NEW METHODS IN RESILIENCE MEASUREMENT

EARLY INSIGHTS FROM A MOBILE PHONE PANEL SURVEY IN MYANMAR USING SUBJECTIVE TOOLS

Lindsey Jones

Working paper

BRACED
KNOWLEDGE MANAGER

CONTACT THE AUTHORS

Lindsey Jones is a Research Associate at the Overseas Development Institute, working on issues of climate change, adaptation and development. He leads BRACED Rapid Response Research which seeks to explore issues of subjective resilience and the use of mobile phone surveys in a range of BRACED countries.

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Executive summary

Despite growing support for resilience-building initiatives within the international development community, efforts to measure resilience face a number of critical challenges. Evaluators have difficulties not only in defining resilience but also in choosing the right indicators and finding ways of recognising the many intangible elements that contribute to a household's resilience (such as power, social networks and norms). New methods and tools are desperately needed to help address some of these shortfalls.

This paper presents early insights from the Building Resilience and Adaptation to Climate Extremes and Disaster (BRACED) programme's Rapid Response Research (RRR) in Myanmar, which is trialling two innovations. The first is the use of subjective approaches to resilience measurement that seek to use people's knowledge of their own capacities to deal with risk. This contrasts with traditional 'objective' approaches that rely heavily on expert judgement and external verification to decide what makes other people resilient. The second is the use of mobile phones to collect near-real-time cheap panel survey data in post-disaster contexts.

Initial findings from the RRR survey show how subjective resilience is strongly associated with factors such as education, poverty, number of household occupants and well-being. While traditional objective assessments reflect many of these, a number of disparities exist between subjective and objective assessments – such as role of livelihood types and resilience of female-headed as against male-headed households. Levels of subjective resilience vary considerably across resilience-related capacities and depend heavily on whether we consider resilience to a wide range of overall shocks or to a specific hazard. The RRR will continue to collect data as part of efforts to track post-disaster recovery rates; this paper documents early lessons learnt in rolling out the mobile phone survey to

help others interested in using either of the two techniques to measure resilience. Finally, we call for greater innovation and experimentation in resilience measurement, recognising the need for a wide range of measurement tools to support the diverse contexts and assessment needs of the development community.

1. INTRODUCTION

IMAGE: ASIAN DEVELOPMENT BANK

Key messages:

- Resilience measurement can help ensure investments in resilience-building are effective and target the most vulnerable communities and households.
- Measuring resilience is a challenge because the concept is poorly defined, difficult to compare across groups and costly to collect information on.
- BRACED's Rapid Response Research (RRR) aims to trial new methods of addressing these measurement gaps through a combination of digital innovations and subjective measurement tools.

- Working with partners in Myanmar, BRACED has set up a mobile phone panel survey in Hpa-An township comprising 1,200 households. The survey seeks to collect information on resilience and disaster recovery in post-disaster contexts over a one-year period.
- This paper discusses the process of undertaking the RRR survey to date and emerging findings. Findings challenge several assumptions for supporting resilience in Myanmar and elsewhere.

Development funders and practitioners are increasingly turning their attention to the notion of 'resilience' as a tool for responding to current and future risk. Investments in resilience are widely seen as a means of helping to protect long-term development gains and reduce the need (and cost) of humanitarian action (Bahadur et al. 2015). This shift has resulted in a range of international commitments to supporting resilience, through approaches such as disaster risk reduction, climate change adaptation and social protection. In a context of increasing donor funding for resilience-building activities, development actors need to develop accurate and reliable ways of measuring progress towards resilience-building. This is to allow funders to track investments over time and ensure resilience-building interventions target those who need them most. However, a number of technical challenges hamper measurement efforts. For one, 'resilience' is poorly defined: there are many different interpretations of what a resilient person or community looks like. Second, a person's resilience is made up of a range of different factors, many of which are intangible and impossible to measure directly (Jones et al., 2010). Lastly, collecting information on resilience can be costly – in terms

of both money and time – especially given the range of different indicators that are typically required in measuring complex and multidimensional properties like resilience. This often means that many development actors cannot afford data that is vital to improving the delivery of resilience-building interventions.

While a range of resilience measurement tools exist, there is a clear need for innovation and the trialling of new methods that could address some of these critical challenges. This is where BRACED's Rapid Response Research (RRR) programme aims to contribute. Working alongside BRACED partners in Myanmar, the RRR tracks the resilience of people and communities over time using two innovations. The first is the use of mobile phones to collect survey information through standardised questionnaires delivered via a remote call centre. If rolled out with care, mobile surveys may be cheaper, and – under favourable circumstances – just as methodologically robust as traditional face-to-face surveys (Dabalen et al., 2016; see also Leo et al., 2015). In fact, mobile surveys are increasingly being used in developing countries to gather real-time household-level data (e.g. Croke et al., 2013) and to assess humanitarian needs (e.g. Morrow et al., 2016). However, their potential in disaster-affected areas has yet to be explored, although mobiles are likely to offer unique opportunities for the safe and timely collection of data and for more frequent data collection.

The second innovation is the use of subjective methods for evaluating resilience (Maxwell et al., 2015; Jones and Tanner, 2017). Resilience has traditionally been measured via objective means. These normally consist of expert-driven processes that make assumptions about the factors that support other people's resilience and measure them through external verification and observation. Subjective tools take a very different approach. They make use of people's knowledge of their own resilience

and the factors that contribute to it (see Jones and Tanner, 2017 for further details and clarifications on the distinctions between the two concepts). Similar to the field of subjective well-being, tools for measuring subjective resilience seek to quantify levels of perceived resilience using standardised survey methods (Claire et al., 2017). If validated, subjective tools may offer a more bottom-up way of understanding and measuring resilience. Importantly, they also permit the much quicker collection of resilience-related information than conventional objective approaches do: most require only a handful of questions – hence their potential suitability for mobile phone-based data collection.

In this paper we describe how these methods have been trialled for collecting resilience-related information as part of the RRR in Myanmar. We showcase early findings from the baseline phase of the panel survey and discuss their implications when compared with traditional objective measures. We then reflect on the process of setting up a mobile panel survey and share preliminary insights into the rollout and analysis of the RRR project. Finally, we touch on the implications and opportunities for scaling these new methods up and using them in related fields.

2. CHARACTERISING RISK IN MYANMAR

IMAGE: EMIL HELOTIE/ FINNISH RED CROSS

Key messages:

- Myanmar is at high risk of disasters and humanitarian crises.
- Disaster risk in Myanmar is characterised by a complex interaction of exposure to natural hazards, socioeconomic conditions and conflict.
- Development challenges are acute in South-East Myanmar as the peace process unfolds.

2.1 The situation in Myanmar

Before delving into the activities of and findings from the RRR, it is important to understand the nature of disaster risk in Myanmar, as well as the context of Kayin state (where the RRR research is taking place). Myanmar is at a critical point in its political and economic transition from a closed economy under military rule to a market economy and plural democracy. Armed conflict (between ethnic groups, and between these groups and central government) has plagued Myanmar since independence, with grievances stemming from marginalisation, inequitable distribution of natural resources, underdevelopment and restricted socio-cultural and citizenship rights. In addition to a rapidly evolving political and economic environment, there are multiple societal 'fault lines' (along ethnic and religious lines), exacerbated by the fact that Myanmar has multiple areas that are vulnerable to natural hazards. The Myanmar context is therefore characterised by 'a combination of vulnerability to natural hazards, armed conflicts, inter-communal tensions, statelessness, trafficking and migration' (HCT, 2015: 7).

The Index for Risk Management (INFORM) ranks Myanmar as the 12th most at-risk country in the world for humanitarian crises and disasters (INFORM, 2017: 7), while the Climate Risk Index ranks it as the second most affected by extreme weather events between 1995 and 2014 (Kreft et al., 2015). Myanmar is particularly exposed to cyclones and storms, with associated flooding, landslides and coastal surges, with significant loss of life and economic costs, especially in the Delta region. The country also faces the risk of earthquakes and associated landslides, particularly in the north. The south-east is prone to regular and flash flooding, and major storms now occur, on average, every year (Prevention Web, 2014).

Cyclone Nargis, the worst recorded disaster in Myanmar's history, occurred in 2008, killing approximately 140,000 people and generating a total loss equivalent to 21% of the country's 2007 gross domestic product (TCG, 2008: 20). Despite improvements in disaster risk management since then, the government's response capacity and institutional reach across the country remains generally low (DRR Working Group, 2013: 12). In 2015, Myanmar experienced major floods across 12 of the country's 14 states/regions, which killed 172 people and temporarily displaced 1.7 million (HCT, 2015: 10). In contrast with the situation in 2008 after Cyclone Nargis, this time the government welcomed international assistance and there were concerted efforts to encourage a coordinated and integrated approach to emergency relief and longer-term recovery (ibid.). However, the 2015 floods affected many communities and households that were already in precarious circumstances, making recovery challenging.

Conflict exacerbates vulnerability to natural hazards because there are disproportionately higher levels of poverty in conflict-affected areas, especially among internally displaced persons (IDPs) and refugees. In turn, exposure to natural hazards has negative impacts on conflict dynamics, particularly if there is resulting displacement and cascading effects on physical health, livelihoods and overall well-being.

2.2 The south-east

Eastern and south-east Myanmar – comprising Tanintharyi division, Mon state, Kayin (Karenni) state, Kayah (Karen) state and southern Shan state – have experienced decades of conflict and associated poverty and under-development, resulting in protracted humanitarian crises, exacerbated by landmine contamination and restricted humanitarian access.

It is misleading to refer to the south-east as a homogeneous region; although it is predominantly rural and has large areas of remote and inaccessible terrain, it is ethnically diverse. Alongside displacement, the region suffers high levels of in – and out-migration, land-grabbing and tensions over land ownership, a lack of livelihood opportunities and poor infrastructure, all of which limit people's access to services (KHRG, 2015). Since 2011, the government has reached bilateral ceasefire agreements with the majority of the main ethnic armed groups (EAGs), and it signed a National Ceasefire Agreement in 2015 as a precursor to the peace process (HCT, 2015: 7). But, in many ceasefire areas, large numbers of people remain displaced, particularly in the south-east. Refugee and IDP camps on the Thai/Myanmar border have often been in place since the 1980s. There are some, albeit uncertain, prospects of return of refugee populations as a result of increasing stability (and pressure from Thailand) but this is dependent on the progress of the peace process (Burma Partnership, 2015; Joliffe, 2015; UNHCR, 2016).

