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Impacts of increasing community resilience through humanitarian aid in Pakistan

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Summary

Extreme weather events and natural disasters, like floods and earthquakes, can cause great losses in human and physical capital. The impact of these events can be particularly disastrous on developing countries that are often under-prepared for such emergencies. Catastrophes have often severely impacted poor and vulnerable populations, and have led to recurrent humanitarian disasters in the past years. They intensify existing vulnerabilities in communities such as lack of proper shelter, livelihoods and sanitation, thereby contributing to the spread of disease and malnutrition.

This impact evaluation sheds light on whether and how vulnerabilities to negative shocks can be reduced. To study this question, we collaborated with ACTED, a humanitarian non-governmental organisation that operates in areas affected by political and economic crises as well as those affected by natural disasters. It has vast experience of humanitarian interventions during crises such as those in Darfur, Nepal and Syria.

For this study, we worked with ACTED-Pakistan, as Pakistan is one of the world's most severely affected countries with regard to natural disasters. Disasters in Pakistan leave behind critical supply gaps and further vulnerabilities within affected communities. Natural disasters are often followed by chronic malnutrition. In this setting, humanitarian aid interventions that target areas facing a high likelihood of exposure to natural disasters or emergencies are key to preventing degradation of already fragile communities and making them more resilient to future disasters.

This evaluation report focuses on understanding the impact of interventions aimed at capacitating communities in the face of humanitarian emergencies caused by natural or weather-related disasters. This report captures the impact of the basic humanitarian aid package, a residual recovery and preparedness programme delivered by ACTED in two rural districts of Sindh in 2016, in its first year of implementation. The package includes interventions in shelter and non-food items, water sanitation and hygiene, and food, security and livelihoods. The purpose of the interventions is to build local capacity, meet life-saving needs, support community-level recovery and enhance resilience for future events.

This report shows evidence of the basic humanitarian aid package's socio-economic impacts and adapted behaviour among beneficiaries of the capacity-enhancement training delivered by the NGO. Overall, treated villagers are more likely to have safe shelters, better sanitation and safe water, and can implement the new fertility and livestock management techniques. With the help of three-year panel data and a random allocation of village clusters into the programme, we are able to show that the effects persist even one year after the programme ended in the respective areas. Additionally, we also found that these interventions translate into a higher likelihood for villagers to own livestock and face fewer shelter damages in areas affected by extreme weather events.

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Abbreviations and acronyms

ACTED	Agency for Technical Cooperation and Development
BHP	Basic humanitarian aid package
BMI	Body mass index
DRR	Disaster risk reduction
EWE	Extreme weather event
FGD	Focus group discussion
FSL	Food security and livelihood
GSE	Generalised self-efficacy scale
HH	Household
ITT	Intention-to-treat effect
LATE	Local average treatment effect
PLW	Pregnant and lactating women
PMD	Pakistan Meteorological Department
WASH	Water, sanitation and hygiene
WHO	World Health Organization

1. Introduction

Emergencies caused by earthquakes, tsunamis, floods and armed conflicts are characterised by massive physical destruction and take an enormous toll on lives, leading to physical and mental suffering. Due to an increasing number of natural disasters and heightening political instability, there is an urgent need for effective humanitarian aid solutions. So far, the majority of humanitarian aid response to emergencies is reactive, for example addressing urgent reconstruction and recovery needs. A prevention approach recognises that some of the worst impacts of disasters are preventable and enables steps to mitigate harm in the case of emergency (Wessells 2009).

The devastating effects of disasters are well documented. Apart from immediate consequences, disasters have far-reaching impacts that further hinder investments in human capital and technology (Barro 2009; Noy 2009; Loayza et al. 2012; Fomby et al. 2013; Deschenes and Moretti 2009; Currie and Rossin-Slater 2013; Rocha and Soares 2015). Disasters have been found to not only lead to fewer and less risky investments (Binswanger et al.1993; Dercon and Krishnan 1996) and different borrowing behaviour (Del Ninno et al. 2003), but also to change risk behaviour up to nine years after the event (Cameron and Shah 2015). Disasters also result in persistently high levels of poverty and malnutrition.[1] In fact, the adverse effects of disasters can be felt over decades and generations, with observable changes in consumer behaviour due to hunger periods (Kesternich et al. 2015), worse educational outcomes (Groppo and Kraehnert 2017; Caruso 2017) and higher mortality levels (Lindeboom et al. 2010).[2]

Pakistan is one of the world's most severely affected countries with regard to natural disasters. Its recurrent disasters and natural hazards such as floods, earthquakes, droughts, monsoons, cyclones and landslides leave behind critical supply gaps and intensify vulnerabilities within affected communities. Natural disasters are often followed by humanitarian crises. Two floods in Pakistan in 2010 and 2011 particularly stood out in terms of intensity and damage caused. The 2010 flood was its most devastating since 1950, flooding one fifth of the country and leading to 20 million affected people and over 1,700 deaths (WHO 2010). The recovery rate was slow, especially for poorer households (Kurosaki et al. 2012). In this setting, humanitarian aid interventions that target areas facing a high likelihood of exposure to natural disasters or emergencies are key to preventing degradation of already fragile communities by making them more resilient to future disasters.

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[1] The fetal origins literature tests the impact of droughts or wars, which lead to hunger during pregnancy with adverse health effects on offspring (Almond and Currie 2011). For cross-country studies and overviews of empirical studies finding negative effects of natural disasters on income in the short-run, in particular in developing countries and for severe disasters see Noy (2009); Loayza and colleagues (2012); Fomby and colleagues (2013); and Sawada and Takasaki (2017). See also evidence for the Philippines by Datt and Hoogeveen (2003).
[2] Lindeboom and colleagues (2010) find that the exposure at birth to (weather-related) famine has been shown to reduce life expectancy (on average, boys lose 4 years and girls lose 2.5 years of life after age 50).

The core question we address in this paper is: Can regions that are exposed to disasters causing developmental degradation overcome this geographical disadvantage through better preparedness to extreme weather shocks? While post-disaster reconstruction and support programmes (by public agencies and/or humanitarian aid organisations) as well as disaster-insurance aim to provide relief and support after a disaster strikes, there has been renewed interest in preparing communities, households and individuals beforehand (ex-ante) against disasters and make them more resilient and able to cope. This appears to be particularly relevant in poor countries where climate change-related disasters are expected to become more common and/or more severe in the future, and where population growth further increases the total number of people at risk (which is also the case for South Asia).

Addressing needs in disaster-prone areas is important. Natural disasters, earthquakes, and floods can cause great losses in human and physical capital. Their impacts can be particularly severe in developing countries that often lack the capacity to prepare and respond to such events. In fact, natural catastrophes have often severely impacted poor and vulnerable populations and have led to recurrent humanitarian disasters in past years. They have further heightened already existing vulnerabilities, such as lack of safe shelters and functional sanitation systems, which can quickly contribute to outbreaks of diseases and malnutrition.

In this context, the reduction of losses and risks is a key challenge for research and policymakers. Evidence is urgently needed for more timely and efficient aid allocation. During the acute phase, when funds are available and the sense of urgency is high, a number of humanitarians and non-governmental organisations (NGOs) pour in and conduct emergency work. After the acute phase, they rush off to the next crisis. Having learned from past crises and exploiting seasonality of weather events, policy planners and donors increasingly turn to better coordinated and early aid.

Still, little is known about mitigating the consequences of natural disasters, in particular the use of ex-ante mechanisms that could be put in place beforehand. It is believed that boosting the resilience of individuals and communities in vulnerable regions will decrease vulnerabilities to negative shocks such as natural disasters and armed conflicts. Underlying these goals is an interest in better understanding the coping and adaptation strategies already chosen by individuals and communities, as well as the identification of potential new and effective approaches to increase resilience. While policy planners want individuals and communities to become more “resilient” towards negative shocks, specific preparedness and resilience activities have not yet been tested systematically.

Given the robust body of evidence on the adverse effects of disasters, there is a dearth of rigorous research on the impacts of recovery and preparedness interventions. One reason for this lack of evidence on effective approaches is the challenge of setting up a strong impact evaluation design for developmental aid in general and humanitarian aid in particular. A strong evaluation design addresses ethical questions and reduces potential biases that stem from the selection of those who receive aid. In this paper we address both challenges. First, recovery and preparation needs can be addressed through the continuity of resource flows and better planning. The predictability of humanitarian aid allows sufficient time to set up a robust impact evaluation. Our contribution to the literature is to show that communities can be objectively and subjectively prepared for extreme weather events in disaster-prone areas and eventually become more resilient.

In this paper we provide the first causal evidence of the impact of humanitarian aid measures, which not only addresses recovery needs from past disasters but also explicitly and proactively plans and tests policies in a pre-disaster setting to reduce loss of lives, cost, and socioeconomic impacts of future extreme weather events. We assess a programme that ex-ante aims to increase resilience along the dimensions identified by prior research (Patel et al. 2017). Implemented by ACTED and funded by the Department for International Development, the 'Responding to Natural Disasters in Pakistan 2015-2019' programme focuses on natural disaster preparedness, response and recovery. We have assessed the first year of its implementation and refer to it as a basic humanitarian aid package (BHP). The programme delivers residual recovery packages to households affected by past disasters and includes programme elements (relief assistance) to those who might be affected by disasters in the future. We tested training events and infrastructure interventions in the spheres of water, sanitation and hygiene (WASH), shelter and non-food items, and food security and livelihood (FSL) support. They were designed to build local capacity, meet life-saving needs, support community-level recovery and enhance resilience. They include the repair and set-up of new shelters, the provision of sanitation, education about hygiene practices, and the distribution of seeds that resist floods or can be harvested earlier.

This paper focuses on understanding the impact of the preparedness interventions covered under the BHP. In early 2016, the programme was randomly allocated to 148 clusters of sub-villages. The other 139 clusters were allocated to the control group, which did not receive the humanitarian package. During the baseline assessment, 3,841 households were surveyed and reported to have been hit by a disaster 1.7 times on average between 2010 and 2015. The assessment found an exceptionally high need for recovery initiatives, despite the fact that 56 percent reported having received aid over the past five years. Every second child is malnourished and every second family faces problems in meeting their food needs.

We assess the programme against its ex-ante objectives by defining and fixing an objective definition of preparedness within a set of output-related indicators, which we refer to as intermediate outcomes.[3] We find that the intervention worked in the expected direction. The programme had a strong impact on the intermediate outcomes and the villagers have adapted and applied the preparedness messages delivered by the NGO. The BHP leads to improved hygiene habits (ITT: 5.0 percentage points (pp), $p<0.001$, more households wash hands correctly; 8.0pp, $p<0.001$ use only latrines), an increased adoption of disaster risk reduction (DRR) techniques learned (ITT: 4.8pp repair houses, $p<0.001$) and, to a limited extent, improved knowledge on agricultural and livestock management methods (ITT: 3.8pp improved awareness of livestock needs, $p<0.05$).

We estimate the impacts on a range of subjective perceptions of preparedness to extreme weather events in the future. The objective level of preparedness is mirrored in

[3] We reviewed the training material and a priori conducted interviews with local experts. Thereafter, we uploaded a pre-analysis plan on the AEA (is expanded form to be mentioned) website before the midline data was collected ID: AEARCTR-0001782).

an increase of subjective feelings of preparedness to extreme weather events as reported by the villagers. The share of households that report high or relatively high life satisfaction increased (ITT: 5.9pp, $p<0.001$), more households believe that NGOs do a good job (5.6pp, $p<0.001$) and more households report that they feel prepared for future disasters or extreme weather events (5.8pp, $p<0.001$). Moreover, since the mental outlook of an individual and a community is a key element that predicts response to adversity (Davydov et al. 2010), we also assessed 'mental' resilience in communities, comparing outcomes with or without intervention and then with or without the adverse event. We chose to measure the general self-efficacy which has been found to be an influential variable related to adaptation to stress.

The generalised self-efficacy scale (GSE) by Jerusalem and Schwarzer (1992) is an appropriate instrument for this purpose, and was also validated in an intercultural population sample (Romppel et al. 2013). We also estimate the impact on the psychological well-being of females. An increase on the GSE, which captures a battery of questions on psychological well-being that were asked to females only, indicates that the programme produces tractable results. Women from treated clusters display higher confidence to deal with unexpected events and report finding ways to get what they want in case of someone opposing them (ITT change in scale by 5.9, $p<0.05$).

The outputs also translate into objectively observable outcomes. Villagers are more likely to have safer shelters, better sanitation and safe water, and are more likely to apply new fertility and livestock management techniques. Additionally, we find that the activities translate into a higher likelihood of owning livestock (4.6pp, $p<0.01$). We also compare outcomes on nutrition and food security, mental resilience in communities with and without the intervention, and without the adverse event. Despite positive and strong effects of the treatment on WASH-related intermediate outcomes reported in the last chapter, no robust evidence can be reported for self-reported outcomes related to WASH practices – most importantly regarding cases of diarrhoea, nutrition, and changes of anthropometric measures for children under five. When looking at anthropometric measures of children, pregnant and lactating women (PLW), we also do not see any statistically significant results. The zero results are in line with growing evidence of the limited effects of WASH interventions on child development.[4]

Most importantly, we are able to test the objectives against the programme's goal of increasing not only preparedness, but also resilience. We capture changes in resilience that can be causally linked to the impacts of the programme. Thereby, we understand resilience as the capacity to recover and/or withstand climate-related dangers and difficulties once such events occur. In the course of this study, about every fifth village experienced an extreme weather event, which is a similar scope to the treatment and control clusters. Exploring the interaction effect of humanitarian aid and extreme weather events (especially exceptionally heavy rainfalls) in summer 2016, we capture households' resilience in terms of coping strategies chosen, income and health-related outcomes.

[4] See studies by Null and colleagues (2018); Luby and colleagues (2018); Pickering and colleagues (2018).

We observe that in affected areas, those households with ex-ante recovery and preparedness interventions have ex-post fewer shelter damages and increased livestock. In case of extreme weather events, households that resided in clusters receiving BHP reveal fewer problems with respect to meeting their food needs. Living in a cluster that received treatment reduces the number of households with at least one member having had diarrhoea or being sick in the previous month. These results are in line with our expectations of how the programme would work (i.e. evidence that the BHP in case of an extreme weather event (EWE) increases resilience to potential negative impacts associated with these events). Altogether, the results from the impact evaluation show that the BHP decreased vulnerability to possible future shocks. Moreover, we present a new approach as to how resilience can be measured empirically by exploiting the interaction effects of extreme weather events and preparedness interventions.[5]

This study attempts to fill the evidence gap on how to mitigate the consequences of natural disasters. First, we complement the literature, which argues that resources matter in the wake of a disaster. These studies show that disasters affect people living in poverty disproportionately. Strömberg (2007), for example, argues that for every death caused by disasters in high-income countries, there would have been 12 deaths in low-income countries. Similarly, using data from 1980 to 2002, Kahn (2005) shows that national income (distribution and mean) would play a role in determining the number of deaths resulting from natural disasters, whereby poor people would face greater exposure than wealthy people to natural disaster risk.

However, what exactly makes richer countries and communities more resilient to disasters remains largely an open question. It could be attributed to insurance, access to finance (Noy 2009), investments in better housing and zoning, technologies (computer modeling of storms, early warning information), and better education and information, which could increase the ability to respond quickly in mass evacuations (Dacy and Kunreuther 1969; Klinenberg 2015). Apart from formal or informal insurance, direct preparedness and adaptation interventions are believed to cushion negative effects. Barreca and colleagues (2016), for example, describe opportunities to adapt to climate change in the US. The authors show that air conditioners can be a central determinant of the reduction in mortality risk associated with high temperatures during the twentieth century.

