Fast Action for Floods: RCT Evidence on Forecast-based Cash Transfers from Bangladesh and Nepal

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Abstract

As increasingly frequent extreme weather events disrupt lives, institutions are turning to early-warning systems and advance preparation to accelerate aid delivery. We present evidence from a randomized controlled trial in Bangladesh and Nepal testing whether providing cash within days of a flood leads to greater benefits than delivering the same assistance months later—or if it simply shifts the timing of benefits without improving overall welfare. Results suggest that timely cash assistance leads to overall gains in food security and psychosocial well-being. This evidence supports efforts to forecast crises and release disaster relief quickly.

Keywords: Cash Transfers, Climate Change, Forecasts

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1 Introduction

Forecast-based anticipatory action (FbAA) is an innovation to the humanitarian aid system. Institutions leverage early-warning weather systems to deliver aid before a predicted hazard occurs or its most severe impacts are felt. When the forecast probability of extreme weather events such as floods exceeds a pre-defined threshold, humanitarian funding is disbursed. This approach represents a significant departure from the more common model of humanitarian relief where support is provided after a disaster strikes. The opportunity to respond quickly to shocks is made possible by dramatic improvements in scientists' ability to predict extreme weather events and better aid distribution systems that reach households more quickly. As of 2024, FbAA had become a cornerstone of programming for major institutions including World Food Programme (WFP), United Nations Office for the Coordination of Humanitarian Affairs (OCHA), and the Food and Agriculture Organization (FAO).

Despite growing enthusiasm for anticipatory action, there is limited causal evidence comparing its effectiveness to humanitarian assistance delivered after disasters occur. This paper examines whether receiving FbAA provides additional benefits beyond those that households would have gained if they received assistance later—or whether it merely shifts those benefits earlier in the season, without generating overall welfare gains. Near the peak of a shock, FbAA assistance is disbursed, and is designed to provide critical support: improving mental health, helping households maintain food security, and allowing them to meet urgent needs without relying on costly coping strategies. After the crisis has passed, when assistance would typically be disbursed, it is ambiguous whether FbAA continues to provide an advantage or not. Outcomes may be better for households receiving support after the shock, suggesting that FbAA simply shifts the timing of benefits without improving overall results. This could happen if the need for support grows as the crisis unfolds, or if market disruptions immediately after a shock make later cash assistance more effective. However, if the FbAA group experienced short-term benefits that put them on a stronger long-term path, they could experience overall gains from receiving assistance earlier. Finally, as households recover and return to their stable equilibrium, further differences between FbAA and traditional assistance may emerge. These differences may stem from avoiding the negative consequences of harmful coping strategies or benefiting from time sensitive investments made during the early recovery period.

To examine this question, we analyze the World Food Programme's (WFP) FbAA program. We conduct this study in two countries—Bangladesh and Nepal—to build a stronger evidence base on the impacts of FbAA. In Nepal, we randomly assigned 138 villages to two treatment arms, FbAA and a post-flood assistance arm representing the normal timing of

transfers delivered by humanitarian assistance. Similarly, in Bangladesh we randomly assigned 300 villages to the same two treatment groups, (1) FbAA and (2) post-flood assistance. In Bangladesh, we extended the design to vary the timing of post-flood assistance.

Both FbAA and post-flood assistance groups received a warning about riverine floods, experienced the flood event at the same time, and received a one-time lump sum transfer of the same value. The only difference between the two groups was the timing of the transfer in relation to the flood event. The FbAA group received transfers within days of the flood trigger. In Nepal, approximately 46% of FbAA households received transfers 3 days after the flood peak, and over 90% of the FbAA group received the transfer within 2 weeks of the flood peak. In Bangladesh, transfers were distributed through mobile money, and the FbAA group received their transfers 2 days before the floodwaters reached their peak. The post-flood assistance group received transfers much later in both countries – approximately 1.5 months after the flood peak in Nepal, and 1 month after the flood peak in Bangladesh.

We compare outcomes between the FbAA group and the post-flood assistance group to assess the impact of FbAA relative to post-flood assistance. To measure these effects, we conducted three survey rounds (referred to as short-run, medium-run, and long-run). The short-run survey took place a few weeks after the FbAA group received their transfer and after the flood peak, but before the post-flood group received theirs. The medium-run survey was conducted a few weeks after the post-flood group received their transfer, well after the flood peak, such that both groups had received their transfers. Finally, the long-run survey was conducted six months after the post-flood group received its transfer in Nepal, and 1.5 months after the post-flood group received their transfer in Bangladesh.[1]

We document three key findings. In the short run, soon after the flood—a period of acute stress for households—we find that FbAA significantly improves food security in both countries. The pooled results show that households assigned to FbAA have a food consumption score (FCS) that is 1.1 points (2.4%) higher, and are 4.2 percentage points more likely to reach "acceptable" food security levels, driven by more households eating meat. Additionally, the Reduced Coping Strategies Index (rCSI), a proxy for household food insecurity, decreases significantly for the FbAA group in both countries by approximately 1.1 points (6.8%). We also find that FbAA boosts psychosocial well-being in both countries. We see that our measure of depression (PHQ-4) falls (less depressed) by 0.101 SD, while our measure of life satiscation (Cantril ladder) improves (better life) by 0.179 SD. These improvements are larger per dollar of transfer to the effects of multi-faceted anti-poverty interventions,

[1]The timing of the long-run survey varies because of the third group in Bangladesh who received their transfer one month after the post-flood assistance group. Therefore, the long-run survey was timed to occur two weeks after this last transfer to make sure the timing of the survey relative to the transfer was similar to the previous two rounds.

which show an approximate average impact of 0.1 standard deviations per $1,000 PPP in cash transfers (Ridley et al., 2020). Finally, we observe reduced borrowing and increased savings in Bangladesh (these data were not collected in Nepal), which may help explain the improvements we find in food security and mental health.

In the medium run, after the crisis has passed, and the post-flood assistance group has received their transfer, we find that both groups have similar FCS and rCSI scores. This suggests that the FbAA group's receipt of earlier funds improves their food security sooner without a trade-off of (relatively) lower food security in the future. Similarly, we find that the psychosocial well-being of both groups remains comparable at this time. Once again, this suggests that FbAA provides early benefits while leading to similar outcomes later.[2]

In the long run, as households recover and return to their stable equilibrium, we see no differences between the FbAA group and the post-flood assistance group. Taken together these results show that receiving early FbAA support leads to overall gains: the total benefits for the FbAA group—combining short-run, medium-run and long-run outcomes—are higher. Households in the FbAA group experience positive benefits of the cash transfers early after the floods, but continue maintaining equal or better outcomes than the post-flood group, suggesting an overall superior trajectory in the FbAA group.

One limitation of the results so far is that, by the medium run, both groups have received transfers. While outcomes appear similar for the FbAA and post-flood groups in the medium and long-run, this convergence could reflect two possibilities: either both groups are benefiting equally from the cash transfers, or the effects of FbAA have faded while post-flood transfers have little impact. We address this limitation in Bangladesh by including a third group that remains untreated in the medium run, allowing us to test whether the effects of FbAA persist over time. We find that the FbAA group has significantly higher food security scores than the pure control group at this point in time. By comparing the impact of FbAA transfers to the impact of recently received post-flood transfers (when both are compared to the group who has not received transfers), we find that the FbAA group outperforms the group that has not yet received transfers, suggesting the benefits of FbAA persist for at least 2 months after the flood. We also observe that the FbAA group performs at least as well as the post-flood group — if anything, the improvement in food security indicators relative to the as-yet untreated group is somewhat higher, though we cannot reject equivalence in these two coefficients.

This paper makes three primary contributions. First, we contribute to a growing lit-

[2]We find no significant changes in the other outcomes we measured, including non-food expenditure, financial outcomes (borrowing, savings, and assets), migration, and non-agricultural earnings. This suggests that early cash assistance is effective for improving food security and mental health but does not drive larger-scale investments or broader economic changes over this time horizon.

erature investigating how early assistance can help households cope with extreme weather events. We build on Balana et al. (2023) who compare an anticipatory action program to post-flood assistance in Nigeria and Pople et al. (2023) who study a slow onset event (droughts) in Niger and report similar effects from providing early transfers. To our knowledge our study is the only one compare early and late cash transfers in response to sudden climatic shocks (floods), measuring outcomes at different points in time: the short-run – when only anticipatory action has been disbursed – as well as in the medium and long run – when both anticipatory and post-flood assistance have been transferred. Crucially, we measure the impact of FbAA in two different country contexts and find remarkably similar results in both, providing strong evidence for the external validity of our findings.

