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Spatial, network and temporal dimensions of the determinants of adaptive capacity in poor urban areas

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Highlights

- Adaptive capacity is measured in three slums in Kampala, Uganda

- Key determinants are attachment to place, social networks and duration of residence

- Critically, adaptive capacity has dimensions of urban form, social group and time

- Resilience building in slums should leverage less tangible local capacities

- Urban resilience assessments should allow for differentiation of these dimensions

Abstract

Slums and informal settlements are home to rapidly growing populations in urban areas globally and face a range of significant shocks and stresses. The sustainability of these places is critically intertwined with the resilience of their populations. The nature of the capacity for populations to adapt to shocks, as an element of resilience, is related to the evolving knowledge and networks of those populations and is suggested here to have significant spatial and temporal

variation. We analyse the key determinants of adaptive capacity and hypothesise that they are related to spatial dimensions of urban form, temporal dimensions of migration, place attachment, and to social differentiation. We investigate these dynamics of adaptive capacity across a transect of urbanisation from inner city to periphery in Kampala, Uganda using diverse methods including a sample survey of residents (n=720) and ego-network analysis. Results show that the key determinants of individual-level adaptive capacity are attachment to place, social networks, and duration of residence. There are significant differences in adaptive capacity between slum areas, as well as strong social group and temporal dimensions. These findings suggest the importance of measuring adaptive capacities at appropriate spatial and temporal scales in order to identify specific interventions for slums that build the resilience of their populations.

1. Introduction

Slum areas in cities are characterised as being marginalised in terms of governance, service provision and infrastructure (Arimah, 2011). While there has been progress in improving slums worldwide, estimates of populations in these areas show that they are continuing to grow: there was a 28% increase from 670 million to 880 million people living in slums in 2014 compared to 1990 (UN-HABITAT, 2016). The prospect of continued growth in slums is in large part due to continued urban expansion in developing countries (Angel et al., 2011). Throughout the history of urban expansion, there is long documented evidence of how populations in these settlements face a range of shocks and stresses testing their own resilience and that of their communities.

There is a renewed focus on the resilience of people and populations in these informal settlements (i.e. *social* resilience) and on pathways of potential transformation in urban areas, both in the context of making cities sustainable and also disaster risk reduction (Ahern, 2011; Kernaghan & da Silva, 2014; Leichenko & Silva, 2014). Those bodies of knowledge show that resources and assets are important dimensions of social resilience, alongside social organisation to learn from and adapt to risks (Berrou & Combarnous, 2012). Studies on disaster resilience in particular show that the factors leading to resilience are different in pre-disaster and post-disaster circumstances (Baker, 2012).

Research has highlighted the tensions between integrating slum areas into larger development trajectories, often at the expense of the urban poor, and simply making slum populations resilient to shocks (Tacoli et al., 2015). This paper focuses on the resilience of populations within slum areas, not as a long-term normative goal, but in order to understand the dynamics of the lived reality of

shocks that slum-dwellers face, and the factors that can be leveraged to build resilience in these places. While disaster resilience is part of that landscape, we focus here on the factors that bring more general social resilience, in the sense of making populations able to cope with multiple shocks and stresses. These include disasters as well as more everyday shocks such as crime, threats of eviction, lack of access to services, and exposure to pollution (Banks et al., 2011). General resilience in this context therefore encompasses slum-dwellers' ability to progress, resist and develop roots in place (Brown, 2016).

At the most general level, system resilience is the ability to deal with shocks and stresses whilst maintaining structure and function; the autonomy to implement change; and the capacity to learn, adapt and even transform (Carpenter et al., 2001; Walker et al., 2006). Tyler and Moench (2012) identify systems, agents and institutions as the key components contributing to urban climate change resilience, while Arup (2016) identify four dimensions of city-scale resilience as leadership and strategy, health and wellbeing, infrastructure and ecosystems, and economy and society, with twelve goals within those (Arup, 2016). City-scale or system-based accounts of resilience are, inevitably, limited in their focus on agency, on how individuals are constrained within political systems, and on their individual capacities to act (Brown, 2014). Hence in this study we focus on the capacity of individuals within slum areas, examining which factors realise their opportunities to be resilient.

Adaptive capacity is a central element of resilience. It is the capacity of individuals to manage and influence their resources and risks (Walker et al., 2006). Adaptive capacity is not fixed: while it is well-established that the elements of adaptive capacity are unevenly distributed within populations, there is less focus on how adaptive capacity varies across space and time for individuals. Studies into adaptive capacity recognise that it is scale dependent: measures at one scale rarely are meaningful at other scales (Adger & Vincent, 2007). Moreover marginalised social groups are most often disproportionately vulnerable to a range of shocks through an absence of adaptive capacity (Hardoy & Pandiella, 2009; Revi, 2008). This social differentiation is often further manifest and accentuated in spatial heterogeneity in vulnerability (Cutter & Finch, 2008; Jankowska et al., 2011). It is also clear that relationships to place radically change over time (Lewicka, 2011) and elements of resilience differ significantly before and after significant events such as disasters (Rose, 2009). Variable capacity across space and time may well then affect overall system resilience and has been argued to make interventions ineffective given the dynamic changes in adaptive capacities (Cutter & Finch, 2008).

This study therefore investigates the determinants and heterogeneities of individuals' adaptive capacity in slum areas. We hypothesise that differences are related to spatial dimensions of urban form, temporal dimensions of migration and length of residence, place attachment and social differentiation. The study tests these ideas using data collected in three slum areas in Kampala, Uganda's capital and largest city. The analysis is primarily based on data from a survey of 720 slum residents across three areas across the city, analysed for their spatial and social dimensions and using ego-network analysis to analyse the importance

of social capital. We disaggregate the results according to social groups, and analyse how they change with residents' duration of residence. The results reveal specific determinants of adaptive capacity, pointing towards the importance of considering socio-cognitive factors, and different types of social support networks. Moreover, there are clear spatial, social group, and temporal dimensions to social resilience within the three slums. Wider implications include the case for assessing general resilience, and assessing adaptive capacity at the local level.

2. Resilience and Adaptive Capacity in Poor Urban Areas

Resilient systems have various characteristics. They are, for example, those that can deal with, and respond to, a spectrum of shocks and perturbations whilst retaining the same structure and function. But systems have also been argued to be more resilient with greater autonomy and agency for action; and with greater capacity to learn, anticipate change and possibly respond to external perturbations (Nelson et al., 2007; Walker et al., 2004). This understanding of resilience is more than just bouncing back or persistence therefore. It includes the capacity of individuals and communities to learn, anticipate change and possibly respond in the face of change to a different state (Folke, 2006; Matyas & Pelling, 2015).