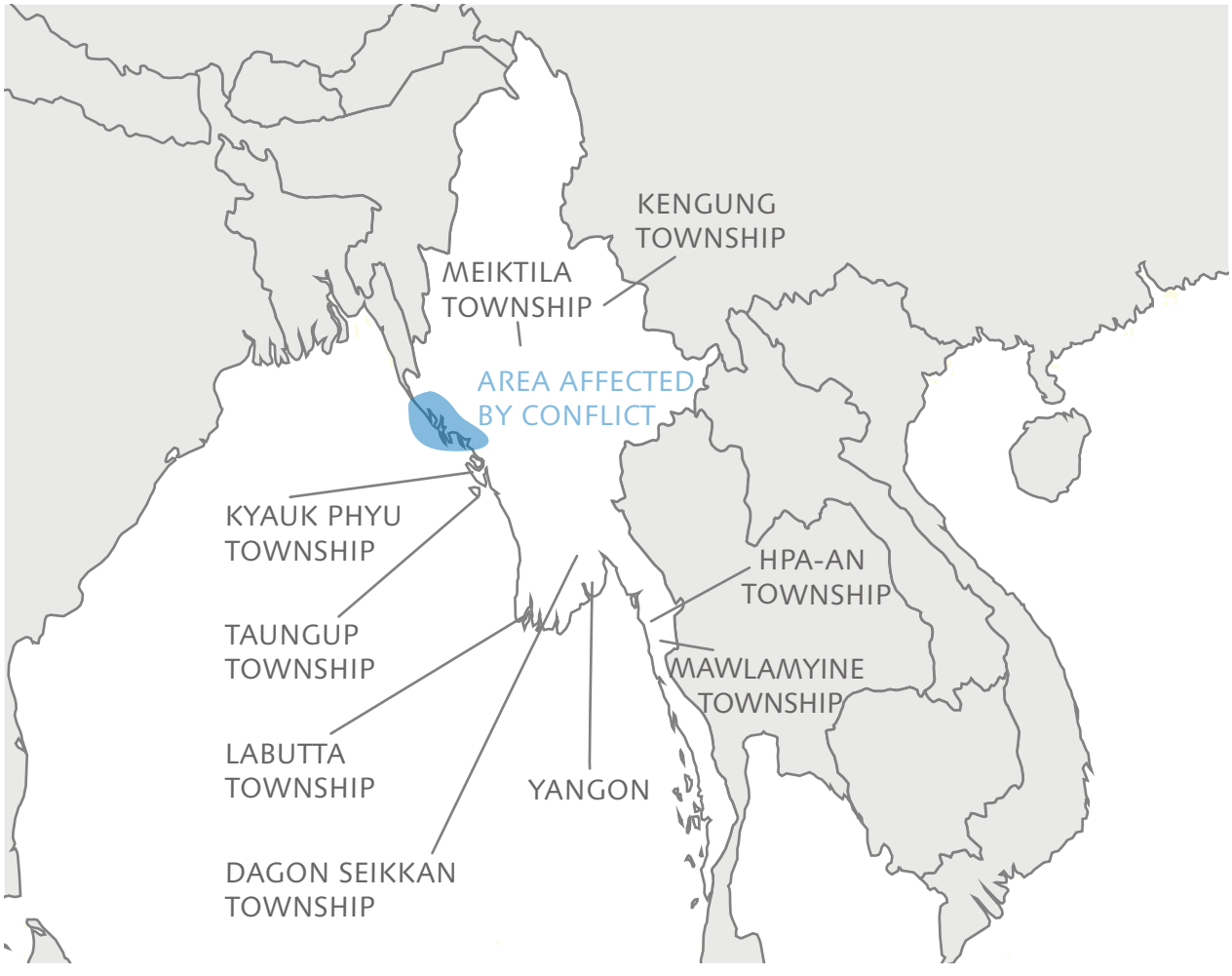
While there has been a significant reduction in active conflict in the south-east, the peace process is ongoing and complex. The fundamental drivers of conflict remain largely unchanged and the situation is volatile, particularly in Kayin and Kayah states (South, 2011; CPCS, 2014, 2016). Key questions remain around political legitimacy and representation, and whether/how the benefits of investment (particularly around natural resources) will reach ethnic communities (Joliffe, 2014). 'Convergence' – the alignment of government – and EAG-provided services – is a highly complex issue, with concerns about reduced access to basic services as government control increases (Christian Aid, 2014). Clashes between and within the various armed groups also occur sporadically in parts of the south-east, including in Kayin state (Kempel and Nyein, 2014).

The operating environment in Myanmar remains challenging and restrictive. The humanitarian system is constrained by poor coordination, competing mandates, overlapping yet variable agency coverage and inconsistent political will to adapt to evolving conditions. New and complex crises have resulted in a focus on responding to immediate humanitarian needs, while there has been insufficient focus on approaches designed to address protracted humanitarian needs effectively, reduce vulnerability and build resilience through humanitarian and development interventions in protracted crisis areas. In the south-east, the aid landscape is fractured, with no unifying strategy – largely because the region is not included in the 2017 UN Humanitarian Response Plan and there is instead a separate Durable Solutions Framework for the South East – and the lines between humanitarian assistance and development work are particularly blurred (UNCT, 2015).

2.3 BRACED activities in Myanmar

The BRACED Myanmar Alliance is a consortium led by Plan International who work with five partner agencies: ActionAid, World Vision, BBC Media Action, the Myanmar Environment Institute and the UN Human Settlements Programme (UN-Habitat). The project has been operating in Myanmar since 2015 and delivers a range of resilience-related activities in eight townships across the country (shown in Figure 1). The overall objective is to strengthen community preparedness and response, as well as the ability to adapt to climate extremes and disasters by empowering communities to take leadership in determining their local priorities for disaster risk reduction and climate change adaptation.

Figure 1: Location of BRACED sites across Myanmar



To achieve this, the Myanmar Alliance works at multiple levels to inform government, stakeholders and communities of the impacts of shocks and stresses, and provides advice and support on how to adapt through risk planning. Practical training on masonry, carpentry, financial literacy and women's empowerment is provided, as well as infrastructure support. The programme also links scientists with government officials and communities, and climate information dissemination is provided through public service announcements.

BRACED Myanmar Alliance activities include:[1]

- **Monsoon forums** enable dialogue between hydro-meteorological scientists, generating climate information, and end-users in hazard-sensitive sectors, highlighting weaknesses in forecasts.
- **Township disaster management plans:** Townships are supported in their environmental and disaster assessments and planning. Trainings are provided to government and support is given to implement key recommendations in local plans.
- **Village savings and loans associations (VSLAs)** are established and supported by World Vision and Vision Fund to create access to finance to fund businesses and other activities. VSLAs are targeting women for asset creation and protection.
- **Township environmental assessments** feed into other activities at the village and government levels to help guide planning through mapping vulnerable locations and providing data.
- **Climate information dissemination:** BBC Media Action has developed public service announcements for dissemination via TV and the radio to provide preparedness information in response to shocks and stresses.

Spanning three geographical locations – hilly, coastal and dry – the project targets 20,196 community members from 9 ethnic groups and includes a multi-level approach to build resilience to climate shocks and stresses (including cyclones, floods, storm surges, intense rains, extreme temperatures and droughts) (Hilton et al., 2016).

1 Activities are derived from BRACED Fund Manager (2017).

3. THE RAPID RESPONSE RESEARCH (RRR) APPROACH IN MYANMAR

IMAGE: EMIL HELOTIE/ FINNISH RED CROSS

Key messages:

- The RRR panel survey consists of two phases: a face-to-face baseline survey where households are each given a mobile phone and solar charger; and a follow-up mobile survey carried out once a month via a remote call centre set up in Yangon.
- The innovative nature of the RRR approach allows for the collection of information in near-real time and at a fraction of the cost of normal household panel surveys.
- The RRR also seeks to trial methods of measuring subjective resilience using self-evaluations of people's own resilience. The approach recognises the wealth

of knowledge people have of their own capabilities and capacities, and could complement traditional objective ways of measuring resilience.

The RRR seeks to track levels of resilience in disaster-affected areas using innovative methods for measuring resilience. Namely, it makes use of two advances: the use of mobile phones for remote data collection; and the trialling of subjective tools for assessing resilience. The former has been made possible by the rapid expansion of mobile phone and social media coverage in Myanmar. The latter takes advantage of recent advancements in using self-reported surveys for resilience measurement (Béné et al., 2016; Jones and Samman, 2016; Claire et al., 2017).

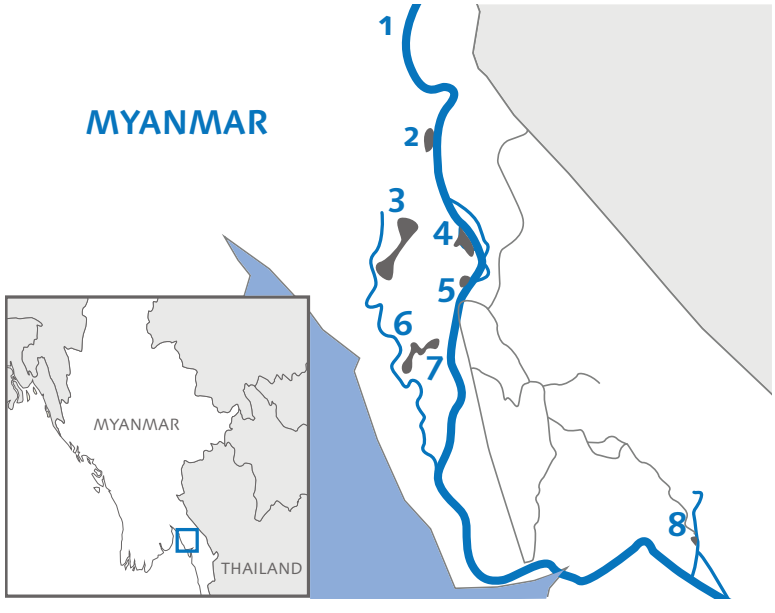
Myanmar was identified as an ideal candidate for the rollout of the RRR on the basis of high levels of vulnerability to disaster risk and a diverse set of livelihood groups; high penetration of mobile phone usage and network proliferation; and a close relationship between communities, BRACED partners and government stakeholders. Furthermore, the RRR chose to narrow the focus of the study down to a single site location, owing to logistical difficulties in surveying across regions, as well as the opportunity this generated to collect far more contextualised information. Of the eight sites in which the BRACED Myanmar Alliance has ongoing activities, Hpa-An was selected as the best suited, for a number of reasons.

First, the site is located on the banks of the Thanlyin River, which is prone to seasonal flooding as well as a number of other natural hazards. This provides an ideal opportunity to examine the effects of both seasonal disaster risk and infrequent covariate shocks. Second, unlike a number of other BRACED sites, Hpa-An is not as severely affected by political instability (when compared with regions such as Rakhine state). Lastly, the site in Hpa-An is made

up of eight individual villages, each with different livelihoods, socioeconomic characteristics and risk profiles (see Figure 2). Such diversity allows for the comparison and testing of differences in resilience capacities among groups.

Before delving into the results of the RRR we outline the various steps taken in setting it up. Below we document the processes used in running the RRR and outline the theoretical and technical justifications for the choices made.

Figure 2: List and location of village tracts within Hpa-An used in the RRR



	VILLAGES INCLUDED IN THE RRR
1	Ta Kaung Boe
2	Wet Gyi
3	Kaw Yin (Upper)
4	Mote Ka Di
5	Hlar Kar
6	Pann Kone
7	Ya Thae Pyan
8	Kha Yae Kannar

3.1 Phase I of the RRR

Preparation and questionnaire

The RRR is a panel survey comprising two main phases. The first involves a traditional face-to-face household survey, which aims to map the profiles and livelihood characteristics of respondents. A total of 1,203 households were chosen to taken part in the survey, spread across eight villages. This represents the total population of households receiving support from BRACED and means the RRR survey is, in theory, fully representative of these targeted areas (i.e. a census survey of the BRACED sites). Reasons for site selection related primarily to the fact that the chosen village tracts were prone to flood risk (a climate hazard that affects many areas of Myanmar) as well as to the opportunity for direct access to households, given the association with the BRACED programme. It is for this reason that non-BRACED village tracts were not selected; political access to communities could not be assured and there was a high risk of caller dropout. As such, the survey does not seek to provide impact evaluation for BRACED's activities in Hpa-An. Rather, it aims to understand the dynamics of resilience in the areas where BRACED is operating and uncover the various characteristics that support recovery from disasters in the site. Though the survey is limited to a handful of villages, it is hoped the results broadly reflect the conditions and characteristics of communities affected by disasters across Myanmar.

Questions in the baseline survey cover a range of socioeconomic characteristics, such as levels of education, livelihood types, asset ownership, subjective resilience and a number of other hazard-related items. Another important component was a list of 10 questions used to calculate the likelihood of household-level poverty, known as the Progress Out of Poverty (POP) score

(see Desiere et al., 2015). The POP methodology has been used across a number of developing countries. It uses statistical methods to match household survey data with census data to derive a likelihood of a household being below or above a poverty line. For a number of countries, including Myanmar, country-specific sets of POP questions are available to measure the poverty likelihood of households within the given context. The POP approach is particularly useful as it allows for robust assessment of the likelihood of poverty using simple and low-cost methods. Additionally, its 10 indicators are well suited to capture changes in a household's actual poverty status and are applicable all over Myanmar (Schreiner, 2012).

