-0.178	-0.290*	-0.143
	(0.119)	(0.153)	(0.157)
Education: Primary	Ref	Ref	Ref
Secondary	0.259	0.277	0.365
	(0.216)	(0.269)	(0.283)
Nitec/Higher Nitec	0.281	-0.0387	0.640
	(0.360)	(0.450)	(0.473)
A Levels / Diploma	0.0383	0.153	0.00887
	(0.241)	(0.301)	(0.316)
Bachelors	0.178	0.331	0.138
	(0.254)	(0.317)	(0.333)
Postgraduate	-0.0150	0.180	-0.139
Dwelling Type: HDB 1-Room	Ref	Ref	Ref
HDB 2-Room	-0.294	-0.736**	0.0129

	(0.285)	(0.356)	(0.374)
HDB 3-Room	-0.0280	-0.269	0.147
	(0.232)	(0.290)	(0.305)
HDB 4-Room	0.0868	-0.0725	0.235
	(0.246)	(0.307)	(0.322)
HDB 5-Room	-0.0908	-0.485	0.140
	(0.248)	(0.309)	(0.325)
Condominium	0.0528	-0.0423	0.258
	(0.343)	(0.428)	(0.450)
Landed Property	0.0853	-0.450	0.490
Health Status: Excellent	Ref	Ref	Ref
Very Good	-0.155	-0.322	-0.0725
	(0.163)	(0.210)	(0.216)
Good	-0.263*	-0.525**	-0.152
	(0.154)	(0.199)	(0.204)
Fair	-0.193	-0.288	-0.212
	(0.165)	(0.212)	(0.218)
Poor	-0.0102	-0.246	0.0361
	(0.316)	(0.407)	(0.418)
Employment: Employed	Ref	Ref	Ref
Unemployed	0.224	0.239	0.235
	(0.146)	(0.188)	(0.193)
Retired	0.113	0.0197	0.164
	(0.253)	(0.326)	(0.335)
Homemaker	-0.166	0.420	-0.738
	(0.344)	(0.443)	(0.455)
Constant	3.751*** (0.390)	4.338*** (0.502)	3.620*** (0.515)
Observations	93	93	93
R-squared	0.306	0.308	0.295

Standard errors clustered at respondent level in parentheses *** p<0.01, ** p<0.05, * p<0.1. NOTE: the range group 80-89 was chosen as reference because it is the group that experienced the most the flash floods in the area. However, tests comparing the different group across each other were also done. The respective results are reported in the main text.

