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Impacts of the World Food Programme's interventions to treat malnutrition in Niger

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Summary

This is the final report of a DFID- and 3ie-funded and WFP-supported impact evaluation on the relationship between the provision of WFP assistance and the incidence of moderate acute malnutrition (MAM) in Niger. This report focuses on understanding the impacts of WFP's Protracted Relief and Recovery Operation (PRRO) – a multifaceted grouping of nutrition interventions – on the prevalence of MAM. The broad remit of the PRRO is to reduce MAM through three main sets of activities. The first – targeted food assistance (TFA) and blanket supplementary feeding (BSF) – are implemented during Niger's lean season (June to September), with the aim of preventing MAM developing due to seasonal fluctuations in food availability. The second – targeted supplementary feeding (TSF) – is a so-called treatment programme and is provided to children already suffering from MAM. The third – activities designed to increase poor households' access to food and assets, particularly through land rehabilitation, water harvesting and local purchases. In particular, we are interested in food for assets (FFA), an agriculturally sensitive form of assistance.

We use panel survey data collected by the Niger Institute for National Statistics (INS) under contract by the WFP country office in Niger. A baseline of this data was collected in March 2014, before this project began, and an endline, which aimed to follow up all children and households from the baseline, in September 2016. Due to the structure of these data, where almost every household received only FFA at the baseline, we focus our analysis on the relationship between FFA and MAM. Specifically, we study the impact of losing FFA but gaining at least one of BSF, TSF and TFA relative to losing FFA and gaining nothing; the impact of losing FFA versus the impact of maintaining FFA and, additionally, receiving at least one of BSF, TSF and TFA; and finally, the comparative impact of receiving FFA and at least one other form of assistance versus not receiving FFA but receiving at least one other form of assistance. In combination, empirical analyses of these research questions allow us to isolate the impact of FFA; the impact of (combinations of) other forms of assistance; and the synergies that may be built through joint provision of FFA with other forms of assistance. In short, the data permit us to study interesting and relevant combinations of assistance over time, with particular focus on understanding agriculturally sensitive forms of assistance and how they may create synergies if combined with other forms of assistance.

This contrasts slightly with our initial research questions, which focused on the relative and synergistic impacts of treatment and prevention programmes in a challenging environment. Given that ex post, we learnt that only a very small number of individuals received only treatment or only prevention programmes, it was also technically not possible to answer all initial research questions given the available data. At the same time, the broad remit of these questions is mirrored, except that we look at differences and synergies between FFA and other forms of assistance.

In this regard, we generate three 'assistance groups'. Group 1 moves from receipt of FFA-only to receipt of no assistance in the endline. Group 2 moves from receipt of FFA-only to receipt of (at least one of) TFA, TSF and BSF but no FFA. Group 3 moves from receipt of FFA-only to receipt of FFA and (at least one of) TFA, TSF and BSF. We refer to these assistance combinations, respectively, using the shorthand –FFA, –FFA+ and FFA+.

		Endline status		
		No assistance	No FFA but at least one of TFA, TSF, BSF	FFA and at least one of TFA, TSF, BSF
Baseline status	FFA-only	Group 1 –FFA	Group 2 –FFA+	Group 3 FFA+

From these groups, we define three main research hypotheses:

1. The loss of FFA can – at least to some extent – be mitigated by the provision of at least one of TFA, TSF or BSF. That is, individuals in Group 2 will exhibit significantly lower incidence of MAM compared to those in Group 1.
2. Individuals who receive FFA and at least one of TFA, TSF and BSF will exhibit significantly reduced MAM compared to Groups 1 and 2.
3. Synergies are present when FFA is provided with other forms of assistance, such that the difference between Group 3 and Group 1 is larger than the sum of the differences between Group 1 and Group 2, and Group 2 and Group 3.

These hypotheses are grounded in WFP's theory of change, which notes the impacts of treatment or prevention provision; the potential nutritional impacts of FFA; and the added benefits that can be developed by the joint provision of FFA and other forms of assistance.

Given the presence of structural sample attrition between the survey waves and the likely endogeneity of the group a given household falls into, we conduct our baseline empirical analyses using econometric techniques that account for sample selection bias and omitted variables bias. This approach, jointly, implements instrumental variables and Heckman-style selection bias approaches.

We conduct three baseline analyses:

1. A comparison of the outcomes of Groups 1 and 2. This analysis allows us to isolate the impacts of BSF, TSF and TFA. We repeat these analyses with TSF removed, to allow us to understand directly the impact of prevention programmes.
2. A comparison of Groups 1 and 3. This provides an understanding of the impact of FFA, particularly when viewed with respect to the results of the previous analysis.
3. A comparison of Groups 2 and 3. This provides an understanding of the (marginal) additional impact of multiple forms of assistance.

Due to the absence of anthropometric data for pregnant and lactating women (PLW), we focus these analyses on children aged 6–59 months in March 2014.

We demonstrate that **certain modalities of WFP assistance significantly improve the MAM situation in Niger**. Specifically, we find that children who live in households receiving food for assets plus treatment and/or prevention (FFA+) assistance, are almost 20% less likely to suffer MAM than those in households who receive no assistance (-FFA) in the endline; and that children in households that receive FFA+ are 15.5% less likely to experience MAM than those in households that receive only treatment and/or prevention assistance (–FFA+). Given that FFA is not specifically designed to combat

MAM, this is a particularly impressive result and implies that FFA+ assistance should be provided to as many households as possible.

In other words, **the combination of agriculturally sensitive and more standard assistance provided by WFP turns out to have the strongest positive impact on child MAM in Niger**. Such an outcome is intuitively plausible to the extent that agriculturally sensitive assistance may strengthen the long-term food-producing capacity of households. Our results suggest that FFA+ should be considered as an anti-MAM strategy in Niger, as it proved more effective than specific MAM prevention interventions in this context.

However, we find no evidence of positive impacts from treatment and/or prevention programming only. Rather, we show that this programming approach can have negative impacts. In other words, **some combinations or forms of assistance do not have the desired impact**. At first sight, this is a surprising finding. It could be that the expected benefits decline over time and come to be dominated by one or two other influences on child malnutrition. Specifically, we posit two reasons for this finding: either that other coping strategies are more effective than receiving this form of food aid; or that receiving this assistance alters intra-household decisions on nutrition.

For example, a highly food-insecure household that does not access a standard WFP programme may instead choose to engage in migration. Remittances received can, in turn, reduce food insecurity and may in fact dominate the impact of the programme itself. Alternatively, a household that receives such programmes may take scarce resources away from eligible children to give to other household members, leading to reductions in those children's level of nutrition but not at the level of the household as a whole.

Given the costs involved in delivering the PRRO, these results imply that interventions combining BSF, TFA and FFA activities lead to improved nutrition indicators in the range of 0.28 standard deviation (SD) per US$100 spent. In other words, the average cost of bringing a MAM child to non-MAM status is estimated at US$352.60 as part of combining prevention and agriculturally sensitive assistance. The cost-effectiveness analysis indicates that the combined approach in WFP intervention has been the most cost-effective compared to the single interventions.

Qualitative work in support of the quantitative component of this evaluation was undertaken in November 2017. This work was based around focus group interviews with individuals in the survey sample frame from villages that were selected for the qualitative sample using random stratified sampling. Sampling was restricted to locations relatively close to Niamey (capital of Niger), due to budgetary restrictions. Villages within a cut-off of 250km from a regional capital were stratified by agro-ecological zones and two villages randomly selected from each of these lists.

Broadly speaking, qualitative results support the quantitative findings and provide intuition for the underlying theories that might explain these findings. In particular, this work reveals that households changed their behaviour and choices with regard to nutrition as a result of assistance received. This includes highlighting evidence for so-called 'perverse effects'. For example, households sometimes sell malnutrition treatment in markets rather than consuming them at home. In some households, malnutrition was

re-induced in ‘cured’ children in order to maintain eligibility for support. Those who received FFA, however, which intuitively has lower transfer capacity, experienced fewer nutritional crises, a reduction in labour migration and increased productive assets and usage of fertilisers.

We note that further research on PRRO could contribute to a more nuanced understanding of the programme’s impact. We find, for example, that certain combinations of assistance perform significantly better than others. While we can offer a number of plausible theoretical explanations for why such findings are present, we cannot empirically analyse these theories with available data.

At the same time, explicit analyses of these theories would provide significantly stronger policy recommendations because they would provide understanding of the internal dynamics that result from the provision of programming. For example, while we note that prevention (and prevention and treatment) forms of assistance do not appear to achieve their aims, the reasons we posit do not directly relate to the assistance provided, but rather to households’ response to assistance. **Direct testing of how, or if, households respond to programming and how this can be mitigated, should therefore lead to better programming outcomes in future**.

Such analyses, however, require further data collection efforts and more specific analyses. **We therefore recommend the collection of subsequent waves of panel survey data from the sample used in this analysis**. Not only would this significantly improve the reliability of the statistical findings presented in this report, but it would also allow the collection of data and analysis that specifically focus on the context of findings presented here.

Content

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Abbreviations and acronyms

BSF	Blanket supplementary feeding
FE	Fixed effects
FFA	Food for assets
GAM	Global acute malnutrition
HH	Households
M&E	Monitoring and evaluation
MAM	Moderate acute malnutrition
MUAC	Mid-upper arm circumference
OLS	Ordinary least squares
PLW	Pregnant and lactating women
PRRO	Protracted Relief and Recovery Operation
SD	Standard deviation
SF	School feeding
TFA	Targeted food assistance
TSF	Targeted supplementary feeding
UNEG	United Nations Evaluation Group
WAZ	Weight for age z score
WFP	World Food Programme

1. Introduction

1.1 Motivation

The treatment and prevention of moderate acute malnutrition (MAM) is a fundamental pillar of the programme of the WFP (World Food Programme) and nutrition-specific interventions (WFP 2013a), and feature heavily in its current strategic plan (WFP 2013a, 2013b) and its operational manuals (for example, WFP 2016). Accordingly, in order to target millions of children worldwide who are wasted, WFP's MAM programmes have grown significantly in scope and reach in recent years. The targeting of children under five years of age (and in some cases, under two) is in line with recommendations for addressing MAM. *The Lancet* (2008) series on nutrition, for example, encourages emphasis on a child's first 1,000 days, suggesting that cost-effective interventions in this period yield high returns (Nabarro 2013).

While evidence for the efficacy of MAM assistance programming in 'optimal conditions'[1] is quite strong (for example, WFP's 2013–2015 Office of Evaluation Impact Evaluation Series on Moderate Acute Malnutrition Programming)[2], more evidence is needed on the impact of MAM assistance programming in more challenging locations. This is important, not least because MAM is multi-causal and the effectiveness of assistance programmes is likely to interact strongly with the environment in which they are, to be able to understand the impact implemented.

Conducting a study in Niger provides an opportunity for a range of MAM programming in just such a challenging environment. Niger ranks almost at the very bottom of the UNDP Human Development Index (HDI)[3]; suffers systematic institutional weakness; faces a range of internal and external physical threats; has faced episodes of forced migration; and has also suffered a number of food crises since the turn of the millennium.