As the questionnaire is designed to be short and non-cognitively demanding, interviews generally lasted no longer than 30–40 minutes and were delivered in a range of local languages. Field interviews were carried out by a Yangon-based survey company (ThirdEye) with extensive experience in running large-scale household survey projects. A total of 14 trained enumerators and supervisors using Computer Assisted Personal Interviewing (CAPI) were deployed to conduct the baseline interviews. The use of CAPI[2] allowed for the collection of GPS coordinates and accurate time-stamps, as well as instant basic data checks and question routing. Prior to the launch of the survey, a preliminary version of the questionnaire was piloted by conducting interviews in 24 households. This exercise – which also served as training for the interviewers – helped improve question structure and survey protocol.

2 Interviews were conducted using the software package Survey Solutions, developed by the World Bank: https://solutions.worldbank.org/account/login?ReturnUrl=%2f

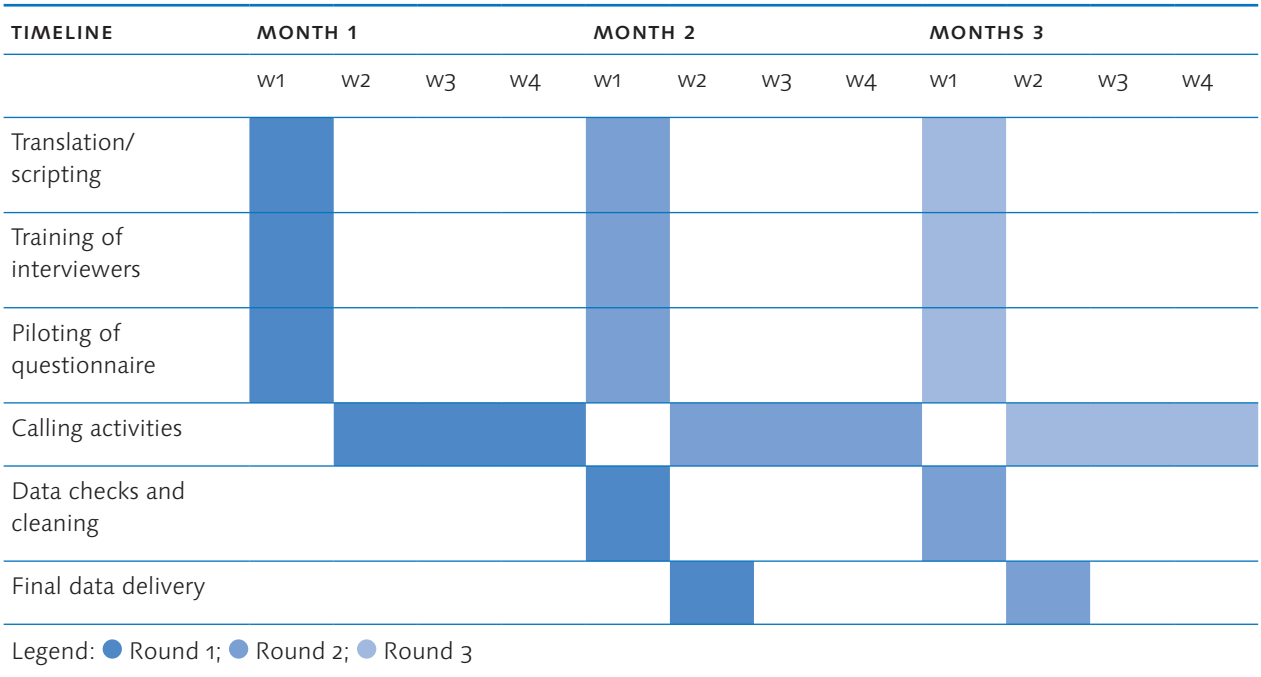
Sampling and survey protocol

Although the survey was conducted at the household level, one individual was selected per household to complete the survey. In each case, the head of the household was interviewed by means of random selection from among the main breadwinning partnership within the household. This helped ensure roughly equal male and female representation in the survey. Only respondents 18 years and older were considered. As part of the interview process, respondents were also asked if they were willing to participate in the follow-up mobile phone surveys (98% of respondents agreed to take part in this during the baseline survey).

After completion of the face-to-face survey, each household was given a mobile phone and a rechargeable battery pack free of charge. Households that did not have access to on-grid electricity were also provided with a solar charging battery pack. Respondents were informed that use of the phone was unrestricted and that they could use the phone as they pleased. Respondents who had agreed to be interviewed in the future were, however, asked to answer the phone for upcoming rounds of the RRR survey (though this was by no means mandatory and was impossible to enforce). In addition, the phone numbers of all current household members and immediate neighbours were collected for each household, in case the RRR phone was unreachable or the respondent preferred to be called on another number for convenience. After completion of the face-to-face surveys, the survey supervisors carried out a quality assurance procedure, ringing each household to confirm a short number of questions and matched them with the answers given to the field enumerators. Aside from quality assurance, these call-backs also functioned as a brief moment of phone contact with respondents, even before the first mobile phone survey round could commence. In previous mobile survey projects, prolonged

periods of panel inactivity consistently resulted in higher early drop-out rates (Dabalen et al., 2016).

Figure 3: Sequencing of RRR activities for phone survey data collection after the face-to-face baseline



3.2 Phase II of the RRR

Once all face-to-face surveys and quality assurance procedures were completed, the second phase was rolled out: a series of mobile phone interviews to track changes in people's lives in real time. A call centre was set up in Yangon by the surveying company that had conducted the baseline interviews. This was staffed by a team of eight enumerators who started calling households within one month of initial contact. To ensure enumerators had sufficient familiarity with the project and the survey topics, all were recruited from the pool of field interviewers.

Similar to the face-to-face surveys, each phone survey was piloted with a small subset of the panel (18 households in total). Survey questions were then refined to ensure the wording and question structure were suitable. Calling of respondents then took place for up to a period of three weeks to ensure as many respondents as possible could take part. Data were then verified by survey supervisors using systematic call-backs. Rounds were sequenced so as to ensure data could be continually collected on a monthly basis (see Figure 3).

Though the results and analysis discussed here are limited to the first round of the phone survey, the intention of the RRR is to continue to collect survey data via the mobile phones once a month for up to a year in total (and perhaps beyond). Each survey round will feature a series of identical questions to allow for temporal comparisons, as well as a set of questions around a specific theme, such as gender, early warning and risk perceptions.

As panel mortality is a major issue in all longitudinal survey projects, considerable efforts are put into minimising non-response rates. In case a respondent cannot be reached on the designated RRR mobile phone number, the phone enumerator tries the supplementary numbers of family members and neighbours that were collected during the baseline. If a respondent is unavailable to answer questions, a suitable time for the enumerators to redial is agreed.

To encourage people to stay in the panel, each respondent receives a small amount of airtime credit (equivalent to $0.50) on their phone once a phone interview has been completed. Studies from previous phone surveys have established that even small financial incentives are effective in encouraging people to remain responsive and do not bias results (Dabalen et al., 2016). In addition, the survey was designed to be quick and easy to answer over the phone, with most interviews lasting

10 minutes. These measures, along with the positive association with the BRACED programme, helped ensure the first round of the phone panel had a retention rate of 98.9% of households.

3.3 Assessing subjective resilience

One innovation of the RRR is the use of subjective tools to measure the resilience of households and individuals. Traditionally, resilience has been measured using objective tools: methods that rely on external judgement and observation. This typically means resilience is characterised by 'experts' or other external groups that define what resilience is and come up with a set framework to measure it. Measurement frameworks often rely on a large set of proxy indicators that require significant amounts of socioeconomic data to be collected for each household. Most importantly, objective approaches do not take into account the wealth of knowledge people have of their own resilience and the contextual information that can help inform it.

This is where subjective tools differ. They start from the premise that people understand the risks they face, and can use methods of self-evaluation to subjectively measure their resilience. Similar to measuring subjective well-being, resilience can also be assessed by asking individuals to rate whether they feel able to deal with a range of risks. While it may be possible to measure resilience in a single question, the RRR chooses to break it down into a series of resilience-related characteristics instead. Not only does this help avoid the definitional challenges associated with resilience (the word means many different things to many different people), but also it allows people to break resilience down in a variety of ways. For a full explanation of subjective methods of resilience measurement and their strengths/limitations, see Jones and Tanner (2017), Jones and Samman (2016), Béné et al. (2016) and Maxwell et al. (2015).

Nine resilience-related characteristics were chosen for the RRR survey (see Table 1 for the full list). Respondents were asked to rate their levels of agreement with the statements provided, ranging from strongly agree to strongly disagree. The choice of questions was guided largely by a review of resilience literature,[3] as well as a pilot exercise used in a related BRACED survey in Kenya in early 2017. While the questions inherently cannot cover all aspects of resilience, and other capacities that could feature as part of the list undoubtedly remain, they give a useful indication of the household's subjective resilience.

Respondents were asked to score their level of resilience for each capacity using a Likert scale that could be converted into a numerical score (Strongly disagree = 1, Strong agree = 5).[4] Each characteristic can therefore be compared individually, as well as allowing the generation of a collective score. This collective score acts a rough marker of overall subjective resilience – herein referred to as the 9-capacities (9Cs) model of overall resilience.[5] Importantly, the score also allows for resilience scores to be compared with other socioeconomic characteristics and across

3 Note that, in prescribing a set of resilience-related characteristics, the RRR's subjective module can be argued to be somewhat objective in nature. A fully subjective approach could ask people to self-identify their own characteristics of resilience and then measure themselves accordingly, though this would be less prone to cross-cultural comparison. The distinction highlights the fact that objectivity and subjectivity are not binary and are more akin to a continuum. Every measurement tool will have aspects that relate to both subjectivity and objectivity. See Jones and Tanner (2017) for a more thorough review.

4 While numerical conversion of Likert scale responses of this type is typical across the social sciences, it is important to recognise assumptions of cardinal comparability are disputed (Kristofferson, 2017).

5 As with any attempt to boil resilience down into a single number, caution should be used in any interpretation and application of a resilience metric.

Table 1: List of nine resilience-related capacity questions used in the 9Cs model of overall resilience[6]

RESILIENCE-RELATED CAPACITY	QUESTION	REFERENCES
Absorptive capacity	Your household can bounce back from any challenge that life throws at it	Béné et al. (2012) Bahadur et al. (2015)
Transformative capacity	During times of hardship, your household can change its primary income or source of livelihood if needed	Béné et al. (2012) Kates and Travis (2012)
Adaptive capacity	If threats to your household became more frequent and intense, you would still find a way to get by	Jones et al. (2010) Béné et al. (2012) Bahadur et al. (2015)
Financial capital	During times of hardship, your household can access the financial support you need	Mayunga (2007 Birkmann (2006)
Social capital	Your household can rely on the support of family and friends when you need help	Cox and Perry (2011) Aldridge (2012) Sherrieb et al. (2010)
Political capital	Your household can rely on support from politicians and government when you need help	Birckmann (2006) Magis (2010) Renschler et al. (2010)
Learning	Your household has learned important lessons from past hardships that will help you better prepare for future threats	Folke et al. (2002) Cutter et al. (2008) O'Brien et al. (2010)
Anticipatory capacity	Your household is fully prepared for any future natural disasters that may occur in your area	Paton (2003) Foster (2007) Bahadur et al. (2015
Early warning	Your household receives useful information warning you about future risks in advance	Thywissen (2006) Twigg (2009) Kafle (2012)

6 This definition of transformation used here is largely based around the ability of a household to modify livelihood activities when and if required – see Bene et al (2012) and Kates and Travis (2012) for more.

different social groups. To ensure computational ease and transparency, we convert each of the resilience-related capacity questions into a numerical value and average the scores across the nine capacities for each respondent. While this score is neither exhaustive nor holistic in measuring a respondent's subjective resilience, it does provide a useful starting guide. As a robustness check, we also devise a score using an alternative weighting procedure derived from Principal Component Analysis (PCA); as overall results appear to be almost identical between the simple averaging and PCA, we present results from the equal-weighted score in this paper.