Second, we contribute to a related literature from predominantly non-emergency settings which has recognized that the timing of programs can affect their impacts (Jalan and Ravallion, 2003; Datt and Ravallion, 1994; Bertrand et al., 2017). Beegle, Galasso, and Goldberg (2015) explicitly shift a cash-for-work program from the harvest to the lean season, but find no evidence that food security improves. In contrast, Lane (2024) finds value in targeting households earlier in the growing season with a guaranteed credit. In contrast to these studies, our research explicitly compares pre-shock and post-shock assistance within a humanitarian context.

Finally, we contribute to a global effort to identify programs that help households cope with climactic shocks. The literature on the impact of immediate relief efforts in emergency settings is relatively scarce (Jeong and Trako, 2022), and our study offers direct evidence on the effectiveness of cash transfers for humanitarian relief in response to shocks. A broader literature in non-emergency settings—e.g., Emerick et al. (2016), Kondylis et al. (2023), and Jones et al. (2022)—shows that agricultural technologies can improve outcomes in the face of weather shocks, but these interventions are less well-suited for rapid response.

2 Context: Flood Assistance and FbAA

Bangladesh and Nepal are particularly vulnerable to natural disasters (Eckstein, Künzel, and Schäfer, 2021). Climate projections suggest that the frequency and intensity of extreme weather events, including heavy monsoon rainfall, will continue to increase in the region (World Bank, 2021). A significant share of the population in both countries depends on subsistence agriculture (69% in Nepal and 87% in Bangladesh), making their livelihoods highly vulnerable to flooding.

Post-flood assistance. The WFP's post-flood response involves working with governments to identify flood-affected areas, mobilizing resources, validating which households were impacted by floods after the flood peak, and distributing resources accordingly. This often means support through cash transfers only reaches households 2-3 months after floods occur (Pople et al., 2023).

Forecast-based Anticipatory Action. In the past decade, WFP has launched FbAA programs around the world. The FbAA system ensures that vulnerable households in flood-prone areas receive financial assistance within days of peak flooding. These programs use weather forecasts to set thresholds that activate program response. In Nepal, the triggers are based on the Global Flood Awareness System (GloFAS) forecast for riverine floods—which is part of the European Commission's Copernicus Emergency Management Service (Centre for Humanitarian Data, 2023). Bangladesh uses riverine flood triggers derived from a forecast that includes both GloFAS and national forecasts produced by the Flood Forecasting and Warning Centre of the Bangladesh Water Development Board. In Nepal (2022), FbAA households received transfers a few days after the flood peak, and in Bangladesh (2024), they received them a few days before the peak.[3]

Comparing FbAA to post-flood assistance FbAA delivers cash within days of a shock, helping households maintain consumption, improve food security, and avoid costly coping strategies—factors that may also reduce stress and support better mental health. While the short-term benefits of receiving assistance immediately following a shock are expected to be positive, it is unclear whether FbAA puts households on a stronger long-term trajectory or simply shifts the timing of benefits associated with cash transfers earlier in the season. In the latter case, post-flood groups would eventually experience similar benefits, just at a later point in time. Indeed, receipt of cash transfers may be equally or more beneficial later in the season if conditions worsen in the months following the flood or if financial support is more practical later, when markets have stabilized, and prices are less volatile.

It is important to note that our experiment does not assess the targeting implications of acting earlier versus later. If forecasts are inaccurate, acting early may either mistakenly target additional unaffected households, or fall short of targeting all affected households, relative to post-flood assistance. In our study, however, recipients in both the FbAA and post-flood groups are selected before the flood occurs. This means we do not capture differences in targeting, and our results reflect the effects of early assistance, net of any targeting variation between approaches.

[3]See Online Appendix B for details on the trigger system.

3 Research Design

3.1 Sample

To build the sample, the WFP first identified a set of eligible districts that were historically subject to flooding, were economically disadvantaged, and were covered by the GloFAS flood forecast. Villages within these districts were then selected based on having between 25 and 60 registered households. In Nepal, this process resulted in a sample of 140 villages across the Karnali River Basin, and 2,983 registered households for the evaluation of which we surveyed a random sampled of 2,212.[4] In Bangladesh, this process resulted in a sample of 300 villages, and 11,810 registered households for the evaluation of which we surveyed a random sample of 4,721.

3.2 Intervention

Cash transfer timing To measure the impact of FbAA, we randomly assigned villages to a group that received FbAA, and another that received traditional post-flood assistance. Both groups received warnings about the flood, experienced the flood at the same time, and received transfers of equal value. The only difference between them was the timing of the transfers.

In Nepal, households in the FbAA group started receiving the one-off transfers a few days after the flood peak. The post-flood group received transfers approximately 1.5 months after the flood peak. The transfers to both groups were valued at NPR 15,000 (115$ USD). This represents 80% of the minimum monthly food expenditure basket.

In Bangladesh, households in the FbAA group received the one-off transfers a few days before the flood peak. The post-flood transfer group received transfers approximately 1 month after the flood peak. The transfers to both groups were valued at Tk 5000 ($ 41), and they were issued once via mobile money. This represents 39% of the minimum monthly food expenditure basket. In Bangladesh, some villages were also randomly assigned to a third group, which received transfers with a longer delay—approximately 2 months after the flood peak and 1 month after the post-flood group received their transfer. In the short and medium run — before the third group receives any transfers — this setup allows us to assess whether the FbAA and post-flood assistance groups experience significant benefits from cash transfers compared to receiving no assistance. Once this third group receives their transfer, we can evaluate whether the FbAA and post-flood assistance groups continue to perform as

[4]Two villages of the original 140 villages selected could not be surveyed because of security concerns, both were assigned the FbAA treatment. As a result, our final study sample consists of 68 FbAA villages and 70 Post-flood villages.

well—or even better—than this last group. In other words, this setup allows us to assess whether the benefits of FbAA persist or fade over a longer time horizon than what we can speak to in the Nepal context.

Intervention triggers In Nepal, the flood trigger was met in the Karnali basin on October 8, 2022. Geospatial data from the WFP's Asset Impact Monitoring System (AIMS) confirmed that extensive flooding occurred in October, affecting approximately 25% of the agricultural land in the survey area. Media reports also indicated that the October 2022 floods were severe, causing flood-related deaths along the river monitored by our study's flood trigger (BBC, 2022). In Bangladesh, the trigger was announced on July 4, 2024. The flooding was severe, with water levels staying above the trigger level for two weeks. Satellite imagery from July 16, 2024, confirms that large parts of the study area still had standing water 12 days after the trigger was announced.

4 Data

4.1 Data Collection Timeline

Figure 1 overlays the data collection timelines with the time series of water level, as well as the timing of transfers in our two treatment arms. In Nepal, the flood peak occurred on October 9th with the FbAA group received transfers starting from October 11th, while the post-flood group received transfers approximately 1.5 months later in late November. We conducted three rounds of surveys. We first interviewed households in early November 2022 (what we call the "short-run"), approximately one month after the FbAA group received their transfer, but before the post-flood group received theirs. We ran a second interview in mid-January 2023 (what we call the "medium-run"), approximately 1.5 months after the post-flood group received their transfer, thus capturing a period after which both groups had received transfers. We conducted the final survey in late May 2023 (what we call the "long-run"), just before the next main planting season.

In Bangladesh, the trigger was activated on June 18th, 2024 and the flood continued to rise and peaked on July 6th. The FbAA group received transfers starting July 4th, a few days before the flood peak. The post-flood group received transfers approximately one month later in early August. The last group, which serves as a comparison group, received transfers on September 6th. We conducted three rounds of surveys. We first interviewed households in early July 2024 (the "short-run"), approximately two weeks after the FbAA group received their transfer, but before the post-flood group received theirs. We ran a second interview in

mid-August 2024 (the "medium-run"), approximately two weeks after the post-flood group received their transfer – such that both the FbAA group and post-flood group had received transfers. We conducted the final survey in September 2024 (the "long-run"), approximately 2 weeks after the last group received their transfer.

4.2 Survey Data

The two primary outcomes for the study are households' food security and psychological well-being, which we capture across all three rounds of data collection. We utilize the Food Consumption Score (FCS) index that was developed by WFP for our main measure of food security. To construct this index, we ask about frequency of consumption of nine different food groups, customized to the local contexts. These values were weighted according to their nutritional values. Additionally, we include a Reduced Consumption Strategies Index (rCSI) that assesses whether households employed specific strategies to manage food consumption over the past 4 weeks. Next, we measure psychological well-being in two ways. First,the PHQ-4 patient health questionnaire for anxiety and depression and a self-reported life satisfaction via a Cantril's ladder. We also collect a set of secondary outcomes. This includes non-food consumption expenditure over the past month; financial outcomes including savings, borrowing and assets; non-agricultural earnings including wages, business profits, and livestock; and migration.

4.3 Administrative Data

We also have access to administrative data from the WFP on eligible beneficiaries before the transfers were distributed, allowing us to assess baseline characteristics and balance. Tables A1 and A2 show that our treatments groups are balanced in both countries. Otherwise, these tables show that the majority of households are, as expected, in engaged in agriculture (89% in Nepal and 80% in Bangladesh), making them especially exposed to the flood shock.