Moreover, given the structure of the PRRO programmes, we are able to study within certain limitations the interaction of various forms of assistance. For the purpose of this study, we are interested in four WFP assistance types: (1) food for assets (FFA) – an agriculturally sensitive form of assistance; (2) blanket supplementary feeding (BSF) and (3) targeted food assistance (TFA) – MAM prevention assistance programmes; and (4) targeted supplementary feeding (TSF) – a MAM treatment programme. Given the range of possible combinations of assistance received, a potentially rich research background arises from these four forms of assistance. At the same time, the extent of this research is tempered by practical and empirical concerns that relate to the size of each feasible group represented in the data collected.

[1] We do not use this term lightly and understand that any environment that requires any form of nutrition assistance can reasonably consider 'optimal' in any traditional way. Rather, we use the term to refer to the conditions in which MAM assistance programmes have the opportunity to function optimally. These conditions include: (relatively) stable populations; absence of conflict or other threats to human security; absence of mixed/forced migration and so on.
[2] Available at <https://www.alnap.org/system/files/content/resource/files/main/wfp258882.pdf>
[3] Available at <http://hdr.undp.org/en/content/human-development-index-hdi>

1.2 Malnutrition in Niger

A Sahelian country in West Africa with an arid climate, Niger is characterised by a low level of development, ranking in last place in the UNDP HDI in 2014. Malnutrition is widespread in the country, particularly among infants and young children. In 2012, 14.8 per cent of children aged 6–59 months suffered from global acute malnutrition (GAM) (DHS 2013). In rural areas, this rises to 15.7 per cent of children, a sharp increase on the 10.7 per cent rate in urban areas. Similarly, children aged 6–23 months are significantly more likely to experience GAM than older children, with almost one quarter of children aged under two years experiencing GAM. In four regions of Niger (Diffa, Maradi, Tillaberi and Zinder), GAM prevalence was above the emergency threshold.

One in three children is underweight; chronic malnutrition affects 42 per cent of children aged 6–59 months. At any given time, somewhere between 1 million and 3 million individuals suffer food insecurity in Niger annually (Concern 2013). Since 2007, the proportion of chronically malnourished children has remained above the 40% 'critical threshold'; 73% of children suffer micronutrient deficiencies and 46% of women are anaemic. The country has suffered four acute food crises since 2000.

Numerous factors contribute to the widespread situation of malnutrition in Niger. Poverty is widespread, with over 40 per cent of the population living on less than US$1.25 per day according to most recent statistics (UN 2017). A reliance on rain-fed agriculture (Shideed 2017), deteriorating natural resource endowments, unstable and corrupt political structures, low education levels, gender biases in intra-household decision-making and some of the world's highest fertility rates are all thought to have added to a sizeable population that is vulnerable to food insecurity (DHS 2013). Chronic malnutrition affects almost half of all children, and GAM prevalence among children aged 6–59 months is consistently above the WHO 'warning threshold'. Malian and Nigerian refugees further contribute to the country's food insecurity.

Women are particularly disadvantaged by a number of interrelated factors, which can also contribute to food insecurity, given differences in intra-household bargaining and children's outcomes (Nuhu 2015). These include extreme poverty, vulnerability to climate and agricultural shocks, lack of basic services and, particularly, patriarchal social norms. Population movements, recent terrorist threats and the rise of radical Islamist opposition movements exacerbate the political and economic exclusion women experience. According to the UN Index of Gender Equality, for example, Niger ranks 151 out of 152 countries in terms of women's rights. Moreover, a number of factors of concern relate to the situation of women and female-headed households which, in turn, feed into the wider nutrition picture. These include male migration, lack of access to services and markets, lack of access to birth control without permission from her husband, inequitable rights to land and property and a pro-natalist culture.

To reduce food insecurity and malnutrition, including MAM, WFP works with the government of Niger to provide food assistance through regional emergency operations and the PRRO. Four forms of assistance under the PRRO umbrella (BSF, FFA, TFA and TSF) are the focus of this impact evaluation. WFP (2013a; 2016) notes that WFP MAM programmes operate in highly diverse contexts. While the interventions and their impacts are intuitive in theory, the contexts in which they take place are complex and are thus

highly relevant for impact evaluation. Olivier de Dardan (2008), for example, notes that 'makeshift' survival strategies, such as migration, have proved more effective than food aid during past Nigerien food crises. In such contexts, it is important to understand whether programmes focused on reducing MAM have their desired impacts in this highly complex environment or not.

1.3 Knowledge gaps

We define and address three broad knowledge gaps that are relevant from academic and policy perspectives.

Firstly, a key knowledge gap concerns the nature of the impacts of multi-strand malnutrition programming, such as WFP's PRRO. It is unclear if different programme typologies should, or do, have differing effects or if there are layers of complementarity in such approaches. For example, it is important and interesting to know if there are differential effects between treatment and prevention programmes (which is beyond the capacity of the data collected for this project), or between agriculturally sensitive programmes and prevention programmes (which we discuss directly).

Similarly, it is also important to note if the joint provision of two (or more) kinds of assistance can produce greater impacts than either single-assistance typologies or the separate provision of both kinds of assistance. The different strands of the PRRO are substantively different from each other, yet the interactions that take place between them could potentially be crucial for the effectiveness of the programme as a whole.

Secondly, although there is considerable evidence for the effectiveness of MAM assistance provision in 'optimal conditions' (WFP 2013a; WFP 2016), there is insufficient understanding and clarity about the relationship between the treatment and prevention of malnutrition and the building of resilient livelihoods in more challenging environments. This opens up a number of related issues, namely: consideration of the relative impacts of various forms of assistance; when it might be optimal to switch from one kind of assistance provision to another; the cost-effectiveness of various approaches; and the existence of synergies between different forms of provision.

Such knowledge is critical for WFP and similar actors, as it feeds directly into the setting of priorities and strategies to deliver on these priorities. This is particularly the case for developing strategies and assistance programmes in various emergency and post-emergency conditions, because outcomes may vary as a result of these precise conditions.

In the academic literature, some of these issues have proved controversial. WFP (2006) shows that food transfers were five times more expensive than cash payments in a programme in Honduras, but that cash payments had no impact on calories consumed or use of health facilities. Transfers, on the other hand, positively affected both. Over and above this, provision of nutritional supplements and education proved even more effective than other forms of assistance, specifically related to social preference. Accordingly, it is important to account for the relationship between interventions and the context in which they take place.

Thirdly, the effectiveness of targeting and uptake for reducing malnutrition is also an important knowledge gap, not least because only a significant minority of individuals in Niger take up programming available to them. For example, while TSF was technically available to everyone in our baseline survey (which included almost 6,000 children), we find only 95 cases of uptake. On this topic, Handa and others (2012) show differential impacts of differing targeting strategies. They examine three cash transfer programmes in Kenya, Malawi and Mozambique. All three countries employed community-based targeting, but each targeted different kinds of households and employed different methodologies. Given a lack of alternative targeting methodologies in Niger, such direct analyses are precluded in our case, but intuition can still be developed, because of the treatment groups into which a household falls. In turn, new information can be provided on the kinds of households current targeting strategies are not reaching.

1.4 Derivation of the final empirical research strategy

The initial hypotheses of this research revolved around attempting to understand how well WFP's treatment and prevention programmes worked, compared to each other and in combination when compared to single forms of assistance. In reality, however, we find that the sample sizes in the panel survey data of individuals receiving (only) these forms of assistance are too small to conduct robust empirical analyses of these relationships.

In contrast, almost all households in the baseline received FFA, with very few individuals receiving either no assistance or FFA in combination with any other form (or forms) of assistance. This contrasts with our initial proposal, which had aimed to look at a 'control' group of TSF-eligible individuals. Our 'control' group is, in reality, composed of households that received FFA. In turn, our analysis looks at the dynamic changes in assistance combinations received, which permits us to isolate the impact of various forms of assistance in the spirit of the original research proposal.

Thus, the initial research questions aimed to compare outcomes across three groups: 'treatment eligible' (eligible to receive TSF); TFA and/or BSF + treatment eligible; and FFA + TFA and/or BSF + treatment eligible. In this approach, FFA was a component of only one group. The reality of the data implies that it is a part of all three groups that we can define. In this sense, the analysis of FFA plays a much larger role in this analysis than had been intended. Despite this change of plan, however, a number of other important and related questions can be answered, given feasible group decompositions.

Specifically, we define three groups: Group 1 (–FFA); Group 2 (–FFA+); and Group 3 (FFA+), into which a vast majority of our sample falls. Comparisons of these groups and subsamples of these groups allow us to answer a range of research questions on the 'synergies'[4] that arise from receipt of multiple forms of treatment. Comparison of Group 1 and Group 2, for example, in effect compares receipt of (at least one of) BSF, TFA and TSF against receipt of no assistance. Analysis of the subsample of this group, which received only BSF or TFA, allows us to provide evidence on the impacts of prevention

[4] We use the term 'synergy' in its traditional definition. Put in another way, this means that we evaluate whether or not receiving a specific combination of forms of assistance has impacts over and above what the impacts would be of receiving each form of assistance separately.

programmes.[5] Comparison of Group 1 and Group 3, particularly when considered relative to the comparison between Groups 1 and 2, allows us to isolate the impact of receipt of FFA on MAM and MAM-linked indicators. Comparison of Groups 2 and 3 allows us to test directly for synergies, as we can estimate the (marginal) impact of receiving FFA, over and above receipt of other forms of assistance.

Overall, this research project therefore makes important contributions to academic and policy debates. In academic circles, little is known about the kinds of synergies that the availability of multiple assistance forms can deliver in terms of MAM impact. In policy debates, such results will allow us to make strong recommendations on programming modalities and in terms of which forms and/or combinations of assistance deliver the strongest impacts on MAM indicators.

1.5 Research questions

The research questions asked and answered in this report are closely linked to those presented in our initial proposal and in our pre-analysis plan. However, as discussed above, they also differ subtly due to the nature of the actual sample we work with. The construction of these samples implies that it is infeasible to robustly analyse the initial research questions, which focused on the relative impact of receiving different combinations of treatment and prevention programming. Instead, we use the features of the same construction to understand the impacts of a slightly different combination of assistance programmes.

Firstly, we study the impact of, in addition to FFA, receiving at least one of BSF, TSF or TFA in comparison to a 'control group', who receive no assistance in the endline. Secondly, we study the impact of individuals who receive at least one of TFA, TSF and BSF in the endline, compared to individuals who receive no assistance. Finally, we compare individuals who receive FFA and at least one of TFA, TSF and BSF in the endline to those who do not receive FFA but who receive at least one of TFA, TSF and BSF. In combination, this allows us to isolate the impact of FFA; to understand the impact of receiving at least one of TFA, TSF or BSF, compared to receiving nothing; and to understand any synergies that are present between receiving FFA and other forms of assistance.