To explore subjective resilience in further detail, we look at different variants of such resilience in order to reflect the various definitions and interpretations of resilience across the literature. First, we use a sub-set of the nine resilience-related characteristics to generate models of resilience that reflect widely used resilience frameworks. These included the 3As model of resilience (Bahadur et al., 2015), which comprises of anticipatory, absorptive and adaptive capacities, as well as the AAT model (Béné et al., 2012), made up of absorptive, adaptive and transformative capacities. We also explore a second variant of subjective resilience relating to a hazard-specific reference point. The capacity questions that comprise the overall subjective resilience scores above are explicit in not referring to a particular hazard or disaster type – that is, all questions are framed in relation to generic disaster risk. Accordingly, alongside the main questions, we also include a smaller module of resilience questions that refers specifically to flood, drought and cyclone events. These questions mimic those used in the overall resilience module, but instead ask respondents to imagine a hypothetic hazard event when self-reporting (Table 2). Questions are deliberately worded to match those used in the 9Cs overall

resilience module to allow for comparisons. Response items to the three questions ranged from 'Extremely likely' to 'Not at all likely' (with four items in total).

Table 2: List of three resilience-related capacity questions used in the 3As model of hazard-specific resilience

RESILIENCE-RELATED CAPACITY	QUESTION	REFERENCES
Anticipatory capacity	If a [flood/drought/cyclone] occurred in the near future, how likely is it that your household would be fully prepared in advance?	Paton (2003) Foster (2007) Bahadur et al. (2015)
Absorptive capacity	If a [flood/drought/cyclone] had recently ended, how likely is it that your household could fully recover within six months?	Béné et al. (2012) Bahadur et al. (2015)
Adaptive capacity	If [floods/droughts/cyclones] were to become more frequent and severe in the future, how likely is it that your household could deal with the new threats presented?	Jones et al. (2010) Béné et al. (2012) Bahadur et al. (2015)

4. INSIGHTS FROM THE FIRST TWO WAVES OF THE RRR PANEL SURVEY

IMAGE: FLICKR

Key messages

- Levels of poverty, education and livelihood vary considerably across the Hpa-An site.
- Overall subjective resilience is strongly associated with education, poverty, number of household occupants, head of household's gender and well-being. Considerable variation exists across villages.
- Defining overall resilience according to different combinations of resilience-related capacities makes little difference to self-evaluated scores. However, large differences exist between overall resilience (resilience to multiple or all apparent risks) and hazard-specific resilience (resilience to a single hazard).

- Of the 1,203 households in the baseline survey, 98.9% took part in the second phone round of the RRR survey. Of those, 14% had been affected by a shock or disaster in the previous month (predominantly floods).

Below we present early insights from the RRR survey. We first show descriptive statistics and comparison of means between different social groups. In order to control for confounding factors, we also report results from a series of multivariate regression analyses allowing for insights into the relationships between resilience and various socioeconomic factors. Finally, we showcase early results from the first round of the mobile phone survey.

4.1 Household characteristics of the sample

During the baseline round of the RRR survey, information was collected from 1,203 households. As Table 3 shows, household characteristics within the sample vary considerably. Unsurprisingly, agriculture forms the mainstay of household income and livelihoods across the eight BRACED villages, with causal labour also representing a significant share. Together, these two occupations are the main livelihood source for 60% of respondent livelihoods. Close to a quarter of all households in the panel are women-headed; of these, 62% are widowed. Levels of education are diverse: while almost half of household heads have received some form of high school education or above, a third of the sample have had no formal schooling at all. A mix of languages – and hence ethnicities – is also clear, with roughly half the panel speaking Burmese as their primary language (the national language of Myanmar), 39% speaking Kayin (the dialect of the region) and 9% speaking Hindi

(mainly Burmese Indians – those with roots in India). The area is affected by high levels of poverty: nearly a fifth of the population have a 90% likelihood of being below the national poverty line.[7]

Table 3: Breakdown of household characteristics and subjective resilience scores across the RRR panel

HOUSEHOLD CHARACTERISTIC	PERCENTAGE OF PANEL RESPONDENTS (%)*	MEAN SUBJECTIVE RESILIENCE SCORE
Gender of survey respondent		
Female	48	3.36
Male	52	3.41
Gender of household head (HH)**		
Female	23	3.38
Male	77	3.43
Number of household occupants		
1–3	31	3.36
4–7	53	3.45
7+	16	3.42
POP score (% likelihood of not being in poverty)		
0–25	44	3.39
26–50	28	3.44
51–75	24	3.42
76–100	4	3.43
Primary source of livelihood for household		
Agriculture	42	3.37
Casual labour	18	3.25
Daily wage	8	3.43
Foreign remittance	8	3.51
Regular daily wage	7	7.50
Selling foods and goods	6	3.53
Selling groceries/foods/goods	6	6.35
Livestock/hunting/fishing	5	3.50
Service and salaried jobs	4	3.64
Remittance (local)	<1	3.03
Other	6	3.50

7 Figures obtained using POP score conversation rates (see Schreiner, 2012).

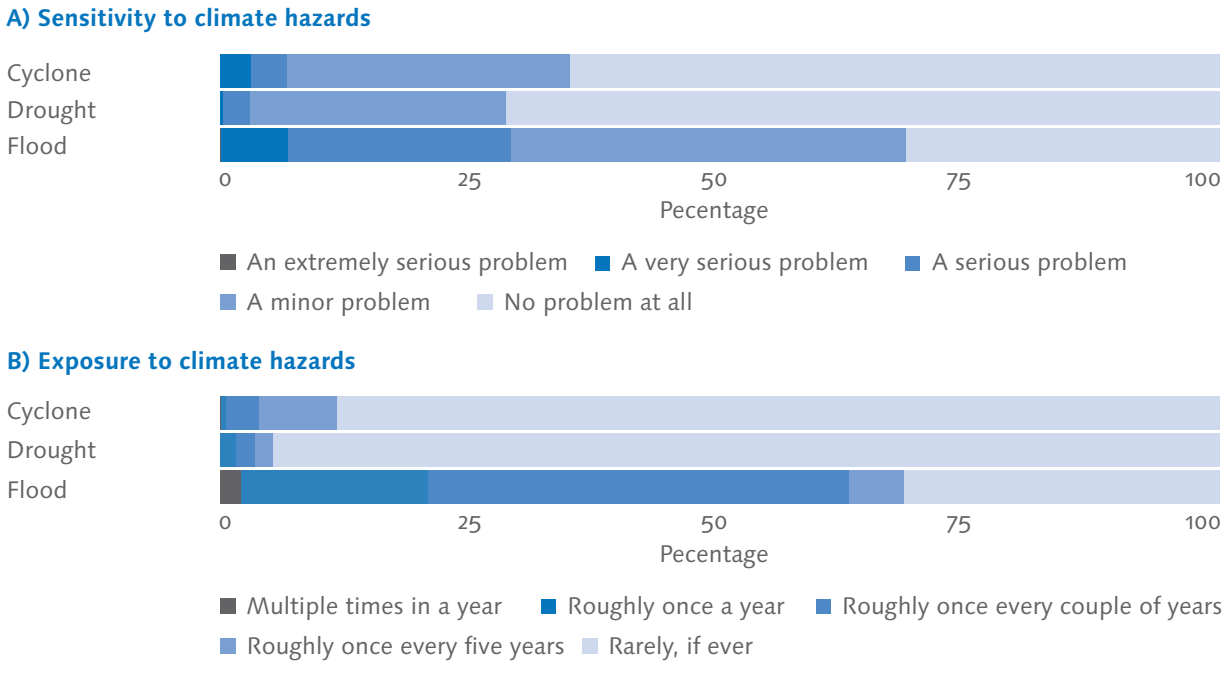
HOUSEHOLD CHARACTERISTIC	PERCENTAGE OF PANEL RESPONDENTS (%)*	MEAN SUBJECTIVE RESILIENCE SCORE
Main language spoken in household		
Burmese	51	3.38
Kayin	39	3.42
Hindi	9	3.46
Arabic	<1	3.50
Highest level of education for household head		
None	30	3.32
Some primary	6	3.41
Some middle school	16	3.48
Some high school or above	48	3.57

Notes: *Grouped percentages may not total to 100 owing to rounding
**This relates to the gender of the self-identified main breadwinner in the household. In the case of Hpa-An, breadwinners tend to be male. Female heads of household are often unmarried or widowed, or have a husband who has sought temporary employment elsewhere.

4.2 Relationship between socioeconomic factors and subjective resilience

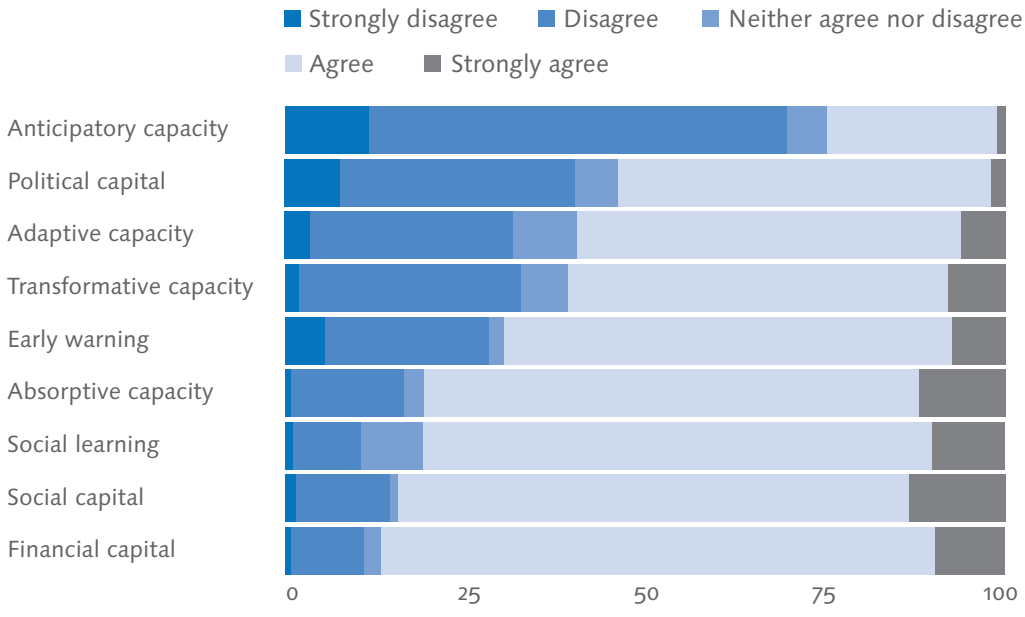
Looking at the impacts of climate-related hazards in Hpa-An, results from the baseline survey reveal that flooding presents by far the largest risk to households across the RRR survey sites (Figure 4). Close to 60% of respondents reported exposure to flooding events at least once every two years. This contrasts markedly with drought and cyclone events, which appear to be comparatively rare. Similar patterns are evident with regard to household sensitivity to climate hazards. A far higher proportion of respondents expressed an opinion that flooding was a minor or serious problem (68%) compared with droughts and cyclones (29% and 35%, respectively).