Luechinger and Raschky (2009) study the effects of floods on life satisfaction in 16 European countries between 1973 to 1998. They argue that risk transfer mechanisms such as mandatory insurance could have large mitigating effects. They found that flood disasters lower life satisfaction by 0.044pp [125%] in regions without mandatory insurance, yet in regions with mandatory flood insurance the effect was zero. Von Peter

[5] While donors, policymakers and NGOs attempt to increase resilience, the evidence is hard to pin down since the term "community resilience" means different things to different researchers. In psychology, resilience is considered the capacity to recover following stress and to maintain mental health despite adversity (Davydov et al. 2010; Shastri 2013). In social sciences, the concept is hard to capture. In a recent meta study, Patel and colleagues (2017) conclude that community resilience is an “amorphous concept”. They identify several of its elements such as local knowledge, community networks and relationships, communication, health, governance and leadership, resources, economic investment, preparedness, and mental outlook.

and colleagues (2012) use insurance market penetration to present the first cross-country evidence that links the effect of natural disasters with insurance markets. They show that when treating uninsured and insured losses separately, uninsured disaster-related losses lead to income declines, whereas there are no negative effects for insured losses.

Analysing data on Indonesia, Cameron and Shah (2015) show a reduced propensity to take risks up to nine years after a natural disaster. The authors argue that insurance could counter the impact of natural disasters that partly stem from changes in risk behaviour. Their analysis also suggests that the benefits of infrastructure investments aimed at reducing the likelihood of floods and mitigating the impacts of natural disasters would be far higher than estimated. However, the applicability of these results to the majority of poor countries is questionable. In these circumstances insurance coverage is extremely low, and resources already scarce. Thus, people rely on informal insurance mechanisms and a range of coping strategies such as drawing down savings, selling physical assets, reciprocal exchanges of gifts and loans, expanding income-generating activities, increasing school drop-out, using buffer stocks of grain, and reducing consumption expenditures (Rosenzweig and Wolpin 1993; Morduch 1999; Jacoby and Skoufias 1997; Lim and Townsend 1998; Del Ninno et al. 2003).

Evidence of quick, practical and effective solutions in such contexts remains almost nonexistent and even controversial. Deaton (1992), for example, stresses that some coping mechanisms, such as using buffer stocks or savings, can be ineffective in the face of natural disasters. When harsh conditions are likely to persist for several years, households would need large stores of assets to achieve adequate protection. Blattman and Ralston (2015) review the types of interventions that work for the poorest people. Instead of skill-based training and microfinance, they argue in favour of supply-side interventions in the aftermath of wars or natural disasters. These would have the potential to increase the speed of recovery, helping people to rebuild stocks of human and physical capital. One instrument for setting up preparedness interventions is supply-side humanitarian aid. Addressing risk can be one important complement to humanitarian aid, especially for interventions focusing on high-risk events such as natural disasters. To our knowledge, this is the first study estimating the impact of preparedness measures in the context of a developing country.

In the next section, we present the background context to the intervention (situational analysis). In Section 3, we present the preparedness programme and the theory of change. Data and the baseline descriptive statistics are presented in Section 4, in addition to the evaluation design and estimation strategy. This section discusses the random assignment into the programme and presents the descriptive statistics for the baseline covariates. Results are outlined in Section 5 and the conclusion is presented in Section 6, followed by a section on specific findings for policy and practice.

2. Background: Situational analysis before the intervention

According to the Multidimensional Poverty Index, 45 per cent of Pakistan's population lived in poverty with high rates of child mortality, low levels of schooling, and disadvantaged housing conditions in 2017. Poverty rates in rural Pakistan are twice as high as in the urban areas. Only half of the population in the rural areas has access to basic improved sanitation (Oxford Poverty and Human Development Initiative 2017) and one third uses improved and safely managed water supplies (WHO and UNICEF 2015).

Pakistan is also among the most disaster-prone countries in the world, and is recurrently hit by cyclones, floods, earthquakes and droughts. The most devastating natural hazards in the past decades were the floods in 2010 and 2011. The 2010 flood caused 69,000km^2 of Pakistan's most fertile cropland to submerge, killing 200,000 livestock and washing away massive amounts of grain, causing long-term food shortage. Additionally, the ILO (2010) report estimated that the flood resulted in a loss of 53 million jobs in total. The flood in 2011 had similar disastrous effects, deluging 27,581km^2 of land within a period of only two months, forcing over 8.9 million people to leave their homes. As a consequence, health risks dramatically increased due to lack of shelter and safe water, food insecurity and poor sanitation, and many health facilities were damaged or destroyed (WHO 2010).

In order to implement the activities, ACTED selected areas that have been heavily affected by disasters in the past, and which have not fully recovered from the massive 2010 and 2011 floods, and thus were in dire need of humanitarian assistance. ACTED chose two vulnerable districts of Sindh: Badin in South Sindh, and Kashmore in North Sindh. In Kashmore and Badin, more than 2.5 million people were affected by the 2011 floods, which resulted in destruction of 347,000 shelters and over 775,000 acres of degraded land (USAID 2014a; USAID 2014b). When miles of farmlands are flooded, food supply goes down and prices go up, which is how natural disasters are linked to chronic malnutrition. In Sindh, the incidence of food insecurity increased sharply. Moreover, almost three million houses were damaged or destroyed by the floods in Pakistan, resulting in the displacement of millions of people and high demand for emergency and recovery assistance (UN OCHA 2011).

3. Humanitarian aid interventions

3.1 Intervention

This section describes the activities implemented under the intervention of this study. The programme was implemented by ACTED, an international NGO. ACTED has been present in Pakistan since 1993 and has become a leading relief and development aid provider in the country.[6]

The evaluated programme is called ‘Responding to Natural Disasters in Pakistan 2015–2019’. This multi-year humanitarian programme focuses on natural disaster preparedness, response and recovery. It is implemented as part of a consortium of

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[6] ACTED's main goals are delivering integrated, multi-sectoral relief and immediate recovery to households in the aftermath of an emergency, as well as strengthening communities' capacity to manage and reduce risks and increase their resilience for the future. Besides disaster preparedness and emergency response, ACTED is mainly engaged in delivering programmes focusing on the rehabilitation and construction of infrastructure such as shelter, sustainable energy development, livelihood support, agricultural development, education, vocational training and WASH (ACTED 2016). Some of these activities are also the main components of the programme we are evaluating.

NGOs under the official name "Consortium for natural disaster preparedness, response and recovery in Pakistan". The programme officially started on 7 August 2015 and is expected to end on 7 August 2019. Following an initial eligibility assessment, the delivery of activities on the ground started in March 2016. The impact evaluation under discussion focuses on the first phase (the first year of the four-year cycle) of the project, and more specifically on the residual recovery intervention implemented by ACTED in North and South Sindh.[7]

ACTED's main intervention, BHP, was composed of three independent components: WASH, shelter and FSL. A treated cluster received either all three components, only some of them, or none of them. The content of the activities was determined by ACTED following its needs assessment and an attempt to deliver the activities comprehensively.[8]

The programme adopted a proactive approach through residual recovery activities geared towards building communities that are more resilient. According to its theory of change, WASH activities were supposed to improve health by decreasing community members' exposure to infectious diseases. The goal was to induce behavioural change in sanitation and hygiene practices and to provide access to improved facilities and water sources. Shelter activities included beneficiary-driven design and construction, supported by technical training events and mentoring in the field. The activities were expected to translate as direct output into the availability of more resilient shelters and basic knowledge of rebuilding shelters in case of future natural disasters and extreme weather events.

FSL activities aimed to provide food security by supporting agriculture-productive activities during or after a disaster. The provision of seeds that resist floods or can be harvested earlier, food storage, and local vegetable production were envisioned not only to prevent hunger and lack of resources during emergencies, but also to enable communities to start working in a less risky environment with more stable returns. This in turn was thought to promote further investment in agricultural activities, possibly increasing the production equilibrium level in the community itself and raising nutrition levels with it. In the following sections, we describe the intervention's activities in detail. To do so, we combine the programme description with monitoring data on implementation progress collected a few months after the onset of the interventions (by end of August 2016). Figure 1 displays monitoring results based on ACTED's internal monitoring data.

Water, sanitation and hygiene (WASH). The WASH component of the integrated recovery package is modelled after the 'Pakistan approach to total sanitation' policy, which promotes a 'community-led total sanitation' approach. It supports community mobilisation to construct their own household latrines. The idea is that through the creation of demand within communities and support for supply interventions, communities become free of open defecation. This approach includes subsidy support for the most vulnerable in the form of demonstration latrines and the distribution of a 'latrine/sanitation kit' that provides the key materials needed to build a latrine for those

[7] The programme was rolled out to the control areas after the endline.
[8] The BHP could not be delivered to some clusters that were intended to receive one or more components due to budget constraints towards the end of the implementation.

deemed vulnerable. Support for rehabilitation of water supply schemes in these communities is also part of the programme and is based on the exact needs of the localities. The intervention also includes support for behavioural change related to improved hygiene practices and options for household treatment of water (distribution of water filters to some beneficiaries).

In fact, 47 per cent (73 clusters out of all 148 treatment clusters) received at least one of the above-mentioned WASH intervention measures. The number of community-led sanitation training events per cluster ranges from 0 to 94 per cluster. Treated households received latrine/sanitation kits to build their own latrines with up to 16 latrine kits per cluster of treatment villages. Further, ACTED installed up to 20 bio-sand water filters for clean water (per cluster) and was involved in hand pump rehabilitation (i.e. repairing hand pumps for access to clean water accompanied by the instalment of new hand pumps). The rehabilitation of hand pumps took place in 27 different clusters (18 per cent of all eligible clusters) by the time of observation, which was a few months after the onset of the interventions (by end of August 2016).

Shelter and non-food item assistance. Beneficiary households have been supported to integrate DRR practices into shelter construction in a way that aims to strengthen resilience to local hazards. Strong emphasis was placed on beneficiary-driven design and construction, supported by technical training events and mentoring in the field. Some of the most vulnerable beneficiary households received conditional cash support, in addition to shelter repair and shelter tool kits, to support payment for construction labour. In flood-prone areas, examples of DRR techniques include: raising plinths, reinforcing the base of the wall with a mud 'toe', using a mud-lime combination to plaster walls, corner bracing, and constructing lighter roofs. Targeted households included those that suffered from disasters in the past (mostly during 2010-2011 floods) and are still in need of shelter rehabilitation or construction. These households received shelter repair kits as well as shelter construction training by technical staff. At least one shelter intervention measure was provided for 71 per cent, or 109 clusters out of 148 treatment clusters, with up to 66 constructed shelters per cluster. The training events were conducted in local languages and included information, education and communication material distribution, including a pictorial booklet to ensure easy comprehension of those who cannot read. The purpose of these training events was to raise awareness among communities on the prevailing hazards in their areas and how to mitigate their impacts.

FSL support. ACTED's FSL activities involved training on agriculture, water, livestock management and livestock vaccination. Agriculture and water management training events aimed to build the capacity of farmers by organising them into water user groups. A quick demonstration of improved farm, crop and water management techniques was taught to the beneficiaries. In addition, livestock training aimed at providing essential knowledge and skills was delivered to communities that own livestock so that they are able to cope with calamity and minimise livestock losses through proper mitigation and preparedness. The training specifically covered different types of livestock emergencies and risks, planning, distribution of inputs in disaster-hit areas, and handling disease outbreak.

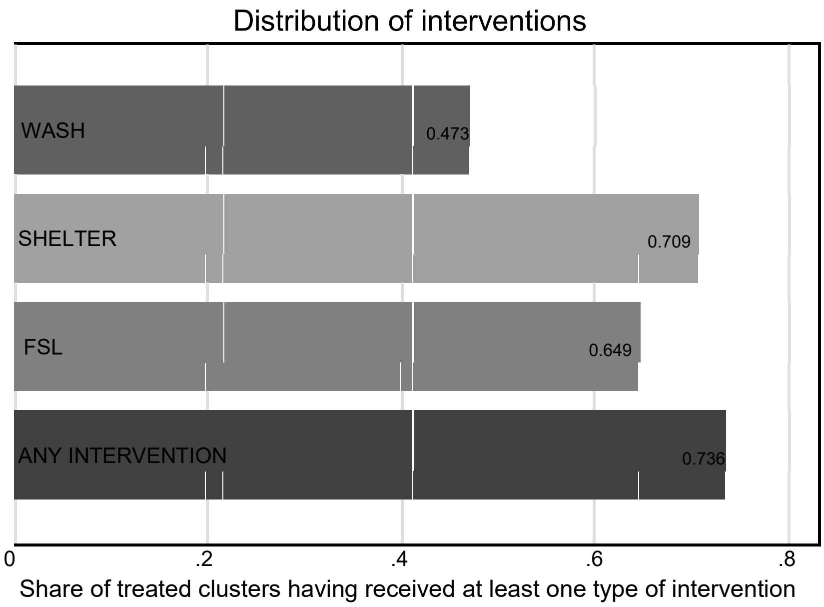
Moreover, seeds and other agriculture inputs were distributed to a limited number of households. Others also benefited from kitchen gardening training, which was conducted in the local language and included information, education and communication material distribution and a pictorial booklet. On the cluster level, 65 per cent (100 clusters out of all 148 treatment clusters) experienced at least one FSL intervention measure. Among these clusters, up to 94 households per cluster received agricultural training. ACTED also provided training in permaculture and distributed the requisite plants in five clusters.

In addition, ACTED implemented "cash for work" activities, which were expected to generate income for recovery while reviving livelihoods. They aimed to increase selected households' access to cash through short-term livelihood support while being engaged in a cash-generating and community-benefiting activity. Cash for work was provided to rehabilitate or construct irrigation channels, drainage lines, stoves and river filters. The main intention was primarily to improve village-wide living conditions and livelihoods infrastructure, in addition to offering income and stimulating the local economy.

Figure 1 presents monitoring information from ACTED's internal data source for the 148 implementation areas. In 73.6 per cent of the treatment areas, at least one of the above-mentioned interventions took place. The majority of areas received at least one shelter intervention.

By reviewing the implementation plans under BHP, such as the training modules for the beneficiaries and check-lists for reconstruction and recovery activities, we (ex-ante) defined a set of outcomes which would be expected to change. We will capture these as intermediate outcomes. All components together are believed to increase overall preparedness to extreme weather events. Some of the activities address remaining needs from extreme weather events occurring in the past (i.e. recovery activities); other aspects, however, specifically aim to better prepare villagers for extreme weather events in the future.

Figure 1: BHP component delivery in treatment areas



Note: Figure 1 shows monitoring results from ACTED's internal data-source (by the end of August 2016). The Figure shows how many of the 148 treatment clusters received each intervention component, respectively.

Refresher trainings. After the core design was implemented, the treatment group was further split into four groups in order to test the idea that additional personal training could improve knowledge on WASH-, shelter- and FSL-related topics. We selected three treatment refresher groups and one control group, where the BHP was implemented but no further refreshers were introduced. That is, in BHP villages we randomly assigned additional 'refresher' training events to some clusters. According to our monitoring data, 78 out of 148 treatment clusters did not receive the WASH component of the BHP and 70 clusters did receive it. Out of these 70 clusters, 26 did not receive any refresher, 13 received a WASH refresher, 16 received a shelter refresher, and 15 received an FSL refresher. By design, 30 refreshers of each type were delivered. This implies that 30 - 13 = 17 clusters received a WASH refresher but no previous WASH intervention (i.e. the refresher acted as first-time training). The 'shelter component' and 'FSL component' rows are read analogously. Note that the three components are not mutually exclusive: most treatments received more than one component. The goal of these additional packages was to reinforce and transmit key messages regarding WASH, shelter or FSL. In further analysis, we address two main questions: (1) Does reinforcing key training messages via additional refresher training events increase the benefits of the main intervention? and (2) What are the individual effects of the WASH, shelter and FSL refresher intervention components, respectively?