Table 11: OLS estimators for the 10 indicators on the demographic and socio-economic characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
					INDICATORS					
VARIABLES	Information Knowledge	Intention to Act	Actionable Knowledge	Community Bond	Sense of Community	Trust	Community Engagement	Collective Efficacy	Crisis Preparedness	Leadership
Gender: Male	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Female	-0.155	-0.141	-0.0286	0.0774	0.0602	-0.0419	-0.201	-0.130	-0.0480	0.0303
	(0.226)	(0.137)	(0.167)	(0.189)	(0.178)	(0.162)	(0.182)	(0.172)	(0.238)	(0.230)
Ethnicity										
Chinese	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Malay	1.212*	-0.191	0.772	-0.198	-0.658	-0.266	-0.00843	0.231	0.359	0.589
	(0.696)	(0.420)	(0.513)	(0.581)	(0.549)	(0.498)	(0.562)	(0.530)	(0.734)	(0.709)
Indian	-0.142	0.0106	0.401	0.324	0.00206	0.565**	0.674**	0.466*	0.510	0.470
	(0.364)	(0.226)	(0.268)	(0.304)	(0.287)	(0.260)	(0.293)	(0.277)	(0.383)	(0.370)
Other	0.0309	0.139	0.0161	-0.362	0.250	0.321	-0.733**	-0.226	0.297	0.864**
	(0.419)	(0.257)	(0.308)	(0.350)	(0.330)	(0.299)	(0.338)	(0.319)	(0.441)	(0.426)
Age: 80-89	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
70-79	-0.364	0.314	0.166	0.337	0.342	1.044**	0.494	0.779	1.039	0.272
	(0.631)	(0.380)	(0.465)	(0.527)	(0.498)	(0.451)	(0.509)	(0.480)	(0.665)	(0.643)
60-69	-0.0510	0.532	0.370	0.474	0.547	1.066**	0.173	0.843*	0.889	0.240
	(0.638)	(0.385)	(0.470)	(0.533)	(0.503)	(0.456)	(0.515)	(0.486)	(0.672)	(0.650)
50-59	-0.437	0.00361	-0.00318	-0.382	-0.204	0.213	0.0278	0.00987	0.182	-0.252
	(0.665)	(0.405)	(0.490)	(0.555)	(0.524)	(0.476)	(0.536)	(0.506)	(0.701)	(0.677)
40-49	-0.471	-0.0749	-0.0758	0.268	0.239	0.835*	0.395	0.835	0.663	0.471
	(0.693)	(0.424)	(0.510)	(0.579)	(0.546)	(0.495)	(0.559)	(0.527)	(0.730)	(0.705)
30-39	0.203	0.216	0.314	-0.128	-0.0688	0.425	0.676	0.851	0.764	-0.313
	(0.701)	(0.445)	(0.516)	(0.585)	(0.552)	(0.501)	(0.565)	(0.533)	(0.738)	(0.713)
20-29	-0.246	0.0568	-0.310	-0.131	-0.294	0.489	0.389	-0.0408	0.630	0.0302
	(0.732)	(0.449)	(0.539)	(0.611)	(0.577)	(0.523)	(0.590)	(0.557)	(0.771)	(0.745)
Presence of children: No	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Yes	-0.266	-0.232	-0.424**	-0.0714	-0.237	-0.189	0.0285	-0.458**	0.0777	-0.265
	(0.252)	(0.152)	(0.185)	(0.210)	(0.199)	(0.180)	(0.203)	(0.192)	(0.265)	(0.256)
Education										
Primary	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Secondary	1.088***	-0.150	0.245	0.481	0.666*	0.220	0.371	0.0206	0.656	0.105
	(0.399)	(0.272)	(0.324)	(0.363)	(0.352)	(0.328)	(0.365)	(0.358)	(0.474)	(0.459)
Nitec/Higher Nitec	0.461	-0.579	0.343	1.345**	0.831	-0.0225	0.964	0.357	1.370*	-0.319
	(0.666)	(0.448)	(0.541)	(0.606)	(0.588)	(0.548)	(0.609)	(0.599)	(0.792)	(0.767)
A Levels/ Diploma	1.019**	-0.372	0.248	0.0141	0.359	-0.331	0.200	-0.0967	0.470	-0.542
	(0.446)	(0.301)	(0.362)	(0.406)	(0.393)	(0.366)	(0.407)	(0.400)	(0.530)	(0.513)
Bachelors	1.782***	-0.336	0.217	0.200	0.350	-0.0866	0.185	-0.0264	0.869	-0.393
	(0.469)	(0.316)	(0.381)	(0.427)	(0.414)	(0.386)	(0.429)	(0.421)	(0.558)	(0.540)
Postgraduate	1.437**	-0.269	-0.0238	0.137	-0.263	-0.295	0.0693	-0.487	0.413	-0.724
Dwelling Type										
HDB 1-Room	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
HDB 2-Room	-0.974*	-0.593*	-0.756*	-0.224	-0.00561	-0.313	0.226	0.125	0.529	-0.0633
	(0.527)	(0.354)	(0.428)	(0.479)	(0.465)	(0.433)	(0.482)	(0.473)	(0.627)	(0.606)
HDB 3-Room	0.0718	-0.365	-0.373	0.0198	0.541	-0.110	0.183	0.0210	0.406	0.0473
	(0.429)	(0.289)	(0.348)	(0.391)	(0.379)	(0.353)	(0.392)	(0.386)	(0.511)	(0.494)
HDB 4-Room	0.208	-0.253	-0.0347	0.296	0.454	0.0683	0.532	-0.0303	0.0486	0.0600