5 Results

In each country, we estimate the impact of FbAA relative to post-flood transfers on all outcomes through the following regression equation:

$$y_{ijkt} = \beta_t FbAA_j * Round_t + \theta_{tk} + \epsilon_{ijkt} \tag{1}$$

where y_{ijkt} is an outcome for household i in village j and municipality k measured in

survey round t. Our coefficient of interest is β_t, the impact in survey round t of being in a village assigned to receive FbAA transfers; the omitted category is the post-flood group.[5] We include fixed effects at the district-round level (θ_{tk}), as district is our randomization strata. We cluster standard errors at the level of villages j.

In Round 1 (the short-run), the post-flood group has not yet received any cash: β_1 therefore identifies the value of receiving cash early relative to not receiving any cash yet. In Rounds 2 (the medium-run) and 3 (the long-run), the post-flood comparison group has received cash: our estimates then capture the difference between receiving funds earlier versus later. One additional note is that Round 3 was conducted at different times after the flood peak and transfer receipt in Nepal and Bangladesh (eight months post-flood peak in Nepal and three months in Bangladesh), which makes direct cross-country comparisons difficult. However, in both cases, the survey was conducted after the floodwaters had fully receded, months after the flood peak when households may be considered to be returning to a non-active flooding equilibrium (see Figure 1).

To estimate the combined effects of FbAA across our two countries, we take the estimates from each country and weight them by the inverse of their variance. This approach gives us the average impact for the typical country in our sample, with more precise estimates being given greater weight. Alternatively, we run a specification that pools the data and includes country fixed effects, which yields the average impact for any individual exposed to the treatment in our sample (not reported). Both estimation strategies produce similar results in this case.

Short-Run: Impacts in the immediate aftermath of the floods Table 1 (Columns 1 and 2) presents the impact of FbAA on two key measures of food security in Round 1: the Household Food Consumption Score (FCS) and the Reduced Coping Strategy Index (rCSI). Panel A shows results for Nepal, Panel B for Bangladesh, and Panel C presents an inverse-variance weighted average of the treatment effects from both countries. Pooling these estimates across countries, we find that the FbAA group experiences significantly better food security. Their FCS score is 1.1 points (2.4%) higher than the post-flood group, while their rCSI is 1.1 points lower (6.8%), indicating reduced reliance on negative coping strategies. These trends are broadly consistent across both study locations.[6] In Nepal, we observe a 2.9-point (6%) increase in FCS and a 1 point (5.7%) decrease in rCSI, indicating improved food security. In Bangladesh, while the FCS coefficient is positive, it is not statistically significant. However, as we discuss later, we find a significant improvement in another food

[5] For Bangladesh we also include $\gamma_t Postflood_j * Round_t$ to control for the third treatment arm.

[6] Note that in Bangladesh, the transfer value was less than half the value of transfers distributed in Nepal, so on a per-dollar of transfer basis the food security impacts are similar across countries.

security measure collected only in Bangladesh —the Food Insecurity Experience Scale (FIES) —which decreases by 0.27 points (4.5%). Bangladesh also experiences a significant decrease in their rCSI of 1.3 points (8%). In both countries, the changes in FCS are driven by an average (significant) 12% increase in the consumption of meats. This suggests that FbAA improved access to one of the most expensive and calorie-dense food groups.

We now examine how the early distribution of cash affects mental health in the immediate aftermath of a shock, focusing on two measures: PHQ4, a screening tool for anxiety and depression risk, and self-reported life satisfaction using the Cantril Ladder. Table 2, Columns 1 and 2, show the impacts in this round. Panel C presents the pooled estimates where we find that PHQ4 falls (less depressed) by 0.101 standard deviations, while life satisfaction increases (more satisfied) by 0.179 standard deviations. These effect sizes are quite large relative to what others find in the literature. A meta-analysis by (Ridley et al., 2020), show an average impact of anti-poverty programs on PHQ9 of 0.1 standard deviations per $1,000 PPP. The FbAA program achieves the same impact with only a tenth of the transfer size.

We also collected a series of secondary outcomes variables, including Financial behavior (Table A7) and Non-agricultural earnings (Table A8). The only statistically significant results in this round are a positive effect on financial behaviors (only collected in Bangladesh in Round 1), where the FbAA group saved 3 USD (37%) more and borrowed 9 USD (17%) less than the post-flood group who had not yet received transfers. In a context where thin credit markets lead to high borrowing costs and financial stress, this boost in savings and avoided borrowing costs could be a channel to the improvements we find in food security and mental health. We find no differences on wage income or business income. These comparisons suggest that while cash assistance arriving as early as possible through FbAA is effective for improving food security and mental health, and impacts savings and borrowing, it does not lead recipients to change their other economic behaviors or income generation strategies as they cope with floods in the short term.

Medium Run: Relative impacts of early transfers compared to recently delivered post-flood transfers in the early recovery period This round measures outcomes for both groups shortly after the post-flood group has received transfers. This is now a comparison of the FbAA group who received cash as quickly as possible after a flood trigger against a group who has received cash more recently to this survey round. This period is particularly important for evaluating the effectiveness of FbAA relative to post-flood transfers. Given that the post-flood group has received cash recently, we might expect that higher food security and better mental health among this group relative to FbAA. In this case, the impact of FbAA relative to a post-flood transfer would simply be moving the

benefits of cash receipt earlier without an absolute gain across all time periods. However, if instead the post-flood group reports similar outcomes as the FbAA households (or remains behind them), then this implies that FbAA improves well-being immediately with no relative cost in the future. Therefore, FbAA would represent a pure welfare gain relative to post-flood transfers as it puts households on a better trajectory.

Table 1 (Columns 3 and 4) compares food security outcomes between the FbAA and post-flood groups in this round, after both groups received their transfers. We find no significant differences between the groups for either measure of food security. The pooled coefficient for FCS is positive but not statistically significant, while it is both positive and borderline-statistically significant ($p = 0.121$) for Bangladesh. While the post-flood group recently received their transfer, they show no noticeable improvement in food security compared to the FbAA group, which received their transfer weeks or even months earlier. Equal food security in this round suggests an overall benefit for the FbAA group who earlier had higher food security and now achieves equivalence.

We next look at mental health outcomes (Columns 3 and 4 of Table 2). In both the pooled and country-specific estimates, we now cannot reject that mental health and subjective well-being are the same in both groups, again indicating that post-flood assistance merely allows recipients to catch up to, rather than surpass the levels achieved by the FbAA group.

Turning to other outcomes, we again find small differences between the FbAA group and the post-flood group. Table A6 shows the impact of FbAA on non-food expenditure (newly collected in this round). We find a negative effect in Nepal, where the FbAA group spent 15 USD ($p = 0.092$) less on non-food items compared to the ex-post group. This difference is primarily due to 11.2 USD lower expenditures on house repairs. Since we did not collect this data in the previous round, we cannot rule out the possibility that the FbAA group in Nepal made house repairs immediately after receiving transfers, while the post-flood group delayed such expenditures.

On financial behaviors (Table A7) and non-agricultural livelihoods (Table A8), the only statistically significant effect we find pooled across rounds is a 4 USD (11%) increase in wage income in the FbAA group compared to the post-flood group ($p = .085$). In Nepal, we also find a marginally significant decrease in the FbAA group on business profits ($p = .099$), but these earnings are small in this round with an estimate of impact of -2.5 USD or 38% of the mean earnings across countries of 6.6 USD. Finally, migration outcomes were only collected in Bangladesh in this round (Table A10), and we find no effects.

Long-Run: Relative Impacts of Early Transfers Compared to Post-Flood Transfers During a Later Recovery Period Our final assessment involves comparisons of

FbAA against post-flood response in a round at least three months after the flood peak.[7]

Columns 5 and 6 of Table 1 compare the FbAA and post-flood groups in this round on food consumption and coping strategies. We see no effects for FCS in either country, suggesting that the food security gains from FbAA have diminished over time. Notably, FbAA outcomes remain at least as good as those of the post-flood group, indicating that early assistance did not lead to worse long-term food security outcomes. Indeed, in Bangladesh, where rCSI was still collected in this round, we continue see a statistically significant reduction (4%) in negative coping strategies among the FbAA group relative to the post-flood group. Turning to mental health in columns 5 and 6 of Table 2, we still cannot reject the equivalence of PHQ4 and Cantril ladder in the two groups, suggesting that differences in cash transfer timing do not lead to measurable differences in mental health in the long run.

Finally, in this round, we find no statistically significant impacts on our measures of non-food expenditure (Table A6) financial behaviors like borrowing, savings, or assets (Table A7), non-agricultural livelihoods (Table A8), agriculture activities (Table A9), or migration (Table A10) with most point estimates close to zero.