For cities and their populations, then, what constitutes a resilient system? There are now well-established tools for assessing resilience that identify the critical components at a city scale (Arup, 2016; UN-HABITAT, 2012). Another study has identified the characteristics of a 'safe and resilient community', including that it is knowledgeable and healthy, organised, connected, has infrastructure and services, economic opportunities and can manage its natural assets, although this is not specific to urban issues (Arup, 2011). While these frameworks contain measurements of levels of human vulnerability, economic opportunities and some measure of community cohesion, there is evidently a limited understanding of the dynamics of individual populations adaptability given the scale of study. Community-scale resilience assessments in urban areas so far focus on climate risks (Cities Alliance & WRI, 2017) or the impacts of urban development (Woolf et al., 2016).

This study focuses on slum residents as agents and the determinants and dimensions of their adaptive capacities to influence general resilience. General resilience in this context refers to how individuals respond to a range of shocks, rather than individual ones, hence general rather than specific resilience. Assessments of vulnerability and resilience are often focused on a specific type of shock (Meerow et al. 2016). We consider general resilience here given that it is likely to be difficult to pinpoint specific adaptive measures in the urban poor context where the shocks individuals face are multiple and synergistic (Nielsen and Vigh, 2012; Waters et al., 2010).

Adaptive capacity is not simply a set of resources or sets of capital assets. Core elements have been argued to encompass resources, structure, and agency (Cinner et al. 2015; Lemos et al. 2016). Resources generally refer to assets and

hard and soft infrastructure. Structure includes factors such as social class, religion, gender, ethnicity, and customs, while agency refers to the 'ability to mobilise' resources and more subjective, socio-cognitive factors. All three areas have been shown to individually influence adaptive capacity (Amendah et al., 2014; Grothmann and Patt, 2005; Kuruppu and Liverman, 2011; Marshall et al., 2007; Moser et al., 2010; Opiyo et al., 2014). Eakin and colleagues (2014) distinguish between generic capacity and specific capacity in dealing with risks and that generic capacity is often limited at collective scales of governance. Marshall and colleagues (2012) and Cinner and colleagues (2015) have shown how adaptive capacity, at both individual and collective levels extends beyond resources to include dimensions of learning, skills in planning, and willingness to undertake adaptive actions (see also Berkes & Ross, 2013). These insights suggest that while adaptive capacity can be indicated more generally by resource or asset based measures, more fine-grained understanding requires insights on individual and psychological resources, and on social networks.

How does adaptive capacity vary in spatial, social, and temporal dimensions? There is evidence that across cities, poor urban areas are highly heterogeneous in their residents' adaptability (Chatterjee, 2010; Jankowska et al., 2011; Simon, 2011). Stark differences across social groups in cities include vulnerability of women, young and elderly populations to stresses such as heatwave risk and flooding (Gasper et al., 2011; Hardoy and Pandiella, 2009). Second, there is evidence from disaster risk situations that individuals' adaptability changes in pre- versus post-disaster situations based on their underlying resilience and networks (Maston, 2015). Third, place attachment is strongly predicted by residence duration (Lewicka, 2011). Hence, it appears adaptive capacity varies across standard measures of social differentiation, is context and place specific, and is mutable and likely to alter across the lifecourse.

Specific challenges and elements of adaptive capacity appear in low-income marginalised urban contexts. Slums and informal settlements are vulnerable to a range of natural and man-made shocks, often because they are located in marginal areas such as steep hillsides, floodplains or other high-risk areas (Baker, 2012; Chatterjee, 2010); and because the poor quality, densely packed housing with lack of infrastructure increases the risk of hazards further (Hardoy & Pandiella, 2009). In addition to high exposure, slum-dwellers often face other vulnerabilities such as exclusion from the formal economy, lack of voice or political representation (especially for migrants), and lack of tenure and service provision (Moser et al., 2010; Revi, 2008; Zimmer, 2008). Rather than being able to rely on resilience that is accumulated from government-provided infrastructure and services therefore, in these contexts the source of resilience is mainly bottom-up assets, capabilities and networks (Satterthwaite, 2012; Thorn et al., 2015).

Hence in this paper we explore the determinants and dimensions of adaptive capacity relevant for the lived experience of urban slums. The integration of knowledge from disaster risk reduction, and from studies of adaptive capacity in the context of climate and other risks, suggests that these dimensions are related to spatial dimensions of urban form, temporal dimensions of migration and place

attachment, and to social differentiation. But we further explore how these elements of adaptive capacity are distributed and change over time with a view to deriving implications for how adaptive capacity can be built and enhanced.

3. Study design and Methods

3.1 Study Area

Globally, the current rate of urbanisation is leading to rapid growth of slums for a number of reasons. The causes and symptoms include high levels of urban poverty, an inability of the urban poor to access land for housing, insecure land tenure, and shortfalls in infrastructure and service needs of growing populations. Much of this urban growth is happening in the developing world, with Sub-Saharan Africa having the fastest growing urban population worldwide (Angel et al., 2011). Around two thirds of city-dwellers already live in slums or informal settlements in Sub-Saharan Africa, with an urban population set to double from 2007 to 2030, and slum growth to match (UN-HABITAT 2008, 2010). The definition of what constitutes a slum is contested (Milbert, 2006; Simon, 2011). We refer in this paper to slums, following standard UN categories, as settlements characterised by at least some of the following features: lack of durable housing of a permanent nature that protects against extreme climate conditions; sufficient living space which means not more than three people sharing the same room; easy access to safe water in sufficient amounts at an affordable price; access to adequate sanitation in the form of a private or public toilet shared by a reasonable number of people; security of tenure that prevents forced evictions (UN-HABITAT, 2006).

This study focuses on Kampala in Uganda, as a core example of a city region with dynamic populations facing shocks and with highly differentiated adaptive capacity. Kampala has a resident population of around 1.5 million (UBOS, 2014), although doubling each day commuting from outer areas. The growth rate of the city is uncertain with estimates ranging from 2% (UBOS, 2014) to 5.5% (Vermeiren et al., 2012). While poverty is in absolute decline in Uganda there is significant urban poverty and inequality (Mukwaya et al., 2011). An estimated eighty five percent of urban residents in Ugandan cities live in slums or informal settlements (UN-HABITAT, 2010), and many of these areas are in valleys of the city where they are prone to flooding (Lwasa, 2010).