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	(0.454)	(0.306)	(0.369)	(0.413)	(0.401)	(0.373)	(0.415)	(0.408)	(0.540)	(0.523)
HDB 5-Room	-0.657	-0.625**	-0.148	0.00954	0.360	0.0631	0.184	0.0181	0.304	0.101
	(0.458)	(0.308)	(0.372)	(0.416)	(0.404)	(0.376)	(0.418)	(0.411)	(0.544)	(0.527)
Condominium	0.205	-0.140	-0.128	0.337	0.869	0.0599	-0.0402	-0.0700	0.443	0.332
	(0.635)	(0.428)	(0.515)	(0.577)	(0.560)	(0.522)	(0.580)	(0.570)	(0.755)	(0.730)
Landed Property	-0.499	-0.989*	0.367	-0.215	0.800	-0.274	0.527	0.529	1.293	1.071
Health Status										
Excellent	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Very Good	-0.373	-0.507**	0.0865	0.00244	0.148	-0.209	-0.0721	-0.0002	-0.424	0.0445
	(0.346)	(0.218)	(0.255)	(0.289)	(0.273)	(0.248)	(0.279)	(0.263)	(0.365)	(0.352)
Good	-0.759**	0.552***	-0.241	-0.195	-0.392	-0.214	-0.0293	-0.172	-0.313	0.220
	(0.328)	(0.204)	(0.241)	(0.274)	(0.258)	(0.234)	(0.264)	(0.249)	(0.345)	(0.334)
Fair	-0.207	-0.327	-0.203	-0.449	-0.262	-0.349	-0.0569	-0.431	-0.108	0.148
	(0.350)	(0.219)	(0.258)	(0.292)	(0.276)	(0.250)	(0.282)	(0.266)	(0.369)	(0.356)
Poor	-0.217	-0.670	0.396	0.597	-0.436	0.274	0.286	0.205	-0.551	-0.282
	(0.671)	(0.404)	(0.494)	(0.560)	(0.529)	(0.480)	(0.541)	(0.511)	(0.707)	(0.683)
Employment										
Employed	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Unemployed	0.236	0.157	0.256	0.324	-0.195	0.202	0.425*	-0.0338	0.375	0.428
	(0.310)	(0.199)	(0.229)	(0.259)	(0.245)	(0.222)	(0.250)	(0.236)	(0.327)	(0.316)
Retired	-0.253	0.212	-0.0504	0.429	0.567	0.416	-0.158	-0.157	-0.315	0.213
	(0.537)	(0.324)	(0.396)	(0.449)	(0.424)	(0.433)	(0.409)	(0.566)	(0.566)	(0.547)
Homemaker	0.103	0.533	0.534	0.204	-1.180**	-1.024*	-0.244	-0.327	-1.312*	-1.478*
	(0.731)	(0.441)	(0.538)	(0.610)	(0.576)	(0.523)	(0.589)	(0.556)	(0.770)	(0.744)
Constant	4.220***	4.648***	4.004***	3.824***	4.375***	3.695***	3.231***	4.375***	2.467***	3.357***
	(0.828)	(0.498)	(0.610)	(0.691)	(0.653)	(0.592)	(0.668)	(0.630)	(0.872)	(0.843)
Observations	93	92	93	93	93	93	93	93	93	93
R-squared	0.286	0.339	0.272	0.295	0.255	0.348	0.274	0.312	0.308	0.265

Standard errors clustered at respondent level in parentheses *** p<0.01, ** p<0.05, * p<0.1. NOTE: the range group 80-89 was chosen as reference because it is the group that experienced the most flash floods in the area. However, tests comparing the different group across each other were also done. The respective results are reported in the main text.

Table 12: Summary of results from the demographic and socio-economic characteristics assessment

Demographic and Socio-economic Characteristics
Indian • Higher in 'social capital' block due to high scores on trust, community engagement and collective efficacy than Chinese and Malay
People with children • Higher in 'climate change awareness' block and actionable knowledge and collective efficacy
Employed • Higher sense of community, trust, crisis preparedness, and leadership than homemakers • Lower level of community engagement compared to the unemployed
Secondary school education or above • High information knowledge than those with lower level of education
40—49 and 60—79 years old • Higher level of trust compared to those who were between 80-89 years old • People between 60—69 years old scored higher on collective efficacy than those between 80—89 years old
HDB 2-room • lower overall score in 'climate change awareness' than all others HDB 5-room • lower score on the intention to act than those living in an HDB 1-room apartments

4. Discussion

4.1 Key Results

We asked citizens from the Cambridge Road area to complete a questionnaire in order to assess their climate change awareness, their social capital and their demographic and socio-

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economic characteristics. The questionnaire was designed such that each of the respondents gave a specific score to each of the individual variables and indicators in the 'climate change awareness' block and in the 'social capital' block. Summing up the scores delivered an aggregate score for the two blocks and for the entire survey. The range of scores — especially for the social capital aspect — was set such that higher scores represented a higher degree of social resilience.