Summary Overall, the results suggest that FbAA leads to immediate improvements in food security and mental health. In Bangladesh, we also find that households increase their savings and reduce reliance on costly borrowing. These financial adjustments may help explain the improvements we observe in food security and mental health. When the post-flood group also receives an equivalent transfer, this group merely catches up to the level of the FbAA group rather than surpassing them, suggesting that the early realization of impacts for the FbAA group is a pure gain relative to post-flood humanitarian transfers. This pattern highlights the advantage of anticipatory action in achieving better outcomes early on, with similar outcomes later.

Adding a Comparison to the Short and Medium Term Estimates in Bangladesh In Bangladesh, the research design included a third group that received cash transfers two months after the FbAA group and one month after the post-flood group. We refer to this group as the later post-flood group. Importantly, this group serves as a "pure control" for the first and second survey rounds in Bangladesh, allowing us to compare the FbAA and post-flood groups to individuals who had not yet received any assistance. We estimate the

[7]Recall the long-run survey was conducted six months after the post-flood group received its transfer in Nepal, and 1.5 months after the post-flood group received their transfer in Bangladesh. In both countries, we do not find significant effects on these measures, so we don't have reason to believe impacts are sensitive to this choice of intervals for the final follow-up.

impacts of FbAA and Post-Flood relative to Later Post-Flood with the following regression:

$$y_{ijkt} = \beta_t FbAA_j * Round_t + \gamma_t Postflood_j * Round_t + \theta_{tk} + \epsilon_{ijkt} \quad (2)$$

where $Postflood_j$ is the 1 month post-flood group, and the excluded category is now the later post-flood group who receives cash two months after the FbAA group, representing the longer humanitarian response timeline. The coefficient β_t represents the impact of FbAA relative to the later post-flood group who will receive their transfer two months after the flood. The coefficient γ_t represents the impact of the post-flood group (who receives their transfers 1 month after the flood) compared to the later post-flood group who will receive their transfer two months after the flood. This specification allows us to compare the impact of FbAA transfers and recent post-flood transfers, each relative to a group that has not yet received any assistance. Crucially, it helps us assess whether the medium-run similarities we documented above between the FbAA and post-flood groups reflect genuine improvements in both, or instead indicate that the effects of FbAA have faded while post-flood transfers have limited impact.

Earlier, we found that FbAA improved food security compared to the 1-month post-flood group in the short-run. Table 3 further shows that the FbAA group also experienced better food security outcomes than the 2-month post flood group: FCS improves (insignificantly) by 0.59 points (1.2%), rCSI falls by 1.58 points (6.4%) and FIES falls by 0.27 points (4.5%). Similarly we see improvements in both PHQ4 ($p = 0.109$) and the Cantril Ladder ($p = 0.055$) compared to the 2-month post flood group (Table 4). We do not interpret differences between the 1 month post-flood and 2 month later post-flood group in the short run, as neither had received their transfer at that point.

In the medium-run, when the 1-month post-flood group has recently received their transfer but the 2-month later post-flood group has not, the FbAA group continues to experience better food security outcomes relative to the 2-month post-flood group: FCS improves by 2.25 points, rCSI falls by 0.98 points and FIES falls by 0.24 points. In fact, the point estimates in this round are nearly the same magnitude as they were in the first round indicating that the benefits of early cash transfers persist with little to no decline, even six weeks after the FbAA transfer. We do not find significant differences in psychological outcomes, however. We also find that the 1-month post-flood group (who had just received transfers) shows improvements in FCS, rCSI, and FIES relative to the 2-month post-flood group (who had not yet received transfers), though these differences are not statistically significant.

These patterns suggest that the improvements in food security that we observe among the FbAA group in the medium-run reflect the remarkable persistence of FbAA impacts:

even two months later, the FbAA group continues to show outcomes that are better than a group that has yet to receive transfers, and at least as strong (if not stronger) as those of the post-flood group.

Finally, in the long-run, the 2 month post-flood group has now received their transfer. We do not see clear differences in food security measures, or psychosocial outcomes, either for the FbAA or 1 month post-flood group, relative to the 2 month post-flood group. This indicates no lasting differences across groups by the end of data collection.

6 Conclusion

In this paper, we assess the impact of the timing of humanitarian transfers in response to a flood in Nepal and Bangladesh. We find that the FbAA group experiences better food security and mental health after receiving a cash transfer, compared to the post-flood group, which has yet to receive theirs. After the post-flood group receives their transfers, we see no meaningful differences between the two groups, even though the post-flood group received their transfer more recently. The fact that the FbAA group does not perform worse relative to the post-flood group, even when the post-flood group has received cash much more recently, suggests that FbAA provides early benefits without compromising gains later on. The consistency of these results across countries suggests the impact of FbAA may not be unique to a particular context. Future research will need to explore a range of additional outcomes including trade-offs associated with targeting errors, and the intersection between these anticipatory-action programs with other climate-adaptation measure.

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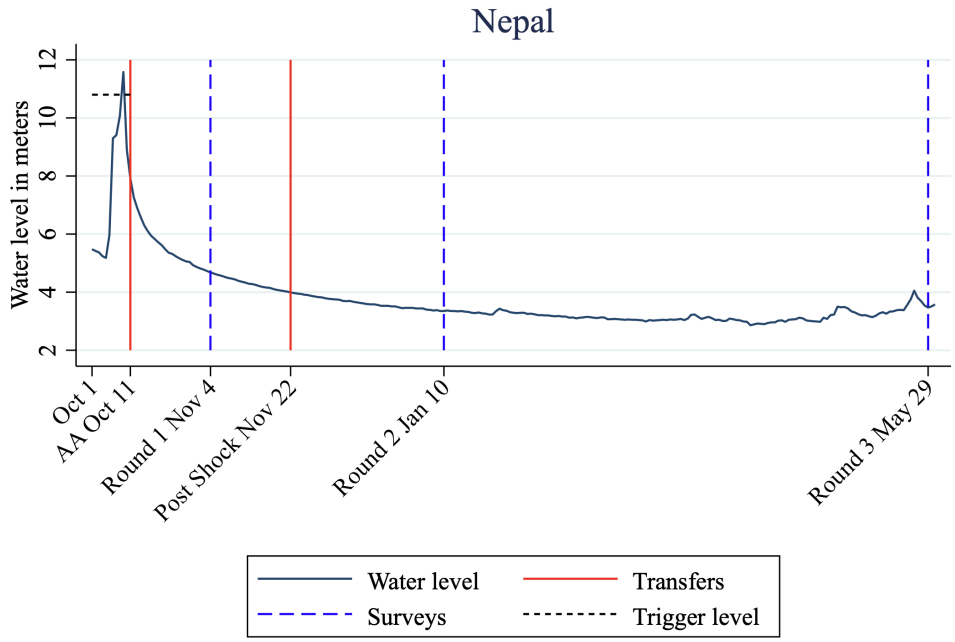
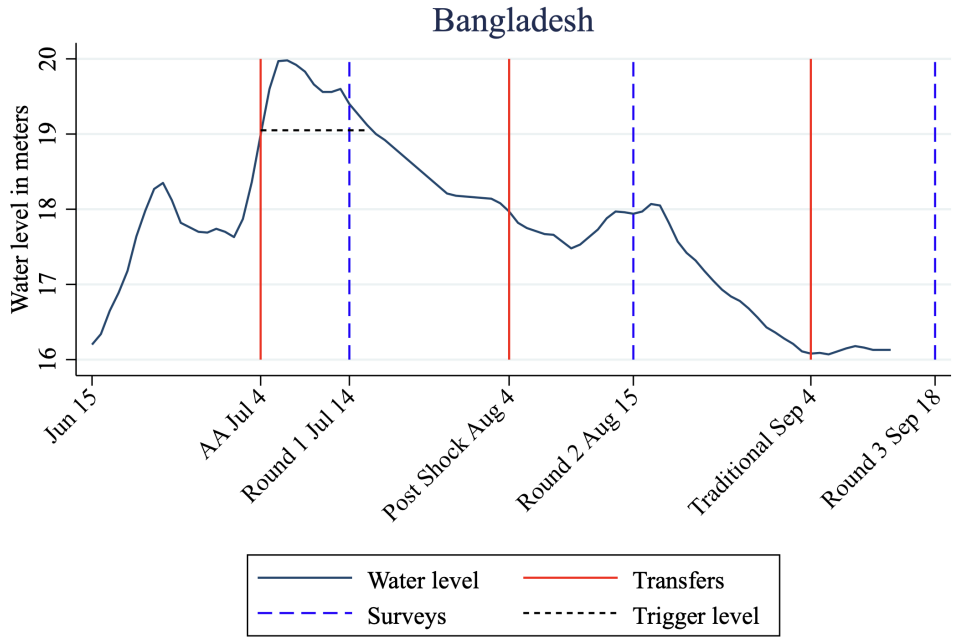
Figures

Figure 1: Timeline of Flooding and Transfers



Chisapani station measured water level.