The study samples three slum areas as a transect from inner city to periphery. Kisenyi, Mulago and Bwaise represent some of the most deprived slums in the city, with inadequate sanitation and water supply, high unemployment, solid waste issues, and high levels of crime. Kisenyi is close to the city centre and adjacent to one of the main markets and central business district. Mulago is more distant to the city centre and principal economic activities, while Bwaise straddles the northern ring road.

3.2 Research design and data

This study uses a mixed method approach that combined surveys of individuals (n=720), focus groups (n = 9) and qualitative interviews (n = 20) using open-

ended questions. This combination is used to develop a quantitative analysis of adaptive capacity determinants as well as a rich understanding of vulnerabilities and specific group differences. Principal data collection was carried out between March and November 2011. Sample size for the individual survey and stratified sub-samples allows for statistically significant comparisons to be made between the three slums, according to a power analysis using census data for the population, a 95% confidence level and a margin of error of just over six percent (Raosoft, 2010).

We conducted random open-ended in-depth interviews during site transect walks at the beginning of the fieldwork in order to scope the main threats, pilot test survey questions, and obtain statements for the adaptive capacity assessment, and focus groups after the main survey. Details on the survey sampling and interview protocols are available in Waters (2013).

We implemented 720 questionnaire surveys in the three study slum areas (240 in each), within which four representative areas (administrative zones) of the slum were chosen in each. Selection of study participants was through systematic random sampling of every five dwellings, starting from the four corners of each zone and working towards the centre.

The surveys generated data on respondent's livelihood and household, where they moved from and how long they had lived in the area; their use of natural goods and services, and shocks and challenges they faced; elements of adaptive capacity; ego-network analysis and socio-demographic information. Each interview took on average 30 minutes, interviews were audio recorded with permission from each interviewee.

The adaptive capacity elements of the survey elaborated the protocols of Marshall and colleagues (2007), by asking respondents to consider real shocks they mentioned previously, and presenting them with statements that represented different facets of adaptive capacity. The statements were developed from prior pilot open-ended interviews, and respondents were asked to what extent they agreed on a four-point Likert scale. The statements were in three categories: adaptive strategies, abilities of individuals to respond, and social sensitivities, characteristics of how each individual responds to their surroundings (see Appendix A). With the respondents' results, groups of statements were checked for reliability using Cronbach alpha scores, and refined such that final groups all had Alpha scores over or very near 0.7 (Nunnally, 1968; from Marshall et al., 2007). Factor analyses produced composite scores for groupings, and then correlation analysis with Bonferroni corrections revealed associations between determinants and actual responses.

The analysis of individuals' social networks involved an ego-network analysis. This analysis is appropriate for data from sample surveys of large populations: full social network analysis requires covering at least 80-90 per cent of all network nodes of individuals and hence is only used for surveys of whole, normally small, populations (Hanneman & Riddle, 2005; Halgin & Borgatti, 2012). The data collection involved asking respondents to name the people who

helped them out in the most recent time of crisis (consistent with adaptive capacity assessment), and then to give information on each of those contacts who assisted or helped them. This information included their relationship to the respondent, the type and amount of help received, and other information about alters used in subsequent in-depth social networks analysis (unpublished data; see Waters 2013). The data were entered into Egonet software (Egonet, 2012), and then matched with other data for analysis in SPSS.

Focus groups involved a number of targeted population groups across a range of relative incomes and ages, including migrant groups (Somalis and Karamajong), young men, and a women's group. Groups of eight to twelve residents were gathered through contacts developed in the field season. The participants were asked broad questions around the themes of adaptive strategies, sense of place, migration decisions and place-specific issues and feelings. The meetings were audio recorded with permission from all attendees, and data were transcribed and analysed for viewpoints on key issues such as group-specific adaptive strategies.

4. Results

The data reveal particular determinants of adaptive capacity that associate with adaptive responses, and that these determinants vary according to spatial, social and temporal dimensions. This section describes the main determinants of adaptive capacity in the three slums of Kampala then discusses the spatial heterogeneities of adaptive capacities, and finally the heterogeneity by social group. Finally we discuss how these capacities change with time, in this case duration of residence.

4.1 Determinants of adaptive capacity

4.1.1 Slum dwellers' responses to shocks

In order to understand the most important determinants of adaptive capacity, it is necessary to understand how slum dwellers responded to crises. Relatively few people leave the area entirely during a time of crisis, with only 12% returning to the village and slightly more elsewhere within the city. To help explain this, there are correlations between the decision to leave, and not receiving help from their neighbours ($r[714]=-.115$, $p=0.002$) and not learning from others ($r[717]=-.102$, $p=0.006$). In other words, the few individuals who leave are not well connected with those around them in the slum.

Regarding adaptive responses in situ, dealing with problems well associates with responding with the help of others, rather than in isolation. For instance self-efficacy correlates with 'getting help' in general ($r[718]=.127$, $p=0.001$); and the most useful statement for assessing this, the inverse of "I just gave up", strongly significantly correlates with getting help, and learning from others ($r[718]=.127$, $p=0.001$; $r[718]=.191$, $p\leq0.001$). By contrast self-efficacy is inversely related with not just dealing with problems on your own, just staying put, or just praying

to God. For the residents of the three slums therefore, it appears there is an intrinsic notion that problems are best dealt with using the help of others.

4.1.2   The most significant determinants of adaptive capacity

Correlation analysis shows that innovation, belief in change, and feelings of control are particularly important adaptive capacities, while attachment to place, the existence of networks and an 'appreciation of the local environment' are important social sensitivities (see Appendix A for list of factors and corresponding statements). The correlation scores in Appendix B show which 'capacities' influence adaptive responses: 'getting help from friends or relatives' is associated with belief in change and innovation (r[659]=.147, p≤0.001; r[714]=.161, p≤0.001), getting help from neighbours correlates with having options ('other things to earn money': r[712]=.153, p≤0.001). In fact, many aspects of getting help are correlated with 'feelings of control'. Self-efficacy and learning from others (the other two adaptive responses) are both associated with feelings of control (r[708]=.258, p≤0.001; and r[709]=.164, p≤0.001) and innovation (r[714]=.191, p≤0.001 and r[715]=.249, p≤0.001, respectively). Other specific correlations were found, including some negative relationships, but are more peripheral findings and are discussed in more detail in Waters (2013).