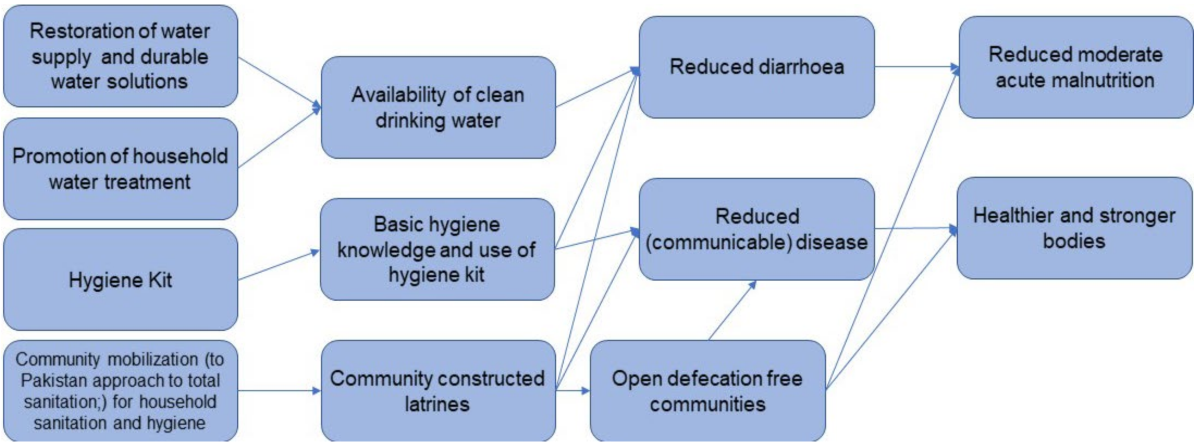
Our results provide the first signs that the refreshers training events may support behavioural change. We find significant effects for some intermediate outcomes. For example, receiving any refresher training shows a highly significant effect on one outcome only. In clusters that received a refresher, 7.2 percentage points more households use (only) latrines (significant at the 1 per cent level). Two further WASH outcomes are significant at the 5 per cent level. However, these results are not robust enough for definite conclusions. This is partly due to the short duration of the refresher sessions and the small number of clusters as compared to the BHP. Testing the refreshers in larger samples could potentially detect further and more robust effects.

3.2 Theory of change

This section presents the theory of change (Figure 2) that joins ACTED's actions to impact, particularly addressing the underlying causes of vulnerability and malnutrition.

WASH theory of change. WASH activities are expected to improve population health and nutrition status by decreasing the exposure of community members to infectious diseases. They are supposed to improve access to improved water and sanitation facilities and induce a change in hygiene behaviour, including better hand washing and less open defecation. Direct outputs of WASH activities are the availability of clean drinking water, hygiene knowledge, utilisation of hygiene kits and better access to improved community sanitary facilities. These results are expected to reduce the spread of communicable diseases and in particular lower the incidence of diarrhoea. Diarrhoea is particularly harmful to the growth and development of children because it deprives their bodies of macro- and micro-nutrients. Constant exposure to faecal bacteria due to lack of sanitation facilities, sub-optimal waste disposal, and poor hygiene behaviour can further lead to environmental enteropathy, which inhibits the absorption of nutrients in the intestine.

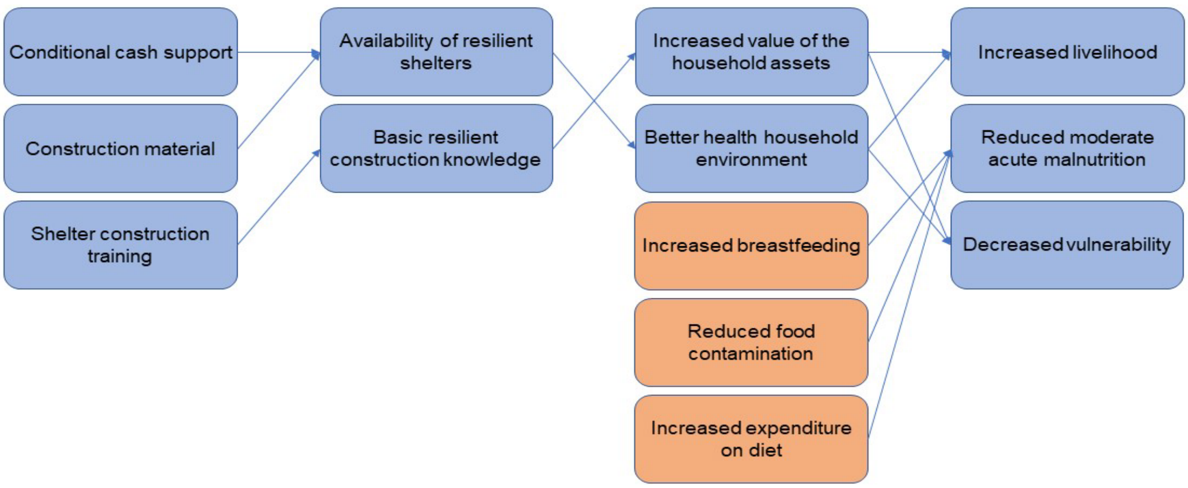
Figure 2: Theory of Change, WASH



Shelter theory of change. Shelter activities are directed to reduce household vulnerability to shocks, improve health outcomes, increase livelihoods by creating a safer and more stable housing environment, and protect durable assets. They are tailored to the needs of beneficiaries and supported by technical training and mentoring in the field. Some beneficiary households receive conditional cash support or materials to enable construction. In flood-prone areas, DRR techniques such as raising plinths, reinforcing the base of the wall with a mud 'toe', using a mud-lime combination to plaster walls, corner bracing and construction of lighter roofs are encouraged. In treatment areas, households that have suffered from past disasters and are still in need of shelter receive shelter repair kits and shelter construction training by technical staff. The most vulnerable households who cannot participate in their own shelter construction receive grants to pay for skilled labour to build or rehabilitate their shelter.

This translates as direct output into the availability of more resilient shelters and basic knowledge on how to rebuild shelters in case of future natural disaster. The expected outcome (Figure 3) is the increased value of assets and safe housing that protects households from health and disaster hazards. Improved housing conditions can affect safety in food preparation, lower exposure to soil-borne and animal-transmitted diseases (Headey and Hirvonen 2016). This leads to improved overall nutrition. Together with more resilient shelters, this decreases the vulnerability of households to shocks.

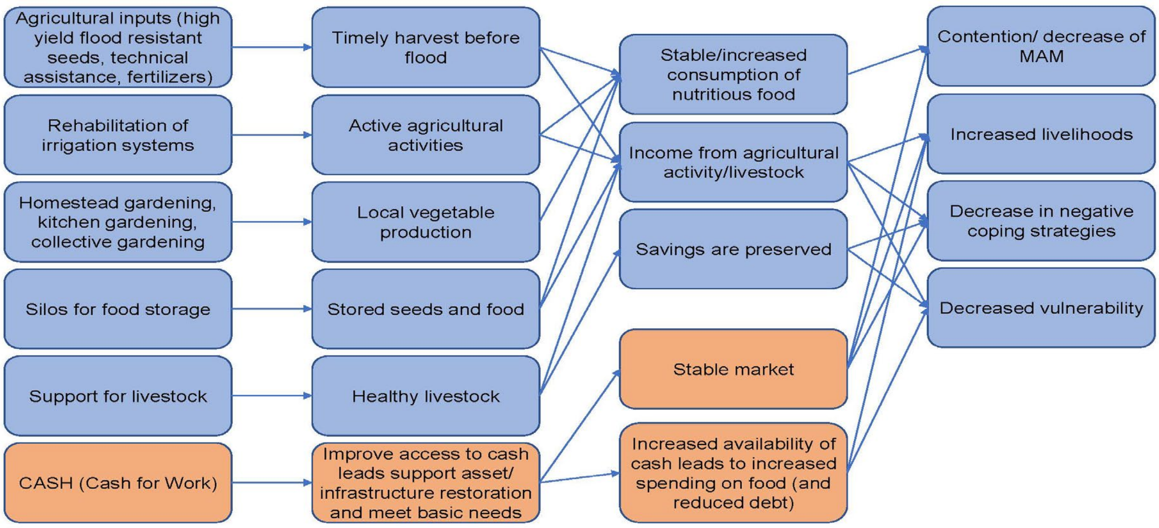
Figure 3: Theory of change, shelter



Food security and livelihoods theory of change. FSL activities are meant to provide food security to households by supporting and improving home-based food production through agricultural activities (Figure 4). The provision of seeds that resist floods or can be harvested earlier, food storage, and local vegetable production do not only prevent hunger and lack of resources during emergencies, but also enable communities to start working in a less risky environment with less risky returns. This, in turn, promotes further investment in agriculture activities, possibly increasing the production equilibrium level in the community and with-it raising nutrition levels.

Altogether, the activities stabilise food consumption and income and prevent the depletion of productive assets. This is expected to contain or decrease moderate acute malnutrition, increased livelihoods, and lead to a decrease in negative coping mechanisms and vulnerability to possible shocks in the future. This is particularly true for livestock, which in many cases comprise a household's lifelong savings and can be used to smooth consumption in times of need. Moreover, healthy livestock facilitates agricultural activities, increases agricultural productivity and provides a source of nutritious foods.

Figure 4: Theory of change, food security and livelihoods



4. Baseline data collection and randomisation

Study area. ACTED aimed to implement BHP activities in areas that were in need of humanitarian aid after being heavily affected by disasters, and had not yet fully recovered from the 2010 and 2011 floods. Two vulnerable districts of Sindh — Badin in South Sindh, and Kashmore in North Sindh — were identified for this purpose.[9]

The sampling of the study followed a two-stage procedure. First, ACTED carried out a needs-based assessment in 400 randomly selected sub-villages at risk (*goath* in Sindhi) in Badin and Kashmore in November and December 2015, interviewing 4,000

[9] The two districts were identified based on the past occurrence of natural disasters and affected population over the period of 2005 to 2015. To do so, a wide source of secondary information was employed.

households. Additionally, 400 focus group discussions (FGDs) were conducted wherein, on average, 10 participants were asked about the situation in their village. The FGDs consisted of mixed groups of villagers with respect to age, occupation, etc., who jointly discussed the questions. The baseline data collection was performed in Taluka Tando Bago in Badin and Taluka Kandhkot and Tangwani in Kashmore.

Following this sampling, we defined 301 clusters as the main units of our analysis in order to prevent possible spillover effects between sub-villages. Clusters were geographically distant units of sub-villages. In other words, sub-villages that were eligible for the programme but too close to each other were merged into one cluster. About 1.3 sub-villages comprised one cluster, ranging from one to three sub-villages per cluster. After eliminating non-eligible clusters, 287 clusters were found eligible.[10] Thus, in each of the clusters, about 15 households were interviewed and at least one FGD was carried out. Households were selected randomly based only on the criteria of having children under five years of age. Programme implementation was at the cluster level (i.e. if a cluster was selected for the BHP, all sub-villages were eligible to receive the treatment). The following paragraphs describe how, using the eligible pool of 287 clusters, we selected the treatment (or BHP-assigned) clusters.[11]

Table 1 presents summary statistics of the clusters and households before the programme was rolled out. There are 287 clusters of sub-villages in the sample with an average size of 60 households per cluster. The baseline data consists of 3,841 household interviews and 384 interviews in which 10 community representatives provided responses (we refer to them as FGDs). All variables presented in these tables were used for randomisation and will serve as control variables X_i. A more detailed description of the variables can be found in Appendix A.

Between 2010 and 2015, clusters were affected on average by 1.72 disasters. Out-migration compared to in-migration was high with an average of 183 people moving out of the clusters and only 10 moving into the clusters. Every second household reported having lost employment opportunities due to disasters. More than half of the clusters were recipients of aid between 2000 and 2015. We have on average 1.09 clusters in which link roads needed for agriculture were not rehabilitated.

WASH variables indicate a low level of sanitary standards. Three quarters of the households do not use soap when washing their hands and 80 per cent of the households have no access to latrines. This is also observable in a substantial share of households with at least one member having diarrhoea, whereby every fifth household seemed to have been affected at baseline. The number of shelters destroyed documents

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[10] Eligibility for the programme was defined following a summary index for need at the village-level, jointly developed with ACTED.

[11] In more detail, nearby sub-villages were joined into "clusters". The final clusters consist of one, two or three sub-villages. In the final dataset there are 301 clusters. Of these clusters, the 5 percent of least-needy clusters were taken out, since funding constraints of ACTED did not permit implementation of activities in all villages. The 95% percentile of the total poverty score was about 34.5, such that all villages with scores above were deleted from the following process. After deleting the least-needy villages, the number of remaining clusters is 287, with 145 clusters in Badin and 142 clusters in Kashmore. These clusters contain in total 384 sub-villages, with 194 sub-villages in Badin and 190 sub-villages in Kashmore.

that most of the damage was done in the years 2010 to 2012 with 51%, 52% and 48% of shelters destroyed in the years of the great floods and immediately after. From 2013 to 2015 only 1%, 1.7% and 11% of shelters were destroyed.

At baseline, the FSL variables indicate a difficult food security and livelihood environment. A total of 42% of households at baseline display a poor or borderline food consumption score and 55% have problems covering their food needs. This is also reflected in the poor state of nutrition of the sample children: 42% of children are underweight based on their weight-for-age, and 24% underweight according to their mid-upper arm circumference. Stunting rates are even higher at 49%, pointing to long-term undernourishment. Furthermore, the share of households with access to a malnutrition programme is 32%. Overall, these numbers coincide with secondary data reports on the situation in the aftermath of the disasters.[12]

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[12] 72 per cent of the population in Sindh suffered from food insecurity, with global acute malnutrition rates of 17.5 per cent among children under five — (well above the WHO critical threshold of 15%) — and over one million children acutely malnourished (Bhutta 2011). In addition, up to three quarters of women and children were experiencing one or more micro-nutrient deficiencies. The most widespread micro-nutrient deficiencies include iron deficiency, anaemia, vitamin A deficiency, and zinc deficiencies. According to demographic and health survey data collected in 2012 and 2013 (NIPS/ICFInternational 2013), 45% of children under the age of five years were stunted, 11% were wasted and 30% were underweight. These figures are even higher for rural areas. In this setting, interventions that target areas that are constantly under pressure from natural disasters are crucial to prevent degradation of their already fragile situation. Sindh appears to be the poorest and most food-deprived province. According to the 2011 National Nutrition Survey only 28% of households were food secure (Bhutta 2011), and in rural Sindh 48% of the children are underweight (weight-for-age, percentage below -2 standard deviations]) compared to 29% in rural Punjab, according to the demographic and health survey 2012 to 2013 (NIPS/ICF International 2013).