Bahurabad station measured water level.

Notes: This figure show the time of events in Nepal and Bangladesh respectively. It shows transfer dates (solid red lines) for the FbAA, post-flood group, and status-quo (Bangladesh only) group. It also shows survey dates (dashed blue lines) for all three rounds of surveys. The water level height in meters (solid dark-blue line) is also plotted across the study period. The trigger level, which was used to initiate FbAA transfer is shown also shown (dashed black line).

Tables

Table 1: Main results: Food outcomes

	Round 1		Round 2		Round 3	
	FCS	rCSI	FCS	rCSI	FCS	rCSI
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Nepal						
Anticipatory Action	2.883**	-0.959*	-0.063	0.220	0.386	
	(1.200)	(0.557)	(1.347)	(0.339)	(1.077)	
	[0.018]	[0.087]	[0.963]	[0.518]	[0.720]	
	N=2212	N=2212	N=2365	N=2365	N=2408	
Panel B: Bangladesh						
Anticipatory Action	0.542	-1.337**	1.168	-0.397	0.455	-0.887**
	(0.707)	(0.562)	(0.751)	(0.566)	(0.547)	(0.429)
	[0.445]	[0.018]	[0.121]	[0.484]	[0.405]	[0.039]
	N=4721	N=4721	N=4761	N=4761	N=4485	N=4485
Panel C: Inverse-Variance Weighted-Average						
Anticipatory Action	1.146*	-1.146***	0.876	0.057	0.441	
	(0.609)	(0.396)	(0.656)	(0.291)	(0.487)	
	[0.060]	[0.004]	[0.182]	[0.846]	[0.365]	
Avg in Post-flood grp:NEP	47.9	6.5	47.9	2.6	47.4	
Avg in Post-flood grp:BGD	47.0	24.2	48.0	23.4	50.9	21.7
Avg in Post-flood grp:Pooled	47.4	16.8	48.0	14.6	49.3	
Strata X Round FE	Yes	Yes	Yes	Yes	Yes	Yes
N Clusters	428	428	438	438	438	438
N Observations	6933	6933	7126	7126	6893	4485

Notes: This table presents the impact of being in the FbAA group relative to the post-flood group on Food Consumption Score (FCS) and Reduced Consumption Strategies Index (rCSI), across the three survey rounds. Panel A shows results for Nepal only. Panel B shows results for Bangladesh only. Panel C shows an invest-variance weighted average of the results from Nepal and Bangladesh. Asterisks indicate statistical significance at the 1% ***, 5% **, and 10% * levels.

Table 2: Main results: Psychological outcomes

	Round 1		Round 2		Round 3	
	PHQ4	Cantril Ladder	PHQ4	Cantril Ladder	PHQ4	Cantril Ladder
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Nepal						
Anticipatory Action	-0.097	0.154*	-0.059	0.084	0.022	0.009
	(0.070)	(0.084)	(0.069)	(0.086)	(0.061)	(0.067)
	[0.167]	[0.068]	[0.395]	[0.330]	[0.716]	[0.890]
	N=2212	N=2212	N=2365	N=2365	N=2408	N=2408
Panel B: Bangladesh						
Anticipatory Action	-0.104*	0.195***	0.044	-0.013	-0.014	0.023
	(0.057)	(0.066)	(0.054)	(0.043)	(0.038)	(0.035)
	[0.068]	[0.003]	[0.411]	[0.763]	[0.705]	[0.509]
	N=4721	N=4721	N=4761	N=4761	N=4485	N=4485
Panel C: Inverse-Variance Weighted-Average						
Anticipatory Action	-0.101**	0.179***	0.005	0.007	-0.004	0.020
	(0.044)	(0.052)	(0.043)	(0.039)	(0.032)	(0.031)
	[0.021]	[0.001]	[0.901]	[0.865]	[0.897]	[0.516]
Avg in Post-flood grp:NEP	0.051	-0.079	0.030	-0.043	-0.011	-0.004
Avg in Post-flood grp:BGD	0.067	-0.103	-0.009	0.022	0.009	0.018
Avg in Post-flood grp:Pooled	0.060	-0.093	0.007	-0.006	-0.000	0.009
Strata X Round FE	Yes	Yes	Yes	Yes	Yes	Yes
N Clusters	428	428	438	438	438	438
N Observations	6933	6933	7126	7126	6893	6893

Notes: This table presents the impact of being in the FbAA group relative to the post-flood group on PHQ4 score and Cantril ladder across the three survey rounds. PHQ4 and Cantril ladder were standardized to create z-scores using mean and standard deviation within each round. Reduction in PHQ4 implies better mental health. Panel A shows results for Nepal only. Panel B shows results for Bangladesh only. Panel C shows an invest-variance weighted average of the results from Nepal and Bangladesh. Asterisks indicate statistical significance at the 1% ***, 5% **, and 10% * levels.

Table 3: Bangladesh: Food outcomes

	Round 1			Round 2			Round 3		
	FCS	rCSI	FIES	FCS	rCSI	FIES	FCS	rCSI	FIES
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bangladesh									
Anticipatory Action	0.592	-1.584**	-0.274***	2.246***	-0.982*	-0.241**	0.654	-0.047	-0.032
	(0.806)	(0.645)	(0.089)	(0.715)	(0.564)	(0.097)	(0.547)	(0.473)	(0.081)
	[0.463]	[0.015]	[0.002]	[0.002]	[0.082]	[0.013]	[0.233]	[0.920]	[0.689]
Post-flood Transfer	0.105	-0.512	-0.120	1.078	-0.586	-0.134	0.198	0.840*	0.007
	(0.842)	(0.712)	(0.090)	(0.812)	(0.551)	(0.088)	(0.558)	(0.427)	(0.072)
	[0.901]	[0.472]	[0.182]	[0.185]	[0.288]	[0.128]	[0.723]	[0.050]	[0.924]
P-value $\beta_t = \gamma_t$	0.563	0.119	0.101	0.121	0.484	0.283	0.405	0.039	0.622
Average in delayed post-flood	47.123	24.711	6.086	47.479	23.686	5.984	50.809	21.050	5.658
Strata X Round FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N Clusters	300	300	300	300	300	300	300	300	300
N Observations	4721	4721	4721	4761	4761	4761	4485	4485	4485

Notes: This table presents the impact of being in the FbAA group and the post-flood group relative to the status-quo group on Food Consumption Score (FCS), Reduced Consumption Strategies Index (rCSI), and Food Insecurity Scale (FIES), across the three survey rounds. Asterisks indicate statistical significance at the 1% ***, 5% **, and 10% * levels.

Table 4: Bangladesh: Psychological outcomes

	Round 1		Round 2		Round 3	
	PHQ4	Cantril Ladder	PHQ4	Cantril Ladder	PHQ4	Cantril Ladder
	(1)	(2)	(3)	(4)	(5)	(6)
Bangladesh						
Anticipatory Action	-0.106	0.142*	-0.041	0.009	-0.037	0.041
	(0.066)	(0.074)	(0.057)	(0.046)	(0.037)	(0.035)
	[0.109]	[0.055]	[0.481]	[0.848]	[0.327]	[0.242]
Post-flood Transfer	-0.004	-0.108*	-0.085	0.022	-0.022	0.018
	(0.066)	(0.064)	(0.057)	(0.047)	(0.034)	(0.036)
	[0.948]	[0.093]	[0.135]	[0.641]	[0.515]	[0.621]
P-value $\beta_t = \gamma_t$	0.118	0.001	0.411	0.763	0.705	0.509
Average in delayed post-flood	0.064	-0.023	0.095	-0.008	0.015	-0.026
Strata X Round FE	Yes	Yes	Yes	Yes	Yes	Yes
N Clusters	300	300	300	300	300	300
N Observations	4721	4721	4761	4761	4485	4485

Notes: This table presents the impact of being in the FbAA group and the post-flood group relative to the status-quo group on PHQ4 score and Cantril ladder across the three survey rounds. PHQ4 and Cantril ladder were standardized to create z-scores using mean and standard deviation within each round. Reduction in PHQ4 implies better mental health. Asterisks indicate statistical significance at the 1% ***, 5% **, and 10% * levels.