Our results suggest that the events such as tree-planting and pop-up booths were effective in the sense that citizens who had participated in two events showed a higher resilience score than those who participated in one or none of the respective events. These results was consistent for the entire survey as well as for the two blocks 'climate change awareness' and 'social capital'. For the 'social capital' the highest significant score difference was observable. Persons that had participated in one event scored significantly higher than those that had not attended any event. However, this difference might be due to a selection effect: people with higher scores for climate change awareness and social capital might have been more likely to participate in an event than those with lower scores. Yet, when participating in two events, the difference compared to non-attending persons was even stronger. Therefore, it was possible that participating repeatedly in engagement and information events had a positive effect on social resilience towards climate change-related risks.

Yet, given the sample, the question of causal relationship has to remain open. From the current sample, we identified the profile of respondents in the CLC events that were inclined to answer our questionnaire. It would appear that citizens who had attended the events were already better informed than those who had not. Hence, it is not very surprising that well-informed citizens were receptive to additional information and additional reflections on social resilience towards climate change-related risks. They were prepared to take up further inputs and to become even more resilient, based on these inputs. Therefore, the crucial question is whether individuals who are not well-informed about climate change-related risks can be incentivised to become more resilient through information and awareness events like those organised by CLC in the Cambridge Road area. If this were the case, such events would be an effective instrument to increase citizens' social resilience for an entire community. In order to detect the effectiveness of the events, we would need a bigger and particularly a more representative sample than the one we have so far.

Based on the current sample, we find that persons that participated in one event had performed better on some of the individual indicators (i.e., information knowledge, intention to act, actionable knowledge, community engagement, collective efficacy, and leadership) than persons that had not attended any event. As mentioned, this might be a selection effect and not due to a reaction to the event itself. Nonetheless, for those that had attended two events, we see a positive effect for social resilience for other individual indicators (i.e., community bonds, sense of community, trust, and crisis preparedness), and this could point to the effectiveness of such events for an increase of the social resilience towards climate change-related risks.

Concerning the role of demographic and socio-economic characteristics for social resilience towards climate change-related risks, we found no significant differences between females and males. Differences between different ethnic groups may exist, but we would need more statistical power in order to derive reliable conclusions. In addition, older people tended to have more trust than younger people, and citizens with children scored higher on the 'climate change awareness' block and on the indicators of actionable knowledge and collective efficacy than

those without children. Compared with fully employed respondents, homemakers scored lower on the sense of community, trust, crisis preparedness, and leadership, while unemployed people scored higher on community engagement.

4.2 Next steps

From the data we collected, we see an accumulative positive effect from the participation in successive information and awareness events, on social resilience towards climate change-related risks. However, the number of citizens that had participated in one or two events and completed the questionnaire is small and unlikely to be representative of the population of the Cambridge Road area. In order to validate the findings, a larger and representative sample is necessary. The next events and citizen workshops organised by CLC would be good opportunities to strengthen this database.

Furthermore, from a more theoretical perspective, it is useful to re-think the elements constituting social resilience blocks and overall scores. Together with representatives from the area, we could identify further variables that appear relevant for the area and give different weights to the indicators that are considered.

For the time being, some basic tendencies are clear and further interventions may be taken by CLC to strengthen the community's capabilities to cope with climate change-related risks. Once a more detailed and data-rich analysis is undertaken, community authorities together with citizen representative may derive additional or further-reaching measures to ensure that more of their citizens become more resilient with respect to climate change-related risks. While it seems premature to suggest specific measures, it appears that often-repeated awareness-raising measures as well as a general strengthening of citizens' social capital could be helpful. Choosing specific threats like flash floods, heat, food waste, etc., could serve as interesting focal points in bringing different citizens together, while working on the developing threat and strengthening their social resilience (Aldrich & Meyer, 2015; Aldrich, 2012).

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ANNEX A: survey questionnaire divided by block and indicators

Eligibility Check and treatment allocation – to be completed by researcher

Only residents who live in the community area can participate in this study.