Table 1: Treatment and control group balance statistics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Mean	SD	Median	Min	Max	Mean	Mean	***Diff/SE***
	All					T	C	
Exposure to and Consequences of Past Natural Disasters								
Number of times a cluster was affected by disasters since 2010	**1.72**	0.48	2	0	3	1.696	1.737	**-0.04(0.06)**
Number of persons that migrated out of the cluster	**183.1**	291.9	79	0	3000	187.142	178.878	**8.26 (34.53)**
Number of persons that migrated into the cluster	**10.3**	43.6	0	0	600	10.020	10.691	**-0.67(5.16)**
Share of HHs reporting employment opportunity loss as a reason	**0.51**	0.30	0.50	0	1	0.51	0.52	**-0.01(0.04)**
Cluster where link roads are not rehabilitated/reconstructed	**1.09**	1.63	0	0	4	1.05	1.14	**-0.09(0.19)**
Average number of HHs per cluster	**60.1**	57.4	45	16	500	60.10	60.13	**-0.03(6.79)**
Share of clusters receiving assistance in the past 5 years	**0.56**	0.46	0.50	0	1	0.54	0.58	**-0.04(0.06)**
WASH								
Share of people washing hands with water only	**0.73**	0.21	0.75	0	1	0.73	0.73	**0.00 (0.02)**
Share of HHs with no access to latrines	**0.80**	0.22	0.90	0	1	0.80	0.80	**-0.01(0.03)**
Share of respondents per village with no access to latrines	**0.84**	0.24	0.95	0	1	0.84	0.85	**-0.01(0.03)**
Average toilet score	**0.43**	0.57	0.20	0	3	0.44	0.42	**0.02(0.07)**
Share of HHs with at least one HH member with diarrhoea in the past 15 days	**0.22**	0.18	0.20	0	0.9	22.68	21.82	**0.86(2.10)**
Shelter								
Share of shelters destroyed in 2010	**0.51**	0.48	0.50	0	1	0.50	0.52	**-0.03(0.06)**
Share of shelters destroyed in 2011	**0.52**	0.50	1	0	1	0.52	0.52	**-0.01(0.06)**
Share of shelters destroyed in 2012	**0.48**	0.48	0.50	0	1	0.48	0.48	**0.00(0.06)**
Share of shelters destroyed in 2013	**0.01**	0.091	0	0	1	0.01	0.01	**0.01(0.01)**
Share of shelters destroyed in 2014	**0.02**	0.11	0	0	1	0.02	0.02	**-0.00(0.01)**
Share of shelters destroyed in 2015	**0.11**	0.29	0	0	1	0.11	0.10	**0.01 (0.03)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Mean	SD	Median	Min	Max	Mean	Mean	***Diff/SE***
	All					T	C	
FSL								
Share of HHs with poor or borderline food consumption score	**0.63**	0.25	0.67	0	1	0.62	0.64	**-0.02(0.03)**
Share of HHs with problems covering their food needs	**0.55**	0.27	0.60	0	1	0.53	0.56	**-0.03(0.03)**
Share of HHs that have own land	**0.26**	0.25	0.20	0	1	0.26	0.25	**0.02(0.03)**
Average size of own land	**0.85**	1.13	0.55	0	8.50	0.89	0.80	**0.08(0.13)**
Share of HHs that own livestock	**0.71**	0.25	0.80	0	1	0.72	0.71	**0.01 (0.03)**
Share of HHs with at least one buffalo	**0.41**	0.28	0.40	0	1	0.41	0.46	**0.00(0.03)**
Nutritional Status								
Share of moderate or severely underweight children per cluster (WAZ)	**0.42**	0.15	0.41	0	0.87	0.41	0.42	**-0.01(0.02)**
Share of moderately or severely stunted children per cluster	**0.49**	0.15	0.49	0	0.92	0.50	0.49	**0.01(0.02)**
Share of moderately or severely underweight children per cluster (BMI)	**0.12**	0.09	0.11	0	0.38	0.12	0.13	**-0.01(0.01)**
Share of moderate or severe: Arm circumference-for-age z-score (middle upper arm circumference)	**0.24**	0.12	0.23	0	0.64	0.24	0.24	**0.01(0.02)**
Share of HHs with access to a nutrition programme	**0.32**	0.40	0	0	1	0.30	0.34	**-0.04(0.05)**
Household Characteristics								
Average number of HH members	**7.79**	1.56	7.50	5	12.80	7.91	7.65	**0.26(0.18)**
Average age of respondent	**36.6**	4.03	36.1	28	47.70	36.44	36.72	**-0.27(0.48)**
Average number of rooms per person	**0.19**	0.04	0.18	0	0.34	0.19	0.18	**0.00(0.00)**
Share of non-educated HH heads	**0.62**	0.21	0.60	0	1	0.61	0.63	**-0.02(0.02)**
Share of HHs with all children attending school	**0.38**	0.19	0.35	0	1	0.37	0.38	**-0.01(0.02)**
Average poverty score	**18.6**	5.33	17.7	8	38	18.68	18.60	**0.08(0.63)**
Median monthly HH income	**7746.7**	2562.2	7250	3000	17500	7706.25	7789.75	**-83.50(303.12)**
Share of HHs with air conditioner	**0.01**	0.043	0	0	0.30	0.01	0.01	**0.00(0.01)**
Share of HHs with cooking stove	**0.06**	0.18	0	0	1	0.06	0.07	**-0.01(0.02)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Mean	SD	Median	Min	Max	Mean	Mean	***Diff/SE***
	All					T	C	
Share of HHs with vehicle	**0.09**	0.14	0	0	0.90	0.09	0.09	**-0.00(0.02)**
Share of HHs with TV	**0.09**	0.11	0.05	0	0.50	0.09	0.09	**-0.00(0.01)**
Further Variables	**2.85**							
Average number of HH members in productive age		0.74	2.60	2	6.10	2.90	2.79	**0.11(0.08)**
Share of HHs with a refrigerator, freezer or washing machine	**0.05**	0.10	0	0	0.60	0.05	0.05	**-0.00(0.01)**
Average eligibility score across all categories	**24.6**	4.94	25	9	34	24.66	24.63	**0.03(0.58)**
Share of HHs reporting health setback caused by violence as a consequence	**0.06**	0.11	0	0	0.80	0.06	0.06	**0.01(0.01)**

Note: SD = standard deviation; BMI = body mass index. Table 1 documents the baseline variables used for randomisation.

Column (1) reports the mean for the full sample, followed by the standard deviation, median, min and max values in the dataset. Column (6) reports the mean for the BHP group, column (7) for the control group, column (8) the corresponding T-test.

Sample: n=287 clusters. Collected in 2015. Information based on HH and FGD interviews.

All variables are described in detail in Appendix A.

The household characteristics show that a household in our sample has on average about eight members, with the household representative respondent being on average 36.6 years old. On average, five people share one room. Overall education levels are low: 62 per cent of household heads are uneducated and only 38 per cent of households have all children attending school. Twenty-six per cent of households own land. With only 0.85 acres on average, the size of the land is rather small. However, 71 per cent own their own livestock. With a poverty score that indicates below 12 as being ultra-poor and above 50 as being not poor, an average of 18.1 shows that the majority of households are rather poor. This is verified by the average median monthly household income of 7,746.7 Pakistani rupees, which was about 72 US dollars in November 2015. The average number of household members in productive age is about three, which, given the household sizes, points to a rather high dependency ratio (adult-to-child ratio). The average eligibility score to the programme is 24.6. Finally, the share of households reporting violence as a setback of disaster is 6.2 per cent.

The last three columns of Table 1 indicate whether there are any statistical differences in means between treatment and control group. However, we find no such differences.

Randomisation. We employ a cluster randomised controlled trial design. The benefit of randomisation is that, given a large enough sample size, both groups will be on average similar in both observable and unobservable characteristics, and any post-intervention difference can thus be causally attributed to the intervention.

Randomisation was carried out at the cluster level using a re-randomisation procedure. We randomly allocated clusters of villages into a control and a treatment group (i.e. 148 clusters were randomly allocated to receive at least one of the BHP components). The other 139 clusters were allocated into the control group. Within the treatment group, the WASH, shelter and FSL interventions were not randomly assigned to clusters.

The main objectives of the randomisation protocol were: (1) to attain balance between treatment and control groups on selected variables (discussed previously); (2) possibility of randomisation inference; (3) to ensure that approximately 100 sub-villages are treated in each of the two districts (Kashmore and Badin); (4) to ensure the same number of similar treatment arms in both districts; and (5) to ensure that nearby sub-villages have the same treatment status (that is why randomised assignment referred to village-clusters).

Randomisation into treatment and control clusters was carried out with the help of the baseline data, ensuring balance between treatment and control groups. The baseline data helped us to ensure that before the onset of the BHP implementation, treatment and control clusters were comparable across a wide range of characteristics. Therefore, changes in outcomes in the aftermath of the randomisation can be more credibly causally attributed to the programme itself and not to other potential influences (such as other NGOs or general time trends).

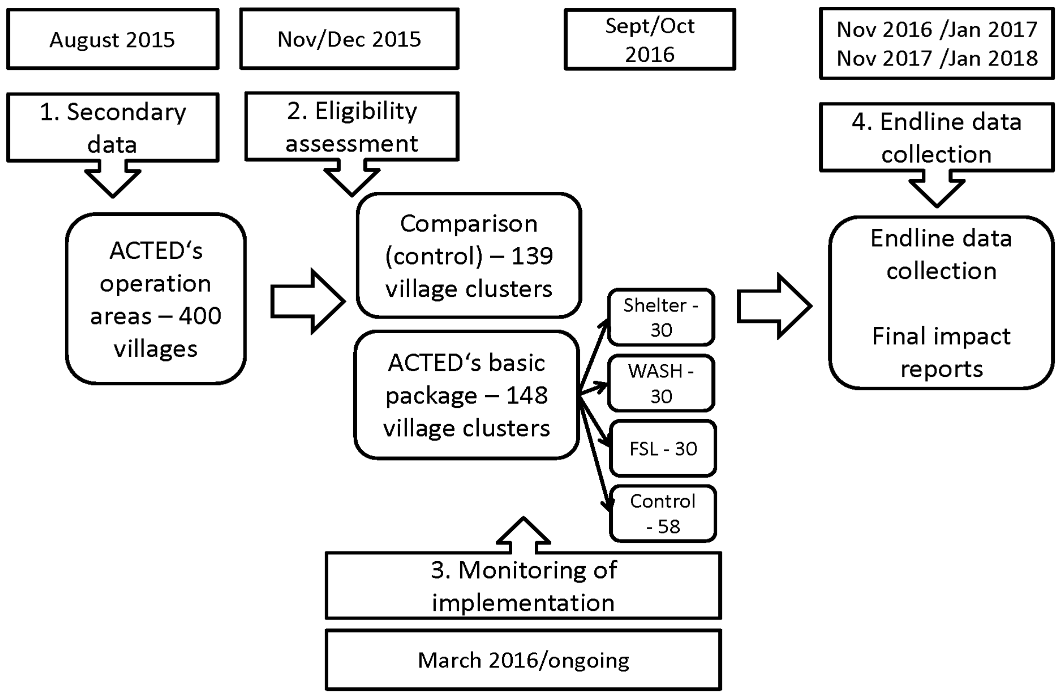
Before the programme started, we compared treatment and control clusters with regard to their past exposure to extreme weather events, their need for assistance, hygiene, health status, nutritional status, availability of productive assets and several other household characteristics. As expected, there are no significant differences for any variable between the BHP treatment group and the control group at baseline.

Additional variables. Based on ACTED's internal monitoring data in implementation (treatment) areas we define the variable, "any intervention received", which captures whether a cluster received at least one of the BHP components or not.[13] We also collected additional information at midline and endline, extending the baseline survey with new modules and questions. For example, reviewing the finalised plans for implementation, we defined a set of indicators that were monitored at midline and endline, as well as in the treatment and control group. These indicators were extracted from ACTED's training manuals and implementation guidelines for reconstruction and preparedness activities. An index was constructed by giving one point for each time the respondent or enumerator reports behaviour in line with the training (with a minimum of 0 and a maximum of *n*). Then this index was standardised so that the minimum is 0 and the maximum is 100. The final preparedness index was constructed by taking the average of the WASH, shelter and FSL indices. We will refer to these outcomes and indices as the intermediate outcomes. Again, Appendix A describes the construction of all indicators in detail.

4.1 Timeline

Figure 5 describes the timeline of the survey period, including the preparation phase. The assignment started in August 2015 with secondary data analysis on the area of operations of the ACTED programme. In November/December of the same year, 400 villages were assessed on their eligibility for the programme. The random assignment into the control and treatment groups took place in March 2016, followed by the implementation of BHP.

Figure 5: Timeline



[13] In the course of implementation, four clusters had to be shifted from the control to the treatment group.

Midline data collection took place between November 2016 and January 2017, when the BHP implementation was completed. Another wave of data collection (the endline data collection) was conducted between November 2017 and January 2018. In each wave, the same baseline households were revisited and re-interviewed. We have a very low attrition rate of 5.96 per cent (229 households) from midline to endline and a total attrition rate of 8.37 per cent (322 households) from baseline to endline.[14] Additionally, we refreshed our sample with 843 new randomly selected households at endline (approximately three per cluster).

4.2 Empirical strategy

Under the ideal setting of a randomised controlled trial, identifying the causal impact of treatment is rather straightforward. We can simply compare the outcome variables of interest for the BHP treatment and control group. Throughout we will estimate the combined effect of what ACTED refers to as a comprehensive approach to humanitarian aid. The clusters allocated into treatment received a BHP, which included WASH, shelter and FSL. In practice, this could mean that in some treatment clusters all three intervention packages were delivered, while in others only WASH or shelter or FSL, or even none of the activities took place. In general, the treatment activities were targeted according to need (following further need assessments conducted by ACTED). In other words, we are estimating an average treatment effect (ATE) of the BHP without disentangling the different effects that the three types of different interventions might have had individually.

Main specification. We construct a panel of clusters *i* (*i*= 1*, ...,* 287) that has two waves: *t* (*t = midline [2016], endline [2017]*). The unit of observation is hence the cluster, not the household. If not otherwise indicated, the number of observations is 574 (T=2 × n=287 clusters). In all regressions, we estimate the effect on variables that are averaged at the cluster level to account for the fact that the interventions took place at this level.[15] In all estimations, we control for the baseline covariates (*X*), which had been reported in the

[14] In more detail, out of 3,841 eligible households in the baseline sample, 3,660 households were re-interviewed during the midline data collection. This translates into 4.71 per cent attrition (181 households) from baseline to midline. At endline, data-collection supervisors were trained to follow a certain procedure of replacement. First, enumerators were supposed to look for baseline households to interview, regardless of their availability in the midline phase. If the enumerators could not interview the baseline household for any reason, enumerators were obliged to first check if there was a midline replacement household (out of 181). If there was no midline replacement household, only then were enumerators allowed to randomly select a new endline replacement household. At endline, 322 households were replacement households, consisting of 93 households that were already missing in midline and needed to be replaced again, and 229 households that were not missing at midline, but were missing at endline. This translates into an attrition rate of 5.96 per cent (229 households) from midline to endline and a total attrition rate of 8.37 per cent (322 households) from baseline to endline. The total attrition from baseline to endline is less than the sum of attrition from baseline to midline and from midline to endline, due to the fact that 88 of the 181 attrition households that were missing at midline were found again in endline.

[15] In more detail, we calculate cluster means as a simple mean over all sub-villages within one cluster without weighing villages by the number of households interviewed. The information at the village level stems from household interviews and FGDs.

previous section. Finally, we will report the results of the effects as intention-to-treat effects (ITTs) and local average treatment effects (LATEs). The obtained effects will represent a lower bound of the true effect, since we measure the effects at the cluster level, averaging results for households that were ACTED-beneficiaries and households that might have never been targeted for the household-level interventions.[16]

We distinguish two types of outcome variables: the intermediate (*M*) and the final (*Y*) ones. For the intermediate variables, we examine whether the interventions induced behavioural changes in the expected direction (towards more preparedness for weather shocks). That is, we look at a list of outcomes such as the share of households that only use a latrine, the share of waterproof shelters, and the share of households that take action to control livestock disease transmission, to name just a few. In addition, we test the impact on the so-called preparedness index described above. The final variables relate to the villagers' changes in socio-economic well-being, capturing changes in subjective well-being and perceptions, as well as changes in livestock ownership, income and debt. Finally, we look in more detail at outcomes such as food security, health, psychological well-being and coping strategies.

The estimation equations for the ITT take the following form:

$$M_{it}=\alpha_t+\beta_1 BHP_i+\mathbf{X}_i\delta+u_{it}, \qquad (1.1)$$

$$Yit = \alpha t + \beta 1BHPi + Xi\delta + uit, \qquad (1.2)$$

where M_{it} is an intermediate outcome of village cluster *i* (*i* = 1,.., 287) in wave *t* (*t* = *midline [2016], endline [2017]*), α_t are wave fixed effects, BHP_i is an indicator for being assigned to the BHP, and X_i is the vector of baseline covariates (all variables on which that treatment was randomised on at baseline).

BHP interventions were not delivered to all originally assigned clusters due to funding limitations. As discussed in Section 3.1, about two thirds of all originally assigned treatment areas received at least one BHP component. To consider the variation in actual implementation, we estimate the LATE. This is necessary as the actual implementation in certain clusters is likely to be related to the cluster characteristics and is hence no longer random. In a two-stage estimation procedure, we therefore first estimate the likelihood of receiving treatment based on the original treatment assignment and then estimate the treatment effect only for those clusters that received treatment. Intuitively, this procedure is similar to simply dividing the ITT-coefficient by 73.6 per cent, the share of clusters that were de facto treated.