Meanwhile three key determinants within the 'social sensitivity' factors significantly associate with adaptive strategies. Appendix C shows that for all three types of 'getting help', attachment to place and the existence of support networks are strongly correlated (help from neighbours and friends/relatives with attachment to place: r[710]=.142, p≤0.001; r[711]=.100, p=0.008; and general, neighbours and friends/relatives with networks strength: r[715]=.105, p=0.005; r[713]=.296, p≤0.001; r[714]=.126, p=0.001). For self-efficacy and learning from others, the only significantly associated factor is an appreciation of nature (r[706]=.175, p≤0.001; r[707]=.202, p≤0.001), indicating the importance of this factor. In summary, attachment to place, both strong and wide networks, and an appreciation of nature all correlate with adaptive responses.

Lastly unlike the other three adaptive responses, adaptive mobility is not significantly associated with any of the factors at all. There are just two moderate negative associations – with an appreciation of nature ("Not stay here": r[704]=-.106, p=0.005), and feelings for the village (r[709]=-.105, p=0.005). While the latter result simply indicates that individuals who do not like the village do not move back there, the other result reiterates the importance of individuals' appreciation of any natural habitat around.

4.2 Spatial heterogeneities in adaptive capacity

4.2.1   Shocks and how different slum dwellers respond

While overall slum residents face a wide range of shocks, the most significant shocks for residents are different in the three slum areas. Table 1 below shows the average scores for each study area. Key differences are that Bwaise residents, located on the edge of the city and adjacent to a wetland face far more severe

flooding (see Appendix D: H=411, p≤0.001); in Mulago severe crime and loss of life is more often mentioned (H=11.9, p=0.003); while in Kisenyi in the middle of the city residents report sickness far less (H=17.2, p≤0.001) but eviction far more.

Despite the different shocks that individuals face, adaptive responses are similar across all three slums (see Table 1 Adaptive Strategies section). This is with the exception of social support, or how much help residents receive in times of crisis (H=46.8, p≤0.001). In this case, Kisenyi residents receive the least help, those in Mulago most from friends or relatives, while in Bwaise people receive marginally more from neighbours. In other words inner-city slum dwellers are less supported by locals than their peri-urban counterparts.

Table 1: Average scores on adaptive capacity factors from presentation of statements, for each slum study area; results according to 1-4 Likert scale of disagreement (1) to agreement (4). Statistically significant results (according to Kruskal-Wallis test) in bold.

Adaptive Capacity Statements			
IMPACTS	**KISENYI**	**MULAGO**	**BWAISE**
Flooding	**1.72**	**1.36**	**3.72**
Money	**3.35**	**3.56**	**3.72**
Loss of life	**2.72**	**3.09**	**2.88**
Sickness	**2.62**	**2.91**	**3.07**
I - ADAPTIVE STRATEGIES			
Adaptive mobility			
Shift elsewhere in city	1.80	1.63	1.61
Shift to village	1.68	1.58	1.53
Stay here (inv)	**1.73**	**2.17**	**1.84**
Help			
No help from others (inv)	**2.51**	**3.07**	**2.82**
Help from neighbours	**2.42**	**2.68**	**2.79**
Help from friends/relatives	3.01	3.21	3.13
Self-Efficacy - *Gave up (inv)*	3.06	3.18	3.09
Learned from others	2.91	3.16	3.13
II - DIMENSIONS OF RESPONSE			
Feelings of control - *Believe can change my life*	3.48	3.58	3.51
Belief in change - *Believe will get better*	**3.17**	**3.14**	**2.87**
Readiness to move - *I am ready to move if life gets worse*	3.50	3.31	3.14
Innovation - *Thinking of new ways to earn*	**3.39**	**3.43**	**3.29**
Job flexibility - *Ready to try a new job*	**3.61**	**3.41**	**3.37**
Options to change - *Many other things can do to earn*	2.43	2.22	2.42
Planning & preparedness - *Prepared for when problems come*	**2.88**	**3.05**	**2.68**
III - SOCIAL SENSITIVITY			
Appreciation of nature - *Want to look after natural environment*	**3.17**	**3.25**	**3.00**
Attachment to place - *I am proud to tell people I live here*	2.74	2.84	2.62
Feelings for village - *Would prefer to live in the village (inv)*	3.29	3.35	3.37
Attachment to occupation - *Proud of my job/what I do*	2.78	2.93	2.83
Strong networks - *Have strong friendships*	2.87	2.91	3.07
Wide networks - *Socialise with different people*	**3.25**	**3.14**	**3.15**
Socialise with those around (inv)	**3.17**	**3.34**	**3.09**
Employability - *Do not have abilities to do another job (inv)*	3.05	3.33	3.26

4.2.2 Spatial differences in adaptive capacities

While adaptive responses only differ spatially according to levels of social support, there are significant differences between the three slums in both capacities and sensitivities (see Sections II and III of Table 1). On average residents in the more central slums have higher individual capacities than those living further out – Bwaise showed significantly lower belief in change (H=11.1, p=0.004), innovation (H=12.5, p=0.002), job flexibility (H=16.7, p≤0.001) and planning capabilities (H=19.6, p≤0.001). By contrast, residents of Bwaise received more help in times of crisis especially from neighbours, as mentioned above (4.2.1). Furthermore, utilising the results of the ego-network analysis (see Waters, 2013) backs up this difference in social support. Table 2 shows that Bwaise residents report to receive quantitatively more social support (H=30.1, p≤0.001), the most material help (food, money and resources as opposed to advice or emotional support: H=25.4, p≤0.001), and that residents have the longest-known helpers (H=15.1, p=0.001).

These results indicate a striking spatial dimension to adaptive capacity in the slums: while individual capabilities are higher in the inner city slum, social cohesion and support are higher in the peripheral poor urban areas of the city. This relates to the makeup of the three slum areas: the inner-city slum (Kisenyi) is adjacent to the central business district and contains more individuals seeking out employment in the many informal industries located there as well as enclaves of international migrants; the threat of eviction also contributes to social fragmentation (Dobson et al. 2011). By contrast the peripheral slum, Bwaise, shows greater cohesion (strong social support networks) but contains many individuals who are 'stuck' there, lacking the opportunities of the inner city and showing lower capabilities (see Waters 2012 for more detail). Lastly one social sensitivity factor that does not follow the trend described is 'appreciation of nature', which is significantly higher in Mulago (H=11.6, P=0.003).