EC1. Are you over 21 years old? 您的年龄是否21岁以上?
- ❏ 是   Yes (继续调查 Continue with study)
- ❏ 不是   No (终止调查 Terminate the study)

EC2. Do you reside in the community area presented in the map below? 您是否居住在图中划出的社区?
- ❏ Yes 是 (Continue with study 继续调查)
- ❏ No 不是 (Terminate the study 终止调查)
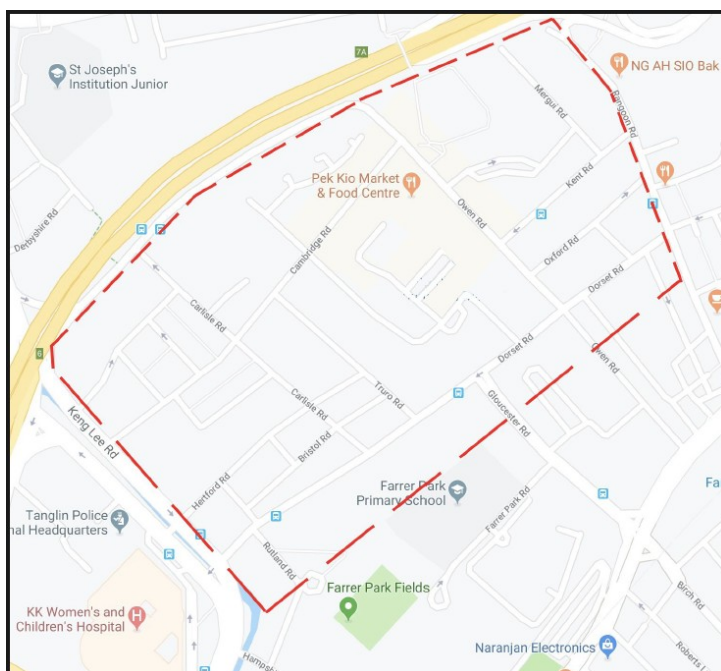
EC3. How many years have you lived in the community: _____years
你在这个社区住了多少年? _____年

1. Please indicate the extent to which you agree or disagree with the following statements:
请示意您是否同意或不同意以下句子：

	Strongly Disagree 强烈不同意	Somewhat Disagree 有点不同意	Neutral 中立	Somewhat Agree 有点同意	Strongly Agree 强烈同意
I understand what 'climate change' means. 我对于'气候变化'的现象有所了解。					
Over the last 12 months, I improved my understanding of climate change related risks in Singapore. 在过去的12个月里，我加深了对新加坡可能面对的气候变化风险的认识。					
Climate change is an urgent problem in Singapore. 对于新加坡来说，应对气候变化是一个紧迫的问题。					
Actions to better cope with the impacts of climate change need to be taken in Singapore. 能够帮助新加坡更好地应对气候变化影响的措施必须实行。					
Actions to better cope with the impacts of climate change need to be taken in the Cambridge Road area. 能够帮助剑桥路社区更好地应对气候变化影响的措施必须实行。					
More money should be invested to address the changes in climatic conditions faced in Singapore. 更多的资金应该投注在能够帮助新加坡应对气候变化的措施。					
Singapore is doing enough to cope with the impacts of climate change. 新加坡在应对气候变化方面做了足够的工作。					
The government should take the lead on coping with the impacts of climate change. 政府应该带头采取应对气候变化影响的措施。					
Businesses in Singapore are doing enough to reduce their CO2 emissions. 新加坡的企业在减少二氧化碳排放方面已经做了足够的工作。					
Only if we act together as a community, we can have an important impact on coping with the impacts of climate change. 唯有社会整体群策群力共同行动，我们才能够在应对气候变化影响这方面达到有效的成绩。					
I regularly take actions because I am concerned about climate change. 我会经常采取行动，因为气候变化现象令我有所担忧。					
I know what actions to take to reduce my household's CO_2 emissions.					

	Strongly Disagree 强烈不同意	Somewhat Disagree 有点不同意	Neutral 中立	Somewhat Agree 有点同意	Strongly Agree 强烈同意
我知道应该采取怎样的行动来减少我家的二氧化碳排放量。					
I use public transport to reduce my CO_2 emissions. 我会乘搭公共交通以减少二氧化碳排放。					

2. Living in this community area, I am worried about:
生活在这个社区，我担心：

	Strongly Disagree 强烈不同意	Somewhat Disagree 有点不同意	Neutral 中立	Somewhat Agree 有点同意	Strongly Agree 强烈同意
i. Higher Temperatures 高温					
ii. Dry Spells 干旱					
iii. Heavier rainfall and Floods 降雨量增加以及淹水					
iv. Haze 雾霾					
v. Other, please specify _____ 其他，请说明____					