Any other delineations in this report are purely methodological, designed to overcome specific analytical problems associated with the rollout of WFP assistance and sample attrition between baseline and endline. In our view, this is not a major departure from our proposal or pre-analysis plan, because these are essentially methodological refinements of our previously stated approaches. We include the workhorse models from our proposal and pre-analysis plan for full disclosure of the approaches.

The rest of this report is structured as follows: in section 2, we discuss the intervention, targeting of beneficiaries, and the theory of change, in addition to the research hypotheses that stem from them. In section 3, we discuss the context in which the

[5] Both fortunately and unfortunately, the subsample of Group 2 who receives TFA, or TFA only, is incredibly small. This facilitates the analysis of the impact of prevention programming, as we lose only a very small number of observations when we focus on this subgroup. At the same time, however, it also precludes direct analysis of the (relative) impact of treatment programming.

intervention was conducted. In section 4, we discuss the timeline of the project phases implemented. In section 5, we discuss the design and data used to conduct the impact evaluation. In section 6, we discuss the implementation context of the intervention. In section 7, we introduce our main empirical methodologies and results. In section 8, we provide discussions and conclusions, and in section 9 our policy recommendations.

2. Intervention, theory of change and research hypotheses

2.1 Intervention

In this evaluation, we focus specifically on four components of WFP's PRRO in Niger. The PRRO is designed to tackle multiple facets of Niger's food crises over a three-year time horizon. Within this wider strategy, four components are of particular interest for MAM:

1. Targeted food assistance (TFA)
2. Blanket supplementary feeding (BSF)
3. Food for assets (FFA)
4. Targeted supplementary feeding (TSF)

The first two programme strands aim to reduce the impact and constraints of seasonal livelihoods on nutritional outcomes. FFA aims to increase access to food and assets for the poorest households in Niger; TSF aims to treat acute malnutrition among children whose nutrition indicators are below specific thresholds. Given the timing of the lean season in Niger, these programmes are sequences throughout the year according to non-crisis year calendars. As food availability decreases in the lean season, malnutrition peaks; and in response, WFP increases its activities in this period.

TFA, in the form of food, cash or vouchers, offers a safety net for very poor households during the lean season (June–September) and is implemented to protect assets and livelihoods. BSF provides nutritional supplements to very poor households and targets children aged 6–23 months. It is linked to the lean season TFA safety net and has a provision to transfer children with acute malnutrition to treatment programmes. FFA focuses on land rehabilitation, water harvesting and irrigation through partnerships in pastoral zones (WFP 2016).

Asset developments are targeted and maximised through the technical experience and inputs of various partners and government bodies. These programmes include specific activities and unconditional transfers to allow labour-constrained households to also benefit. TSF targets MAM through government health facilities. Beneficiaries are screened at health centres or identified through WFP and UNICEF community screening. WFP provides cooked meals for caregivers with child patients to reduce drop-outs.

2.2 Targeting and beneficiaries

WFP targets programmes geographically in three stages. First of all, 'priority districts' are defined using available indicators of food security, nutrition, livelihoods, population movement, infrastructure and other aggravating factors. These districts are essentially ranked in terms of the adversity they face, the provisions that are available according to the budget, and administered to those with the worst observable characteristics. In the first round of programming (essentially corresponding to our baseline survey), 70 priority

districts were targeted. Due to a decreasing budget, however, only 37 districts were targeted in the next phase.

This means that, between the baseline and endline, assistance in effect ended in 33 districts in Niger. Broadly speaking, priority villages are decided in the same way. This implies that the 33 districts that lose assistance are likely to be those out of the initial 70 that are least vulnerable. This 'phase-out' of some areas from receipt of assistance is the backdrop to one of the major analytical processes we use in this research, but the nature of selection here implies the need for the use of bias-correction techniques. Given that the methodology used to define WFP's priority areas relies on the Niger government's Structural Adjustment Programme analysis[6], it is perhaps unsurprising that there is some overlap between these priority districts and those of the government.

Within WFP's priority districts, the second stage targets villages that are determined to be under particular stress. This approach is based on a list generated by WFP that looks at deficits in food availability and weak local adjustment capacity, based on analysis of data the government collected. It includes targeting areas where food security was over 30 per cent from 2006 to 2011 and where GAM has been above the 15 per cent emergency threshold at least twice. Indicators for school completion, prevalence of nomadism, agricultural potential and convergence of partners' activities have also been integrated into this process. At village level, the final stage then selects specific households to receive assistance. Implementation partners, village committees and WFP take this decision jointly. This approach aims to define which households are 'very poor' and is defined at community level using the household economy approach. Given the involvement of a range of actors, including village authorities, certain questions can, then, be raised about whether assistance (always) makes it to the households with the worst (un)observable conditions.

2.3 Theory of change

PRRO programming is based on a clear theory of change and embedded in an explicit national Nigerien strategy to reduce malnutrition. The programme was launched on the basis of targeting the real needs of vulnerable communities in accordance with the national priority plans of the country. This established that malnutrition in Niger is multi-causal and has significant long-term development impacts. In Niger, this is compounded by gender inequality. In countries where nutritional programmes lag behind economic growth, discrimination against women is common. This exclusion of women is often associated with high rates of child malnutrition and low birth weight. In contrast, in societies in which women are highly educated and participate widely in the family and in society, nutrition has improved markedly.

Climate change and associated impacts on variability in weather and agricultural production are a real threat to the environment and the ecosystem, and the consequences for rain-fed production are well established. Change can lead to rapid degradation of arable land and excessive land fragmentation. Poor communities, children, women and small-scale farmers are obviously affected due to limited adaption

[6] More information is available at <https://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Niger._Structural_Adjastment_Programme__SAP_V___EN_.pdf>

capacity. The recurrence of cereal deficits reveals the high level of food insecurity risk, which is accompanied by a high rate of malnutrition in the country.

The consequences of malnutrition are significant, irreversible and have impacts on health (growth, cognitive development) and work (knowledge, productivity). For example, the impact of chronic stunting on individuals extends to reduced school attendance and lost productivity in adulthood. Stunting can lead to higher mortality, disability and chronic vulnerability to diseases. The most disastrous effects of malnutrition occur during pregnancy and during the first two years of life; the effects of this early damage on health, brain development, intelligence, trainability and productivity are largely irreversible.

The PRRO aims to tackle this by screening for malnutrition; preventing malnutrition; treating malnutrition; retaining children in school (where school feeding can take place); and nutrition education. To do so, treatment (TSF) and prevention (BSF and TFA) programmes are offered to treat and prevent the onset of malnutrition, respectively. FFA is also designed to contribute through land rehabilitation, which in turn boosts access to food. In turn, the programme anticipates that the intervention should have at least three outcomes: a reduction of (moderate acute) malnutrition; an improved diet; and better school outcomes. The first of these focuses is the main interest of this impact evaluation.

To achieve this reduction in (moderate acute) malnutrition, the PRRO aims to directly provide supplementary nutrition and build resilience to climate and agricultural hazards. The PRRO aims to boost food security through the development of agricultural livelihoods. Households that are more secure in terms of food consumption stand the best chance of adapting to such hazards and seasonal variations in food availability and consumption. For example, the two activities of strategic objective 1 of PRRO – TFA and BSF – that coincide with the lean season will allow households to avoid a peak of acute malnutrition and mortality during this period. However, FFA will focus on land rehabilitation, water harvesting and irrigation through partnerships in pastoral areas and local purchases from small farmers to promote access to markets, economic growth and agricultural development.

Despite the intuitiveness of this theory of change, however, two major concerns arise which, feasibly, might prevent these goals from being achieved. The first is the take-up of offered assistance, and the second is the use of what Olivier de Dardan (2008) denotes ‘makeshift’ strategies. In terms of take-up, a number of challenges remain. For example, despite our entire baseline sample being technically eligible to receive TSF, only 95 individuals (less than 2 per cent of the sample) actually report receiving it. If assistance is not taken up by those who could benefit from it, it seems unlikely that the PRRO can achieve its key objectives.

WFP must, therefore, ensure that not only is assistance provided, but it also reaches the widest possible range of beneficiaries feasible. That said, it should be noted that this is a problem which is likely to affect the theory of change in aggregate, rather than at individual level. Second, however, is that during previous major food crises, ‘makeshift’ strategies for survival (for example, migration; borrowing; sale of possessions; change of food habits) tended to be more effective approaches than food aid (ibid.).

A host of subsidiary concerns also arise from this, however. First is the perception of unfairness in access to assistance (ibid.; Issa 2008); the requirement of beneficiaries to take an active role in their future, which complements the effectiveness of programming (Bakou and Guillermet 2008); and on the strategies that households employ in order to capture food aid (Koné 2008), which might not be universally positive. For example, a household may redistribute food to some children, knowing that a malnourished child will receive assistance. Each of these concerns provides a major challenge to the intuitive theory of change.

In contrast, FFA is a form of assistance that is not designed to specifically target MAM. This does not imply, however, that it does not provide MAM relief, as elucidated in WFP (2016), which discusses how FFA programming can be tailored to have a strengthened focus on nutrition. This work discusses the channels through which FFA can contribute to improvements in nutrition and how it can be transformed into a nutrition-sensitive action. Primarily, WFP (2016) notes that FFA interacts with a number of the underlying determinants that boost nutrition, including: access to food; access to clean water, healthcare and hygiene; provision of livelihood assets; and education, particularly of mothers, leading to better caregiving decisions. In turn, by identifying how FFA interacts with these phenomena, one can understand how and why FFA may lead to improved nutrition.

Firstly, WFP (2016) notes that nutrition should be included in FFA during the planning phase. This includes ensuring the FFA contributes to the empowerment and participation of women and other vulnerable groups; providing education and information on undernutrition and stunting and its impacts; to focus on specific seasonal fluctuations in nutrition and food security in the location a programme is to take place; providing information on the production and consumption of key nutrients; and identifying projects and asset creation processes that develop nutrition.

Secondly, FFA-targeting should also pay particular attention to providing assistance to women and other vulnerable groups. This not only builds on their participation from the very beginning, but also ensures that they will benefit from the programme and have control over the assets that are developed in the longer term. In these considerations, the timing of activities is also important. Assets that can be developed and later used as coping strategies during lean seasons, for example, are more likely to have beneficial impacts on nutrition than those that cannot. It is important to note, however, that potential negative effects may also arise that need to be mediated. For example, PLW engaging in hard labour could compound pre-existing issues meeting already complex nutritional needs; while other activities may adversely interact with child-raising activities.

A third approach to ensuring that FFA can boost nutrition and reduce MAM is that the assets that are developed focus on boosting nutrition in the medium and long term. For example, assets that facilitate either the volume or diversity of food that can be produced and consumed; those that improve access to markets; those that provide protection against (food) shocks; those that improve basic WASH (water, sanitation and hygiene) and other services; and those that increase the amount of time women allocate to livelihood-generating activities.

Two further recommendations focus on integrating FFA with nutrition-specific training and other nutrition programmes, as is done in the PRRO. If FFA is complemented with nutrition-specific interventions, such as nutrition education or interacts with other WFP nutrition-boosting programmes, the gains from the first three recommendations could become even greater.