Appendix

Table A1: Balance test Nepal: FbAA vs Post-flood

Variable	(1) FbAA Mean/(SE)	(2) Post-flood Mean/(SE)	(1)-(2) Difference in means P-value
Has AG job	0.88	0.89	0.74
	(0.02)	(0.02)	
Has skilled job	0.15	0.21	0.08*
	(0.02)	(0.03)	
Has pregnant woman	0.04	0.05	0.16
	(0.01)	(0.01)	
Has disabled person	0.09	0.09	0.68
	(0.02)	(0.01)	
House brick wall	0.33	0.34	0.74
	(0.04)	(0.04)	
Receives Welfare	0.27	0.28	0.67
	(0.02)	(0.01)	
F-test of joint significance			1.06
Number of observations	1205	1203	2408
Number of clusters	68	70	138

Notes: This table presents descriptive statistics and balance tests across treatment arms using administrative data collected by WFP during registration before floods. Column 1 shows means of variables in the AA group with variance in parentheses. Column 2 shows means in the post-flood group. Column 3 shows the difference in means. Asterisks in Column 3 indicate statistical significance from a pair-wise t-test on the difference in means at the 1% ***, 5% **, and 10% * levels.

Table A2: Balance test Bangladesh: FbAA vs Post-flood vs Delayed Post-flood

	(1)	(2)	(3)	(1)-(2)	(1)-(3)	(2)-(3)
	FbAA	Post-flood	Delayed Post-flood	Difference in means		
Variable	Mean/(SE)	Mean/(SE)	Mean/(SE)	P-value	P-value	P-value
Has AG job	0.79	0.80	0.79	0.52	0.83	0.61
	(0.02)	(0.02)	(0.01)			
Has skilled job	0.02	0.02	0.02	0.60	0.64	0.94
	(0.00)	(0.00)	(0.00)			
Has pregnant woman	0.15	0.16	0.15	0.38	0.84	0.48
	(0.01)	(0.01)	(0.01)			
Has disabled person	0.07	0.08	0.07	0.80	0.95	0.86
	(0.01)	(0.01)	(0.01)			
House brick wall	0.07	0.06	0.07	0.59	0.73	0.83
	(0.01)	(0.01)	(0.01)			
Evacuated house before	0.29	0.29	0.29	0.93	0.94	0.87
	(0.04)	(0.03)	(0.04)			
F-test of joint significance				0.22	0.06	0.12
Number of observations	1594	1600	1619	3194	3213	3219
Number of clusters	100	100	100	200	200	200

Notes: This table presents descriptive statistics and balance tests across treatment arms using administrative data collected by WFP during registration before floods. Column 1 shows means of variables in the AA group with variance in parentheses. Column 2 shows means in the Post-flood group. Column 3 shows means in the Delayed Post-flood group. Column 4 shows the difference in means between column 1 and 2. Column 5 shows the difference in means between column 1 and 3. Column 6 shows the difference in means between column 2 and 3. Asterisks in Columns 4-6 indicate statistical significance from a pair-wise t-test on the difference in means at the 1% ***, 5% **, and 10% * levels.

In Tables A3, A4, and A5, we disaggregate effects on food consumption as measured by FCS into the component food group types that comprise the FCS. This provides a way to benchmark the changes in food security according the types foods consumed. This analysis reveals significant increases in the consumption of meats for the FbAA group (0.26 days per week, 12%). The gains in meat consumption occurred in both countries, increasing by 0.32 days per week (13%) in Nepal and 0.16 days per week (7%) in Bangladesh. This suggests that FbAA improved access to one of the most expensive and calorie-dense food groups. One way to benchmark the size of the overall FCS effect is to assess the change in the proportion of people who achieve the "acceptable" standardized threshold of the food consumption score. Rates of acceptable food security in the post-flood group in this round when they had not received transfers were 73.7% in Nepal and 77.54% in Bangladesh. FbAA increases the share of households whose FCS exceeded this threshold by 4.2 percentage points across each country, or 8.3 percentage points in Nepal and 2.2 percentage points in Bangladesh.

Table A3: FCS disaggregated-Round 1

	Cereal (1)	Meat (2)	Vegetable (3)	Pulses (4)	Fruit (5)	Milk (6)	Sugar (7)	Oil (8)
Panel A: Nepal								
Anticipatory Action	0.081**	0.321***	0.174	0.318	0.015	0.030	0.171	0.172*
	(0.037)	(0.075)	(0.169)	(0.198)	(0.102)	(0.156)	(0.208)	(0.099)
	[0.032]	[0.000]	[0.303]	[0.111]	[0.880]	[0.846]	[0.412]	[0.086]
	N=2212	N=2212	N=2212	N=2212	N=2212	N=2212	N=2212	N=2212
Panel B: Bangladesh								
Anticipatory Action	0.016	0.160*	-0.183	-0.007	0.146	-0.018	-0.012	0.013
	(0.047)	(0.093)	(0.113)	(0.065)	(0.092)	(0.057)	(0.064)	(0.051)
	[0.741]	[0.086]	[0.107]	[0.910]	[0.113]	[0.751]	[0.850]	[0.802]
	N=4721	N=4721	N=4721	N=4721	N=4721	N=4721	N=4721	N=4721
Panel C: Inverse-Variance Weighted-Average								
Anticipatory Action	0.056*	0.258***	-0.072	0.024	0.087	-0.012	0.004	0.046
	(0.029)	(0.058)	(0.094)	(0.061)	(0.068)	(0.053)	(0.061)	(0.045)
	[0.057]	[0.000]	[0.444]	[0.697]	[0.201]	[0.817]	[0.952]	[0.313]
Avg in Post-flood grp:NEP	6.820	1.315	4.931	4.218	0.953	1.380	3.597	6.343
Avg in Post-flood grp:BGD	6.787	2.857	3.605	2.911	2.409	0.898	0.687	6.646
Avg in Post-flood grp:Pooled	6.801	2.207	4.164	3.462	1.795	1.101	1.913	6.518
Strata X Round FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N Clusters	428	428	428	428	428	428	428	428
N Observations	6933	6933	6933	6933	6933	6933	6933	6933

Notes: This table presents the impact of being in the FbAA group relative to the post-flood group on the number of days in last week where household members ate each food group that features in the FCS score in Round 1. Panel A shows results for Nepal only. Panel B shows results for Bangladesh only. Panel C shows an inverse-variance weighted average of the results from Nepal and Bangladesh. Asterisks indicate statistical significance at the 1% ***, 5% **, and 10% * levels.

Table A4: FCS disaggregated-Round 2

	Cereal (1)	Meat (2)	Vegetable (3)	Pulses (4)	Fruit (5)	Milk (6)	Sugar (7)	Oil (8)
Panel A: Nepal								
Anticipatory Action	-0.028	0.180*	0.056	-0.061	0.034	-0.115	-0.311*	-0.035
	(0.021)	(0.103)	(0.087)	(0.219)	(0.075)	(0.181)	(0.179)	(0.031)
	[0.192]	[0.084]	[0.522]	[0.783]	[0.653]	[0.526]	[0.085]	[0.259]
	N=2365	N=2365	N=2365	N=2365	N=2365	N=2365	N=2365	N=2365
Panel B: Bangladesh								
Anticipatory Action	0.009	0.027	0.024	0.124**	0.153	0.104*	0.102	0.057
	(0.029)	(0.114)	(0.111)	(0.059)	(0.104)	(0.060)	(0.078)	(0.041)
	[0.767]	[0.813]	[0.827]	[0.036]	[0.141]	[0.088]	[0.192]	[0.165]
	N=4761	N=4761	N=4761	N=4761	N=4761	N=4761	N=4761	N=4761
Panel C: Inverse-Variance Weighted-Average								
Anticipatory Action	-0.015	0.111	0.044	0.111**	0.075	0.082	0.036	-0.002
	(0.017)	(0.077)	(0.068)	(0.057)	(0.061)	(0.057)	(0.072)	(0.025)
	[0.377]	[0.147]	[0.521]	[0.050]	[0.219]	[0.154]	[0.615]	[0.940]
Avg in Post-flood grp:NEP	6.983	1.602	6.263	3.121	0.602	1.385	4.641	6.934
Avg in Post-flood grp:BGD	6.922	3.340	4.067	2.865	1.344	0.755	0.759	6.764
Avg in Post-flood grp:Pooled	6.948	2.602	4.999	2.974	1.029	1.023	2.407	6.836
Strata X Round FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N Clusters	438	438	438	438	438	438	438	438
N Observations	7126	7126	7126	7126	7126	7126	7126	7126

Notes: This table presents the impact of being in the FbAA group relative to the post-flood group on the number of days in last week where household members ate each food group that features in the FCS score in Round 2. Panel A shows results for Nepal only. Panel B shows results for Bangladesh only. Panel C shows an inverse-variance weighted average of the results from Nepal and Bangladesh. Asterisks indicate statistical significance at the 1% ***, 5% **, and 10% * levels.