Figure 4: Exposure and sensitivity to natural hazards for RRR respondents



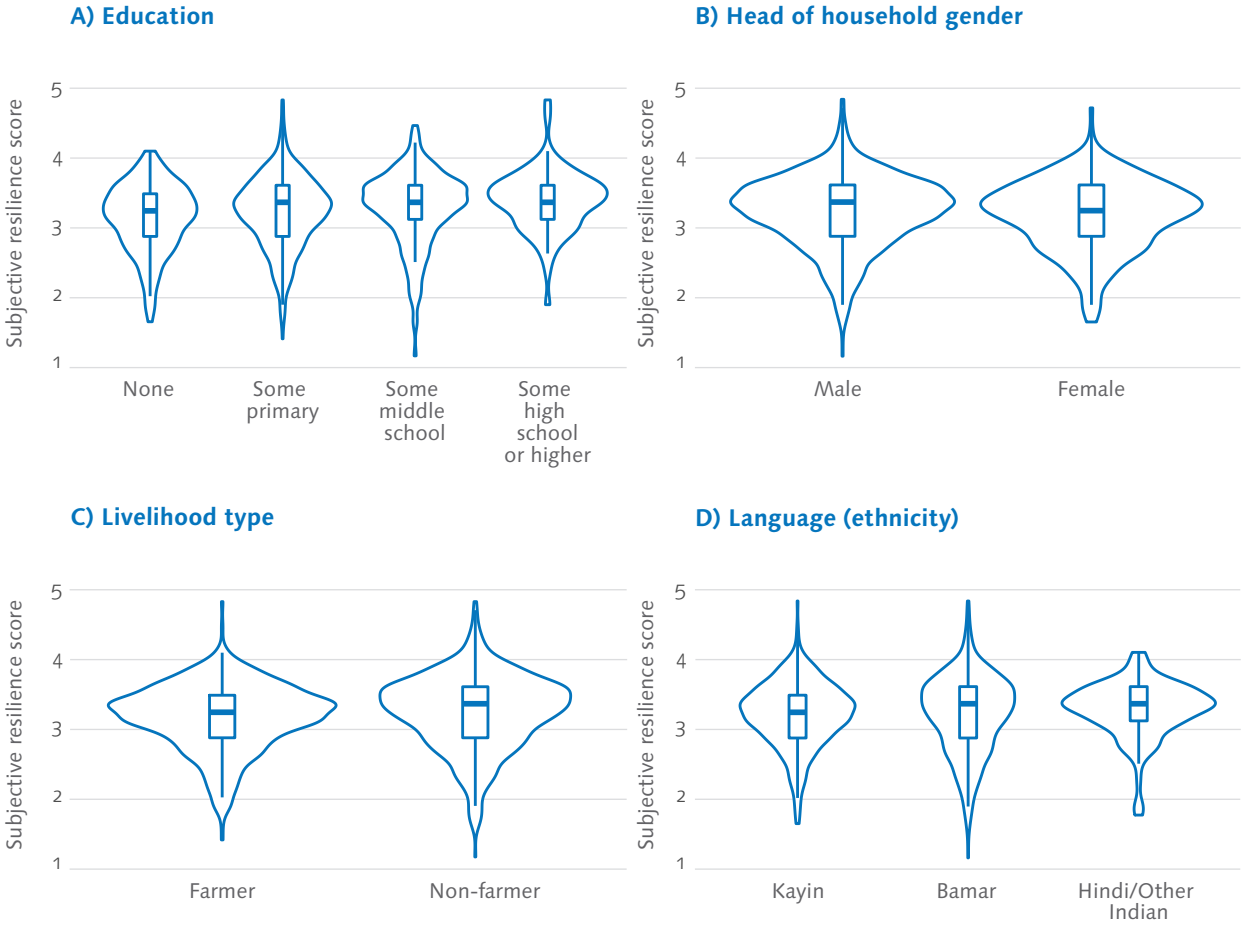
When it comes to a household's ability to deal with disaster risk, Figure 5 shows that self-reported scores across the nine resilience-related capacities vary considerably. Interestingly, the vast majority of respondents perceived themselves to be ill-prepared for future disasters; 70% disagreed with the statement of high anticipatory capacity. Other resilience-related capacities exhibit low comparative scores, including political capital, adaptive capacity and transformative capacity; on each, more than 30% of surveyed households disagreed with the associated capacity statement. Contrastingly, almost three quarters of all respondents expressed an ability to access financial support in times of need (financial capital). Similar high scores are apparent with regard to social capital, social learning and absorptive capacity.

Figure 5: Self-evaluated resilience-related capacities



Using the overall subjective resilience scores (derived as an average of each of the nine resilience-related capacities), we can examine the relationships between resilience and other important socioeconomic groupings. For example, Graph A in Figure 6 suggests a positive relationship between the highest levels of education of the household head and overall subjective resilience. The biggest jump appears to be between those with no formal education and those with some form of primary education. Whether or not the household's main source of livelihood is derived primarily from agriculture also seems to play a role, with farmers reporting somewhat lower scores compared with non-farmers (3.38 and 3.45, respectively). Male-headed households reported slightly higher levels of subjective resilience than did female-headed households (3.43 and 3.38, respectively). Moreover, there also appear to be differences in resilience scores depending on the primary language spoken in the household (and hence the inferred ethnicity).

Figure 6: Relationship between overall subjective resilience (using the 9Cs model) and socioeconomic characteristics



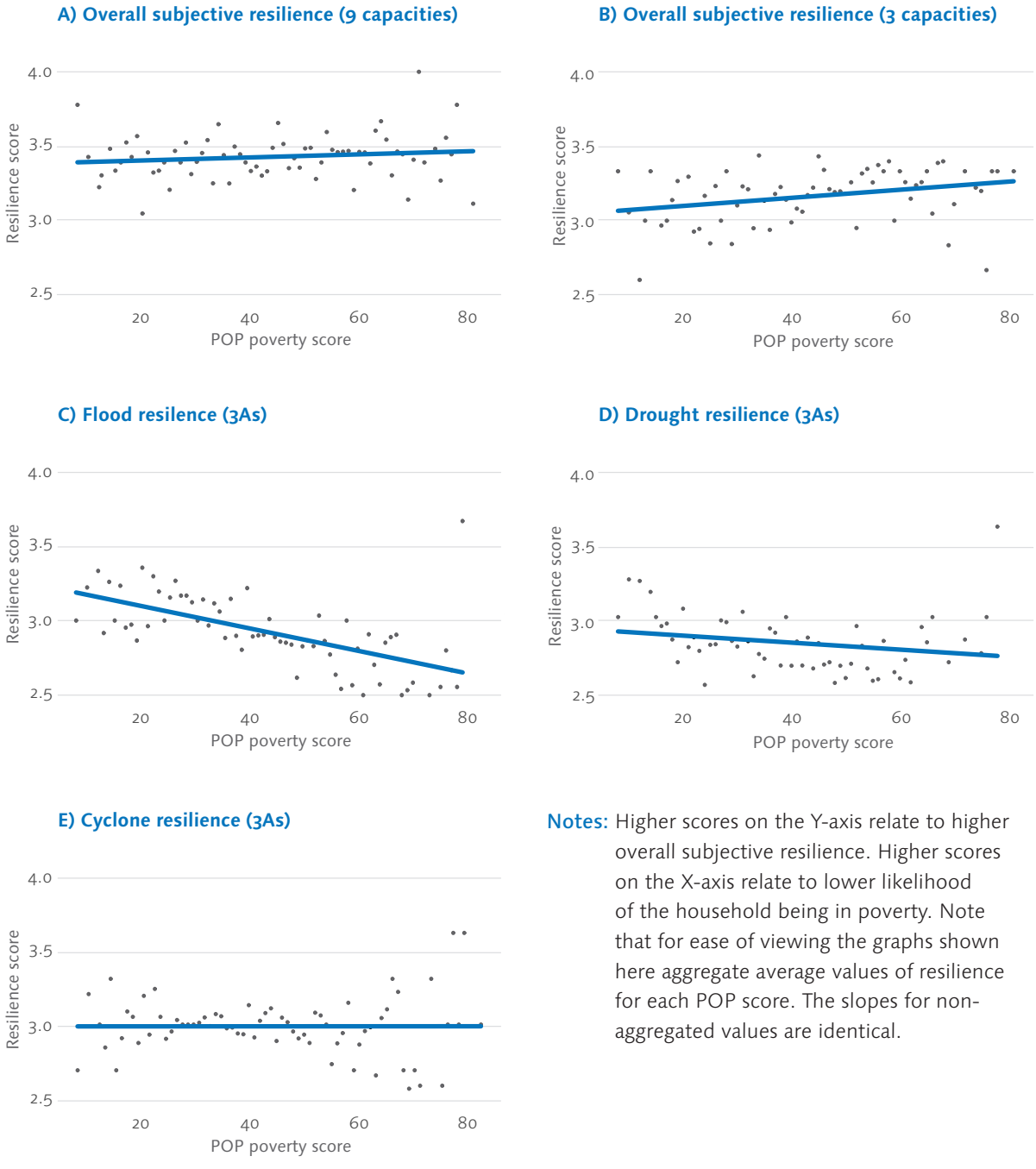
Note: The figure displays violin graphs showing the probability density of data along different values of subjective resilience for each group. Boxes within the plots showcase median values and the interquartile range. Higher scores equate to higher overall subjective resilience.

One of the factors assumed to be closely associated with resilience within the wider literature is level of household poverty. Graph A in Figure 7 shows the relationship between poverty and overall subjective resilience as expressed in the form of the 9Cs model of resilience. Levels of poverty in all cases are

evaluated using POP scores as described above (note that higher POP scores mean *lower* likelihood of the household being below the poverty line). Here, respondents are asked questions related to generalised risk, not specific to any one hazard. Unsurprisingly, the relationship between the two properties is positive: higher POP scores (and thereby a lower likelihood of poverty) are associated with higher subjective resilience. This relationship also holds if we choose to define resilience in ways that mimic commonly used resilience frameworks. For example, Graph 7B uses only absorptive, adaptive and anticipatory capacities to come up with an overall score – a combination of characteristics more commonly known as the 3As framework (Bahadur et al., 2015). As with Graph 7A, subjective resilience using the 3As version of resilience is positively associated with poverty scores.

It is interesting to note, however, that the effect of poverty on subjective resilience is not particularly strong. The difference in average scores between a household with a POP score of 0 (very high likelihood of poverty) and one with a score of 80 (very unlikely to be in poverty) equates to roughly a 0.5-point difference in overall resilience scores (remember that a jump from 'agree' to 'strongly agree' is a 1-point difference). Even more surprising are the associations between poverty and hazard-specific resilience. Graph 9C shows an apparent negative association between POP scores and self-assessed resilience to floods. In other words, households that are less likely to be below the poverty line self-report as less resilient to floods on average (we return to potential reasons for this in more detail in Section 5). There also appears to be a slight negative association for drought hazards (Graph 9D), with no clear trend for cyclones (Graph 9E).

Figure 7: Relationship between poverty and different forms of subjective resilience

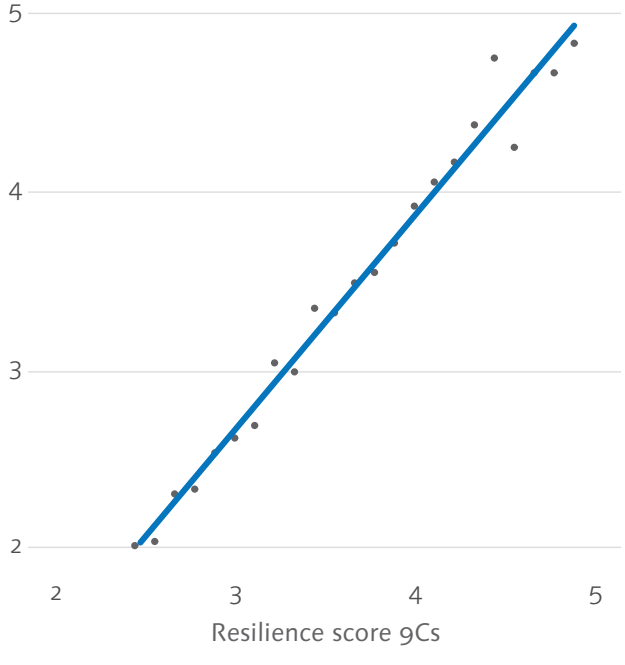


Notes: Higher scores on the Y-axis relate to higher overall subjective resilience. Higher scores on the X-axis relate to lower likelihood of the household being in poverty. Note that for ease of viewing the graphs shown here aggregate average values of resilience for each POP score. The slopes for non-aggregated values are identical.