In this regard, while FFA is not inherently a counter-MAM set of programmes or assistance, there are reasons to believe that it could positively – or, indeed, negatively – interact with the nutrition status of the individuals who receive it. More so, when provided in conjunction with other forms of WFP assistance, as it is in much of our samples. There are also theoretical grounds to believe that synergies could develop.

2.4 Research hypotheses

Our research questions concern the effectiveness of WFP PRRO assistance in impacting MAM in Niger. Firstly, we ask about the effects of receiving assistance in general. Secondly, we seek to understand the effectiveness of prevention programmes versus alternative forms of assistance. Thirdly, we seek to understand if differing treatment combinations have differential impacts. We focus these research questions on three indicators: whether or not a child suffers MAM, a binary variable taking a value of 0 if a child's nutrition indicators fall within the MAM range and 1 if he or she sits above the threshold; and two continuous variables, mid-upper arm circumference (MUAC) and weight for age z score (WAZ).

Three further analyses would be desirable, as per our proposal, but are infeasible due to data restrictions: the first would extend the second research question to compare outcomes between recipients of treatment and prevention assistance; the second would extend the analysis to account for impacts on PLW; the third would seek to understand outcome heterogeneities. Given the small samples available in our data, however, conducting such research could be damaging due to the low reliability of the statistical outputs.

We therefore ask the following research questions:

1. Do recipients of WFP assistance exhibit better MAM indicators than non-recipients?
2. Do recipients of WFP prevention programming exhibit better MAM indicators than recipients of other forms of assistance – specifically, agriculturally sensitive programming?
3. Do recipients of both prevention and agriculturally sensitive programming exhibit better MAM indicators than recipients of single forms of assistance? And if so, can these results be taken to imply programmatic synergies?

From these research questions, we develop four main research hypotheses:

- H_1: Recipients of WFP assistance (Group 2 and Group 3) will exhibit significantly better MAM indicators than those who have stopped receiving assistance (Group 1);
- H_2: Individuals in Group 2 and Group 3 should both experience improved MAM indicators. Moreover, at the marginal level the –FFA+ group should benefit more than an FFA-only group due to the focus of TSF, BSF and TFA on MAM;

- H_3: Individuals in Group 3, who receive more programmatic strands than Group 2, should exhibit (overall) better MAM indicators than those in Group 2; and
- H_4: The presence of synergies is unlikely, due to H_1 raising MAM indicators for all recipients of assistance.

3. Context

Since its independence in 1960, austere military rule has dominated the political landscape of Niger. In general, political structures are weak and unstable. Since 2011, Mahamadou Issoufou has served as president, returning Niger to constitutional civilian rule. Threats to stability, however, are manifold and include porous borders, low resource levels and the growing influence of Islamist terrorist organisations in neighbouring countries. Although its government is heavily dependent on foreign aid, in stark contrast to previous regimes, the current government is committed to tackling Niger's high rates of malnutrition and food insecurity. Fighting malnutrition and food insecurity remains high on the list of priorities for the president, particularly with the initiation of the High Commission for Nigeriens Nourishing Nigeriens. The Ministry of Health coordinates the overall approach to malnutrition, with support from WFP and UNICEF (Burki 2013).

The poverty rate is high in Niger, at 46.3 per cent, with a median per capita income of US$360. The country sits almost last in the HDI. Although GDP growth is forecast at 4.5–5.5%, high birth rates imply low per capita changes (World Bank 2018). Niger is a major producer of uranium and began pumping oil in 2011, but remains challenged in terms of resources. Its agricultural sector, and food production more generally, are challenged by severe and recurrent droughts and seasonal food shortages. The low development status in the country links to the general (nutritional) health of the population. Although disease is widespread, the government spends only US$10 per person annually on healthcare (Burki 2013). Life expectancy is low at 59 years and the fertility rate is high by global standards with 8 births per woman and little availability or recourse to contraception. Niger has one of the lowest literacy rates in the world and only 15 per cent of girls enter primary school (ibid.).

Demography therefore plays a key role in Niger's food crises. Annual population growth is 3.9 per cent, implying a very rapidly growing population. Girls typically marry at 14–16 years. A lack of spacing between births leaves women anaemic, with micronutrient deficiencies, which in turn can lead to low birth weights. According to Save the Children, attempts to tackle malnutrition in Niger must therefore involve all relevant actors in first addressing Niger's population growth and birth rates (Burki 2013).

General inequality is an important determinant of population growth and, accordingly, the political economy of hunger in Niger. At institutional level, land commissions have sought to decentralise land access and introduce statutory legislation to promote gender equality in land access. However, in practice, local structures are more often used to regulate and secure access to natural resources, while religious justifications remain important in excluding women from accessing land (Diarra and Monimart 2006).

Compounding these legal and social realities, there appear to be dual trends of defeminisation of agriculture in Niger and the increasing feminisation of poverty (ibid.). In southern regions, increased land pressures have created greater responsibilities on

mothers and grandmothers to provide food. The result has been that food insecurity has increased for children, whose diet has worsened through lack of variety. In northern regions, exclusion from pastoral production and lack of non-agricultural alternative employment has forced women to farm for derisory returns in highly insecure conditions.

Writing for the second *Lancet* series on maternal and child nutrition, Gillespie and others (2013) suggest that the global political discourse related to undernutrition substantially increased in the period 2008–13. In general, there has been increased harmonisation of stakeholders with regard to understanding the causes of malnutrition and options for addressing it. Politics and governance comprise a central pillar for their 'enabling environments' framework, which highlights the importance of cooperation of multi-sectoral actors, including those among subnational government agencies. This is particularly the case as many sub-Saharan countries move to centralise political, administrative and financial systems.

There is a multitude of stakeholders involved in malnutrition interventions in Niger and WFP closely coordinates with numerous partners to implement the PRRO. Key stakeholders with an interest in the evaluation include:

- Government actors, including partners from the Ministry of Planning, Spatial Planning and Community Development, early warning and crisis prevention (CC/SAP/PC), National System of Prevention and Disaster Management (DNPGCCA), the ministries of education, agriculture and public health through Nigeriens Nourishing Nigeriens (3N);
- UN country teams: WFP, FAO, IFAD, UNICEF, UNDP;
- NGOs;
- Donors: World Bank, AfDB, bilateral donors like DFID, GIZ, USAID and AFD; and
- Semi-state structures: RECA, Facility of Agriculture.

4. Timeline

In Figure 1 below, we show our research timeline since June 2016, when the research team undertook a mission to Niamey. The research team was not directly involved either in administering the intervention or the baseline wave of data, collected in 2014.

As scheduled, data collection for the endline took place in September 2016. During the phase of the project that took place immediately after the data collection, however, significant capacity limitations on the part of our counterparts in Niger to collect panel data became apparent. A number of these related to very practical issues, such as a lack of unique cross-wave identifiers that would allow us to track households from baseline to endline; and unique child-household identifiers that allowed us to link anthropometric and household survey data.

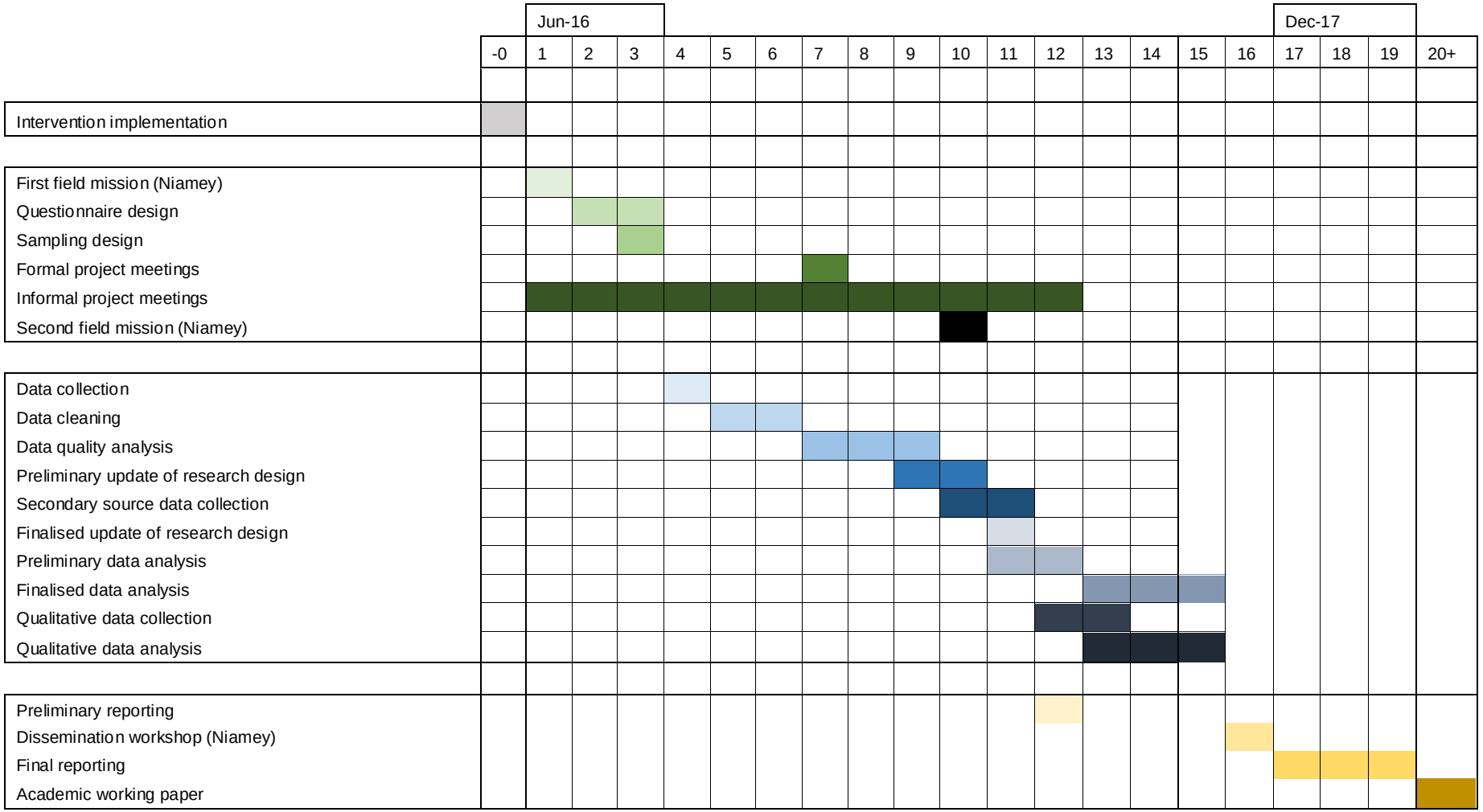
Others were more troubling, such as the large extent of sample attrition that become apparent when we analysed the data collected. In addition to weak capacity, a number of other phenomena such as an upsurge in violence by Boko Haram in Northern Nigeria added to these concerns.