Table 2: Average scores for ego-network measures across the three slum areas; the "amount of help" was from a four-point scale summed across all the alters; the "%from same origin" refers to alters of same origin as ego; "% from same place" to alters living in the same slum area as the ego. Statistically significant results according to the Kruskal-Wallis test shown in Appendix D are shown in bold.

	Average Duration of Residence (days)	Mean no. Alters	Mean Amount of Help	Mean no. Helpers - Material help	Mean % from Same Origin	Mean % from Same Place	Mean Time Known
KISENYI	3246	3.08	8.34	2.48	**54%**	43%	40.79
MULAGO	3416	3.80	9.33	2.63	53%	49%	44.63
BWAISE	3580	**4.32**	**10.98**	**3.27**	43%	**59%**	**49.50**

4.3 Population-group heterogeneities

In addition to spatial dimensions, the hypothesis that adaptive capacity would differ by social group proved correct. Comparing three particular migrant groups from the field study (Somalis, Congolese, and Karamajong) with 'local residents' shows significant differences between population groups. These migrant groups represent both international and internal migrants (Karamajong from the north-east of Uganda).

Adaptive capacity differs between groups across ego-network and adaptive capacity assessment scores, but primarily in terms of levels of social support and strength of social networks (shown in Table 3). The sample sizes of each migrant group were too small to carry out statistical analyses but clear patterns are seen. The factors that clearly differed are shown in Table 3.

Table 3: Average scores for ego-network measures and adaptive capacity scores according to specific population groups. Some scores are negative as they come from composite adaptive capacity indices.

Migrant Group	Local Residents	Somalese	Congolese	Karamajong
Amount of Help	9.86	**6.23**	**6.36**	**7.14**
Time Helpers Known	46.97	**22.94**	**22.36**	**28.50**
Help received	2.85	2.48	2.21	**1.86**
Help from neighbours	2.65	2.61	**1.79**	2.57
Help from friends / relatives	3.13	3.21	**2.50**	**2.57**
Readiness to Leave	0.03	**-0.36**	0.26	**-0.36**
Strength of Network	2.96	**3.09**	2.57	**2.14**
Width of Networks	0.02	**-0.54**	0.34	0.29

Self-efficacy and learning are lower in migrant groups, particularly the Karamajong, but the primary difference in adaptive response is migrants groups receiving less social support (Table 3).

Most individual capacities do not differ greatly between the three groups and local residents, except for 'readiness to leave', 'strength of networks', and 'width of networks' (the only factors shown in Table 1 from the adaptive capacity assessment). However the ego-network analysis shows that the migrant groups have on average less helpers per person, receive less help in total, have known their 'helpers' less time, and more of the support comes from individuals living in the same place. Both assessments therefore show lower social support received by migrant groups.

Qualitative evidence from the focus groups supports this picture of weaker adaptive responses in the migrant groups, mainly due to lower social support. While the full texts cannot be included here, the migrant groups describe different aspects of discrimination that they faced, from generally being ill-treated, to not being considered for employment, to even not getting access to healthcare. There are greater issues of lack of tenure, and isolation through all being in the same zone of a slum and language barriers, although others report that this was sometimes self-imposed. By contrast, the Somalis show remarkable adaptability and report a strong sense of place through historical links with a

particular area, a financial insurance mechanism using lists of names of Somali residents in the area, and the help of international remittances.

These reports of discrimination and isolation line up with the quantitative results of lower social support, and even the exception of the Somalis is supported by ego-network scores that show strong, but narrow networks. Overall, both focus groups and quantitative analysis reveal unique vulnerabilities and levels of adaptive capacity (specifically social networks) in different population groups.

4.4 Temporal heterogeneity – changes in adaptive capacity over time

Having found spatial and social group dimensions, we find that adaptive capacity also changes significantly 'over time' (albeit as a cross-section of duration of residence). Correlation scores show that only local aspects of resilience take time to build (for all results see Appendix E).

In terms of adaptive responses, the likelihood of leaving is most influenced by duration of residence, with all three 'leaving' statements strongly significantly negatively correlated with residence duration ("Shift elsewhere", $r_s[690]=-.215$, $p \leq 0.001$; "back to village", $r_s[691]=-.151$, $p \leq 0.001$; "not stay", $r_s[693]=-.100$, $p=0.008$). Getting help from neighbours (notably not in general or from friends/relatives), and learning from neighbours are the other two responses that change with 'time' ($r_s[691]=.127$, $p=0.001$; $r_s[693]=.110$, $p=0.004$), notably all 'local' features.

Capacities that increase with duration of residence are an unwillingness to leave ("Readiness to leave", $r_s[681]=-.202]$, $p \leq 0.001$), and negative job flexibility i.e. unwillingness to change jobs ($r_s[689]=-.110$, $p=0.004$) – confirming the effect of time on reducing likelihood of leaving, and suggesting (obviously) an increased likelihood of finding a job over time. The sensitivities that change with residence duration are attachment to place ($r_s[689]=.202$, $p \leq 0.001$), attachment to occupation ($r_s[681]=.114$, $p=0.003$), and the strength and width of networks ($r_s[693]=.136$, $p \leq 0.001$; $r_s[690]=.124$, $p=0.001$). Out of these, attachment to place has the strongest relationship with duration of residence.

5. Discussion

In Kampala slums, it appears that residents mostly adapt to crises rather than seeking alternative locations. Our data suggest that the tendency to deal with shocks in location is due to desire to safeguard livelihoods and little social support for those who leave. The results presented here show that the factors associated with how well individuals adapt to crises include capacities such as belief in change, feelings of control and innovation as well as social sensitivities such as place attachment and appreciation of nature. These findings are common to diverse circumstances well beyond slums. Occupational identity and employability are identified as key determinants of adaptive capacity in resource extraction industries, for example (Marshall et al., 2007), and innovation is critical for the adaptive capacity of institutions (Gupta et al., 2010) as much as for individuals and households (Jones et al., 2010; Levine et al., 2011; Thorn et al., 2015). Perceptions of self-efficacy for farmers' adaptability have been demonstrated in Zimbabwe (Patt & Gwata, 2002) while community self-image and trust in the government are important dimensions in studies of Australian indigenous communities (Petheram et al., 2010).