Table A5: FCS disaggregated-Round 3

	Cereal (1)	Meat (2)	Vegetable (3)	Pulses (4)	Fruit (5)	Milk (6)	Sugar (7)	Oil (8)
Panel A: Nepal								
Anticipatory Action	-0.001	0.173*	-0.022	0.002	0.084	-0.052	-0.364*	0.037
	(0.002)	(0.088)	(0.097)	(0.161)	(0.099)	(0.153)	(0.212)	(0.030)
	[0.734]	[0.052]	[0.821]	[0.988]	[0.397]	[0.736]	[0.088]	[0.218]
	N=2408	N=2408	N=2408	N=2408	N=2408	N=2408	N=2408	N=2408
Panel B: Bangladesh								
Anticipatory Action	0.004	0.107	-0.129	0.060	0.134**	-0.033	-0.088	0.020
	(0.009)	(0.076)	(0.080)	(0.072)	(0.066)	(0.066)	(0.092)	(0.022)
	[0.701]	[0.157]	[0.108]	[0.404]	[0.043]	[0.617]	[0.338]	[0.351]
	N=4485	N=4485	N=4485	N=4485	N=4485	N=4485	N=4485	N=4485
Panel C: Inverse-Variance Weighted-Average								
Anticipatory Action	-0.001	0.135**	-0.086	0.050	0.119**	-0.036	-0.132	0.026
	(0.002)	(0.057)	(0.062)	(0.065)	(0.055)	(0.061)	(0.084)	(0.017)
	[0.816]	[0.019]	[0.165]	[0.441]	[0.030]	[0.553]	[0.117]	[0.139]
Avg in Post-flood grp:NEP	6.998	1.447	5.797	3.613	1.136	1.259	2.777	6.906
Avg in Post-flood grp:BGD	6.976	3.605	4.651	2.870	0.841	1.017	1.777	6.877
Avg in Post-flood grp:Pooled	6.986	2.642	5.162	3.202	0.973	1.125	2.223	6.890
Strata X Round FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N Clusters	438	438	438	438	438	438	438	438
N Observations	6893	6893	6893	6893	6893	6893	6893	6893

Notes: This table presents the impact of being in the FbAA group relative to the post-flood group on the number of days in last week where household members ate each food group that features in the FCS score in Round 3. Panel A shows results for Nepal only. Panel B shows results for Bangladesh only. Panel C shows an inverse-variance weighted average of the results from Nepal and Bangladesh. Asterisks indicate statistical significance at the 1% ***, 5% **, and 10% * levels.

Table A6: Main results: Non-food spending

	Round 1	Round 2	Round 3
	Spending	Spending	Spending
	(1)	(2)	(3)
Panel A: Nepal			
Anticipatory Action		-14.857*	-4.795
		(8.744)	(7.813)
		[0.092]	[0.540]
		N=2365	N=2408
Panel B: Bangladesh			
Anticipatory Action		0.754	-2.060
		(2.981)	(2.960)
		[0.800]	[0.487]
		N=4761	N=4485
Panel C: Inverse-Variance Weighted-Average			
Anticipatory Action		-0.872	-2.403
		(2.822)	(2.768)
		[0.757]	[0.385]
Avg in Post-flood grp:NEP		58.9	77.2
Avg in Post-flood grp:BGD		46.1	45.2
Avg in Post-flood grp:Pooled		51.5	59.5
Strata X Round FE		Yes	Yes
N Clusters		438	438
N Observations		7126	6893

Notes: This table presents the impact of being in the AA group relative to the rapid post-flood group on non-food spending. Non-food consumption categories include: electricity, education, fuel, household repairs, medical, and house rent. Values are reported in USD. Panel A shows results for Nepal only. Panel B shows results for Bangladesh only. Panel C shows an inverse-variance weighted average of the results from Nepal and Bangladesh. Asterisks indicate statistical significance at the 1% ***, 5% **, and 10% * levels.

Table A7: Main results: Borrowing, savings, assets

	Round 1			Round 2			Round 3		
	Borrow	Savings	Assets	Borrow	Savings	Assets	Borrow	Savings	Assets
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Nepal									
Anticipatory Action				11.099		-0.095	-22.558		-0.101
				(30.815)		(0.122)	(42.031)		(0.122)
				[0.719]		[0.434]	[0.592]		[0.409]
				N=2365		N=2365	N=2408		N=2408
Panel B: Bangladesh									
Anticipatory Action	-8.786**	2.824**		7.040	1.423		-5.812	-0.320	-0.020
	(4.351)	(1.109)		(5.437)	(2.397)		(10.684)	(6.257)	(0.056)
	[0.044]	[0.011]		[0.196]	[0.553]		[0.587]	[0.959]	[0.724]
	N=4140	N=4140		N=4544	N=4544		N=4485	N=4407	N=4485
Panel C: Inverse-Variance Weighted-Average									
Anticipatory Action				7.162			-6.829		-0.034
				(5.354)			(10.354)		(0.051)
				[0.181]			[0.510]		[0.505]
Avg in Post-flood grp:NEP				240.8		-0.1	379.6		0.2
Avg in Post-flood grp:BGD	50.4	7.7		67.2	17.6		154.2	48.5	0.0
Avg in Post-flood grp:Pooled				142.1			254.8		0.1
Strata X Round FE	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
N Clusters	424	424		438	438	438	438	438	438
N Observations	4140	4140		6909	4544	2365	6893	4407	6893

Notes: This table presents the impact of being in the FbAA group relative to the post-flood group on borrowing since the floods arrived, savings and asset accumulation. Amount borrowed and saved are shown in USD. Panel A shows results for Nepal only. Panel B shows results for Bangladesh only. Panel C shows an inverse-variance weighted average of the results from Nepal and Bangladesh. Asterisks indicate statistical significance at the 1% ***, 5% **, and 10% * levels.

Table A8: Main results: Non-agricultural earnings

	Round 1			Round 2			Round 3		
	Wages	Business	Livestock	Wages	Business	Livestock	Wages	Business	Livestock
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Nepal									
Anticipatory Action	-2.205	0.590		3.507	-2.487*		-7.217	-0.465	-2.526
	(3.317)	(1.517)		(3.676)	(1.499)		(7.408)	(1.124)	(7.127)
	[0.507]	[0.698]		[0.342]	[0.099]		[0.332]	[0.680]	[0.724]
	N=2212	N=2212		N=2365	N=2365		N=2408	N=2408	N=2408
Panel B: Bangladesh									
Anticipatory Action	-1.849	-0.661		5.244	0.834		-0.377	0.735	3.281
	(2.094)	(0.981)		(3.556)	(0.963)		(2.054)	(1.111)	(3.569)
	[0.378]	[0.501]		[0.141]	[0.387]		[0.854]	[0.509]	[0.359]
	N=4721	N=4721		N=4761	N=4761		N=4485	N=4485	N=4485
Panel C: Inverse-Variance Weighted-Average									
Anticipatory Action	-1.950	-0.292		4.404*	-0.137		-0.866	0.142	2.117
	(1.771)	(0.824)		(2.556)	(0.810)		(1.980)	(0.790)	(3.191)
	[0.271]	[0.723]		[0.085]	[0.866]		[0.662]	[0.858]	[0.507]
Avg in Post-flood grp:NEP	44.4	5.3		48.2	6.9		46.5	5.1	58.8
Avg in Post-flood grp:BGD	29.1	5.9		31.4	6.3		31.2	10.2	26.0
Avg in Post-flood grp:Pooled	35.5	5.7		38.6	6.6		38.0	7.9	40.6
Strata X Round FE	Yes	Yes		Yes	Yes		Yes	Yes	Yes
N Clusters	428	428		438	438		438	438	438
N Observations	6933	6933		7126	7126		6893	6893	6893

Notes: This table presents the impact of being in the FbAA group relative to the rapid post-flood group on wage, business and livestock income of the household. Amount borrowed and saved are shown in USD. Panel A shows results for Nepal only. Panel B shows results for Bangladesh only. Panel C shows an inverse-variance weighted average of the results from Nepal and Bangladesh. Asterisks indicate statistical significance at the 1% ***, 5% **, and 10% * levels.