Given the extent of sample attrition, the research team created a preliminary assessment in February and March 2017, resulting in a field mission to Niamey. Following this field

mission, the new research designs were finalised. In addition to the various analyses of data quality that were required to undertake this review, this methodological update meant that this phase of the project was delayed by several months. In turn, the preliminary data analyses were set back, too. These analyses only began in earnest in April 2017 and were further limited as a final version of the dataset was only made available in mid-May 2017.

Following this work, the research methodologies were finalised and suitably tested. The results of these finalised analyses are presented in this report. In the next period, these results were further refined for academic publication. The qualitative data collection, its preparation and its analysis took place in November and December 2017. The final, revised report was produced in January 2018.

Figure 1: Project timeline



Following this, we continued our dissemination process, in an extension of the project that lasted until March 2018. This included a workshop in Niamey that brought practitioners, policymakers and researchers together to discuss the key findings. At this workshop, we contextualised not just our research findings and what they mean in Niger, but also how they can be applied across the region. The research team will also develop an academic research paper that will be submitted to a working paper series and an international journal as well.

5. Evaluation: design, methods and implementation

5.1 Ethical research

We note the importance of ensuring high ethical standards in this project, given that the research is conducted with vulnerable populations. That said, the research was conducted with a sample previously contacted by WFP and that had already been a part of WFP's ongoing process of monitoring, evaluating and checking ethical issues. In this regard, major ethical concerns are somewhat tempered. WFP, as a constituent organisation within the UN, is duty-bound to abide by all standard United Nations Evaluation Group (UNEG) ethical principles. Furthermore, neither the baseline nor the endline were contracted by the research team. INS, which collected the data, had worked with WFP and other UN agencies before and was contractually bound to abide by UNEG principles during the data collection period.

The study, as conducted by the research team, meets 3ie's ethical standards. All additions to the questionnaires suggested by the research team were cross-referenced by WFP, ensuring that these questions, along with the research investigations, matched required ethical guidelines. Finally, a member of the research team, who was based at the United Nations Economic Commission for Africa and thus intimately familiar with UNEG ethical principles, was present during some portions of the data collection and was assigned with the tasks of overseeing and ensuring compliance of the applications of these ethical principles in the field, as well as ensuring that the methods defined by INS matched these ethical standards. As far as the research team could ascertain, all ethical standards were adhered to during the endline data collection and subsequent data analysis.

5.2 Evaluation strategy, including identification strategy

The research described in this report is based on two waves of panel survey data commissioned by WFP Niger and collected by INS. The baseline data were collected in 2014, before the research project started, and targeted recipients of WFP's new FFA programme. Almost the entire baseline sample had received FFA at the time this survey was collected. It was not possible, unfortunately, to collect a midline in 2015.[7] The second wave was then collected in 2016 and was designed to be a follow-up of all households in the baseline, focusing on all children aged under five years previously enumerated in the baseline. Our empirical strategy, therefore, relies on tracking changes

[7] We note that a number of 'midline' surveys were conducted by WFP, including in 2015. However, these surveys were not designed to be panel follow-ups of the baseline and therefore do not constitute the panel structure required in this analysis. We use the term 'midline' here to refer to a midline that would be usable for this analysis, rather than to refer to all data collection efforts.

in the forms of assistance a household received in the previous period and comparing outcomes across these changes.

In both waves, household heads were asked which, if any, WFP assistance programmes they had received. Given that nearly all households in the baseline received FFA, the fact that BSF and TFA were yet to be rolled out and that only a tiny number of our baseline sample (less than 5 per cent) received TSF in any period, our identification strategy relies on households moving 'out' of FFA-only in the baseline and into some new assistance combination in the endline. These movements are: FFA-only to no assistance (Group 1); FFA-only to FFA and other assistance (Group 2); and FFA-only to no–FFA but other assistance (Group 3). Comparisons across these three groups allow us to answer our research questions as follows:

- Intertemporal comparison of Group 1 to Group 2 and Group 1 to Group 3 provides understanding of the impacts of receiving assistance, in general, on nutrition outcomes;
- Comparison of a subsample of Group 2, excluding the very small proportion of households receiving TSF, allows analysis of the impact of prevention programming; and
- Comparison of outcomes from Group 2 and Group 3 allows understanding of the additional impact FFA has on outcomes. Moreover, subtracting the coefficient in the Group 1 versus Group 2 analysis from the Group 2 versus Group 3 analysis and comparing that to the Group 1 versus Group 3 analysis allows understanding of the presence of synergies in the analysis.

We define three indicators of specific interest for MAM in this research: a binary indicator on whether a child suffers MAM or not; WAZ; and MUAC. Analyses are carried out across all three indicators for robustness.

5.3 Sample size and sampling design

Sample size was determined by WFP in 2013, long before the beginning of the research period. This sample was designed to be representative of the households receiving WFP assistance in Niger. The baseline is a survey of N = 5,291 households and N = 5,031 children aged 0–59 months, and was sampled in 236 villages in Niger. This survey data was collected as a part of WFP's ongoing monitoring and evaluation (M&E) work and represents the best-available baseline for our research, as it is the only data source that tracks receipt of WFP assistance. The presence of this survey facilitated this research as an expensive round of data collection was avoided, and also prevented any input from the research team in terms of sampling or questionnaire design.

Our endline survey was designed to resample all households and children included in the baseline, including those who were aged 60 months or older at the time of the endline data collection. In this regard, new sampling frames were not drawn up, not least because the workhorse empirical strategy of this research (difference-in-difference) requires at least two observations from each individual. In this context, little would be gained by sampling new households not present in the baseline. During this phase, the research team had the opportunity to influence the design of the survey questionnaire, but had little say in the data collection strategy, given that contracting took place between WFP and INS.

The endline was conducted under an estimated, expected sample of attrition in the 10–20% range, as is expected in panel data collection efforts in similar contexts. In fact, real attrition was significantly higher. The sample size in the endline is N = 4,310 households and N = 3,757 children, implying attrition of almost 45 per cent. However, information on a large number of children in baseline households that were resampled is also absent. The final panel dataset, therefore, contains only 1,619 children who are in both waves of the survey, implying 'real' attrition of some 75 per cent.

The reasons for this level of attrition are manifold. The Diffa region was excluded from the endline from the outset due to significant security concerns arising from Boko Haram activity in Northern Nigeria. An enumeration team was attacked and robbed in Tillaberi, near the border with Mali. Although no one was hurt, data collected to that point but not digitally backed up was lost and data collection in the area was discontinued. Other security concerns implied that some villages were not visited at all or had truncated data collection periods. Domestic and international migration was present, as were children leaving homes during the harvest season. Due to the nature of the contracting between WFP and INS, a number of villages were also excluded by INS due to time constraints. Our methodologies are fully focused on overcoming these data concerns. We discuss the structural differences between attritors and non-attritors in our results section.

5.4 Assistance

Receipt of assistance is determined by WFP, in conjunction with the priority neighbourhood's approach, the 'at-risk' villages that stem from this and the very poor households that are identified afterwards. In principle, every household living within these regions is entitled to some form of WFP programming. The research team was not involved in the design of these rollout methods. Our empirical methodologies again address biases that could arise from this approach. Receipt of assistance is determined through the survey. Each household surveyed is asked which, if any, forms of WFP assistance they had received in the previous period. From the answers to this question in the survey, it was determined which group each household, and thus each child in that household, belonged to.

5.5 Data collection

Data collection took place over three weeks in September 2016 and was conducted by 16 enumeration teams across Niger. Each team contained six members and one supervisor. Each team was given an approximately circular route of villages to visit, focusing on visiting one village per day. Households were visited in the morning, where the household survey was administered. Anthropometric information was collected centrally in the village in the afternoon, with parents bringing children to have their measurements taken.

5.6 Quality control

The data collection was implemented by INS and overseen by a member of the research team based in Niamey, as well as WFP's own data collection checks. The member of the research team was involved in the training of the enumeration teams and the design of the process. Within limits, the significant sample attrition, nor the reasons behind it, could have been foreseen at the beginning of the research process, not least because no

follow-up of the baseline (as a panel collection effort) had been attempted, precluding direct attrition analyses being conducted on our sample. Once the data had been collected, they were collated and cleaned. During this process, a number of minor input errors were corrected, as were issues surrounding between-wave identifiers and identifiers that linked child anthropometric information to the household. With the exception of the attrition, some of which is the direct product of working in a complicated environment, the data is of high quality.

5.7 Bias

Two potential sources of bias arise given the problems encountered during the data collection process. The first source is attrition bias. Broadly speaking, so long as the nature of this bias is understood, its effects can be mitigated. The research team conducted a mission to Niamey in March 2017 to expressly discuss these matters with WFP, INS and the enumeration teams. These meetings revealed that geography and security were the key determinants of sample attrition at the village level. Subsequent analyses of households in the baseline revealed a separate range of socio-demographic determinants of attrition beyond the data collection process.

To overcome this source of bias, the Heckman-style selection correction models have been adopted, in order to overcome 'selection' into the second wave of the panel. It was found that a village's distance from Niamey was the only significant factor of selection not already included as a control variable. As this variable does not directly determine our malnutrition outcomes, it is suitable for such an analysis.

The second source of bias arises from the non-randomised rollout of WFP programmes. Potential biases arising from this process are overcome by using instrumental variables analyses. The spatial lag of the United Nations Department of Safety and Security's security event data is identified as a valid and appropriate instrument for the three baseline analyses conducted. Not only is this variable highly correlated with group belonging, but as it considers violence that took place outside of the geographic area in which an individual received WFP assistance, it can be reasonably assumed to be exogenous.

6. Programme design, methods and implementation

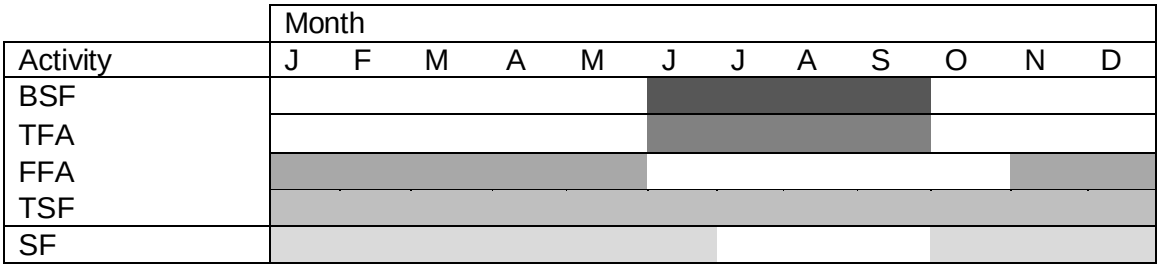
6.1 Intervention

The PRRO addresses Niger's enduring nutrition crisis. The intervention takes place over a period of three years, and has been implemented since January 2014 and is delivered by local service partners, including local, national and international NGOs. Through the analysis of rainfall, agricultural production and prices and the monitoring of household food security indicators, WFP can adjust its response during the implementation phase. The intervention has three main strategic objectives and corresponding activities:

a. **To reduce the impact of constraints and adverse seasonal impacts on lives and livelihoods**. The intervention aims to prevent a peak of acute malnutrition and mortality. The activities of this objective target children aged under two years, PLW and very poor households. Two major activities, TFA and BSF are implemented during the lean season.

b. **To increase poor households' access to assets and food through land rehabilitation, water harvesting and local purchases**. Two major activities are implemented for this purpose: FFA focuses on land rehabilitation, water harvesting and irrigation through partnerships in pastoral areas; and local purchases of the produce of smallholder farmers to promote access to markets, economic growth and agricultural development. These two activities also aim to empower rural women and are implemented during the post-harvest season (November–May).
c. **To support integrated safety nets**. This objective aims to treat acute malnutrition among children aged 6–59 months and PLW. This is achieved by implementing community-based interventions to prevent malnutrition and improve access to and retention in education. The main activities are implemented throughout the year. TSF targets MAM among children aged 6–59 months and PLW through government health facilities. School feeding (SF) provides daily cooked meals, complemented by de-worming tablets provided by the government. WFP provides take-home rations for the families of girls in the final years of primary school and supports the government in encouraging girls to attend secondary school.