In addition to individual traits, the results here show that social support is a critical determinant of adaptive capacity in places such as slums where government formal services are often lacking. This is unsurprising given that many challenges necessitate collective action, such as recovering and rebuilding after floods or dealing with solid waste. We find different types of network enable individuals to adapt – both wide-reaching, broad networks and strong localised networks including neighbours or close friends. Again these determinants resonate with findings in other studies (Adama, 2012; Chatterjee, 2010; Kabiru et al., 2012; Lourenço-Lindell, 2002a; Lyons and Snoxell, 2005): Braun and Aßheuer (2011) for example show that mutual help and social support are the dominant feature of slum-dwellers that survive floods regardless of how strongly people are affected.

We show here, perhaps for the first time in such a context, that slum dwellers' attachment to place, including an ecological attachment, also influences adaptability (Adger et al., 2011; Lewicka, 2011). This result shows that place attachment is a universal phenomenon: people generate community and attachment to places that themselves would be externally perceived as high-risk or even where they have been moved involuntarily (Agier, 2002; Lewicka, 2011).

The results demonstrate clear spatial, temporal and social group dimensions to adaptive capacity in the locations studied. The difference between the inner city and peripheral slums is stark, with individual capabilities relatively high where social cohesion is low in inner city slums, and vice versa in peripheral slums. The results in effect suggest that new migrant populations have less capacity to adapt primarily due to weaker social support networks. The analysis reveals specifically that social networks and the degree of social support in times of crisis differentiate adaptability. As length of residence increases, elements of adaptive capacity increase, although predominantly local features such as attachment to place and neighbourhood ties.

These findings illustrate the importance of including a broad range of factors in local assessments of adaptive capacity. While understanding the structural determinants of resilience such as income and livelihood capacities is important, critical drivers that may be leveraged to build local resilience will include locally specific capacities (Lemos et al., 2016). Given that we show that perceptions of risk and loss drastically alter ability to adapt (Eakin et al., 2010), it is important to understand local motivations including individuals' or communities' willingness to adapt and perceptions of control. Similarly, harnessing innovation may not only contribute to general resilience but also towards transformative change e.g. individuals finding entirely new livelihoods or ways of living (Nielsen & Vigh, 2012; Moore & Westley, 2011).

The findings of strong spatial and social group dimensions in adaptive capacity lend support for more rigorous urban resilience assessments. Knowledge on the different needs of inner city versus peripheral areas and different segments of society could help to avoid resilience interventions that actually create tradeoffs and instead will build on assets and capacities that are geographically and temporally specific (Lemos et al., 2013). Furthermore, as Eakin and colleagues (2010) propose, enhancing adaptive capacity will require a new vision of populations and communities at the centre of assessments, supported by institutions that facilitate cross-scale and intersectoral planning (Moloney et al., 2016).

The results here suggest a number of opportunities for interventions to build resilience in slums. Ascertaining specific motivations and capacities will provide building blocks for increasing generic adaptive capacity. Attachment to place, including ecological aspects, strongly correlates with adaptability: hence there is a strong case for improving the green infrastructure and spaces of these areas. The positive correlation of social cohesion and place attachment with duration of residence means that by securing tenure and removing the threat of eviction will enable the community to build social resilience. Critically, when most developing country governments seem to be investing in adaptation primarily to protect stocks of capital (Georgeson et al., 2016), there is an opportunity to understand and invest in the adaptability of vulnerable people.

The relationships identified here between determinants and adaptive responses are based on statistical associations rather than an understanding of causality. However, the significant proportion of the communities within the sample (720 individuals) suggests the trends observed are representative of those areas sampled. As common in social science studies, we infer a temporal dimension from a cross-section of individuals with different duration of residence. The robustness of findings would of course be enhanced by longitudinal data and, the issue of the latent nature of adaptive capacity would also be enhanced by long term monitoring of actual responses to shocks. We have sought to overcome limitations of adaptive capacity cross-sectional data through referring back to specific events individuals had recently experienced.

6. Conclusions

This study shows that the determinants of adaptive capacity in poor urban areas are highly socially differentiated in space and time, but suggests they are amenable to change. This creates the possibility of focusing on adaptive capacity in efforts to enhance the resilience of communities or particular areas. Many important elements included here are often not considered in urban resilience measurement (Ostadtaghizadeh et al., 2015). The data demonstrate the presence of many standard elements of adaptive capacity, such as the availability of infrastructure and other resources, structural factors including social class, religion, gender, ethnicity, and institutions and governance (Engle & Lemos, 2010; Hill, 2013; Moser et al., 2010; Yohe & Tol, 2002). In this study, however, we have further shown the importance of factors such as perceptions of control, innovation and employability. Hence, we argue that adaptive capacity includes the ability of individuals to take action, constrained by their own perceptions of marginalisation or empowerment (cf Satterfield et al., 2004).

Our study suggests that successful adaptation to multiple everyday and infrequent shocks in urban informal settlements occurs in-place and most often involves social support networks. Social networks are of central importance and closely inter-relate with place attachment and an appreciation of local nature. We have shown that ecological aspects of place attachment are important even in these degraded urban environments: even a small amount of green space can strongly influence social resilience. The implications are that green space is integral to urban landscapes within informal settlements and should be considered in slum development alongside conditions that help build social cohesion.

Critically, the resilience landscape even across poor urban areas is highly heterogeneous, varying in spatial and social group dimensions. In order for focused interventions to take place, it is important therefore for urban development plans to investigate and be aware of highly differentiated patterns of social resilience in the city, including among new resident groups. Highlighting the temporal dimension to local adaptive capacity provides both an opportunity and a challenge: by ensuring certain conditions of political stability and tenure local aspects of adaptability will likely build on their own. Yet the demand for land often crowds out green space to the detriment of adaptive capacity of the residents.

Given these dimensions of adaptive capacity, and even possible tradeoffs in resilience between scales, this study suggests a shift from simple vulnerability assessments to local measurements of resilience that allow differentiation of different slum localities, social groups, and that consider temporal changes. This will require the development of appropriate indicators and flexible methodologies that incorporate informal social networks and variables that are often difficult to quantify (Larson et al., 2013; Patel et al., 2014). Given relationships between scales (Chelleri et al., 2015), these local assessments will ideally be linked with resilience assessments at higher scales. The focus here has been on the adaptive capacity of populations and the results point to means of enhancing such capacities. The challenge remains, of course, to demonstrate how

slum areas and low-income communities, even with enhanced capacities can integrate in positive ways into transformational planning for safe and sustainable cities.