Resilience. We also take into account possible interaction effects between exposure to a post-baseline extreme weather event that occurred in 2016, and the BHP. In other words, we investigate whether the BHP is particularly useful when a cluster is affected by an extreme weather event. To answer this question, we will first split our sample into a sub-sample in which an EWE was reported between baseline and endline data collection

[16] Within a treatment-assigned cluster, ACTED would establish community-wide interventions with potential benefits for a number of households. Other interventions, such as cash-for-work would be targeting most vulnerable households in actual need.

and a subsample where no such event was reported. The equation used for estimating the ITTs for the final outcomes (Y) is as follows:

$$Y_{i,t}=\alpha_t+\beta_1 BHP_i+\mathbf{X}_i^{10EWE}\delta+u_{it} \qquad \textit{if} \quad \text{EWE} = 1 \qquad (1.3)$$

$$Y_{i,t}=\alpha_t+\beta_1 BHP_i+\mathbf{X}_i^{10EWE}\delta+u_{it} \qquad \textit{if} \quad \text{EWE} = 0 \qquad (1.4)$$

where Y_{it} is a final outcome of village cluster i and BHP_i is an indicator for being assigned to the BHP. Given that the extreme weather event occurred only in South Sindh, we will restrict our analysis to the district of Badin only (i=145 clusters). We define a cluster as affected by an extreme weather event (EWE) if an event was reported between baseline and midline in at least one FGD sub-village interview *and* by at least one household in the same sub-village. Splitting this sample into EWE=1 and EWE=0 (i.e. areas that experienced EWEs and areas that did not) reduced the sample further to 68 [136] and 77 [154] clusters [observations], respectively. Overall, the probability of experiencing an EWE did not differ between treatment and control clusters. Still, given that the EWEs occurred after the randomisation, some baseline characteristics between the two groups might differ for these specific subsamples. The reduced sample size does not allow us to control for the full, long list of baseline covariates. We will, therefore, restrict the list to those ten variables ($\mathbf{X}_i^{10EWE}$) that at baseline had the largest imbalances between treatment and control areas in each of the two subsamples. Additionally, we will estimate the interaction effect directly on the whole sample in Badin (n = 145, N = 290 clusters) by interacting EWEs and BHPs:

$$Y_{i,t}=\alpha_t+\beta_1 BHP_i+\beta_2 EWE_i\times BHP_i+\beta_3 EWE_i+\mathbf{X}_i\delta 1+u_{it} \qquad (1.5)$$

where EWE_i is an indicator for being affected by an EWE before midline.

Finally, in all our estimations, we control (averaged) baseline variables reported in Table 1. Given that we observe the same clusters over three waves of data, standard errors are clustered at the cluster level. Note that we take into account the fact that we estimate impacts on a large set of outcome variables. Looking at 22 intermediate outcomes, and thus 22 hypotheses, the probability of finding a significant effect for at least one of the outcomes increased by 67.65 per cent. Furthermore, our outcome variables are correlated. Therefore, the 22 hypotheses are not fully independent. For this reason, we follow Gibson and colleagues (2011), who apply a Bonferroni adjustment that also adjusts for correlation between the outcome variables.[17] We use an alpha of 5 per cent and an inter-variable correlation of 0.14. For 22 intermediate outcomes, this yields a Bonferroni p-value of 0.0035; for the 11 final outcomes it is 0.0063. If we combine the intermediate and final variables, this leads to an adjusted p-value of 0.0025. Consequently, we indicate a further level of significance, namely **** which indicates $p < 0.001$. The choice is well above the Bonferroni threshold.[18]

[17] Without this correlation adjustment, the Bonferroni method would be too conservative in the face of correlated outcomes. A correlation of 0 means full Bonferroni adjustment, while a correlation of 1 means no adjustment.

[18] This holds even when ignoring the correlation between the tests. For 33 outcomes without correlation, the threshold's p-value would be 0.0015 for alpha = 5%.

Health-related outcomes. In addition to the main specifications of intermediate and final outcomes, we analyse outcomes such as food security, nutrition (with a focus on malnutrition), sets of diseases and coping strategies, whereby all outcomes were measured at all three waves. Additionally, we consider individual-level outcomes of PLWs such as commonly used measures of anxiety (using the generalised state-trait anxiety inventory scale and self-efficacy (using the GSE). To do so, we will look at outcomes for all PLWs over time in a balanced sample. We also take a closer look at anthropometric measurements of children who were at least six months old at baseline and yet no older than five years at endline. Here, we will present the results for a balanced sample, tracking the same children over time. Finally, we also evaluate disease patterns and anxiety levels, using information from questions on the number of times and days the child was ill in the previous month, types of diseases, treatment and anxiety levels of a child. Tables on health-related outcomes are presented in further analysis (available upon request); the main results are discussed below.

5. Results

In this section, we report the impact of the BHP on the outcome variables. We are interested in three overarching research questions: Do humanitarian interventions prepare individuals better for emergencies? Can the BHP improve life quality, regardless of whether a disaster occurred? Are households in BHP areas more resilient when weather shocks occur?

5.1 Main specification

We present the main results in Table 2 and Table 3 as follows: Each row shows the label of an outcome variable on the left, the ITT-coefficient of the BHP in column (4) and the corresponding LATE-coefficient of the BHP in column (6). Additionally, we report the mean value of the respective intermediate outcome for the control group in column (1), followed by the standard deviation in column (2). If not indicated otherwise, the number of observations in the regressions is 574 ($T = 2 \times n = 287$ clusters). Moreover, column (7) shows the effect size of BHP relative to the control group mean($\frac{|LATE|}{MEAN_c} \times 100$).

Intermediate outcomes (preparedness). Here, we report the estimation results of equation 1.1. Since the BHP has three major components (WASH, shelter and FSL), we group the intermediate outcomes accordingly. The upper part of the tables shows whether BHP changed WASH-related behaviour. The upper-middle part of the table presents changes in shelter outcomes, followed by FSL-related outcomes. Finally, we aggregate all outcomes into four indices at the bottom of the table, including a WASH-, shelter- and FSL-related outcome index and a summary index across all outcomes which we refer to as the “mean overall preparedness index”.

Overall, the BHP improves intermediate outcomes across all three domains. The impact on the WASH, shelter and summary preparedness index is statistically significant after the multiple hypotheses testing adjustment.

The impact on the WASH index is driven by the strong effect on hand washing and access to latrines. The BHP increases the share of households that report washing their hands correctly by 5.0 percentage points, a practice only 8.5 per cent of households adhere to in the absence of treatment. The LATE is unsurprisingly larger than the ITT effect, with a coefficient of 7.1 percentage points. This is equivalent to an 83.5 per cent increase compared to the control group mean. The share of households that only use latrines increases by 8 percentage points, from a control group mean of 26.2 per cent. We do not find any robust significant impact on water treatment and waste disposal.

The BHP also has a significant effect on shelter-related intermediate outcomes: the share of shelters constructed on an elevation increases by 9.8 percentage points (LATE is 13.9 percentage points, equivalent to 26.8 per cent; the share with a strong foundation increases by 7.8 percentage points; and the share of waterproof shelters increases by 11.8 percentage points). Moreover, the share of households that repair their shelter often and extensively increases by 4.8 percentage points. These treatment effects are also reflected in the shelter preparedness index in a village, which increases by 5.1 points from a control group mean of 37.6.

The FSL results are also indicative of an impact, although their significance level is not below the multiple hypotheses testing threshold. In particular, with a 5 per cent level of significance, we find that the share of households that take action to control livestock disease transmission increases by 4.4 percentage points. The share of households that are aware of the needs of their livestock increases by 3.8 percentage points. The summary index for FSL increases by 1.3 points, significant at the 5 per cent level of significance. The mean overall preparedness index in a cluster increases by 2.8 index points with respect to a control group mean of 39.4. Comparing the LATE to the control mean, this effect translates into 10.2 per cent.

To sum up, we find a positive treatment effect of the BHP on hygiene habits, adoption of DRR techniques learned, and, to a limited extent, improved knowledge on agricultural and livestock management methods. We observe a higher level of preparedness as set out by the ACTED programme. More than a year after the end of BHP implementation we observe a slight decrease in preparedness in both treatment and control clusters, yet the difference between the two (the effect of BHP) persists between midline and endline.[19]

[19] Additional results available upon request (please contact authors).

Table 2: Intermediate outcomes (M)

	(1) Mean (Control)	(2) *SD*	(3) *N*	**(4) BHP ITT**	(5) SE		**(6) BHP LATE**	(7) % Change
Share of HHs that have access to a safe water source	0.298	0.220	574	**0.052**	0.022	**	**0.074**	24.83
Share of HHs that have clean water containers	0.697	0.312	574	**0.023**	0.013	*	**0.033**	4.73
Share of HHs who correctly treat water	0.014	0.041	574	**0.008**	0.006		**0.011**	78.57
Share of HHs that drink safe water	0.003	0.017	574	**0.006**	0.005		**0.009**	300
Share of HHs that wash hands correctly	0.085	0.108	574	**0.050**	0.010	****	**0.071**	83.53
Share of HHs that only use a latrine	0.262	0.237	574	**0.080**	0.020	****	**0.114**	43.51
Share of HHs that correctly dispose of wastewater	0.135	0.168	574	**0.046**	0.014	***	**0.065**	48.15
Share of HHs that correctly dispose of solid waste	0.266	0.238	574	**-0.001**	0.018		**-0.001**	.38
Share of HHs that practice safe waste disposal	0.035	0.075	574	**0.008**	0.007		**0.012**	34.29
Share of shelters made of bricks and/or concrete	0.285	0.261	574	**0.013**	0.019		**0.019**	6.67
Share of shelters constructed in an elevation	0.519	0.250	574	**0.098**	0.021	****	**0.139**	26.78
Share of shelters with strong foundations	0.764	0.233	574	**0.078**	0.015	****	**0.111**	14.53
Share of shelters with a resilient structure	0.084	0.108	574	**-0.001**	0.008		**-0.002**	2.38
Share of waterproof shelters	0.074	0.110	574	**0.118**	0.015	****	**0.168**	227.03
Share of shelters that incorporate safety-improving construction techniques	0.006	0.037	574	**0.013**	0.004	***	**0.018**	300
Share of HHs who repair their shelter often and extensively	0.205	0.231	574	**0.048**	0.014	****	**0.068**	33.17
Share of shelters without observable damages	0.604	0.226	574	**0.079**	0.019	****	**0.113**	18.71
Share of HHs that use soil fertility techniques	0.563	0.261	574	**0.017**	0.020		**0.025**	4.44
Share of HHs that use water management techniques	0.116	0.152	574	**0.025**	0.012	**	**0.036**	31.03
Share of HHs that prefer bio-control agents to chemicals to control pests	0.035	0.076	574	**0.012**	0.006	*	**0.017**	48.57
Share of HHs that take action to control livestock disease transmission	0.399	0.226	574	**0.044**	0.018	**	**0.063**	15.79
Share of HHs that are aware of the needs of livestock	0.615	0.228	574	**0.038**	0.017	**	**0.055**	8.94

	(1) Mean (Control)	(2) *SD*	(3) *N*	**(4) BHP ITT**	(5) SE		**(6) BHP LATE**	(7) % Change
Mean WASH preparedness index	54.516	7.356	574	**2.079**	0.541	****	**2.954**	5.42
Mean SHELTER preparedness index	37.553	8.556	574	**5.057**	0.696	****	**7.183**	19.13
Mean FSL preparedness index	26.240	9.497	574	**1.319**	0.606	**	**1.873**	7.14
Mean OVERALL preparedness index	39.436	5.025	574	**2.818**	0.410	****	**4.003**	10.15

Note: Table 2 documents the outcome variables on the left and the treatment variables on the top. Sample: All clusters, *n* = 287, N = 574.

Columns (1)-(3): Average and standard deviation in the control group (counterfactual scenario). N is the number of observations ($T = 2 \times n$ = 287 clusters)

Column (4): Main estimation. Intention-to-treat effects*:* $M_{it} = \alpha_t + \beta_1 BHP_i + \boldsymbol{X}_i\delta + u_{it}$, where M_{it} is an intermediate outcome of cluster *i* (*i* = 1, ..., 287) in wave *t* (*t = midline [2016], endline [2017]*), α_t are wave fixed effects*,* BHP_i is an indicator for being assigned to the BHP, and X_i is the vector of *baseline covariates (all variables that treatment was randomised on at baseline from 2015). Same households are followed over time. Standard errors are clustered at the cluster level.*

Column (6): Same as column (4), estimating the local average treatment effect.

Column (7): Effect size of BHP relative to control group mean: $(\frac{|LATE|}{MEAN_c} \times 100)$

Related tables: The complete version of the reports contains a set of robustness checks for this specification.

The statistical significance is given as follows: * p < 0.1, ** p < 0.05, *** p < 0.01, **** indicates p < 0.001.

Final outcomes. The structure of Table 3 is analogue to Table 2 above. In column (1), we report the mean value of final outcomes for the control group and the effect of the treatment BHP in column (3). The upper part of the table reports subjective outcomes such as well-being, belief in the work of NGOs, and self-reported feeling of preparedness for future disasters or extreme weather events. The lower part of the table shows economic outcomes, such as observed damage to the shelters and agricultural and financial assets.

The share of households that report high or relatively high life satisfaction increases by 5.9 percentage points in BHP clusters. In the control group, 69.6 per cent report these levels. This corresponds to a LATE percentage change of 12.1 per cent. In treatment areas, the share of households that believe that NGOs do a good job is 5.6 percentage points higher than in the control areas. According to our findings on the increased preparedness index, an increased share of household representatives self-report that they feel prepared for a future disaster or extreme weather events (a 5.8 percentage point ITT-increase). This is a LATE-increase of 31.2 per cent compared to the control group. All effects are significant at the 0.1 per cent significance level.

When we take a closer look at the economic outcomes, we see that the share of shelters showing currently observable damages is 7.9 percentage points lower in BHP clusters.

Considering that not all treatment-assigned clusters actually received BHP interventions, the corresponding LATE captures an effect of 11.3 percentage points reduction in actual BHP implementation areas. Compared to the control mean, this is a reduction of 28.6 per cent. The change is highly significant at the 0.1 per cent significance level.

Being assigned to the BHP increases the share of households that own any livestock by 4.6 percentage points, up from 67.6 per cent, which is an effect significant at the 1 per cent level. The treatment increases the average number of buffaloes owned by a household by 0.08, from a control mean of an average of 0.86 buffaloes per household in a cluster. This effect is significant at the 10 per cent significance level. We observe no differences in the size of cultivated land, monthly income, debt, or savings levels across the treatment groups. Also, the share of poor households remains unchanged in BHP areas. Nevertheless, all monetary outcome variables point in the right direction, i.e. household income and savings have a positive coefficient sign, while debt and the share of poor in a cluster have a negative sign (yet the coefficients are not significant at a high significance level).[20]

In summary, we can constitute that the BHP had effects on outcomes that go beyond the effects we captured for pure output-oriented (intermediate) measures. Thus, changes in knowledge and safer shelters translated into higher levels of subjective well-being and a feeling of preparedness towards future negative shocks. Additionally, we observe some indications of more livestock.

[20] We further analysed whether the BHP increases investments in productive assets or decreases sales of productive assets. Moreover, we explore the possibility of crowding-out effects caused by ACTED's interventions. To do this, we look at investments and sales of productive assets. There are no significant impacts (at the 0.1 per cent significance level) of the BHP on investments or sales of productive assets. Only investments in crops seem to decrease by 2,058.86 Pakistani rupees (control mean is 8,310.66 Pakistani rupees), with a 5 per cent significance level. If this impact is considered to be true, it may give an indication of crowding-out effects on investments in crops. One possible interpretation for such an effect may be a decrease in the households' need to buy seeds, given that their provision was a component of the BHP intervention.

Table 3: Final Outcomes (Y)

	(1) Mean (Control)	(2) *SD*	(3) *N*	**(4) BHP ITT**	(5) SE		**(6) BHP LATE**	(7) % Change
Share of HHs with high life satisfaction	0.696	0.216	574	**0.059**	0.015	****	**0.084**	12.07
Share of HHs that believe that NGOs do a good job	0.853	0.174	568	**0.056**	0.013	****	**0.079**	9.26
Share of HHs feeling prepared for future disaster or EWE	0.266	0.203	574	**0.058**	0.016	****	**0.083**	31.2
Share of shelters with currently observable damages	0.396	0.226	574	**-0.079**	0.019	****	**-0.113**	28.54
Share of HHs that own any livestock	0.676	0.231	574	**0.046**	0.016	***	**0.065**	9.62
Average number of buffaloes owned by HH	0.858	0.666	574	**0.083**	0.050	*	**0.118**	13.75
Average size of irrigation land and rain-fed land (in acres)	3.624	1.491	565	**-0.019**	0.147		**-0.027**	.75
Average monthly HH income	10579.851	3944.093	574	**304.417**	273.733		**432.408**	4.09
Average outstanding HH debt	51102.571	36123.357	574	**-4300.925**	3315.780		**-6109.235**	11.95
Average HH savings	272.699	554.965	574	**191.877**	100.993	*	**272.551**	99.95
Share of poor HHs	0.672	0.191	574	**-0.001**	0.014		**-0.001**	.15

Note: Table 3 documents the outcome variables on the left and the treatment variables on the top.