Figure 2: Sequencing of intervention types throughout the year[8]



Source: WFP 2016[9]

Activities are targeted according to the seasonal calendar of a non-crisis year. As the lean season approaches, access to food for many people in Niger decreases; reliance on negative coping strategies increases; and acute malnutrition peaks. In response, WFP increases its activities in the periods that directly precede lean seasons. Seasonal livelihood planning enables WFP to refine the timeline of interventions to respond to actual onset of the lean season, rather than to its expected onset.

6.2 Targeting and beneficiaries

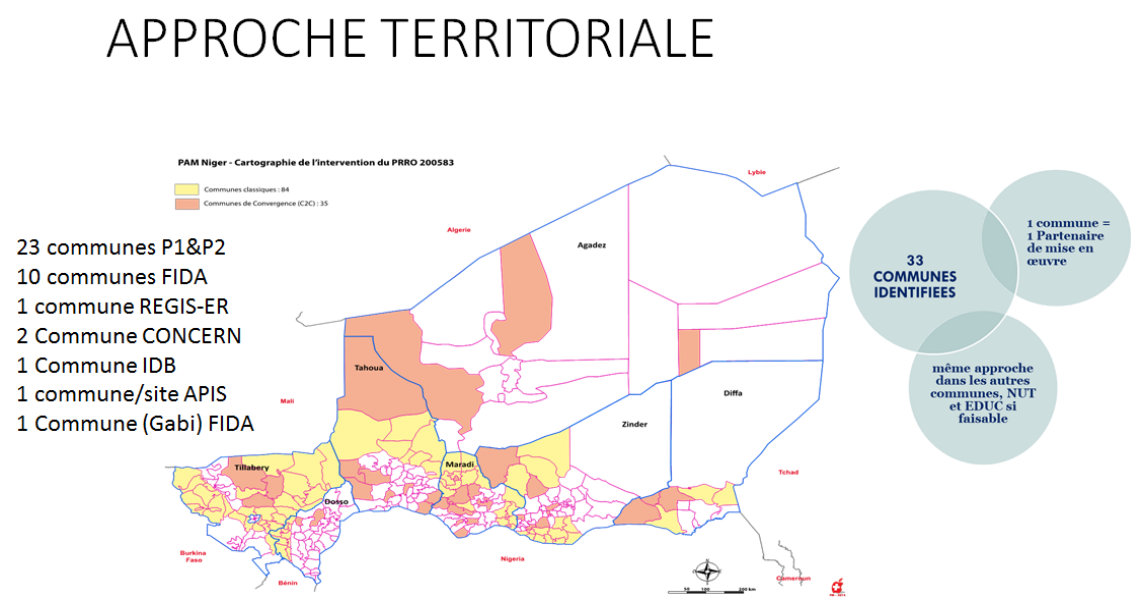
WFP uses geographic targeting to select the priority districts (called communes in Niger) by combining food security indicators, nutrition indicators, aggravating factors, livelihood strategies, population movement and infrastructure. There are some overlaps between these WFP-defined priority districts and those designated as such by the Niger

[8] Diagram based on original WFP/PAM material. BSF and TSF are as described in this document. AAA corresponds to FFA; AAC corresponds to TFA. We do not focus on 'SF' in this evaluation.
[9] Available at: <http://documents.wfp.org/stellent/groups/public/documents/reports/wfp282976.pdf?_ga=2.217418838.1782718482.1501237491-1454915657.1466610304>.

government. In a second step, targeting identifies villages within given districts where food insecurity across households was 30 per cent from 2006 to 2011 and where GAM has been above the emergency threshold (15 cent) at least twice. Indicators for school completion, prevalence of nomadism, agricultural potential and convergence of partners' activities have been integrated into the geographic targeting process.

FFA and TFA linked to BSF are implemented in the following districts: Agadez, Diffa, Dosso, Maradi, Tahoua, Tillaberi and Zinder. TSF to prevent MAM will continue throughout the entire government health system in Niger. Funding and other capacity limitations prevent complete coverage in all districts with FFA, TFA and BSF interventions; SF only targets the following districts: Agadez, Diffa, Dosso, Maradi, Tahoua, Tillaberi and Zinder. As previously noted, the regions targeted in baseline and endline were not the same. In the baseline, WFP targeted 70 communes. Due to budget constraints, this fell to 33 communes in the endline. We use this (reasonably) exogenous variation as part of our empirical strategy, as it means a large number of our sample phase-out of receipt of assistance.

Figure 3: Geographical coverage of the PRRO



Source: WFP 2016[10]

During the lean period, PRRO also includes newly vulnerable villages in the PRRO areas, in addition to those previously identified. After the lean period in each year of the intervention, these additional villages are removed, as the focus of these additions is to cover additional needs due to the lack of production and other seasonal difficulties. After the end of the lean season, only villages that were assisted before the lean season continue to receive assistance. Identification of vulnerable villages during a given year is done by a system under the leadership of the government through a coordination unit of the early warning and crisis prevention system. This process starts early in the year (May) with the identification of villages and areas at risk of a food production deficit.

[10] Available at: <http://documents.wfp.org/stellent/groups/public/documents/reports/wfp282976.pdf?_ga=2.217418838.1782718482.1501237491-1454915657.1466610304>.

Vulnerable villages are determined by consensus among a range of stakeholders by combining the degree of exposure and their adjustment capacity. Household targeting for FFA, TFA and BSF is undertaken jointly by partners, village committees and WFP; the main criterion, which is that a household is considered 'very poor', is defined at community level using the household economy approach. WFP intends to cover 80 per cent of school-age children; in nomadic areas, coverage will be higher. In the event of a shock or large-scale crisis, targeting and beneficiary estimates can be aligned with vulnerability, nutrition and crop assessments and early-warning information.

With the exception of budgeting changes that curtailed the geographic scope of the intervention, its implementation has been as planned.

6.3 Monitoring system

In addition to this impact evaluation, WFP implemented an ongoing M&E strategy. Indeed, the baseline data that this research project uses are a part of this system. A sample of assistance receivers were followed up at approximately six-monthly intervals. These surveys, however, were conducted with almost entirely new sample frames in each wave, such that by the final wave of these follow-ups, just over 50 households in the baseline remained in the sample. These surveys were focused, specifically, at assistance recipients, implying difficulties in using these tools to fully track rollout. Similarly, due to the changing sample, analytical work using this data was not possible. Evaluation of the programme's on-going performance, therefore, relied on simple correlation analysis.

6.4 Recruitment strategy

Three levels of targeting were applied during the PRRO process. Firstly, priority districts were defined based on historical malnutrition and other indicators; secondly, within those regions, particularly at-risk villages were determined; and finally, within these villages, 'very poor' households were specifically targeted. This process is discussed in depth elsewhere within this report. The baseline survey was targeted at households matching these criteria, implying that all households in our baseline were eligible for WFP programming, whether or not they actually took it up. Due to funding restrictions, the geographic scope of WFP programming in Niger was restricted between baseline and endline, such that not all households lived in target regions.

Accordingly, the recruitment strategy broadly relied on the availability of the assistance; on households satisfying the selection criteria; on their knowing the assistance was available; and on their choosing to access it. Due to the very specific targeting of the survey, where everyone in the survey was, in principle, entitled to receive WFP programming at the baseline, no comment can be particularly made on the success, or otherwise, of the targeting system WFP employed. Similarly, in the absence of alternative strategies, it cannot be discussed explicitly how well it performed. We do, however, conduct analyses that look at the determinants of an individual belonging to a particular group. The outcomes of these results are included in the results section of this report. These results imply that there are certain groups that are unfairly excluded given the current recruitment strategy and that future strategies should be aware of this.

7. Impact analysis and results of the key evaluation questions

7.1 Group definitions

Given the empirical specification (section 7.2), we require observations of a given child to be made at least twice – in our case, at the baseline and at the endline. In our data, we have 1,619 children who are in both the baseline and endline surveys, giving a sample size $n \times T = 3{,}238$. In the baseline, almost all children (99.88 per cent) receive FFA and 94.45 per cent of children receive only FFA. Given this data structure, therefore, we look at movements out of FFA-only in the baseline to some other assistance combination in the endline. Given the structure of the data, there are three feasible groups in the endline for study: those who receive nothing in the endline (52.28% of the sample); those who do not receive FFA, but who receive any other form of assistance (19.00% of the sample); and those who receive FFA and anything else in the endline (25.31% of the sample). We denote these groups respectively Group 1, Group 2 and Group 3 and use the shorthand –FFA, –FFA+ and FFA+ to refer to the assistance combinations therein.

Table 1: Summary of group definitions

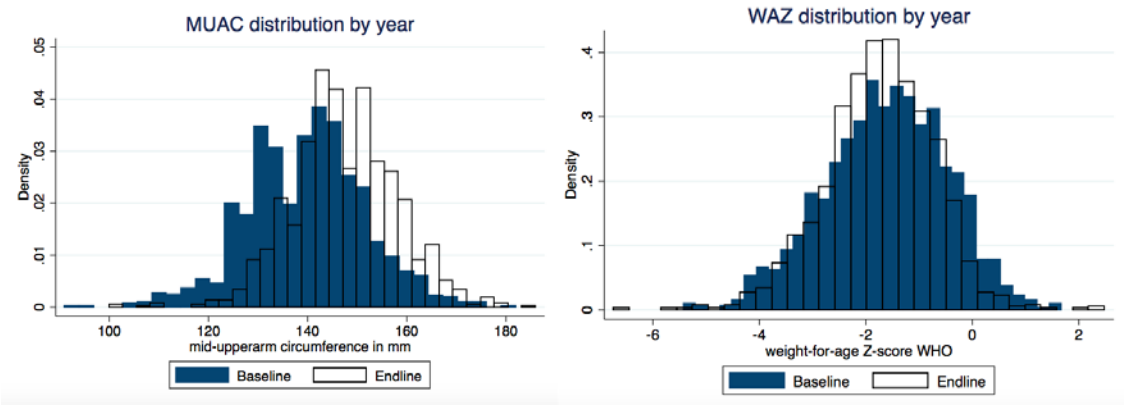
		Endline status		
		No assistance	No FFA but at least one of TFA, TSF, BSF	FFA and at least one of TFA, TSF, BSF
Baseline status	FFA-only	Group 1	Group 2	Group 3

We also test our analyses using a subsample of Group 2 that excludes those receiving TSF, thus turning it into an analysis of receipt of prevention assistance. This sub-sample comprises 15.36 per cent of the sample and 80.81 per cent of the whole Group 2 sample. Results change little between the two sample specifications of Group 2.