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Appendix A: Adaptive Capacity Assessment Statements

<u>Section I: ADAPTIVE STRATEGIES</u>

i)   Adaptive mobility

"When problems came, I shifted to somewhere else in the city."
"When problems came, I shifted back to the village / left the city."
"When problems came, I just had to stay here and deal with it."

ii)   Help

"When problems came, I just dealt with them on my own, without the help of others."
"When problems came, I got help from my neighbours."
"When problems came, I got help from my friends or relatives."

iii)   Self-efficacy

"When problems came, I just gave up."
"When problems came, the only thing I could do is take care of the problems myself."
"When problems came, the only thing I could do is pray to God and let Him handle the situation."

iv)   Learning from others

"I have learned from other people in my community how to deal with these problems."

<u>Section II: ADAPTIVE CAPACITIES</u>

i)   Feelings of control

"I believe I can change my life for the better."

ii)   Belief in local change – Alpha = 0.740

"I believe this place will get better."
"I do not think the situation will improve here."
"I do not think I can improve my life here."
"I do not think there are things I could do to improve life here."

iii)   Readiness to leave – Alpha = 0.622

"I am ready to move if life get worse here."
"I will never leave this place."
"If I had the money I would leave this place."
"I won't move from here unless I have a big problem."

iv)   Innovation

"I am always thinking of new ways to earn money and survive."

v)   Job flexibility

"I am ready to try a new job if there is an opportunity."

vi)   Options to change

"I have many other things I can do to earn some money."

vii)   Planning & reorganisation

"I am prepared for when problems come in the future."

<u>Section III: SOCIAL SENSITIVITY</u>

i)   Appreciation of local area (cultural services) – Alpha = 0.629

"I want to look after my local natural environment."
"I do not care about my local environment."

ii)   Attachment to place – Alpha = 0.647

"I am proud to tell people I live here."
"I do not feel like I belong to this community."

iii)   Feelings for village – Alpha = 705

"I would prefer to live in the village."
"I am glad I am here rather than being in the village."

iv)   Attachment to occupation – Alpha = 0.700

"I am proud of my job/what I do."
"I would change job if I was offered a different one."
"I enjoy my job/what I do for a living."

v)   Networks – strength

"I have some strong friendships and relationships in this neighbourhood."

vi)   Networks – wide – Alpha = 0.813

"I socialise with lots of different people in the community."
"I only socialise with a people living around me."

vii)   Employability – individually

"I do not have the abilities to do another job."

Appendix B: Correlations of Scores between Adaptive Capacities (Section II statements) and Adaptive Strategies (Section I statements)

		Shift elsewhere	Shift back to village	Not stay here	Get help generally	Get help from neighbours	Get help from friends or relatives	Did not give up	Take care of problem myself	All I could do is pray to God	Learned from others
FEELINGS OF CONTROL	Pearson Correlation	-.039	-.053	-.032	.103**	.031	.119**	.258**	-.081*	.038	.164**
	Sig. (2-tailed)	.306	.163	.390	.006	.405	.002	.000	.031	.308	.000
	N	706	707	706	709	707	708	708	708	705	709
BELIEF IN CHANGE	Pearson Correlation	-.089*	-.025	-.046	.056	.107**	.147**	.025	.056	.163**	-.032
	Sig. (2-tailed)	.022	.516	.234	.147	.006	.000	.520	.153	.000	.413
	N	657	658	657	660	658	659	659	659	656	660
READINESS TO LEAVE	Pearson Correlation	-.007	.018	-.016	.008	-.006	.020	.031	-.003	.127**	.053
	Sig. (2-tailed)	.850	.632	.677	.823	.864	.603	.418	.936	.001	.160
	N	700	701	701	703	701	702	702	702	699	703
INNOVATION	Pearson Correlation	-.041	-.078*	-.046	.059	-.012	.161**	.191**	-.061	.055	.249**
	Sig. (2-tailed)	.270	.037	.223	.112	.749	.000	.000	.103	.145	.000
	N	712	713	712	715	713	714	714	714	711	715
JOB FLEXIBILITY	Pearson Correlation	.037	-.003	-.008	-.103**	-.097**	-.034	-.028	.110**	.084*	-.056
	Sig. (2-tailed)	.323	.946	.840	.006	.010	.370	.454	.003	.026	.136
	N	709	710	709	712	710	711	711	711	708	712
OPTIONS TO CHANGE	Pearson Correlation	-.043	.031	.041	.002	.153**	.104**	-.126**	.096*	.029	-.128**
	Sig. (2-tailed)	.256	.414	.273	.965	.000	.005	.001	.011	.442	.001
	N	711	712	711	714	712	713	713	713	710	714
PLANNING & REORGANISATION	Pearson Correlation	-.041	.026	.033	-.004	.054	.046	-.105**	.069	-.065	-.195**
	Sig. (2-tailed)	.276	.489	.375	.911	.147	.219	.005	.064	.083	.000
	N	709	710	709	712	710	711	712	711	708	712

Results of multiple (Pearson) correlations between scores for each individual on adaptive capacities (left-hand column) and scores for adaptive strategies (top row); n = roughly 720. Data derived from presentation of statements and agreement or disagreement on a Likert scale, as described in the Methods section. ** indicates correlation is significant at the 0.01 level (2-tailed), * that is significant at the 0.05 level. However as described above, Bonferroni corrections were applied so even stricter p-values were in fact used to determine which results were significant.

Appendix C: Correlations of Scores between Social Sensitivities (Section III statements) and Adaptive Strategies (Section I statements)