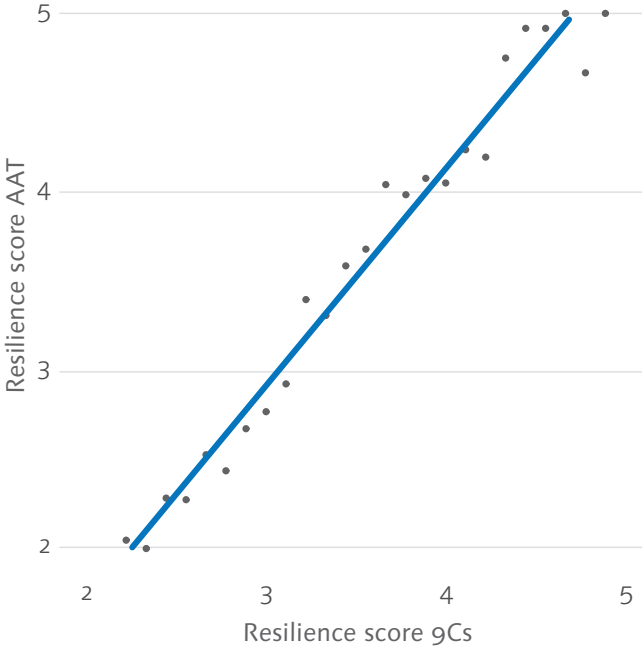
One important observation is that there are close linear relationships between the various models of overall subjective resilience. Figure 8 shows associations between the 9Cs model of overall resilience (all nine capacities) and the 3As and AAT subsets. The associations between the two are both positive and strong, with Spearman rank correlations of 0.77 for both the 3As and the AAT models. This has notable implications for analyses of subjective resilience (and resilience more broadly), as it may suggest there are few differences between frameworks that define resilience according to different subsets of characteristics – a point we return to in the multivariate analysis below.

Figure 8: Relationships between 9Cs, 3As and AAT models of overall subjective resilience

A) Relationship between 9Cs and 3As models of resilience



B) Relationship between 9Cs and AAT models of resilience



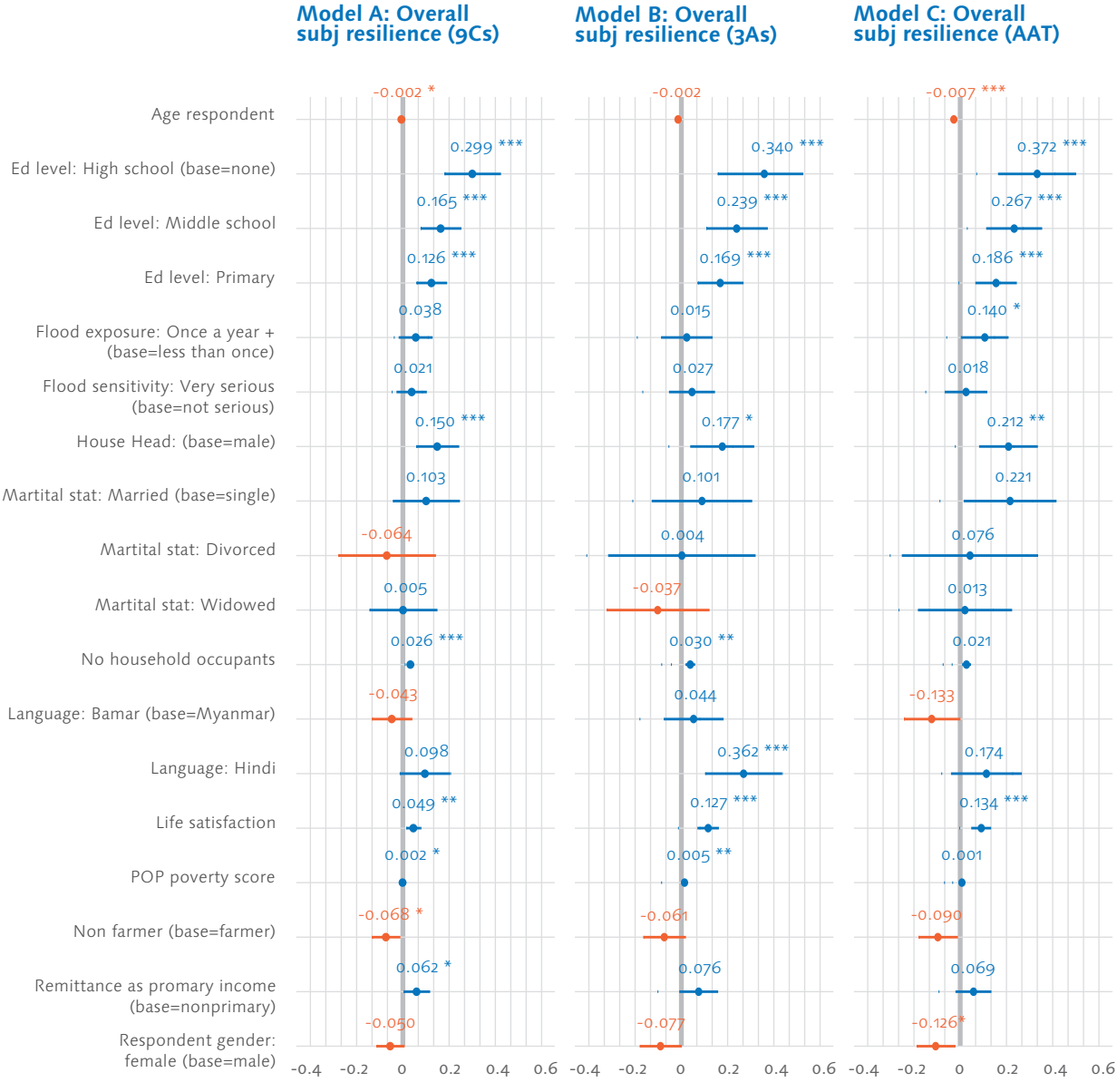
4.3 Multi-variate analysis

While simple comparison of mean scores is informative, it is important to recognise that other observable (and unobservable) factors may be driving the differences between subjective resilience scores and socioeconomic groups. To account for this issue, we run a series of multi-level regression models with ward-level random effects (equivalent to a village in size).[8] This approach helps control for a range of socioeconomic characteristics, as well as recognising the fact that a household's resilience may also be influenced by village-level (or community-level) dynamics. This method allows us to draw firmer conclusions about the relationship between subjective resilience and the individual factors that may be influencing it.[9]

8 A fixed-effects model with village-level fixed effects is also run, showing very similar results (and hence not presented here).

9 Note that these cross-sectional Ordinary Least Squares regressions cannot account for endogeneity, so they will only point to associations between resilience and socioeconomic factors. In later analysis, we will aim to use the panel design of the survey to examine causal relationships.

Figure 9: Marginal effects plot of the associations between overall subjective resilience and socioeconomic characteristics



Notes: All models include ward-level random-effects; numbers and dots represent beta coefficients with bars as 95% confidence intervals; *p<0.05 **p<0.01 ***p<0.001.

Figure 9 illustrates the marginal effects for a range of variables for three different models of resilience: resilience as a full set of nine capacities; resilience as BRACED's 3As; and resilience as AAT. Numbers represent beta coefficients from the multi-level regression model (the expected average change in subjective resilience scores for an increase in one unit). Outputs from Model A (the first column) reflect similar conclusions drawn from the descriptive statistics when considering the 9Cs model of overall subjective resilience. The head of household's education has a strong positive association with overall subjective resilience: the higher the level of education, the higher the likelihood that the household self-reports as resilient. POP scores also have a significant positive relationship – though note that the effect sizes are relatively small compared with education (though this owes partly to the fact that one is an ordinal variable while the other is a unit interval).

Contrary to the simple comparison of grouped means, female-headed households are associated with higher levels of overall resilience than male-headed households when looking at the regression outputs. This is somewhat surprising, given that much of the resilience literature considers female-headed households one of the most vulnerable groups; Section 5 discusses possible reasons for this. Similarly, unlike with the descriptive statistics, households that are not reliant on agriculture for their livelihood score lower in terms of resilience when controlling for other confounding factors. Other interesting statistical associations are also apparent. For example, marital status does not appear to have a large effect on resilience scores – this includes households headed by individuals who are divorced or widowed. Nor does exposure to flood events (the most common natural hazards in the survey area) appear to make much difference to subjective scores.

Importantly, there are clear differences in overall resilience scores across the eight villages in the BRACED site.[10] This may not be such a surprise given that each is likely to have differing levels of exposure to disaster risk. Cultural or other socioeconomic factors may therefore explain some of these community-level differences. They may also reflect the fact that a household's resilience is in part made up of community-level factors. This is in large part why we include village-level random effects in the multi-level regression model, and is an aspect that will be tested in future rounds of the RRR survey. Another strong factor in determining overall resilience is number of household members. Households with more people report themselves as more resilient. Subjective well-being (as measured by life satisfaction scores) also appears to have a strong positive association. Here, however, it is difficult to know the direction of causality: are households that are resilient more likely to be satisfied with their lives or is a household's life satisfaction likely to have an impact on its resilience? Collection over time of further information and the use of panel data methods will help answer this important question.

Lastly, we also compare findings using different models of resilience to see whether the choice of resilience-related characteristics plays a large role in determining associations with overall resilience. Columns B and C in Figure 9 look at the relationship between overall resilience and socioeconomic characteristics when defined as the 3As (adaptive, absorptive and anticipatory capacities) or as the AAT model of resilience (absorptive, adaptive, transformation capacities). All three models of resilience share similarities, with strong associations with education and well-being. There are also strong differences across villages in each (though these do not all match exactly across the models). It is curious to note that