7.2 Key outcome variables

Three key outcome variables are defined which are linked directly to MAM. The first is a binary variable that takes the value of 0 if a child is below the MAM threshold, and 1 if he or she sits above the MAM threshold. This variable is defined using MUAC measurements and standard thresholds. In addition, the research was conducted directly on MUAC measurements and WAZ.

Figure 4: Distribution of MUAC and WAZ



Source: Authors' construction from WFP baseline and endline surveys

7.3 Empirical specification

As discussed in section 2.4, four major hypotheses are derived:

- H_1: Recipients of continued WFP assistance (Group 2 and Group 3) will exhibit significantly better MAM indicators than those who have stopped receiving assistance (Group 1);
- H_2: Individuals in Group 2 and Group 3 should both experience improved MAM indicators. Moreover, at the marginal level the –FFA+ group should benefit more than an FFA-only group due to the focus of TSF, BSF and TFA on MAM;
- H_3: Individuals in Group 3, who receive more programmatic strands than Group 2, should exhibit (overall) better MAM indicators than those in Group 2; and
- H_4: The presence of synergies is unlikely, due to H_1 raising MAM indicators for all recipients of assistance.

To test these hypotheses, a difference-in-difference estimator is deployed as our workhorse empirical approach. This approach works on the assumption of parallel trends. That is, although the nutrition indicators of households that do and do not receive assistance may be different, they are evolving similarly. This methodology is based on three main variables. The first is the assistance variable, which takes the value 1 if a household receives a particular combination of assistance, and 0 otherwise. The second is the time variable that takes a value of 1, for all households, in the period following the intervention, and 0 in the period before the intervention. The third and most important variable is the interaction of the other two variables, which shows the treatment effect when the parallel trends assumption holds.

As we have only two waves of data, we have no empirical strategy to show that parallel trends are present in Niger but naively assume it holds for the baseline analysis. For these baseline results, we therefore conduct a simple difference-in-difference analysis using the following equation:

$$Malnutrition_{ijt} = \alpha + \beta_1 AFTER + \beta_2 TREAT_{jt} + \beta_3 AFTER * TREAT_{jt} + \beta_4 X_{ijt} + \epsilon_{ijt} (1)$$

where: *Malnutrition* is the malnutrition status of child *i* in household *j* at time *t*; *AFTER* and *TREAT* are the after and assistance receipt variables discussed above, and *X* is a vector of control variables at the household level.

Three analyses are conducted using the equation: one comparing Group 1 as the control group and Group 2 as the assistance-receiving group; the second comparing Group 1 and Group 3 in the same way; and a third using Group 2 as a 'control' group and Group 3 as the assistance-receiving group, to test for differential outcomes across the two groups that receive assistance in the endline.

As discussed in section 5.7, two sources of bias can arise in these analyses. To test for the potential presence of these biases, we conduct two preliminary analyses. Firstly, we test for differences between attritors and remainers (at baseline), to test whether or not structural biases determine whether or not an individual is likely to leave the survey. These take the form of simple t-tests for differences in the sample means of a range of survey variables.

Secondly, we conduct analyses that look at the determinants of group belonging. In these analyses, we unconditionally regress key variables of interest on a variable that denotes whether or not an individual belongs to a given group. In addition to showing that there may be structural determinants of belonging to a given group (thus implying omitted variable biases are likely to be present and confirming the need for instrumental variables approaches), these outcomes offer some insight on the quality of targeting of programmes. The results from such an analysis can show, for example, if particular groups are structurally less likely to receive assistance from WFP. In turn, this can be used to improve targeting of future programmes.

Three further approaches are taken to the analyses described. Firstly, we run an instrumental variables analysis, which corrects for endogeneity biases. We show a spatial lag of insecurity to be a strong and valid instrument.[11] As this instrument relates to security situations that take place outside of the region in which the focus household is based, there is no reason to believe that it directly determines MAM status of that household.

Secondly, we conduct a Heckman-style selection bias correction analysis. In this setting, we show that the distance from Niamey, in addition to a number of control variables in our regressions, is a significant driver of attrition from the survey but is not a direct determinant of MAM and thus acts as a suitable selection variable. Finally, we run an analysis that includes both our instrumental variables and Heckman approaches together. This is the main analysis on which our inference is based.

We conduct these analyses on three nutrition indicators of interest and include multiple combinations of control variables as robustness checks.

[11] We instrument 'assistance' in each group. We find that in the comparison of Group 1 to Group 3 and Group 2 to Group 3 (in both cases, belonging to Group 3 is the 'assistance' variable) we find that the instrument is statistically correlated (<1%) with the endogenous variable and the Cragg-Donald F-Statistic surpasses the Stock-Yogo thresholds at 1%. In the analysis comparing Group 1 and Group 2, where Group 2 is the 'assistance' group, the instrument performs slightly less well. It is again highly statistically correlated (<1%) with the instrument, but only surpasses the Stock-Yogo thresholds at about 12%. This implies that some bias may still be present in the analysis, although even in its maximal form, it is not sufficient to change the general inference that is drawn from these analyses.

We run regressions on the following sets of control variables:

1. Basic demographic household information
2. Basic demographic household information + assets index
3. Basic demographic household information + animals index
4. Basic demographic household information + assets index + animals index

As is common in the literature, we separate livestock assets, which can be used for food, from other assets, which cannot be used for food. Furthermore, to maximise the relevance of these indices, we conduct a principal component analysis on the raw data that comprise these indices and include this information in the analyses. Results are robust across all of these specifications. We report only the results from the fourth set of regressions, which implicitly should present the most robust version of our findings.

As nutrition in Niger is seasonal, as discussed in this report, it is prudent to reflect on the impacts our baseline and endline may have, as the baseline was collected in March 2014 and the endline in September 2016. We note that this decision was taken to fit with WFP's own M&E data collection, which enabled this project to build synergies with this ongoing work. As it is, the difference-in-difference methodology is particularly well-suited to dealing with seasonality, given the underpinning manner in which it works.

In essence, this methodology looks at the difference between one set of observations (Cluster A) between two time periods and compares this to the difference in a second set of observations (Cluster B) in the same time periods. The impact of the assistance is then taken to be the difference between these two differences. In effect, therefore, as long as any trend (such as that imposed by seasonality) is the same for both groups, such trends are eliminated from the analysis. In this case, given that we have assisted and non-assisted households in the same areas in our survey, we see no reason to believe why these trends should, otherwise, be different for assisted and non-assisted households. In this manner, seasonality is partialed out of our analysis.

7.4 Qualitative specification

The qualitative research has the following objectives: (1) to compare the quantitative results with perceptions of the impact of WFP's programme; (2) to understand better the impact mechanisms of WFP interventions; (3) to understand better the low participation in treatment of malnutrition in health centres; and (4) to obtain key messages that could be used as testimony (Moussa 2018).

Three types of qualitative interviews were conducted to provide a holistic view of the intervention programme and to provide context for the evaluation:

- Interviews with groups of beneficiaries: these interviews provided an opportunity to trace the mechanisms of the theory of change whereby interventions affect recipients;
- Interviews with groups of non-beneficiaries: these helped to understand the reasons for the low rate of intervention, food and child practices, household decision-making, constraints on access to the programme and nutrition and health education, and to assess whether the chosen targeting is appropriate; and
- Stakeholder interviews: key informants involved or informed about the PRRO were interviewed to collect data on the design and implementation of the

intervention, a low absorption rate and other contextualising factors that shape the programme.

Village sampling, based on a random process, took into account the representativeness of agro-ecological zones ('agricultural', 'agropastoral', 'pastoral and desert'), selecting two villages per agro-ecological zone, considering the distance from the main urban centre of the region (less than 250km) and the attrition rate in the endline survey (between 15 per cent and 50 per cent).

Interviews were conducted by qualified personnel, adapted to the local context. The households participating in the interviews were chosen in partnership with the Nutrition Unit and the High Commission for Nigeriens Nourishing Nigeriens Monitoring and Evaluation Department in Niger, based on the most relevant themes from the survey results and taking into account the heterogeneity of the impact.

7.5 Empirical results

7.5.1 Attrition analysis

Table 2: Attrition analysis – t-test comparison of sample means

VARIABLES	(1) Remainers	(2) Attritors	(3) Difference	
poverty_status	1.172622	1.016892	0.15573	***
agro_eco_zone	2.037867	1.172297	0.86557	***
m_child_0_5	0.0583111	0.0709459	-0.0126348	
m_child_6_59	0.5788444	0.6182432	-0.0393988	
m_hh_size	3.018667	3.111486	-0.092819	
f_child_0_5	0.0583111	0.0540541	0.004257	
f_child_5_59	0.5488	0.4594595	0.0893405	**
f_hh_size	3.25	3.140444	0.109556	
gender head	1.231289	1.25	-0.018711	
marital head	1.630044	1.712838	-0.082794	
age head	44	45.78258	-1.78258	**
educ head	1.5984	1.658784	-0.060384	
job head	4.264356	4.358108	-0.093752	
income head	1.440356	1.442568	-0.002212	
water	1.703289	1.719595	-0.016306	
toilet	4.029867	4.135135	-0.105268	
energy	2.874667	2.959459	-0.084792	***
hh_tenure	1.646044	1.307432	0.338612	***
chair	1.049422	1.084459	-0.035037	***
carpet	0.1701333	0.1351351	0.0349982	*
table	0.8312889	0.4527027	0.3785862	***
bed	0.0311111	0.0202703	0.0108408	
mat	0.6792889	0.4358108	0.2434781	***
jewellery	0.9308444	0.9831081	-0.0522637	***

VARIABLES	(1) Remainers	(2) Attritors	(3) Difference	
iron	0.1139556	0.0472973	0.0666583	***
sew_machine	0.0186667	0.0202703	-0.0016036	
telephone	0.0083556	0.0067568	0.0015988	
tv	0.4243556	0.3614865	0.0628691	**
radio	0.0060444	0.0168919	-0.0108475	**
hoe	0.2007111	0.1824324	0.0182787	
plough	0.8954667	0.847973	0.0474937	***
motorbike	0.1431111	0.1047297	0.0383814	**
bike	0.0344889	0.027027	0.0074619	
lamp	0.0177778	0.0168919	0.0008859	
other	0.9367111	0.8614865	0.0752246	***
animals	0.0307556	0.9831081	-0.9523525	
cows	0.6449778	0.3716216	0.2733562	***
sheep	0.5847111	0.2837838	0.3009273	***
goats	1.314667	0.4560811	0.8585859	***
camels	2.128356	0.902027	1.226329	***
donkeys	0.0698667	0.0067568	0.0631099	**
horses	0.5363556	0.1047297	0.4316259	***

Note: *** p<0.01; ** p<0.05; * p<0.10
hh = households

In Table 2, we compare the sample means of a range of key variables between two groups: those households that remain in the survey in the endline (remainers) and those that leave (attritors). Were attrition entirely random, we should expect to find no differences in the means of these variables between these groups. Any statistically significant differences in the means, therefore, can be taken to imply that there are structural differences between remainers and attritors.