		Shift elsewhere	Shift back to village	Not stay here	Get help generally	Get help from neighbours	Get help from friends or relatives	Did not give up	Take care of problem myself	All I could do is pray to God	Learned from others
APPRECIATION OF LOCAL ENVIRONMENT	Pearson Correlation	-.094[*]	-.079[*]	-.106[**]	.061	.006	.045	.175[**]	.006	.172[**]	.202[**]
	Sig. (2-tailed)	.013	.036	.005	.106	.868	.234	.000	.872	.000	.000
	N	704	705	704	707	705	706	706	706	703	707
ATTACHMENT TO PLACE	Pearson Correlation	-.073	-.019	-.016	.044	.142[**]	.100[**]	-.009	-.022	-.036	-.047
	Sig. (2-tailed)	.053	.617	.675	.238	.000	.008	.819	.564	.340	.214
	N	709	710	709	712	710	711	711	711	708	712
FEELINGS FOR VILLAGE	Pearson Correlation	-.072	-.105[**]	-.042	-.021	.011	.053	-.056	.076[*]	.139[**]	.001
	Sig. (2-tailed)	.056	.005	.264	.579	.763	.161	.135	.042	.000	.982
	N	708	709	708	711	709	710	710	710	707	711
ATTACHMENT TO OCCUPATION	Pearson Correlation	-.032	.054	.014	.016	.109[**]	.043	-.041	-.049	-.154[**]	-.001
	Sig. (2-tailed)	.394	.152	.711	.673	.004	.251	.276	.191	.000	.987
	N	699	701	699	702	700	701	701	701	698	702
NETWORKS STRENGTH	Pearson Correlation	-.061	.004	.039	.105[**]	.296[**]	.126[**]	-.055	-.103[**]	-.137[**]	.078[*]
	Sig. (2-tailed)	.106	.915	.295	.005	.000	.001	.140	.006	.000	.037
	N	712	713	712	715	713	714	714	714	711	715
NETWORKS - WIDE	Pearson Correlation	-.066	-.040	-.033	.042	.162[**]	.101[**]	-.091[*]	-.052	-.007	.061
	Sig. (2-tailed)	.077	.287	.383	.268	.000	.007	.016	.168	.843	.105
	N	709	710	709	712	710	711	711	711	708	712
EMPLOYABILITY	Pearson Correlation	-.052	-.074	-.032	.030	-.008	.026	.101[**]	-.043	.027	.002
	Sig. (2-tailed)	.165	.050	.393	.431	.836	.497	.007	.254	.475	.968
	N	708	709	708	711	709	710	710	710	707	711

Results of multiple (Pearson) correlations between scores for each individual on social sensitivities (left-hand column) and scores for adaptive strategies (top row); n = roughly 720. Data derived from presentation of statements and agreement or disagreement on a Likert scale, as described in the Methods section. ** indicates correlation is significant at the 0.01 level (2-tailed), * that is significant at the 0.05 level. However as described above, Bonferroni corrections were applied so even stricter p-values were in fact used to determine which results were significant.

Appendix D: Comparison of Adaptive Capacity Determinants across Three Slum Areas Using a Kruskal-Wallis Test

	IMPACTS							
	Flooding	Money	Loss of life	Sickness				
Chi-Square	411.003	16.565	11.865	17.239				
df	2	2	2	2				
Asymp. Sig.	**.000**	**.000**	.003	**.000**				

	ADAPTIVE RESPONSES							
	Shift Elsewhere	Shift to village	Did not stay here	Got help	Help from neighbours	Help from friends / relatives	Did not give up	Learned from others
Chi-Square	.557	.364	27.846	46.833	11.316	2.583	1.192	5.797
df	2	2	2	2	2	2	2	2
Asymp. Sig.	.757	.834	**.000**	**.000**	.003	.275	.551	.055

	ADAPTIVE CAPACITIES							
	FEELINGS OF CONTROL	BELIEF IN CHANGE	READINESS TO LEAVE	INNOVATION	JOB FLEXIBILITY	OPTIONS TO CHANGE	PLANNING & REORGANIS ATION	
Chi-Square	.845	11.146	5.091	12.548	16.727	5.996	19.581	
df	2	2	2	2	2	2	2	
Asymp. Sig.	.655	.004	.078	**.002**	**.000**	.050	**.000**	

	SOCIAL SENSITIVITIES							
	APPRECIA TION OF NATURE	ATTACHMENT TO PLACE	FEELINGS FOR VILLAGE	ATTACHMENT TO OCCUPATION	NETWORKS STRENGTH	NETWORKS – WIDTH	EMPLOYABIL ITY	
Chi-Square	11.618	3.032	2.044	2.848	3.343	31.453	12.970	
df	2	2	2	2	2	2	2	
Asymp. Sig.	.003	.220	.360	.241	.188	**.000**	**.002**	

Results of Kruskal-Wallis analysis to test differences in scores across various aspects of social resilience in three study areas. These facets were measured using a method of presentation of statements and agreement or disagreement on a Likert scale. Significant results are shown in bold.

Appendix E: Correlation of Adaptive Capacity and Social Network Scores with Duration of Residence Values

		ADAPTIVE STRATEGIES									
		Shift elsewhere	Shift back to village	Not stay here	Get help generally	Get help from neighbours	Get help from friends or relatives	Did not give up	Take care of problem myself	All I could do is pray to God	Learned from others
DURATION OF RESIDENCE	Correlation Coefficient	-.215**	-.151**	-.100**	.008	.127**	.037	-.055	-.051	-.009	.110**
	Sig. (2-tailed)	.000	.000	.008	.830	.001	.330	.145	.182	.816	.004
	N	690	691	691	693	691	692	692	692	689	693

		CAPACITIES						
		FEELINGS OF CONTROL	BELIEF IN CHANGE	READINESS TO LEAVE	INNOVATION	JOB FLEXIBILITY	OPTIONS TO CHANGE	PLANNING & REOGANISATION
DURATION OF RESIDENCE	Correlation Coefficient	.002	-.004	-.202**	-.011	-.110**	.015	.013
	Sig. (2-tailed)	.963	.929	.000	.779	.004	.700	.743
	N	687	639	681	692	689	692	689

		SOCIAL SENSITIVITIES						
		CULTURAL SERVICES	ATTACHMENT TO PLACE	FEELINGS FOR VILLAGE	ATTACHMENT TO OCCUPATION	NETWORKS STRENGTH	NETWORKS - WIDE	EMPLOYABILITY
DURATION OF RESIDENCE	Correlation Coefficient	.058	.202**	-.043	.114**	.136**	.124**	-.110**
	Sig. (2-tailed)	.131	.000	.263	.003	.000	.001	.004
	N	685	689	689	681	693	690	693

		SOCIAL NETWORK MEASURES					
		Number of Helpers	Total Amount of Help Given	Number of Helpers Giving Material Help	Total Time Helpers Known For	Number of Helpers from Same Place of Origin	Number Helpers Currently Living in the Same Area
DURATION OF RESIDENCE	Correlation Coefficient	.069	.070	.047	.218**	-.006	.018
	Sig. (2-tailed)	.072	.069	.220	.000	.879	.659
	N	686	686	686	686	636	636

Results of multiple (Spearman-rank) correlations between measures of each individual's duration of residence (adjusted to number of days) and various adaptive capacity and social network scores; n = roughly 720 depending on each case. ** indicates correlation is significant at the 0.01 level (2-tailed), * that is significant at the 0.05 level. However as described above, Bonferroni corrections were applied so even stricter p-values were in fact used to determine which results were significant.