10 Not shown in the regression table output given that they are held as random-effects.

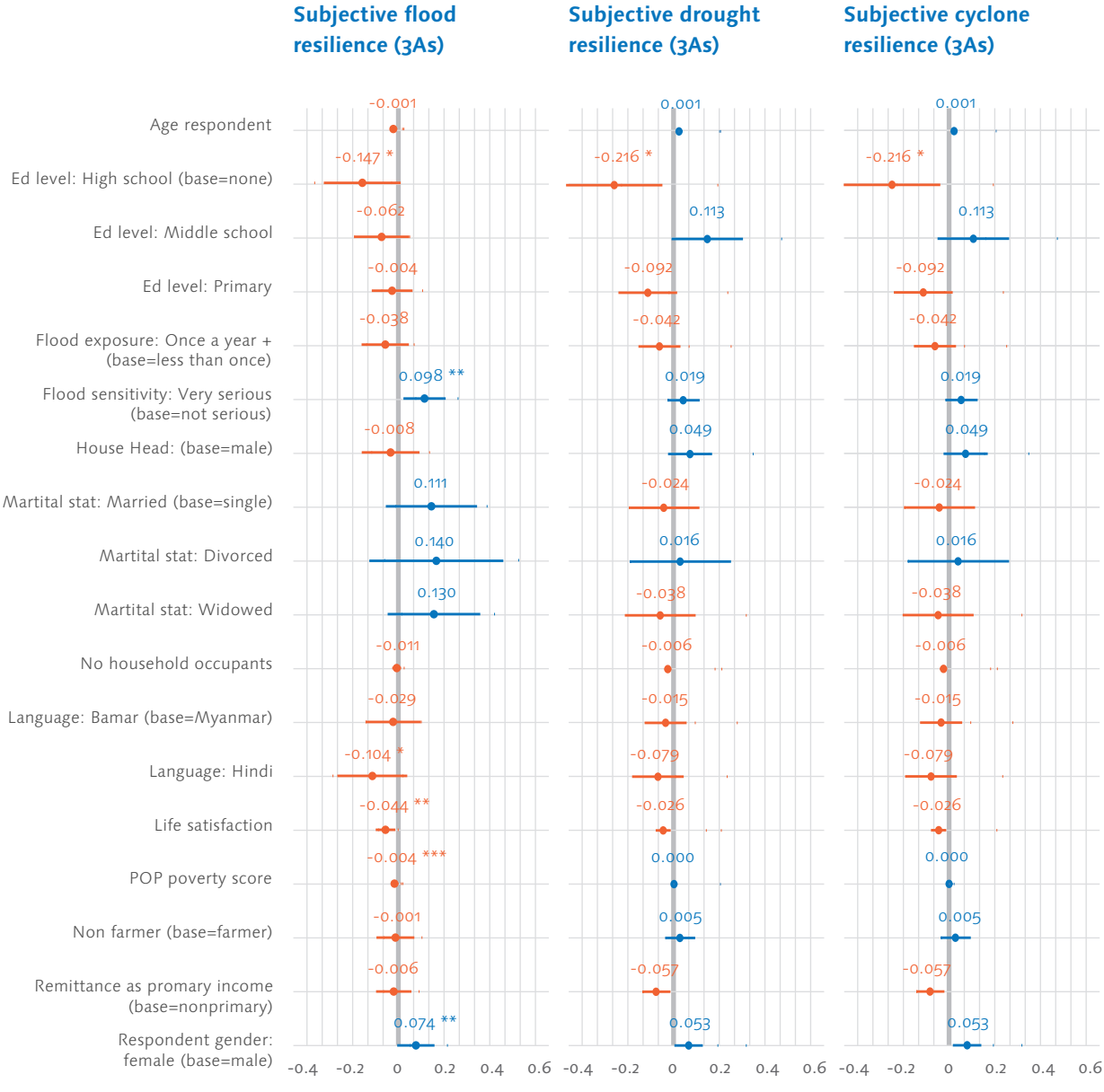
POP scores do not have a statistically significant relationship with resilience as conceptualised by the AAT framework – though the relationship is strong for the 3As and full frameworks. Reasons for this are unclear and may reflect different contributory factors that support the varying conceptualisations of resilience. Validating this further will require the use of upcoming panel data as well as follow-up qualitative analysis. Similarly, livelihood type does not have a strong role to play in the AAT and 3As frameworks when compared with the full version.

4.4 Comparing overall resilience with hazard-specific resilience

In order to understand the links between overall resilience and hazard-specific resilience we also run regressions for resilience scores for each of the three hazards that affect that site: floods, droughts and cyclones.[11] Results in Figure 10 show that the relationship between socioeconomic characteristics and resilience differs considerably when comparing overall with hazard-specific resilience (see Appendix B for a regression table). For one, education does not appear to have a statistically significant relationship across the three hazards (except for lower scores for those with high school education with regard to flood and drought hazards). If anything, the association between the two variables appears to be mixed (as opposed to the strong positive associations with overall resilience). POP scores are significant only for flood and cyclone resilience, again showing a negative association (i.e. those least likely to be below the poverty line self-report as more resilient). On the face of things, this relationship appears somewhat counter-intuitive – though there may be a number of factors at play (more in Section 5).

11 Note that all three hazard-specific resilience scores are characterised using the 3As framing and should therefore be compared with this formulation rather than the full set of nine resilience-related characteristics.

Figure 10: Marginal effects plot of associations between hazard-specific subjective resilience (using 3As model) and socioeconomic characteristics



Notes: All models include ward-level random-effects; numbers and dots represent beta coefficients with bars as 95% confidence intervals; *p<0.05 **p<0.01 ***p<0.001.

Associations between household occupants, Indian language and subjective well-being are also mixed across the three hazards (though not all). As with all forms of resilience (overall and hazard-specific), there is large variation in scores across each of the villages. Most importantly, results from Figure 10 (and Appendix B) underline the importance of specifying whether resilience is taken as an overarching concept (resilience to all combinations of generic risk) or hazard-specific (resilience to specific events).

4.5 Results of the second round of the RRR panel

Though the panel has, as of the time of writing, completed only a single round of the follow-up phone survey, it is possible to draw early insights. Of the 1,203 households that took part in the baseline face-to-face survey, a total of 1,179 completed a full survey under the subsequent phone round. This equates to a 98% retention rate, a number that is relatively high when compared with other global phone panels (Dabalen et al., 2016). Of particularly relevance is the fact that 14% of respondents experienced a shock or significant event (climate-related or otherwise) that had had a large negative impact on their household's way of life in the previous month (i.e. since the baseline survey). The vast majority of these negative impacts have resulted from flooding events, likely owing to the onset of the monsoon season in Myanmar (see Table 4). Flooding has been particularly pronounced in the village of Pann Kone, situated on the banks of the Donthami River – a smaller tributary that feeds into the Thanlyin River (beside which most other villages in the RRR survey are located). Other natural hazards include landsides, strong winds and unseasonal rainfall.

Unsurprisingly, respondents reported a number of other related shocks, such as crop disease and sudden loss of livestock. It is interesting to note that several personal and livelihood shocks also featured, with medical emergencies and loss of job or livelihood constituting close to two fifths of all reported household shocks. When asked how long the household might expect to need to recover fully from shocks, respondents estimated that shocks associated with natural hazards would require between one and six months on average. This compares markedly with personal and livelihood shocks, which were typically expected to need over six months (and in many cases more than 12 months). Data collected under subsequent rounds of the survey will allow for testing of these expectations, to assess how long it takes households to recover from different shock events in practice. Given difficulties in making direct comparisons between face-to-face surveys and phone-enabled surveys, we do not present a comparison of resilience scores between the two rounds. Further collection of resilience-related data using the mobile panel structure will allow for comparison of like-for-like scores.

Table 4: Descriptive statistics in the second round of the RRR panel

	PROPORTION (TOTAL) OF RRR SAMPLE
HH affected by a serious shock in past month	14 (166)
Type of shock (of those affected)	
Flood	52 (87)
Medical emergency	16 (27)
Loss of job or livelihood	7 (12)
Landslide	6 (9)
Irregular/unseasonal rainfall	5 (6)
Sudden loss of livestock	4 (7)
Strong wind/tornado	2 (4)
Crop disease	2 (3)
Social unrest	1 (2)
Fall in price of essential goods	1 (2)
Rise in price of essential goods	1 (2)
Death of income generator	1 (2)
Location of shock events	
Pann Kone	40 (67)
Ta Kaung Boe	14 (23)
Ya Thae Pyan	12 (20)
Kaw Yin (Upper)	9 (15)
Mote Ka Di	9 (15)
Wet Gyi	8 (14)
Hlar Kar	4 (6)
Kha Yae Kannar	4 (6)

5. DISCUSSION AND EARLY INSIGHTS

IMAGE:
TOM CHEATHAM

Key messages:

- Retention of households in the RRR panel is notably high to date. Likely factors behind this success include provision of mobile phones, effective training of call centre enumerators, the short time between baseline and follow-up surveys and the association with the BRACED programme.
- Choosing how to frame resilience is key to resilience measurement. Subtle differences, such as specifying whether resilience relates to one or multiple hazards, can have considerable consequences for self-evaluated scores.

- Subjective resilience appears to challenge a number of assumptions from resilience theory and traditional objective ways of measuring resilience (such as associations between resilience, poverty and gender). More needs to be done to explain these trends and establish causal drivers.
- The RRR aims to address these knowledge gaps and will continue to collect resilience-related information in Hpa-An for up to a year (and potentially longer).

A wealth of information has been collected during the first two rounds of the RRR. While making full sense of this will require time, as well as subsequent rounds of the survey, there are a number of important aspects to consider carefully.

5.1 A recipe for running a panel survey

In reflecting on the early stages of the RRR panel survey, this model appears to offer several advantages. For a start, the use of mobile phones to collect subsequent rounds of the panel has helped reduce operational costs considerably. To illustrate this, the full cost of running the first round of the phone survey was three times cheaper than that of the baseline face-to-face survey. Not only that, but results were shared with the survey team almost immediately, meaning research could be conducted in near-real time. The less-invasive manner of data collection should also help reduce 'survey fatigue', as well as allow respondents who have temporarily migrated out of the site to remain in the panel.

Results from the RRR survey also show that a very high proportion of respondents took part in both the baseline and the phone rounds. Although the survey has been running for only one month, reflecting on the causes of this is important,

not only because retention is crucial to any panel survey but also because lessons may be of relevance to others seeking to roll out similar survey methods. The importance of well-trained, diligent and patient call centre enumerators cannot be overstated. While the average number of phone calls required to complete a full survey was 2.5, in some cases up to 20 call-backs were needed to successfully reach the designated individual. Choosing to conduct the first round of the phone survey so quickly after completion of the baseline was undoubtedly helpful – as other phone panels have noted (Dabalen et al., 2016). Quality of phone reception was also key: fewer than 10% of all calls were cut off at some point owing to network issues. In addition, interviews were designed to be short and cognitively easy to complete, lasting only 10 minutes on average. Inevitably, this also means that content in each of the phone rounds is limited – which means the amount of data that can be collected and analysed is limited.

Easing the process for respondents to take part in the survey is also important. It is for this reason that phones and solar chargers were provided to each household. Indeed, 43% of the phone surveys took place using the phones distributed by the survey enumerators (remember that other mobile numbers in the house were also collected and used if the household deemed them more convenient). A large likely justification for the survey's retention of respondents is also the fact that the area is a BRACED site. Though the enumerators were trained not to give mention to BRACED during household interviews, and to be clear that responses to questions would not feed directly into BRACED programming in Hpa-An, it is difficult to imagine that respondents did not connect the dots. This association is inherently a double-edged sword: on the one hand, people are incentivised to remain in the survey, as they may appreciate the work BRACED carries out; one the other

hand, biases may be induced in cases where respondents may perceive that certain answers are desired (known as social desirability bias). They may also seek to provide answers based on personal or community-level incentives. Those looking to run a panel survey of this kind need to weigh up the implications of being associated with ongoing development activities and to limit the impact of cognitive biases where possible.

5.2 Framing of resilience is key

Early results from the RRR feed into several debates within the resilience literature. For example, the field of resilience is plagued by a wide range of definitions and characterisations, many of which differ considerably. While these differences are no doubt important when it comes to deciding how to design resilience-building activities (and what aspects or capacities to support), findings from the RRR suggest the association of socioeconomic factors with *overall* resilience is largely the same. This is the case even if resilience is broken down into very different formulations. If this finding holds true across future rounds of the RRR, then it will provide some reassurance to the wider resilience measurement community. Not only does it imply that different characterisations of resilience may be capturing the same underlying processes, but also it may point to the unnecessary nature of the proliferation of resilience measurement tools in recent years.

Conversely, the survey points to the importance of how resilience is framed, most notably whether it is framed in relation to dealing with a multitude of risks overall or risk from an individual hazard. In the case of the RRR, considerable differences between overall and hazard-specific resilience are apparent. Indeed, correlation coefficients between overall subjective resilience and flood, drought

and cyclone resilience are -0.15, -0.04 and -0.09, respectively (suggesting weak associations). Indeed, the relationship appears to be slightly negative, implying that, as someone's overall resilience increases, their resilience to specific hazards is reduced. This contrasts with the close similarities between resilience as characterised by the 9Cs and 3As and AAT models (both with positive coefficients of 0.77). Making sense of these relationships is not easy, and answers will require probing further into the causal nature of factors underlying resilience. Irrespective of this uncertainty, these results point to the need for practitioners and evaluators to take care in specifying points of reference (e.g. what kind of resilience? Resilience to what?) when describing resilience (something that is all too often ill-considered and poorly specified).

One other interest point of note is the high degree of 'Agree' responses across the various resilience capacities. While this may reflect a true artefact of people's subjective understanding of their own resilience, other psychological surveys have witnessed high levels of acquiescence bias – that is, the general tendency of a person to provide affirmative answers to items of a questionnaire regardless of the content of the items (Hinz et al., 2007). To probe the extent to which this may be affecting resilience scores, future iterations of the survey will feature randomised models with reverse-coded answers to allow for estimation of the effect sizes.