Sample: All clusters, *n* = 287, N = 574. (Note that three clusters were not engaged in agriculture at all at midline, and six at endline. Hence, there are nine observations less for 'Average size of land').

Columns (1)-(3): Average and standard deviation in the control group (counterfactual scenario). N is the number of observations (T=2 × n=287 clusters).

Column (4): Main estimation. Intention-to-treat effects: $Y_{it} = \alpha_t + \beta_1 BHP_i + \mathbf{X}_i\delta + u_{it}$, where Y_{it} is a final outcome of cluster *i* (*i* = 1, ..., 287) in wave *t* (*t = midline [2016], endline [2017]*), BHP_i is an indicator for being assigned to the BHP, and X_i is the vector of all baseline covariates (measured in 2015). Same households are followed over time. Standard errors are clustered at the cluster level.

Column (6): Same as column (4), but estimating the local average treatmenteffect.

Column (7): Effect size of BHP relative to control group mean: $\frac{|LATE|}{MEAN_c} \times 100$

Related tables: The complete version of the reports contains a set of robustness checks for this specification.

The statistical significance is given as follows: * p < 0.1, ** p < 0.05, *** p < 0.01, **** indicates p < 0.001.

5.2 Health and food-security impacts of the basic humanitarian aid package

In the following section, we discuss the impacts the BHP had on health-related outcomes.[21] Despite positive and strong effects of the treatment on WASH-related intermediate outcomes, we observe no statistically significant changes in the final outcomes that could be related to WASH practices, most importantly in cases of diarrhoea. The same holds true for childhood undernutrition, even though the coefficients point in the right direction.

In more detail, in the full sample, we find zero changes for the Food Consumption Score, and no changes in the occurrence of diarrhoea or other sicknesses. None of the moderate acute malnutrition measures is changed either, with the coefficients being close to zero and not significant at the conventional significance level.

5.2.1 Well-being of women

We will now report the results from modules which were for females only. Since the mental outlook of an individual and a community is a key element which predicts the response to adversity (Davydov et al. 2010), we also assessed mental resilience in communities, comparing outcomes with or without intervention and then with or without the adverse event.

We use two measures of psychological well-being — the generalised state-trait anxiety inventory scale and the GSE — to estimate changes in the well-being of women due to the programme. This index captures self-reported psychological well-being on a generalised state-trait inventory scale for treated versus untreated females who responded to a separate questionnaire module.[22] We chose to use a questionnaire to measure the general self-efficacy, which has been found to be an influential variable related to adaptation to stress. The GSE developed by Jerusalem and Schwarzer (1992) is an appropriate instrument, validated also in an intercultural population sample (Romppel et al. 2013).[23]

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[21] For tables and more detailed results, please contact authors.

[22] It captures self-reported psychological well-being on a generalised state-trait inventory scale for treated versus untreated females who responded to a separate questionnaire module. We asked the female household representatives the following: “A number of statements which people have used to describe themselves are given below. Listen to each statement and then choose the appropriate answer (almost never/sometimes/often/almost always) to indicate how you generally feel.” The specific items asked were “I feel secure”, “I get in a state of tension or turmoil as I think over my recent concerns and interest”, “I am calm, cool, and collected”, “I worry too much over something that really doesn’t matter”, “I am happy”, “I take disappointments so keenly that I can’t put them out of my mind”, “I lack self- confidence”, “I make decisions quickly”, and “I feel like a failure”. The responses were given on a scale from 1 to 4 (almost never [=1], sometimes [=2], often [=3], almost always [=4]).

[23] For a battery of questions, the respondents were asked: "Is this statement [LABEL] exactly true...moderately true...hardly true...not true all?" "It is easy for me to stick to my aims and accomplish my goals", "I am confident that I could deal efficiently with unexpected events", "Thanks to my resourcefulness, I know how to handle unforeseen situations", "I remain calm when facing difficulties because I can rely on my coping", "No matter what comes my way, I am usually able to handle it", "If someone opposes me, I can find means and ways to get what I want".

Results for the GSE reveal an increase in the general self-efficacy scale by 0.56, which is significant on the one per cent level. For example, one of the items shows that households in treated clusters display higher confidence to deal with unexpected events and find ways to get what they want in case of hardships, the results being significant on the 10 per cent level. While we observe changes in the GSE index, we do not see that the STAI index would move due to the treatment.

5.2.2 Well-being of Children

We also looked at anthropological measures of children. We constructed a panel of children and followed the mover time, while controlling for their own anthropological and age values at baseline. We see no significant effect of an assignment to the BHP on the anthropological outcomes of interest. We further analyse disease-related outcomes such as the number of days a child had a certain illness for treated versus untreated children on the extensive margin (i.e. how many days children were sick). Again, we find no robust evidence of differences between the BHP and the control group. At last, we consider anxiety indicators for children. Here again, all effects are insignificant and inconsistent in the direction of the effect.

5.3 Extreme weather events

In the following section we examine whether the programme has different effects in the face of extreme weather events. We first present evidence on the occurrence of EWEs and then estimate the equations 1.3 to 1.5 presented in Section 4.2.

The occurrence of extreme weather events. We used information from the focus group discussions wherein we asked about extreme weather experiences in 2016 and 2017. Enumerators were instructed to define an extreme weather event as "weather phenomena that are rare for a particular place and/or time: especially severe or unseasonal weather. Such extremes include severe thunderstorms, severe snowstorms, ice storms, blizzards, flooding, hurricanes, and high winds, and heat waves." To double-check the information, we asked and compared the same question in the household interviews.[24] In more detail, we first asked whether an extreme weather event occurred and then followed up on the type of event, distinguishing between riverine, rain and/or flash floods, drought, cyclone, wind, hailstorm, salinity, extreme heat, and "other".[25]

At midline, at least one event occurred among about one fifth of our sample as reported by the members of the focus groups. We found differences in the incidence of extreme weather events between the two districts when we compared 2016 and 2017. While Badin appears to be more prone to extreme weather events, it is also notable that the vast majority of reported weather events took place in 2016. Rain floods appear to be the

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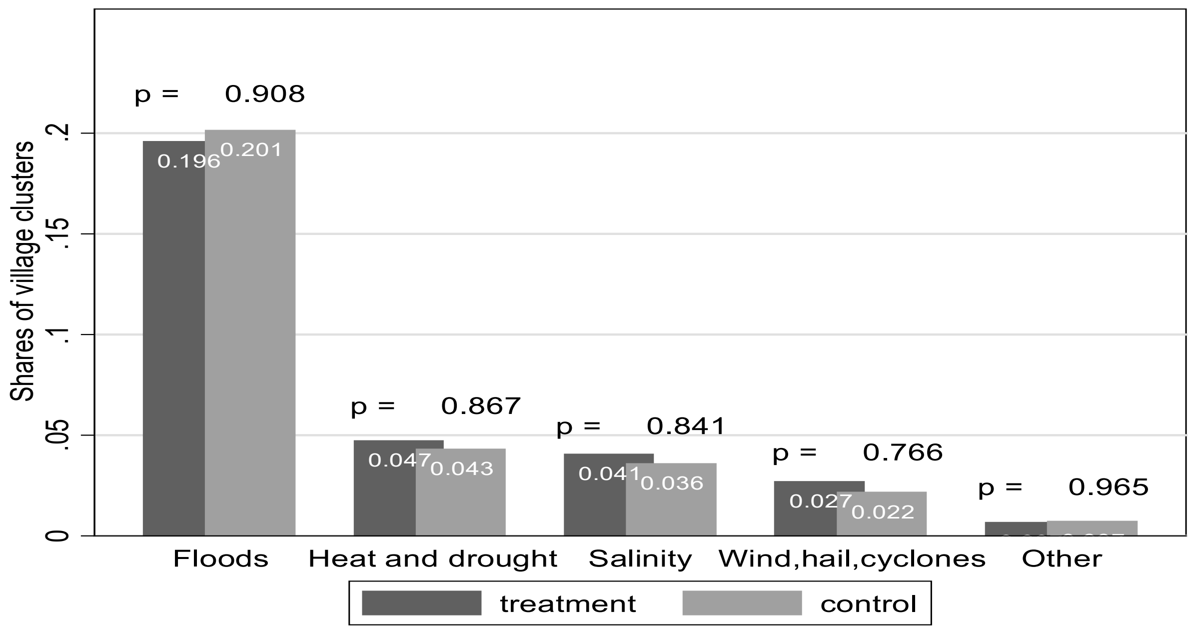
[24] We consider a whole cluster as affected if an event (between baseline and midline) was reported in at least one FGD sub-village interview and by at least one HH in the same sub-village.
[25] For each event, in the household questionnaire we also ask about the frequency of the weather event (number of times it occurred), and the type of consequences the households experienced (death of livestock, reduction in cultivation, migration of household members, etc.). If the household reported no effect of the weather event, we also followed up on the reasons. At the end of the extreme weather module, we ask the respondents about their feeling of preparedness towards these events and whether they were excluded from service provision.

most frequent extreme weather events, with 66 reports in Badin for the year 2016. Other relatively frequent extreme weather events are extreme salinity and droughts. For the validity of the following heterogeneity analysis, it is essential to establish that the probability of facing EWE is similar in the treatment and control clusters. In our analysis, we find no statistical difference in the likelihood of exposure to extreme weather events during the observation period. Figure 6 displays the distribution of the events (combined into broader categories) for all 287 clusters, comparing treatment and control clusters at midline. For each of the subcategories, we present the p-values for the t-test that compares the treatment and control clusters. For example, overall about one fifth of the clusters experienced a flood (mostly rain floods), 19.6 per cent in treatment and 20.1 per cent in control; the p-value for the t-test comparing the two is 0.908, (i.e. the difference is far from being significant at any conventional significance level).

We compare the self-reported evidence with secondary data, namely newspaper reports and official meteorological data. The self-reported evidence coincides with local newspapers reporting 'heavy rain in Badin crippled life in entire Badin district' (Dawn 2016b), and official weather data from the Pakistan Meteorological Department (PMD).[26]

Figure 6: Average occurrence of extreme weather events



Note: Figure 6 displays the distribution of extreme weather events over 2016 for the full sample of 287 clusters. In the histogram, we present BHP treatment clusters on the left and control clusters on the right. For each category, we report the share of affected clusters and present the p-value of the t-test comparing the share of exposure for treatment and control clusters.

[26] PMD is both a scientific and a service department, and functions under the Cabinet Secretariat (Aviation Division) of the government of Pakistan. PMD is responsible for providing meteorological service throughout Pakistan, including the collection and the sharing of rainfall data. PMD collects daily rainfall information across the country with more than 80 collection centres. We used daily rainfall data from the PMD from March 2015 to 2018 and aggregated it at the monthly level.

First, we analyse official weather data from the PMD. We consider reports from two weather stations, one in Badin and the other in Jacobabad, which covers information for Kashmore. Official data on monthly rainfall reveals that rainfall recorded in Jacobabad has been relatively little and steady in the years 2015 to 2017, with a maximum monthly rainfall of 52 mm in 2015, 19 mm in 2016, and 24 mm in 2017. Badin, on the other hand, has been exposed to heavier monthly rainfall in 2015 and 2016, with maximum rainfall of 217 mm in 2015 and 175 mm in 2016. Rainfall reported for Badin was concentrated in heavy rainfalls in single months of July 2015 and August 2016, which coincides with the monsoon season. In 2017, on the other hand, the inhabitants of Badin were exposed to less concentrated but more regular rainfalls distributed over several months (with the heaviest monthly rainfall being only 93 mm in July). The heavy rainfall of 2016 occurred between programme implementation and midline data collection. Therefore, the use of the data collected at midline allows us to analyse the interaction effects of the programme and the August 2016 heavy rainfall event recorded in Badin and reported by our respondents at midline.

Second, the negative impacts of rainfall on the everyday life of vulnerable communities in Sindh have been documented by local newspapers and confirmed by three key informants (local villagers interviewed in March 2018). News reports on the 2016 rainfalls stated, ‘Life in entire Badin district remained crippled due to heavy rains, flooding, and collapse of electricity, water supply, and drainage systems. Roads and arteries also remained deserted as flooding rendered them unusable.’ (Dawn 2016b). Badin had experienced consecutive rainfall for five days. ‘Life in the entire district remained paralyzed for a fifth consecutive day due to intermittent rain and flooding’ (Dawn 2016b). The 2016 heavy rainfalls damaged houses and crops and claimed several lives in various Sindh districts including Badin, according to the country’s leading newspaper Dawn (2016a). Heavy-to-moderate spells of rain resulted in two-to-three feet of rainwater forcing villagers to move out of their villages along with their livestock. Subsequent qualitative interviews revealed that rainfall also damaged roads and limited access to city areas and markets, and disturbed farm-to-market access. They damaged shelters and stagnant water pools near the roads resulted in the proliferation of disease carriers such as mosquitoes.

Despite the evidence presented here, the occurrence of extreme weather events remains non-random. Thus, the following results still need to be interpreted with caution, since other factors that correlate with EWE risk could explain the difference in the effectiveness of the intervention.

Resilience. In the following section, we present the results of ACTED's BHP interventions in the presence of reported EWE. We examine whether the BHP improves outcomes more strongly in EWE-affected areas than in non-affected areas.

In Table 4 we take a closer look at Badin, the district that experienced heavy rainfall in 2016, and split the sample into clusters that experienced an extreme weather event (*n*=68 clusters, column [1]) and clusters that did not experience an extreme weather event (*n*=77 clusters, column [3]). We report ITT effects of the BHP for equations 1.3 and equation 1.4, respectively. We observe that BHP reduces the share of damaged shelters by about two times as much in clusters that experienced extreme weather events as in clusters that did not (a reduction of 17.9 percentage points compared to 8.6 percentage points). Furthermore, households are also more likely to feel prepared once an extreme weather event occurs (an increase of 9.2 percentage points compared to 3.1 percentage points in areas that did not experience an extreme weather event). Finally, we observe an increase in livestock ownership by 7.9 percentage points in EWE areas versus 4.7 percentage points in non-EWE hit areas. These differences are statistically significant, with a p-value for the treatment effect ($\beta_1 + \beta_2$) of 0.003 (column [6]).

In unreported results, we again look at health-related outcomes. While these outcomes were not significant in the main results, in areas affected by EWE we observe a number of significant results for the treatment effect (p-values in column [6]) and also for the difference between areas affected by the EWE and those that were not affected (p-values in column [7]). The treatment effect is notable at an 11.0 percentage point reduction in covering food needs, a 5.5 percentage point reduction in the occurrence in diarrhoea, and 7.4 percentage point reduction in the occurrence of sickness in the households. We find no differences for the anthropological measures.

When comparing the effects across groups of different households, we observe that the ultra-poor benefited most from the programme. Households that already received assistance in the past benefited less than households that received no assistance before.

Table 4: Final outcomes (Y) - extreme weather events in Badin

	(1)	(2)		**(3)**	(4)		(5)	(6)
	Split Sample						Full Sample	
	BHP	SE		**BHP**	SE		Interaction Effect	
Extreme Weather Event (EWE)?	**Yes**			**No**			$\beta_1 + \beta_2$	p-value
Share of HHs with high life satisfaction	**0.021**	0.029		**0.041**	0.026		0.024	0.408
Share of HHs that believe that NGOs do a good job	**0.042**	0.015	***	**0.027**	0.019		0.043	0.005
Share of HHs feeling prepared for future disaster or EWE	**0.092**	0.033	***	**0.031**	0.031		0.085	0.025
Share of shelters with currently observable damages	**-0.179**	0.035	****	**-0.086**	0.038	**	-0.151	0.000
Share of HHs that own any livestock	**0.079**	0.034	**	**0.047**	0.049		0.104	0.003
Average number of buffaloes owned by HH	**-0.003**	0.093		**0.078**	0.089		0.082	0.359
Average size of irrigation land and rain-fed land (in acres)	**0.422**	0.300		**0.067**	0.304		0.303	0.283
Average monthly HH income	**98.778**	455.960		**282.366**	376.997		428.753	0.389
Average outstanding HH debt	**1651.347**	5306.861		**-2948.125**	6278.232		-2102.597	0.679
Average HH savings	**145.589**	179.790		**231.065**	181.543		-4.654	0.985
Share poor HHs	**-0.002**	0.033		**-0.067**	0.032	**	-0.010	0.725
Observations	**136**			**154**			290	

Note: Table 4 documents the outcome variables on the left and the treatment variables on the top.