Table A9: Main results: Post-flood agricultural outcomes

	Round 3					
	Planted	Area	Costs	Yield	Value	Revenue
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Nepal						
Anticipatory Action	-0.037	0.007	-2.755	0.001	11.625	7.664
	(0.030)	(0.037)	(5.470)	(0.085)	(22.932)	(10.409)
	[0.209]	[0.838]	[0.615]	[0.995]	[0.613]	[0.463]
	N=2408	N=2408	N=2408	N=900	N=2408	N=2408
Panel B: Bangladesh						
Anticipatory Action	0.005	-0.001	-0.481			
	(0.019)	(0.005)	(1.393)			
	[0.800]	[0.892]	[0.730]			
	N=4485	N=4485	N=4485			
Panel C: Inverse-Variance Weighted-Average						
Anticipatory Action	-0.008	-0.001	-0.620			
	(0.016)	(0.005)	(1.350)			
	[0.637]	[0.913]	[0.646]			
Avg in Post-flood grp:NEP	0.761	0.330	42.611	1.937	161.684	42.949
Avg in Post-flood grp:BGD	0.297	0.048	14.889		36.599	
Avg in Post-flood grp:Pooled	0.504	0.174	27.259		92.518	
Strata X Round FE	Yes	Yes	Yes	Yes	Yes	Yes
N Clusters	438	438	438	438	438	438
N Observations	6893	6893	6893	900	6873	2408

Notes: This table presents the impact of being in the FbAA group relative to the rapid post-flood group on planting crops after the flood affected season, area planted in hectares, and planting costs. Planting costs and sales revenue are shown in USD. Columns 4-6 were only asked in Nepal as households had not finished harvesting post-flood crop in Bangladesh at time of round 3 survey. Column 4 is yield of wheat crop in Nepal , Column 5 is the harvest value of crop in USD and Column 6 is the sale revenue of all crops in Nepal in USD. Panel A shows results for Nepal only. Panel B shows results for Bangladesh only. Panel C shows an inverse-variance weighted average of the results from Nepal and Bangladesh. Asterisks indicate statistical significance at the 1% ***, 5% **, and 10% * levels.

Table A10: Main results: Migration

	Round 1			Round 2			Round 3		
	Migrated	#	Days	Migrated	#	Days	Migrated	#	Days
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Nepal									
Anticipatory Action							0.010	0.043	
							(0.025)	(0.051)	
							[0.688]	[0.409]	
							N=2408	N=2408	
Panel B: Bangladesh									
Anticipatory Action				-0.005	-0.027	-0.027	0.000	0.027	-1.658
				(0.013)	(0.038)	(1.539)	(0.012)	(0.024)	(2.301)
				[0.681]	[0.482]	[0.505]	[1.000]	[0.266]	[0.472]
				N=4761	N=4761	N=576	N=4485	N=4485	N=565
Panel C: Inverse-Variance Weighted-Average									
Anticipatory Action							0.002	0.030	
							(0.011)	(0.022)	
							[0.864]	[0.173]	
Avg in Post-flood grp:NEP							0.553	0.779	
Avg in Post-flood grp:BGD				0.127	0.241	18.074	0.126	0.188	29.782
Avg in Post-flood grp:Pooled							0.316	0.452	
Strata X Round FE				Yes	Yes	Yes	Yes	Yes	Yes
N Clusters				438	438	438	438	438	438
N Observations				4761	4761	576	6893	6893	565

Notes: This table presents the impact of being in the FbAA group relative to the rapid post-flood group on whether household has any migrants (column 1), number of migrants (column 2) and average duration each migrant was away (column 3). Panel A shows results for Nepal only. Panel B shows results for Bangladesh only. Panel C shows an inverse-variance weighted average of the results from Nepal and Bangladesh. Asterisks indicate statistical significance at the 1% ***, 5% **, and 10% * levels.

Table A11: Main results: FCS acceptable/borderline/poor

	Round 1			Round 2			Round 3		
	FCS-A	FCS-B	FCS-S	FCS-A	FCS-B	FCS-S	FCS-A	FCS-B	FCS-S
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Nepal									
Anticipatory Action	0.083***	-0.066***	-0.017***	-0.009	0.007	0.003	0.014	-0.014	0.000
	(0.025)	(0.024)	(0.005)	(0.027)	(0.026)	(0.003)	(0.025)	(0.024)	(0.004)
	[0.001]	[0.007]	[0.002]	[0.734]	[0.799]	[0.464]	[0.581]	[0.567]	[0.994]
	N=2212	N=2212	N=2212	N=2365	N=2365	N=2365	N=2408	N=2408	N=2408
Panel B: Bangladesh									
Anticipatory Action	0.022	-0.015	-0.007	0.012	-0.007	-0.005	0.000	-0.002	0.002
	(0.017)	(0.015)	(0.006)	(0.018)	(0.017)	(0.003)	(0.011)	(0.011)	(0.002)
	[0.214]	[0.317]	[0.267]	[0.513]	[0.686]	[0.100]	[0.985]	[0.840]	[0.265]
	N=4721	N=4721	N=4721	N=4761	N=4761	N=4761	N=4485	N=4485	N=4485
Panel C: Inverse-Variance Weighted-Average									
Anticipatory Action	0.042***	-0.030**	-0.012***	0.005	-0.003	-0.002	0.002	-0.004	0.002
	(0.014)	(0.013)	(0.004)	(0.015)	(0.014)	(0.002)	(0.010)	(0.010)	(0.002)
	[0.004]	[0.020]	[0.002]	[0.726]	[0.844]	[0.458]	[0.812]	[0.674]	[0.317]
Avg in Post-flood grp:NEP	0.737	0.240	0.023	0.732	0.262	0.006	0.747	0.246	0.007
Avg in Post-flood grp:BGD	0.775	0.198	0.026	0.822	0.169	0.009	0.872	0.125	0.003
Avg in Post-flood grp:Pooled	0.759	0.216	0.025	0.784	0.209	0.008	0.816	0.179	0.005
Strata X Round FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N Clusters	428	428	428	438	438	438	438	438	438
N Observations	6933	6933	6933	7126	7126	7126	6893	6893	6893

Notes: This table presents the impact of being in the FbAA group relative to the rapid post-flood group on whether household meets FCS acceptable criteria (column 1), FCS borderline criteria (column 2) and FCS poor criteria (column 3). Panel A shows results for Nepal only. Panel B shows results for Bangladesh only. Panel C shows an inverse-variance weighted average of the results from Nepal and Bangladesh. Asterisks indicate statistical significance at the 1% ***, 5% **, and 10% * levels.

Table A12: Flood damage reported by country

	(1) Nepal	(2) Bangladesh
Flood: health damage	0.49	0.88
Flood: health treatment	0.47	0.62
Flood: house damaged	0.59	0.23
Flood: field crop damage	0.68	0.14
Flood: crop stored damage	0.27	0.01
Flood: livestock damaged	0.39	0.37
Flood: crop cultivation damage	0.69	0.15
Flood: any farm damage	0.79	0.43
Flood: business damage	0.11	0.02
Flood: flood enter house	0.47	0.39
Flood: evacuated house	0.02	0.14
Observations	2365	4485

Notes: This table shows the share of households reporting flood damage in each country.

Appendix B: Flood Forecast and Transfer Details

In Nepal and Bangladesh, responding institutions rely on two triggers: the 'readiness' and 'action' triggers (Centre for Humanitarian Data, 2023). These triggers are defined based on the Global Flood Awareness System (GloFAS) forecast – which is part of the European Commission's Copernicus Emergency Management Service and serves as an operational system for predicting and monitoring floods worldwide – in collaboration with national meteorology departments.[8]

In Nepal, the readiness trigger is activated when the 7-day Global Flood Awareness System (GloFAS) forecast predicts a 70 percent likelihood of river discharge surpassing a 1-in-2 year return period level (which is a discharge level expected to occur once every 2 years) (OCHA, 2024). In Bangladesh, the readiness trigger is reached when the water discharge at the Bahadurabad gauging station (located on the Jamuna river in the north of Bangladesh) over a period of three consecutive days is forecasted by the GloFAS model with a maximum 15-day lead time to be more than 50% likely to cross the 1-in-5-year return period (OCHA, 2023). Once this readiness threshold is met, the UN's Central Emergency Response Fund (CERF) disburses approval letters and initial rounds of funding to responding agencies (including WFP), which they can use to disseminate early warning messages, dispatch initial supplies, and coordinate with local authorities.

Once a second 'action' trigger is met, institutions (including the WFP) can transfer funds directly to vulnerable households in the identified areas. In Nepal, this action trigger is met if two conditions are fulfilled: first, an alert from Nepal's Department of Hydrology and Meteorology (DHM); and second, either the GloFAS 3-day forecast indicates a 70 percent likelihood of river discharge exceeding the 1-in-2-year return period level, or the river's height exceeds the Nepalese Government's pre-defined trigger level (OCHA, 2024). This means that transfers are provided for floods that are worse than the average year.[9] In Bangladesh, the action trigger is fulfilled when the water level at Bahadurabad is forecasted by the Government's flood forecast and warning center to cross the government-defined "Trigger Level" + 0.85 meters, and GloFAS shows an sustained or increasing trend of water discharge for at least three consecutive days from when the trigger level was crossed (OCHA, 2023). In Nepal (2022), FbAA households received transfers a few days after the flood peak, and in Bangladesh (2024), they received them a few days before the peak.

[8]GloFAS employs automated processing of Copernicus Sentinel-1 Synthetic Aperture Radar (SAR) satellite data, utilizing three state-of-the-art satellite flood detection algorithms in an ensemble approach for flood monitoring (GloFAS, 2023).

[9]We acknowledge that stricter trigger criteria that activate cash transfers for more severe but less frequent events, could yield different outcomes.