3. Living in this community area, I was affected by:
生活在这个社区，我感受到：

	Strongly Disagree 强烈不同意	Somewhat Disagree 有点不同意	Neutral 中立	Somewhat Agree 有点同意	Strongly Agree 强烈同意
i. Higher Temperatures 高温					
ii. Dry Spells 干旱					
iii. Heavier rainfall and Floods 降雨量增加以及淹水					
iv. Haze 雾霾					
v. Other, please specify _____ 其他，请说明____					

4. In the past, I took actions to cope with the impacts of climate change (e.g. decrease my electricity and water consumption, use more public transport, etc)
过去，我曾经采取有效于应对气候变化影响的行动 (例如， 减少我的水电消耗， 多乘搭公共交通， 等等)

❏ Yes 是
❏ No 不是
❏ If yes: please specify: _____ 如果是，请说明: ____
_____

5. For the near future, I plan to take actions to cope with the impacts of climate change (e.g. decrease my electricity and water consumption, use

more public transport, etc)

在不久的将来，我计划采取有效于应对气候变化影响的行动。

- ❑ Yes 是
- ❑ No 不是
- ❑ Don't know 不知道

6. I have taken or I plan to take actions out of concern for climate change (e.g. decrease my electricity and water consumption, use more public transport, etc) because:

我曾经采取或计划采取有效于对抗气候变化的行动，因为：

		Strongly Disagree 强烈不同意	Somewhat Disagree 有点不同意	Neutral 中立	Somewhat Agree 有点同意	Strongly Agree 强烈同意
i.	I love Singapore. 我爱新加坡。					
ii.	I feel responsible for the next generation.我觉得必须为下一代尽责。					
iii.	I am concerned about my family. 我很关心我的家人。					
iv.	I don't want to incure an losses/damages in my possessions. 我不希望受到财务上的损失。					
v.	Others,please specify _____ 其他,请说明____					

7. Over the past 12 months, I have received reliable information about climate change related risks like floods or heat from:

在过去的 12 个月里，我收到有关气候变化相关风险的可靠信息，如淹水或高温，来自于：

	Never 从未	Rarely 很少	Sometimes有时	Often 经常	Very frequently 非常频繁
i. Grassroots leader 基层领袖					
ii. Family 家人					
iii. Friends 朋友					
iv. Neighbours 令居					
v. School 学校					
vi. Radio / television 电台/电视					
vii. Internet / social media 互联网/社交媒体					
viii. Newspaper 报纸					
ix. National governmental agencies 政府机构					

x. Non-governmental organisations 非政府组织	29				
xi. Research institutions 研究机构					
xii. Others, please specify: _____ 其他，请说明_____					

1. Please indicate the extent to which you agree or disagree with the following statements:
   请指出您是否同意或不同意以下句子：

	Strongly Disagree 强烈不同意	Somewhat Disagree 有点不同意	Neutral 中立	Somewhat Agree 有点同意	Strongly Agree 强烈同意
I can recognise most people who live in the neighbourhood. 我可以认出住在我住宅区的大多数人。					
I know the names of my close neighbours. 我知道我的近邻的名字。					
I have close relationships with my neighbours. 我和邻居关系密切。					
I think my neighbourhood is a good place to live in. 我认为我的邻里（或社区）是一个适合居住的好地方。					
I would feel sorry to leave the community where I live in. 如果需要离开我现在居住的社区，我会感到遗憾。					
I feel a sense of belonging to where I live. 我对现在居住的地方有一种归属感。					
I would like to leave my home/property for good. 我希望能够搬离现在居住的地方。					
I would like to move away from my community. 我想搬离现在居住的社区。					
There is trust among our community. 我们的社区居民之间彼此信任。					
I would be happy to help if anything happens to people in this community.如果这个社区的人出了什么事，我乐意帮忙。					
People in this community would take an action if anything happens to me or I need help. 如果有意外事件发生在我身上或我需要援助，这个社区的居民会采取行动。					
The relations between the various social groups in this community are good (e.g., age group, religious groups, ethnic and inter-ethnic groups).					