Sample: Clusters in the Badin district. Columns (1) - (4) include only subsets of this sample.

Columns (1) and (3): Intention-to-treat effects: $Y_{i,t} = \alpha_t + \beta_1 BHP_i + X_i^{10EWE} \delta_1 + u_{it}$, where Y_{it} is a final outcome of cluster i, BHPi is an indicator for being assigned to the BHP, and X_i^{10EWE} contains the 10 most imbalanced baseline covariates between treatment and control areas within sample in column (1) and sample in column (3). In column (1) we consider only clusters that experienced an extreme weather event (n=68 clusters). In column (3) we consider only clusters that did not experience an extreme weather event (n=77 clusters). We consider a whole cluster as affected if an event (before the midline) was reported in at least one FGD sub-village interview and by at least one HH in the same sub-village. The same households are followed over time. Standard errors are clustered at the cluster level.

Columns (5) and (6): Present $\beta_1 + \beta_2$ (column 5) and the corresponding p-value (column 6) that results from the following estimation: $Y_{i,t} = \alpha_t + \beta_1 BHP_i + \beta_2 EWE_i \times BHP_i + \beta_3 EWE_i + \delta_1 X_i + u_{it}$, where EWE_i is an indicator for being affected by an extreme weather event before midline and X_i is the vector of all baseline covariates (measured in 2015). Sample: all clusters in Badin, n = 145, N = 290.

The statistical significance is given as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, **** indicates $p < 0.001$.

Robustness. Next, as a robustness check, we look at self-reported weather damages. If the BHP reduced the number of reported weather damages, this can be interpreted as increased resilience against negative shocks. Our unreported results do indeed provide evidence that the BHP made shelters more resilient: in BHP clusters, 14.7 percentage points fewer households report that their shelter was destroyed or damaged by an extreme weather event in the last year. Compared to a control group mean of 46.6 per cent, this is a reduction of about 30 per cent. In control group clusters that were affected by the shock, 56.4 per cent of FGDs report that *some* shelters were destroyed by EWE. In treatment areas, the share is half of that size. Both effects are significant at the 5 per cent level. Looking at the intensive margin of FGD-reported shelter damages, the coefficient shows a sizeable reduction as well, although the effect is not statistically significant. We find no evidence for reduced losses in livestock, crops or cultivation.

Finally, it is worth pointing out that the EWEs that occurred during the study period were major rain floods, but not full-scale disasters. Natural disasters often trigger immediate, coordinated and full-scale governmental and NGO response. In our design, it would have included humanitarian aid delivery in treatment and control areas. The effects of larger events could be different. Furthermore, EWEs themselves were not randomised. In fact, only Badin was affected, and this district experienced much heavier rainfalls in the past than Kashmore. However, an equal number of treatment and control clusters were affected, and within the EWE-affected areas, most covariates are balanced between treatment and control areas.

In conclusion, the BHP made shelters more resilient against rain floods. While we find few significant effects on further economic outcomes, the BHP also increased perceived preparedness more strongly in areas hit by extreme weather events.

We conduct a number of further analyses, such as replicating the results without control variables, at the household level, and with robust standard errors.

5.4 Qualitative analysis

In this section, we present evidence on each component of the BHP in the form of qualitative interviews. Qualitative data sources are employed to illustrate findings from the experimental data and to explore possible explanations for observed findings. The added value of using qualitative data in our study design is to corroborate or nuance the quantitative findings and to highlight and provide explanations for possible contradictions in findings. The qualitative analysis was conducted by Mariam Nikravech. Data collection, methodology, and tools design were supported by Prof. Dr. Aijaz Wassan and Dr. Sada Shah, both from the University of Sindh. The data was collected after programme roll-out and before the midline in 2016. The methodological choice for the analysis presented in this report is content analysis, based on transcripts from the data collection. The village sample selection included several steps: based on the complete list of treatment and control villages, the researchers identified a combination of two villages in each district. This combination had to include one treatment and one control village. In each village, three to four participants were selected for in-depth interviews.

Villages were randomly selected. Interviews and FGDs were audio-recorded and transcribed.[27]

Use of latrine and hand-washing practices. In treatment villages, qualitative in-depth interviews indicate that the presence of latrines translates into their effective use by villagers. In both control and treatment villages, the main perceived advantage of having latrines was the improvement of health conditions and the environment. In addition, females reported (both in control and treatment villages) that the provision of latrines could significantly contribute to increased levels of privacy for women and children. For example, respondents reported that:

> If latrines were available, women would feel safe, diseases would be reduced, and cleanliness would contribute to our health. — Female, 40 years old, from control village, Badin.

> Through the provision of shelter and latrines, now our wives and children are safe and secure in terms of privacy and security. — Male, 52 years old, from treatment village, Kashmore.

Typically WASH practices do not change overnight with training and awareness alone, especially if training and awareness are not provided over an extended period of time. The qualitative interviews suggest that the complimentary provision of soft and hard WASH components is essential to changing and sustaining attitudes and practices. This is demonstrated by the fact that five interview participants out of eleven in treatment villages from Kashmore and Badin who had received WASH training, but no latrines, reported still practicing open defecation.

> We are still practicing open defecation owing to the absence of latrines, but we are now washing hands with soap and caring more about hygiene. — Female, 27 years old, from treatment village, Kashmore.

The FGDs with both males and females revealed a similar situation:

> We do not have any latrines and sanitation system in our village. Training events provided on hygiene have changed our practice of washing hands and personal hygiene. — Participants from treatment village, Badin, male FGD.

Nonetheless, some of the beneficiaries of WASH training events from Badin and Kashmore perceived the effects of changing hygiene habits on the health of children and pregnant and lactating women to a certain extent:

> This NGO only provided us training events on health and hygiene. After practicing these learnings, we now see that diseases are reduced among the children. — Female, 50 years old, from treatment village, Kashmore.

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[27] A total of 8 FGDs (4 with men and 4 with women). There were 4 in each district: 2 from the case group (1 man, 1 woman) and 2 from the control group (1 man, 1 woman). A total of 22 in-depth interviews (11 from each district, 5 from the treatment group and 5 from the control group). A total of four key informant interviews (two from each district, one with District Social Welfare Officer and one with ACTED staff). A total of two from the government and two from ACTED staff.

> NGO provided us shelter and latrine as well as training on health and hygiene. We have observed change after practicing the knowledge received from the training as compared to before as now diseases have reduced. Before we did not know that diseases spread if we did not practice hand washing. — Female, 29 years old, from treatment village, Kashmore.

Shelter and disaster risk reduction practices. In treatment villages, some villagers observed a positive change in shelter capacity to resist extreme weather events since ACTED's intervention, for instance:

> There was extreme weather [this year] but we did not leave our village. As compared to the past six years, now our shelter is stronger. — Female, 29 years old, from treatment village, Kashmore.

In a treatment village in Badin, a 31-year-old female, and a 27-year-old female benefited from an ACTED shelter. However, they reported that they did not feel safe in their shelter during extreme weather events. Interviewees invoke several reasons for not feeling fully safe in their ACTED-provided shelter. First of all, respondents shared their fear that the mud-plastered shelters are not strong enough to support extreme weather events such as heavy rains and floods:

> Our house is made of mud and wooden sticks. If a flood hits, it would destroy the house. — Male, 35-*year-old*, from treatment village, Badin.

In addition, eight ACTED shelter beneficiaries reported that the bamboo roof construction of ACTED shelters is affected by termites. During the FGDs conducted in a treatment village Badin, beneficiaries explained the limitations of their shelter:

> Shelters given by ACTED are fine in structure and design, but termites have affected the bamboos of those as well. — Participants from treatment village, Badin, male and female FGDs.

Following the feedback, ACTED has since determined that a cost-effective and locally available solution consists in brushing the wood with oil and this is explained to beneficiary households.

Two villagers interviewed who benefited from ACTED shelters found them to be protective from heat, sun and wind. Respondents in this village noted that since ACTED's intervention, the shelter situation had improved to some extent compared to the previous years. The households who received an ACTED shelter shared their feeling of comfort. In Badin, this was captured during all the six in-depth interviews with male and female beneficiaries:

> This project brought positive changes in our whole household lives and we all are living peacefully; We have received a house, and this is also good for women and children [...] Shelter changed in our living style, now we can live easily and relaxed. — Female, 62 years old, from treatment village, Badin.

Five out of seven respondents from the village benefited from the cash for work intervention:

> The NGO gave us cash and a shelter. We spent that cash on disease control. — Female, 62 years old, from treatment village, Badin.

This respondent explained how he used the cash for work money:

> The NGO gave us cash for work, so we bought food with that money. — Male, 35 years old, from treatment village, Badin.

Food security and livelihood (FSL) and nutrition. Qualitative in-depth interviews and FGDs provided insights on the FSL and nutrition situation of villagers in Kashmore and Badin. In-depth interviews with women suggested improvements in FSL since 2015. A female respondent described the changes in her own perception of how to raise her household's livestock due to the training from ACTED on FSL. Concerning natural disasters, she noted that:

> Now we have learned how to protect livestock from natural disasters. — Female, 29 years old, from treatment village, Kashmore.

A female respondent, 50 years old, also perceived positive changes both on her crops and livestock, thanks to ACTED's FSL intervention:

> Now our crops are improved to some extent and our cattle has also improved because of vaccination and proper feeding. — Female, 50 years old, from treatment village, Kashmore.

Treatment villages in both Badin and Kashmore revealed that the 2016 heat wave made it difficult to cook and store food. In Badin, as one respondent explained:

> It is very difficult to cook in the hot weather. We don't have a kitchen and the water is salty. — Female, 31 years old, from treatment village, Badin.

The limited ability to store food is also due to hardship in securing regular wages as Usman said:

> We have not stored anything. We are working to survive. — Male, 35 years old, from treatment village, Badin.

However, in Kashmore, interviews with lactating women in a treatment village revealed changes in attitude concerning feeding practices of children under two as the result of ACTED training:

> Before we used to feed the same food to our children. Now we prepare separate meals for them, feed them three to four times a day and also ensure food diversity. — Female, 50 years old, from treatment village, Kashmore.

The changes in FSL resulting from ACTED's interventions were also criticised as limited to the short term. For instance, female respondents from the FGDs did not perceive sustained changes in livelihood from the intervention:

> We do not feel any special changes. If the project extended further, it would bring positive changes in livelihoods, market, and health. — Participants, from treatment village, Badin, female FGD.

5.5 Attrition

In the quantitative impact evaluation, 3,841 households were our baseline sample. 181 (4.71 per cent) baseline households did not participate in the follow-up data collections at midline, and a total of 322 households (8.37 per cent) dropped out between baseline and endline. We test whether the attrition rate differs by BHP treatment assignment. In unreported regressions, we look at the BHP baseline households and regress on the likelihood to participate in a follow-up, distinguishing different types of attrition (whether the household was not present or whether the household members refused to be interviewed). Standard errors are clustered at the household level. We observe that the treatment assignment status does not predict participation in the follow-up surveys.

Despite the fact that overall attrition is low, we investigate whether households that we did not locate, or those which refused to participate, were significantly different from the household in the final sample. To do so, we regress attrition on baseline characteristics, or variables that describe the pre-treatment state for all eligible households and that we used for randomisation. Additionally, we interact the likelihood of not participating with (1) the occurrence of extreme weather events in Badin, and (2) the BHP treatment itself. The treatment assignment should ideally have no impact on attrition, while the extreme weather event might have an impact on attrition.

In unreported results, we find that households affected by flash floods and river floods are less likely to participate in a follow-up; households that had poor or borderline food consumption scores are more likely to participate; and households that own land, have a higher toilet score, or own air-conditioning are less likely to participate. We find that ACTED's presence under the BHP did not significantly affect the attrition rates. The picture is different if we look at the predictive power of having experienced an extreme weather event. Poorer households are less likely to participate in a follow-up if they were affected by the extreme weather event. Overall, these results are in line with our expectations, but given the very low level of attrition and the fact that treatment and control areas were similarly affected by natural disasters, we conclude that the low level of attrition can be disregarded.

Note that we presented more robustness checks in the midline report, where we followed the pre-analysis plan and explored the role of outliers and variables with low variance. The results are available upon request.

6. Conclusion

Extreme weather events can have disastrous effects on the health and wealth of the population, especially of vulnerable communities. These effects can range from lack of proper shelter and sanitation to the spread of diseases and malnutrition. Preparing communities for natural disasters is of key importance for humanitarian aid. In the backdrop of increasing climate change and natural disasters, mitigation and resilience strategies gain even more importance, while at the same time, research on how to mitigate the consequences of natural disasters through recovery and preparedness interventions is scarce. Our research, carried out in one of the most natural disaster-affected and disaster-prone countries in the world, provides evidence on whether preparedness interventions work to mitigate risks and negative impacts.

For our study, we evaluate a randomised control trial in rural Pakistan using a three-wave panel dataset and qualitative interviews. We find positive treatment effects of a comprehensive programme to improve disaster preparedness. More precisely, the BHP leads to improved hygiene habits, increased adoption of DRR techniques, and to a limited extent improved knowledge about agricultural and livestock management methods. These effects persist two years after the onset of the programme.

Apart from immediate changes, the programme also induced changes for final programme outcomes. The effect of the BHP on the share of households that report high or relatively high life-satisfaction is positive and significant. Also, the share of households believing that NGOs do a good job has increased. In accordance with the objective measures of increased preparedness, an increased number of households report feeling prepared for future disasters or extreme weather events. An increase on the GSE captures improved psychological well-being of females. When we take a closer look at the economic outcomes (such as observed damages to shelters and agricultural and financial assets), we find evidence for improved shelters in the treatment clusters. Being randomly assigned to the BHP increases the share of households that own livestock. We find no robust evidence on disease incidence and nutritional status for children under five and pregnant and lactating women. When comparing the effects across groups of different households, we observe that the ultra-poor benefited most from the programme. Households that already received assistance in the past benefited less than households that received no assistance before.

The design, which allows testing of the impact of humanitarian aid, is the first strong point of our study. Moreover, we hypothesised that if the programme makes clusters more resilient to negative shocks, we would expect to observe greater positive impacts in clusters that had been exposed to extreme weather events after implementation. A further strong point of the evaluation is that we are able to test this hypothesis due to the unexpected occurrence of an extreme weather event during the study period. This event, which occurred in summer 2016, permits us to analyse whether households are indeed more resilient when negative shocks strike. Thus, we are able to identify causal impacts of the programme while distinguishing its impacts on the preparedness and resilience of vulnerable rural communities.

To make this final distinction, we analyse intermediate outcomes and the interaction effect of the programme with the incidence of the EWE. In the face of the 2016 EWE, the BHP made shelters more resilient against rain floods and increased the perceived level of preparedness for an unforeseen shock. We observe that BHP reduces the extent of damaged shelters by about two times as much in clusters that experienced extreme weather events compared to clusters that did not receive BHP.

Households are also more likely to feel prepared, and we observe an increase in livestock ownership once an extreme weather event occurs. When looking at self-reported weather damage as a consequence of the results, our key results on more resilient shelters are confirmed. We find evidence that the BHP reduced the share of households that reported that their shelter was destroyed or damaged by an EWE during last year by one third. In control group clusters that were affected by the shock, more than half of the villagers report that some shelters were destroyed by an EWE. BHP halves this share.

In the case of extreme weather events, households that resided in clusters and received the BHP reveal fewer problems in meeting their food needs. Living in a cluster that received treatment reduces the share of households where at least one member had diarrhoea or was sick last month. These effects are in line with our expectations of how the programme would work (i.e. proven with evidence that the BHP, in the case of an EWE, increases resilience to potential negative impacts associated with these events).