5.3 Challenging the status-quo of objective resilience-measurement

One interesting question that the RRR raises is the role of gender in contributing to household resilience. Female-headed households appear to have significantly higher levels of overall subjective resilience compared with male-headed households when controlling for confounding factors. This contrasts with much of the resilience literature, which suggests female-headed households are one of the most vulnerable groups, owing to a range of socioeconomic and cultural factors (Nelson, 2011; Opiyo et al., 2014). It is important to point out that differences are not significant for the hazard-specific models. Irrespective of this, it is equally surprising that results do not include a significant negative association as one might expect – coefficients are positive across all six models.

This may inevitably be a statistical artefact that will be further revealed as more rounds of the survey are conducted. It may also reflect cognitive differences in how women rate overall household resilience compared with men. A similar artefact is reflected in the literature on subjective well-being, where women report higher levels than men owing to a mixture of empirical and methodological factors (Graham and Chattopadhyay, 2013). Intriguingly however, the effect for respondent gender is negative for female respondents – though only significant at the 5% level for the AAT model (see Figure 9 and Appendix A). These findings do present a challenge to traditional resilience thinking that needs careful consideration. Perhaps female-headed households in the BRACED site have higher levels of social capital or social safety nets compared with male-headed households? Perhaps female-headed households are able to respond more quickly and effectively to shock events? It may also reflect the

fact that, in some cases, widowed households may be subsumed within the families of close relatives and are therefore not classed as female-headed (with only those who are comparatively wealthy or who have high levels of social capital remaining as a female-headed unit). Further insights from the survey, as well as qualitative research, will be needed to better understand the drivers of these trends before relevant policy implications can be drawn.

Another intriguing finding from the RRR is the negative relationship between POP scores and hazard-specific resilience (see Figure 10 and Appendix B). In essence, this means that households that are unlikely to be poor self-report themselves as being less resilient compared with those likely to be in poverty. A somewhat similar negative relationship exists with levels of education (though this not statistically significant). Again, there could be cognitive biases at play here, such as priming. It may also be that wealthier (and better-educated) respondents are better able to 'game the system' and portray themselves as vulnerable to natural hazards – recognising the survey's link with the BRACED programme. However, if this were the case, we would also expect this trend to apply when rating levels of overall resilience (i.e. resilience to risk overall rather than a specific hazard). This is not the case at all: overall resilience has a clear positive relationship between POP scores and education levels (see Figure 9 and Appendix A).

Cognitive biases aside, this may reflect the fact that wealthier households are likely to have more assets – they are therefore more exposed to the impacts of natural hazards. Because resilience is often defined as bouncing back to the same level, this could also mean wealthier households take longer to return back to their original level. Crucially, this would be the case even if wealthier households were able to remain above the poverty line and maintain a decent level of livelihood. Indeed,

they may be better off compared with poor households (that do not face the same difficulties in returning to the same level of poverty) but still be considered as having lower levels of resilience in the eyes of an evaluator. Whether this relative effect should be recognised within resilience measurement is debatable and sensitive. However, it does showcase the need for evaluators to carefully consider the question: resilience to what?

6. CONCLUSIONS

IMAGE: FLICKR

Early insights from the RRR showcase the utility of trialling new methods of resilience measurement. In particular, though the project is in an early phase, the use of mobile phones for panel data collection so far shows considerable promise in the context of Myanmar, with high retention rates and far lower operational costs compared with traditional face-to-face surveys. In addition, the use of subjective methods of evaluation provides invaluable insights into how people perceive the risks they face both now and in the future. While it is too early to comment on the robustness of this new approach, it does challenge a number of critical assumptions within the resilience literature that need to be carefully thought through and explained. As subsequent rounds of the RRR survey are carried out, BRACED researchers will be able to isolate some of the drivers behind subjective resilience and see how they compare with objective measures

of household resilience. More importantly, the methods the RRR uses offer considerable promise in supporting resilience programmes like BRACED and others in understanding the localised nature of disaster risk and better targeting their limited resources. Making use of this information will require researcher and development practitioners to experiment with different ways of collecting, presenting and using this information to guide their day-to-day activities. The hope is that the methods used in the RRR can be adapted and tailored to a wide variety of contexts – in developed and developing countries alike – to plug some of the large data gaps that exist in regard to resilience.

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Appendix A: Association between overall subjective resilience and socio-economic characteristics

SOCIOECONOMIC CHARACTERISTIC	OVERALL RESILIENCE (9CS)	OVERALL RESILIENCE (3AS)	OVERALL RESILIENCE (AAT)
HHH highest education (base=none)			
Some primary	0.126*** (0.032)	0.169*** (0.049)	0.186*** (0.055)
Some middle school	0.165*** (0.043)	0.239*** (0.066)	0.267*** (0.074)
Some high school or higher	0.299*** (0.060)	0.340*** (0.093)	0.372*** (0.103)
Age of HHH	-0.002* (0.001)	-0.002 (0.002)	-0.007*** (0.002)
POP score	0.002* (0.001)	0.005** (0.002)	0.001 (0.002)
Marital status of HHH (base=single)			
Married	0.103 (0.071)	0.101 (0.110)	0.221 (0.122)
Separated/divorced	-0.064 (0.105)	0.004 (0.161)	0.076 (0.179)
Widowed	0.005 (0.073)	-0.037 (0.112)	0.013 (0.124)
Primary HH language (base=Myanmar)			
Bamar	-0.043 (0.043)	0.044 (0.066)	-0.133 (0.073)
Hindi/other Indian	0.098 (0.055)	0.362*** (0.084)	0.174 (0.093)
Number of HH occupants	0.026*** (0.007)	0.030** (0.011)	0.021 (0.012)
Primary livelihood non-farming (base=farming)	-0.068* (0.030)	-0.061 (0.046)	-0.090 (0.051)
Primary livelihood remittance (base=non-primary livelihood)	0.062* (0.028)	0.076 (0.043)	0.069 (0.047)
HHH gender (base=male)			
Female	0.150*** (0.046)	0.177* (0.070)	0.212** (0.077)
Respondent gender (base=male)			

SOCIOECONOMIC CHARACTERISTIC	OVERALL RESILIENCE (9CS)	OVERALL RESILIENCE (3AS)	OVERALL RESILIENCE (AAT)
Female	-0.050 (0.029)	-0.077 (0.045)	-0.126* (0.050)
High flood sensitivity (base=low sensitivity)	0.021 (0.033)	0.027 (0.050)	0.018 (0.056)
High flood exposure (base=low exposure)	0.038 (0.037)	0.015 (0.056)	0.140* (0.063)
Subjective well-being (high score=high SWB)	0.049** (0.015)	0.127*** (0.024)	0.134*** (0.026)
Constant	2.977*** (0.142)	2.238*** (0.209)	2.917*** (0.239)
Ward-level random effects	Yes	Yes	Yes
Observations[12]	1,134	1,143	1,143
Log Likelihood	-652.141	-1,139.884	-1,259.221
Akaike Inf. Crit.	1,346.282	2,321.767	2,560.441
Bayesian Inf. Crit.	1,451.985	2,427.637	2,666.311

Notes: All models include ward-level random-effects; numbers represent beta coefficients with standard errors in parentheses; *p<0.05 **p<0.01 ***p<0.001.

12 Note that regressions in the Appendix (and Figures 9 and 10) are run with 1145 household respondents rather than the 1203 that completed the baseline survey. This is due to the fact that additional descriptive information relating to the socio-economic status of the household was collected in subsequent rounds of the survey (such as age and levels of education for the household head) which are included in the model. The model there includes all matching households across the two round, as well as the removal of 28 households that are set aside for piloting exercises.

Appendix B: Association between hazard-specific subjective resilience (using 3As model) and socioeconomic characteristics

SOCIOECONOMIC CHARACTERISTIC	FLOOD RESILIENCE	DROUGHT RESILIENCE	CYCLONE RESILIENCE
HHH highest education (base=none)			
Some primary	-0.004 (0.030)	0.019 (0.034)	0.057 (0.030)
Some middle school	-0.062 (0.041)	-0.042 (0.046)	-0.025 (0.041)
Some high school or higher	-0.147* (0.057)	-0.092 (0.065)	-0.027 (0.057)
Age of HHH	-0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
POP score	-0.004*** (0.001)	0.0002 (0.001)	-0.002* (0.001)
Marital status of HHH (base=single)			
Married	0.111 (0.068)	-0.024 (0.077)	0.032 (0.068)
Separated/divorced	0.140 (0.100)	0.016 (0.110)	-0.074 (0.097)
Widowed	0.130 (0.069)	-0.038 (0.078)	-0.046 (0.069)
Primary HH language (base=Myanmar)			
Bamar	-0.029 (0.041)	-0.015 (0.046)	0.073 (0.041)
Hindi/other Indian	-0.104* (0.052)	-0.079 (0.057)	-0.086 (0.050)
Number of HH occupants	-0.011 (0.007)	-0.006 (0.007)	-0.029*** (0.007)
Primary livelihood non-farming	-0.001 (0.028)	0.005 (0.032)	-0.020 (0.028)
Primary livelihood remittance	-0.006 (0.026)	-0.057 (0.030)	-0.003 (0.026)
HHH gender (base=male)			
Female	-0.008 (0.043)	0.049 (0.048)	0.029 (0.043)

SOCIOECONOMIC CHARACTERISTIC	FLOOD RESILIENCE	DROUGHT RESILIENCE	CYCLONE RESILIENCE
Respondent gender (base=male)			
Female	0.074** (0.028)	0.053 (0.031)	0.025 (0.028)
High flood sensitivity (base=low sensitivity)	0.098** (0.031)		
High flood exposure (base=low exposure)	-0.038 (0.035)		
High drought sensitivity (base=low sensitivity)		0.113 (0.079)	
High drought exposure (base=low exposure)		-0.216* (0.106)	
High cyclone sensitivity (base=low sensitivity)			0.032 (0.054)
High cyclone exposure (base=low exposure)			0.043 (0.147)
Subjective well-being (higher score=higher SWB)	-0.044** (0.015)	-0.026 (0.016)	-0.037* (0.015)
Constant	3.258*** (0.178)	2.899*** (0.215)	3.289*** (0.191)
Ward-level random effects	Yes	Yes	Yes
Observations	1,145	1,147	1,134
Log likelihood	-604.168	-742.030	-588.924
Akaike Inf. Crit.	1,250.336	1,526.059	1,219.848
Bayesian Inf. Crit.	1,356.242	1,632.002	1,325.551

Notes: All models include ward-level random-effects; numbers represent beta coefficients with standard errors in parentheses; *p<0.05 **p<0.01 ***p<0.001.

BRACED aims to build the resilience of up to 5 million vulnerable people against climate extremes and disasters. It does so through a three year, UK Government funded programme, which supports 15 consortiums, working across 13 countries in East Africa, the Sahel and Southeast Asia. Uniquely, BRACED also has a Knowledge Manager consortium.

The Knowledge Manager consortium is led by the Overseas Development Institute and includes the Red Cross Red Crescent Climate Centre, the Asian Disaster Preparedness Centre, ENDA Energie, Itad and Thomson Reuters Foundation.

The BRACED Knowledge Manager generates evidence and learning on resilience and adaptation in partnership with the BRACED projects and the wider resilience community. It gathers robust evidence of what works to strengthen resilience to climate extremes and disasters, and initiates and supports processes to ensure that evidence is put into use in policy and programmes. The Knowledge Manager also fosters partnerships to amplify the impact of new evidence and learning, in order to significantly improve levels of resilience in poor and vulnerable countries and communities around the world.

For more information on the Rapid Response Research and to access to real-time data and visualisations from the surveys, please visit the Resilience Dashboard:

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