这个社区的不同社会群体之间的关系良好（例如不同的年龄层、宗教团体、同族或异族之间的关系）		31			
I attend activities organized by the community. 我会参加社区组织主办的活动。					
I am doing my best to make our community a better place to live in. 我尽我所能，使我们的社区成为一个更好的居住地方。					
I volunteer at community events. 我会为社区活动当义工。					
I work together with other residents of this community to improve the well-being of this community. 我与这个社区的其他居民合作改善这个社区的福利。					
There is mutual assistance and concern for others in this community. 这个社会里会相互帮助和关心他人。					
I believe that if we work together with other residents of this community, we can overcome an emergency. 我相信如果这个社区的居民共同努力，我们能克服突发事件或紧急情况。					
I believe that if we work together with other residents, we can improve our neighbourhood together. 我相信如果这个社区的居民共同努力，我们可以改善邻里的环境。					
My family and I are familiar with the emergency procedures in this community. 我的家人和我都熟悉这个社区的应急程序（若有紧急情况）					
People in this community are familiar with their role in an emergency. 这个社区的人熟悉他们在紧急情况中必须扮演的角色（或采取的行动）。					
I think this community has effective leadership. 我认为这个社区有有效的领导。					
I feel free to talk to grassroots leaders about community problems. 我随时能与基层领袖谈论社区问题。					
I believe in the ability of my grassroots leaders to lead the community during					

an emergency.我相信基层领袖在紧急情况时刻能够带领居民。					

2. I meet with residents of this community at:
   我与本社区其他居民接触的场所：

	Never 从未	Rarely 很少	Sometimes有时	Often 经常	Very frequently非常频繁
i. My home 我的家					
ii. Their home 他们的家					
iii. Hawker centre 熟食中心					
iv. Local market 巴刹					
v. Community centre 联络所					
vi. Open spaces (playgrounds, void decks, pavilions) 公共场所（游乐场，组屋底层，凉亭）					
vii. Fitness corners / facilities 运动场所					
viii. Green spaces (gardens, pocket parks) 公园/花园					
ix. Places of religious worship 宗教场所					
x. Others, please specify_____ 其他，请说明_____					

3. I have volunteered in this community:
   我在这个社区里自愿帮忙：

	Never 从未	Rarely 很少	Sometimes 有时	Often 经常	Very frequently非常频繁
i. within the last 12 months 在过去的十二个月					
ii. within the last 24 months 在过去的一年					

4. Please indicate the correct answer:
   请注明答案：

	None 无	One to two一到二	Three to five 三到五	Six to nine六到九	Ten or more 十以上
i. How many residents in this community do you see or hear from at least once a month? 你每月至少看到或有联络这个社区的多少位居民？					
ii. With how many residents of this community do you feel at ease to talk about private matter? 在这个社区, 你放心与多少居民谈论私人事务？					

iii.	How many residents of this community do you feel close such that you can call them for help at any time? 你对这个社区有多少居民感到很亲近，觉得随时可以给他们打电话求助？					

5. Please indicate the correct answer:
   请注明答案：

		Never 从未	Rarely 很少	Sometimes 有时	Often 经常	Very frequently 非常频繁
i.	How often do you help (e.g. borrow a household item, watch over a property) your neighbours? 你多久一次协助你的邻居（例如借东西、邻居出外时帮他们看门）？					
ii.	How often do your neighbours help you (e.g. borrow a household item, watch over a property). 你的邻居多久帮你一次？					

6. In difficult times, I can rely on:
   在困难时期，我可以依靠：

		Never 从未	Rarely 很少	Sometimes 有时	Often 经常	Very frequently 非常频繁
i.	Family 家人					
ii.	Friends 朋友					
iii.	People in my community 我社区中的人					
iv.	People from outside my community 我社区以外的人					
v.	Grassroots leaders 基层领袖					
vi.	Religious groups 宗教团体					
vii.	Non-governmental organizations 非政府组织					
viii.	Private sector firms (e.g. insurance company) 私人公司					
ix.	National agencies 政府机构					
x.	Others, please specify: _____ 其他，请说明_____					

II. DEMOGRAPHICS, SOCIO-ECONOMIC STATUS AND HEALTH 个人资料

1. Which sex do you identify with? 性别
    - ❏ Male 男
    - ❏ Female 女
    - ❏ Prefer not to say 不愿分享

2.   Where are you from? _____ 国籍：_____ _____

3.   What is your ethnicity?

你的种族是什么？
- ❏ Chinese 华人
- ❏ Malay
- ❏ Indian
- ❏ Others
- ❏ Prefer not to say 宁愿不说