7. Specific findings for policy and practice

We set up the impact evaluation in areas with a high need for recovery after having been heavily affected by recurring disasters in the past. Following a baseline in 2018, the BHP started at the beginning of 2016 in a subset of randomly selected clusters in two rural districts of Sindh, Pakistan. The beneficiaries received training events and infrastructure in the spheres of WASH, shelter and non-food items, and FSL. In the following paragraphs, we sum up specific findings for policy and practice, focusing on (1) on the impact evaluation design, and (2) the results.

We present evidence based on strong design and a rich, three-wave panel data in disaster-prone areas. Three core lessons on impact evaluation designs in humanitarian settings can be summed up as follows:

- We interview the same households over three years while keeping the attrition rate at a minimum, which allows us to test immediate impacts and the sustainability of the programme. We capture a broad set of outcomes with a wide range of survey questions and anthropometric measures collecting indicators of well-being for household heads, female household heads, children whom we monitored in our sample, and PLWs. At the same time, the analysis was pre-registered using a pre-analysis plan in order to credibly reduce ex-post data-mining and specification searching.
- A strong impact evaluation design (cluster randomisation) allows us to present clear and causal estimates of the effects. However, the impact evaluation design did not allow us to distinguish the differential contributions of the components from the changes in outcomes measured. Future designs should aim at randomising different components to generate even greater insight.
- Close cooperation with the implementing agency and other NGOs operating in the areas allowed us to monitor the roll-out of the programme and report challenges. Close communication was necessary to anticipate and react to possible changes in programme implementation and migration in the face of a potential new extreme weather event. The data provides a rich source of information on what has actually been implemented on the ground.

The evaluation improves our understanding of whether humanitarian aid works, especially at the onset of an emergency. Altogether, the results from the impact evaluation showed that the BHP decreased vulnerability for future shocks. In particular, the impact evaluation showed that the programme had a strong impact in terms of preparedness to extreme weather events. This translates into improved hygiene habits and increased adoption of DRR techniques learned.

This high level of preparedness reflected increased resilience to future shocks in areas that were affected by unusually heavy rainfall in 2016, while households that benefited from the programmes experienced less destruction. Shelters were more resilient against rain floods after the programme. Moreover, perceived preparedness increased, especially in areas hit by EWEs.

We also observe that in the case of EWEs, the BHP reduced the share of households facing problems in meeting their food needs and the share of households having experienced diarrhoea or sickness. Treated households display a higher level of confidence in dealing with unexpected events and find ways to get what they want in the face of hardships.

On the other hand, no strong evidence could be found for anthropometric measures. While the estimates point towards positive effects, they are estimated precisely and thus not corroborated by robust evidence during our study period.

The introduction of additional refresher training events on WASH, shelter and FSL proved beneficial to support behavioural changes on WASH topics. It is however not possible to claim changes on the FSL and shelter topics. The evidence for refresher training events is thus limited and combined with the lack of effects of phone-based interventions, shows the need for face to face interaction.

The results of the cost-benefit analysis showed solid returns on programme investments with a mean value of benefit estimations of 70.6 cents per dollar for LATE estimates.

We observe that the BHP significantly reduced the share of shelters with currently observable damages. When considering countries like Pakistan with heavy seasonal flooding, strong shelters are likely to reduce the cost of periodically repairing shelters. Alternatives such as cash transfers enable beneficiaries to buy services or finance shelter material for repairs; however, more robust shelters may be more cost efficient in this context.

The effects we present are a lower bound approximation, since only a subsample of those households were beneficiaries of the intervention. Moreover, when we speak of households that benefited from the programme, we also consider the number that might have benefited only indirectly, and others that may have never heard of the programme despite living in the implementation area. From this context, the effects we find are even more promising.

Appendix A: Description of variables

Table A1: Description of variables

Cat.	Name	PAP	Table	Q	Nr.	Description
Agriculture	own_land_sB	PAP	Base	HH	q36	We report the percentage of responses by households who own land and report 'yes'.
Agriculture	size_land_sB	PAP	Base	HH	q37	We calculate the mean size (in acres) of cultivable land that HHs currently own.
Agriculture	share_live_B	PAP	BaseDup	HH	q48.2	This variable refers to the Ø number of households per village who possess at least one livestock animal. Livestock animals encompass goats, sheep, cows, buffaloes or bullocks, poultry and other.
Agriculture	buffaloes_sB	PAP	Base	HH	q48.2	We calculate the share of HH, who have at least one buffalo.
Agriculture	own_buffalo_sF		Final	HH	q48	Village Ø of buffaloes owned by HH.
Agriculture	own_livestock_sF		Final	HH	q48	Village Ø of dummy that is =1 if HH owns any form of livestock.
Agriculture	cult_land_total_sF	PAP	Final	HH	q46	Village Ø of sum of rain fed and irrigation fed land that was cultivated in the previous Rabi season.
Background	nr_hh_memberB	PAP	Base	HH	q25	We calculate the mean number of household members per sub-village.
Background	age_resB	PAP	Base	HH	q16.B	We calculate the mean age of respondents.
Background	roomsPP_sB	PAP	Base	HH	q56	We calculate the mean number of rooms per person.
Background	never_school_HH_sB	PAP	Base	HH	q30	We generate an indicator which takes on the value of 1 if the head of the household never attended school. Then we generate a mean value of this indicator for each sub-village and multiply it by 100.
Background	gotoschool_sB	PAP	Base	HH	q31	We generate an indicator which takes on the value 1 if there are no children of ages between 5 and 16 years in the household or all the children in that age range are attending school and the value 0 if only some or none of the children in that age range are attending school. Then we generate a mean value of this indicator for each sub-village and multiply it by 100.

Cat.	Name	PAP	Table	Q	Nr.	Description
Background	aircond_sB	PAP	Base	HH	q50	We calculate the share of households that have an air-conditioner.
Background	cooking_sB	PAP	Base	HH	q52	We calculate the share of households that have at least one cooking stove, cooking range, or microwave oven.
Background	vehicle_sB	PAP	Base	HH	q51	We calculate the share of households that have a TV.
Background	productive_age_sB		Base	HH	q26	Household members in productive age, i.e. household members between 18 and 59 years old.
Background	ref_fre_wash_sB		Base	HH	q49	Indicator whether a household owns at least one refrigerator, freezer or washing machine.
Background	sc8FG_irrigatioB		Base	FGD	q6.8	Score based on needs of households regarding reconstructing link roads and irrigation channels for agriculture.
Background	q2_1_tot_HH_in_villagB		Base	FGD	q14	Average of total number of households per cluster.
HH Well-being	shelters_dmg_observe_sF		Final	HH	Qn50	Village Ø of dummy that is =1 if the enumerator observes any damages to the shelter. =0 if no damages apparent
HH Well-being	mean_fcs_gr_nacB	PAP	BaseDup	HH	q111	We calculate the consumption score according to the WFP's guidance, then we identify those cases where the score is not acceptable, i.e. either poor or borderline. Please refer to the eligibility criterion number 11 which is constructed accordingly.
HH Well-being	psc_sB	PAP	Base	HH	various	We calculate the Poverty Score Card score by creating 12 indicators that capture different aspects of the household. The variables used to calculate the poverty and to assign the different scores as set out by the World Bank can be provided upon request. The Minimum score is 0, the maximum 100. Below 12, HHs are considered ultra poor, above 50 non-poor.
HH Well-being	pvs_dummy_sF		Final	HH	q26 q30 q31 q56 q25 q87 q49 q50 q52 q53 q51 q48 q37 q36	Village Ø of dummy that is =1 if HH poverty score $<$=23, i.e. Poverty Score Card (PSC) indicates that HH is ultra poor, chronically poor or transitory poor.

Cat.	Name	PAP	Table	Q	Nr.	Description
Health	waterhands_sB	PAP	Base	HH	q82	We generate a variable which takes the value of 1 if the respondent answered that he/she washes his hands with water only. Then we generate a mean value for each sub-village and multiply it by 100.
Health	nolatrineuse_avail_sB	PAP	Base	FGD	q2.1 q5.7	The share of households in a village without access to latrines is calculated by dividing the total number of households with no access to latrines by the total number of households in the village. Values higher than 100 are defined as 100 percent .
Health	toilet_score_sB	PAP	Base	HH	q85-87	We generate a toilet score variable with value 0 if there is no toilet in HH, no availability of latrine, the latrine is destroyed by flood, the latrine is not currently functioning or HH members defecate on the field/outside; with value 2 if the HH owns a pit or VIP latrine; and with value 3 if the HH owns a pour flush toilet. Per sub-village, we calculate the Ø (mean) toilet score.
Health	dih_mean_sB	PAP	BaseDup	HH	q91.B	We generate a variable which takes the value of 1 if at least 1 HH member had diarrhoea in the last 2 weeks.
Health	zwei_moderate_n_sB	PAP	BaseDup	HH	q116	Weight-for-age is a composite index of height-for-age and weight-for-height. It takes into account both acute malnutrition (wasting) and chronic malnutrition (stunting), but it does not distinguish between the two. Children whose weight-for-age is below minus two standard deviations from the reference population median are classified as underweight. Z-score means are also calculated as summary statistics representing the nutritional status of children in a population. These mean scores describe the nutritional status of the entire population without the use of a cutoff. A mean Z-score of less than 0 (i.e. a negative mean value for stunting, wasting, or underweight) suggests that the distribution of an index has shifted downward and that most if not all children in the population suffer from undernutrition relative to the reference population.) For all children under five years, excluding babies between zero and six months old, we

Cat.	Name	PAP	Table	Q	Nr.	Description
						first create an indicator variable, which takes the value of one when weight-for-age z-scores are below minus two. We then calculate the mean value per sub-village and multiply it by 100. Outliers of malnutrition components that likely exist due to measurement errors are adjusted, if they are below the lowest 5\% or above the highest 5\% of the measurement distributions.
Health	zlen_moderate_n_sB	PAP	BaseDup	HH	q116	The height-for-age index is an indicator of linear growth retardation and cumulative growth deficits in children. Children whose height-for-age Z-score is below minus two standard deviations from the median of the WHO reference population are considered short for their age (stunted), or chronically malnourished. Stunting reflects failure to receive adequate nutrition over a long period of time and is affected by recurrent and chronic illness. Height-for-age, therefore, represents the long-term effects of malnutrition in a population and is not sensitive to recent, short-term changes in dietary intake. First, we create an indicator variable, which takes the value of one when length/height-for-age z-scores are below minus two. We then calculate the mean value per sub-village and multiply it by 100. Outliers of malnutrition components that likely exist due to measurement errors are adjusted, if they are below the lowest 5\% or above the highest 5\% of the measurement distributions.
Health	zbmi_moderate_n_sB	PAP	BaseDup	HH	q116	The BMI is an anthropometric measure defined as weight in kilograms divided by height in meters squared. A BMI $<$ 17.0 indicates moderate and severe thinness in adult populations. It has been linked to clear-cut increases in illness in adults studied in three continents and is therefore a further reasonable value to choose as a cut-off point for moderate risk. A BMI $<$ 16.0 is known to be associated with a marked increased risk for ill health, poor physical performance, lethargy and even death; this cut-off point is therefore a valid extreme limit.

Cat.	Name	PAP	Table	Q	Nr.	Description
						\url{http://www.who.int/nutrition/nlis_interpretation_guide.pdf} First, we create an indicator variable, which takes the value of one when BMI-for-age z-scores are below minus two. We then calculate the mean value per sub-village and multiply it by 100. Outliers of malnutrition components that likely exist due to measurement errors are adjusted, if they are below the lowest 5\% or above the highest 5\% of the measurement distributions.
Health	zac_moderate_n_sB	PAP	BaseDup	HH	q116	The mid upper arm circumference used for children 6-59 months: severe acute malnutrition ($<$11.5cm), moderate acute malnutrition (12.5 cm to 11.5 cm). Definition used for pregnant and lactating women: Moderate Acute Malnutrition ($>$115 mm and $<$125 mm), Severe Acute Malnutrition ($<$115 mm). First, we create an indicator variable, which takes the value of one when arm circumference-for-age z-scores are below minus two. We then calculate the mean value per sub-village and multiply it by 100. Outliers of malnutrition components that likely exist due to measurement errors are adjusted, if they are below the lowest 5\% or above the highest 5\% of the measurement distributions.
Health	malprog_sB	PAP	Base	HH	q101	To identify whether households had access to a malnutrition programme, the households were asked about their access to an operational malnutrition programme in the respondent's UC.
Income	mediantotincomehhearB	PAP	Base	HH	q60	We calculate the median of the total income per household for each village.
Income	meantotincomehhearn_sF	PAP	Final	HH	q60	Village Ø of earned monthly HH income.
Income	debt_sF	PAP	Final	HH	q67	Village Ø of outstanding HH debt.
Income	savings_sF	PAP	Final	HH	q70	Village Ø of HH savings.
Treatment	treatment	PAP	Treatment			Cluster dummy that is =1 if cluster received any of ACTED's interventions that were part of the basic humanitarian package in WASH, shelter and/or FSL.
Treatment	treatment_refresher_WASH	PAP	Treatment			Cluster dummy that is =1 if cluster received group (or personal) additional training focussing on WASH.

Cat.	Name	PAP	Table	Q	Nr.	Description
Treatment	treatment_refresher_SHELTER	PAP	Treatment			Cluster dummy that is =1 if cluster received group (or personal) additional training focussing on Shelter.
Treatment	treatment_refresher_FSL	PAP	Treatment			Cluster dummy that is =1 if cluster received group (or personal) additional training focussing on FSL
Weather damage	destr2013_sB	PAP	Base	HH	q57	see 2010
Weather damage	destr2014_sB	PAP	Base	HH	q57	see 2010
Weather damage	destr2015_sB	PAP	Base	HH	q57	see 2010
Weather damage	shr_not_repaired_houses	PAP	Base	FGD	q4.1.2 q4.1.3	First, consider the total number of rebuilt/rehabilitated shelters divided by the share of damaged houses. Multiplied by 100, this provided the percentage of shelters in a village, which were repaired. Afterwards, the percentage of shelters in a village which are not repaired/rebuilt yet was calculated by deducting the percentage of shelters in a village which were repaired from 100.
Weather damage	nr_times_disaster_FGD_sB	PAP	Base	FGD	q3.1	This is a key indicator to estimate the need for humanitarian aid. We added up the number of times a village was affected by any kind of flood (river flood, rain flood, flash flood).
Weather damage	q3_2_out_of_viB	PAP	Base	FGD	q3.2	This variable captures the absolute value of people who migrated out of the village during the last disaster reported during the FGD in each village.
Weather damage	q3_3_into_vilB	PAP	Base	FGD	q3.3	Similarly, to out-migration we have gathered information on the number of people arriving at a village in the aftermath of a natural disaster.
Weather damage	mplossempl_sB	PAP	Base	FGD	q71	It measures the share of people who mention a lack of employment opportunities as one of the three main reasons for their loss of income following a natural disaster.
Weather damage	any_assistance_subB	PAP	Base	HH	q105	By assistance or help, we refer to any organised intervention or programme led by external stakeholders such as the

Cat.	Name	PAP	Table	Q	Nr.	Description
						rehabilitation or construction of water supply schemes; support for livestock, sanitation, agriculture, health care, hygiene awareness, housing/shelter, food, access roads, communal infrastructure. To simplify the analysis we use the percentage of village-clusters that have received at least one of these forms of assistance in the past five years.
Weather damage	destr2010_sB	PAP	Base	HH	q57	To assess whether houses were destroyed or partially destroyed during a flood in different years, the household questionnaire contained questions on whether the respondent's house had been damaged or destroyed during a past flood since 2010. The question was repeatedly asked for all years between 2010 and 2015.
Weather damage	destr2011_sB	PAP	Base	HH	q57	see 2010
Weather damage	destr2012_sB	PAP	Base	HH	q57	see 2010
Weather damage/ Needs / Psychological	mphealthpr_sB		Base	HH	q71	Share of households for which setbacks in terms of health (e.g. injuries, handicaps) caused by violence was one of three main reasons for income loss during the last extreme weather event.

Note: BMI = body mass index

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