4. What is your current marital status? 你的婚姻状况如何？
- ❏ Single 单身
- ❏ Married 已婚 Married
- ❏ Widowed 丧偶 (老公/老婆去世)
- ❏ Separated / Divorced 分居/离婚
- ❏ Others, please specify: _____ 其他，请说明_____
- ❏ Prefer not to say 宁愿不说

5. Do you have children? 你有没有孩子？
- ❏ Yes, how many _____ 有，几个_____
- ❏ No 没有

6. What is the highest educational level you have attained? 您的最高学历是是什么？
- ❏ Primary & below 小学以下
- ❏ Secondary 中学
- ❏ Nitec/Higher Nitec 工艺教育
- ❏ A Levels / Diploma 初级学院/文凭
- ❏ Bachelors 大学
- ❏ Postgraduate 研究生
- ❏ Other, please specify: _____ 其他，请说明_____
- ❏ Prefer not to say 宁愿不说

7. What is your current employment status? 您目前的就业状况？
- ❏ Employed (full/part time) 就业(全时/兼职)
- ❏ Unemployed (seeking employment) 失业（在找工作）
- ❏ Unemployed (not seeking employment) 失业（不找工作）
- ❏ Retired 退休
- ❏ Homemaker 家庭主妇
- ❏ Other, please specify: _____ 其他，请说明: _____
- ❏ Prefer not to say 宁愿不说

8. Over the past 12 months, what is the estimated average earnings (SGD) of your household per month?
请问您过去十二个月的平均家庭收入是多少？

- ❏ 两千以下 Below $2,000 per month
- ❏ 两千至三九九九 Between $2,000 to $3,999
- ❏ 四千至五九九九 Between $4,000 to $5,999
- ❏ 六千至九九九九 Between $6,000 to $9,999
- ❏ 十万以上 $10,000 and above

9. Do you have any available savings in case of emergency? 请问您有应对紧急情况的储蓄吗？
   - ❏ Yes 有
   - ❏ No 没有
   - ❏ Prefer not to say 不愿分享

10. What type of dwelling do you live in? 请问您住在什么类型的居所？
    - ❏ HDB 1-Room 一房式
    - ❏ HDB 2-Room 二房式
    - ❏ HDB 3-Room 三房式
    - ❏ HDB 4-Room 四房式
    - ❏ HDB 5-Room or Executive flat 五房式
    - ❏ Condominium or Private flat 公寓
    - ❏ Landed property 洋房

11. Is your dwelling owned or rented by your family? 你住的房子是买的还是租的？
    - ❏ Owned / Co-owned 买的
    - ❏ Rented 租的
    - ❏ Others (please specify:_____) 其他，请说明_____
    - ❏ Prefer not to say 不愿分享

12. With whom are you currently living? Check all that apply: 你现在跟谁一起住？可多选
    - ❏ Alone 自己住
    - ❏ Live with spouse only 跟老公/老婆一起住
    - ❏ Live with spouse and children 跟老公/老婆和小孩一起住
    - ❏ Live with children only 跟小孩一起住
    - ❏ Live with children and grandchildren 跟小孩和孙子一起住
    - ❏ Living with partner 跟伴侣一起住
    - ❏ Live with parents 跟父母一起住
    - ❏ Live with parents and children 跟父母和小孩一起住
    - ❏ Live with other relatives 跟亲戚一起住
    - ❏ Live with friend 跟朋友一起住
    - ❏ Others (please specify:_____) 其他，请说明_____
    - ❏ Prefer not to say 宁愿不说

13. How would you rate your health? 你的健康情况如何？
    - ❏ Excellent 特别好
    - ❏ Very good 很好
    - ❏ Good 好
    - ❏ Fair 一般

- ❑ Poor 差
- ❑ Prefer not to say 宁愿不说

14. Do you contribute to the Central Provident Fund (CPF)? 请问您现在是否缴交公积金？
    - ❑ Yes, I do 有
    - ❑ No, I do not 没有
    - ❑ Prefer not to say 宁愿不说

15. Do you have any type of insurance (e.g. Health insurance, house insurance, etc.)
    请问您是否有任何保险（例如医疗保险，住家保险，等等）？
    - ❑ Yes, I have (please indicate all): _____有，请说明_____
    - ❑ No, no insurance at all 没有
    - ❑ Prefer not to say 宁愿不说

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