In Table 2, we see that a number of key variables between these groups are significantly different. Attritor households are significantly more likely to be ‘very poor’. This is also borne out by the strength and direction of the assets owned by attritor and remainer households. Similarly, we find some differences in household composition and other demographic information, although these are not routinely different. However, given that we find differences between the groups in more than half of the variables under investigation, we must conclude that attrition from the sample is structural and that corrective analyses are therefore required.

7.5.2 Group determinants analysis

In this analysis, we construct an ordinal variable that takes the value of 0 if a household belongs to Group 1, the value of 1 if a household belongs to Group 2, and a value of 2 if a household belongs to Group 3. We argue that such an ordinal variable is appropriate for this analysis as, at each ‘step’ a household receives more treatment combinations. We conduct simple linear analyses on the correlates of this ordinal variable. In effect, therefore, this analysis looks at the reasons why a household may fall into a given treatment group. The purpose of this analysis is two-fold. Firstly, it allows us to

understand some of the key drivers behind belonging to a given group; secondly, it allows us to reflect on the targeting process and the participation in assistance of given households. We present the results from this analysis in Table 3.

Table 3: Analysis showing correlates belonging to treatment groups

VARIABLES	(1) Coefficient	(2) Std. Err.	(3) P>|t|
size_hh	0.024***	0.003	0.000
sex_hh_head	0.019	0.027	0.492
marital_status	0.015	0.014	0.276
education_head	0.029***	0.007	0.000
constant	1.847***	0.042	0.000

Note: * = significant at 10%; ** = significant at 5%; *** = significant at 1%
hh = households

In Table 3, we see that two main variables are correlated with the amount of assistance a given household receives. The first shows that the size of the household (proxied by the number of individuals living in that household) is a positive and significant driver of group belonging. The positive and significant coefficient on this variable implies that if a household gets (exogenously) larger, it is more likely to receive WFP assistance. In a number of ways, this seems *a priori* unsurprising, given the linkages between, for example, high fertility and poverty.

Of more concern, however, is that the education level of the household head is also positively and significantly correlated with the receipt of more forms of assistance. In some ways this is unsurprising – higher education implies a greater likelihood that a household head is aware of the benefits of participating in assistance programmes – but it also implies that households with poorly educated heads may be (unfairly) excluded from receiving assistance. This, in turn, implies a requirement for WFP to ensure that its targeting methodology encourages greater participation from households with weaker educational backgrounds. Given that education may correlate with other variables of particular interest, such as income, employment and so forth, this is doubly important.

We also note that there are at least some structural determinants of the group into which an individual falls, suggesting potential biases arising from simple linear approaches. In turn, this further validates the requirement for an instrumental variables approach.

7.5.3 First stage results

In this section, the suitability of our sectional criterion and instrumental variables are briefly discussed.

Selection criterion: the main requirement of a selection variable is that it is correlated with the selection under investigation (in our case, attrition from the sample), but that it is not a variable that determines the outcome in the main analysis. In our case, therefore, the variable must predict attrition from the sample but not the MAM outcomes under investigation. We argue that the distance of a household from Niamey is a suitable selection criterion. We show the results of an artificial first stage of this analysis in Table

4. To conduct this analysis, we run a probit regression on a binary variable that denotes whether or not a household remains in the sample. Following the approach methodology, we include all control variables from the main regressions, in addition to our selection criterion.

Table 4: Heckman artificial first stage

	(1)
VARIABLES	Selection
Kilometres from the capital	-0.0224***
	(0.00688)
Constant	1.336*
	(0.692)
Cluster	YES
Observations	3,471

Note: Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

As shown in Table 4, the distance a household lives from Niamey is a strong and statistically significant predictor of sample attrition. These results show that, the further a household is from Niamey, the less likely it is to remain in the sample in the endline. Moreover, given that the major part of Niger comprises desert area, including the areas comparatively near to Niamey (that is, places that are closer to Niamey than the furthest reaches of the desert area), this distance is not a significant predictor of a household or child's MAM status. Distance from Niamey, therefore, is a suitable selection criterion and is used in the main specifications of our analyses.

Instrumental variables: an instrument must also satisfy two criteria. Firstly, that it is strongly correlated with the endogenous variable of interest – in our case, the treatment group into which an individual falls. Secondly, that it must not be correlated with the regression error term. In a practical sense, this means that the instrument must correlate with the variable it 'replaces' but should not, itself, determine the outcome in question – in our case, MAM-related indicators. For an instrument to be strong, however, it is not simply enough for it to be highly correlated with the endogenous variable; further restrictions must be satisfied, otherwise new biases may arise through the use of the instrument. Thus, the Cragg-Donald F-statistic must exceed the Stock-Yogo thresholds.

We argue that a very specific spatial lag of security is a suitable instrument for the comparisons between all treatment groups. As shown in Table 5, this spatial lag of insecurity is a significant correlate of the dummy variable in each of our three main analyses. Thus, the lag is significantly correlated with: a binary variable that takes the value of 1 if an individual is in Group 2 and 0 for Group 1; a binary variable that takes the value of 1 if an individual is in Group 3 and 0 for Group 1; and a binary variable that takes the value of 1 if an individual is in Group 3 and 0 for Group 2.

Table 5: Artificial first stage IV analyses

VARIABLES	(1) G2vG1	(2) G3vG1	(3) G3vG2
km_insecure	-0.000233***	0.000924***	0.00122***
	(5.75e-05)	(5.94e-05)	(8.11e-05)
Observations	3,646	3,631	3,631

Note: Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Moreover, we find that in both columns 2 and 3 the instrument surpasses the Stock-Yogo thresholds at the 1 per cent level. This ensures that the instrument is very strong for membership in Group 3 and that biases arising from the IV approach will be minimal. In column 1, however, the instrument is only 'marginally' strong, surpassing the Stock-Yogo thresholds at just over 10 per cent. This implies some risk of bias, although even here this is comparatively small. Analyses show the maximal bias to somewhere around 12 per cent. Although we accept certain caveats must therefore be made with respect to these results, we believe this instrument to be suitably strong for use in all cases and, certainly, to be the instrument currently available to the research team that performs best.

Alone, however, these correlations are not enough, as they do not satisfy the second criterion. As we present a just-identified analysis – that is, an analysis where the number of instruments equals the number of endogenous variables – we cannot statistically show the validity of the instrument. It seems probable, however, that insecurity in a given village should directly affect food security and MAM in that region. However, we use a spatial lag of these data, meaning that we look at the relationship between group belonging and insecurity events that take place elsewhere, rather than in the village in which a household lives. We see no strong reason to believe why violence elsewhere should, therefore, affect (mal)nutrition in a given village. Thus, this instrument reasonably satisfies both criteria required and is therefore employed in our main analyses. As we interact time and the assistance group to generate our impact variable, we generate a second instrument by interacting the spatial lag with time in the same manner.

7.5.4 Main empirical results

The main empirical results from the impact evaluation are presented in Tables 6–14. In Tables 6–8 we present the analyses that compare outcomes between Group 1 and Group 2. In Tables 9–11 we present the analyses that compare outcomes between Group 1 and Group 3. Finally, in Tables 12–14 we present the analyses that compare outcomes between Groups 2 and 3. In Tables 6, 9 and 12 we show the impact of each treatment combination on MAM; in Tables 7, 10 and 13 on MUAC; and in Tables 8, 11 and 14 on WAZ. Each of these tables has five columns. Column 1 presents a simple OLS-based difference-in-difference estimator. Column 2 presents a fixed-effects (FE) version of the difference-in-difference estimator. Column 3 shows the results from a Heckman-selection correction difference-in-difference and column 4 the instrumental variables version. Finally, in Column 5, we present the preferred specification, which runs a difference-in-difference analysis based on both a Heckman-selection correction

model and an instrumental variables model.[12] Accordingly, most discussion takes place in the context of the results presented in column 5.

Table 6: Impact of –FFA+ on MAM in relation to –FFA on experiencing MAM

group2vs1 – MAM					
VARIABLES	(1) OLS	(2) FE	(3) Heckman	(4) IV	(5) Heckman IV
Time	0.0767***	0.0486**	0.0788***	0.293**	0.297**
	(0.0149)	(0.0244)	(0.0153)	(0.119)	(0.119)
group2vs1	0.0183		0.0157	0.889**	0.894**
	(0.0183)		(0.0259)	(0.398)	(0.400)
time_group2vs1	-0.0223	-0.0250	-0.0204	-0.897*	-0.910*
	(0.0238)	(0.0262)	(0.0275)	(0.466)	(0.468)
Observations	1,804	1,804	1,731	1,732	1,731
R-squared	0.054	0.108	0.054		
Control level	level_5	level_5	level_5	level_5	level_5
Number of panel_id		1,056			
P-value Durbin test				.004	.003
Wu-Hausman test				6	6
P-value Wu-Hausman test				.004	.004
Degrees of freedom				2	2
Sargan when overidentified				,	,
,	0	0	0	0	0

Note: Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Excludable instruments: km_insecure km_insecure_time

Table 6 shows children in Group 2 are significantly less likely to suffer from MAM than Group 1, partially implying that WFP's targeting may not reach the households that require it most. Secondly, it shows that receipt of –FFA+ assistance, in relation to a move to no assistance, appears to increase the probability that a child suffers MAM. This finding suggests that if a child were to exogenously move from the –FFA group to the –FFA+ group, he or she would be almost 90 per cent more likely to suffer MAM. It is worth noting, however that this finding is only marginally significant. Given the potential bias that arises from the use of only a marginally strong instrument, caution is urged with strong interpretations.

Either finding, however, is a matter of concern. At best, it implies that prevention programming is having little impact and may actually be exacerbating the risk. If the latter is the case, it is important to consider why this is the case. In part, intra-household decision-making may explain such a finding. To receive assistance, households may transfer food from children to other household members. It is plausible to believe that the assistance received is insufficient to overcome such adverse intra-household decisions. An alternative explanation follows the one given by Olivier de Dardan (2008), who notes that alternative coping strategies (such as those that might be followed by the –FFA group) may have greater impacts than receipt of assistance.

[12] A definition and discussion of this methodology can be found in the Stata user materials, available at:
<http://www.stata.com/support/faqs/statistics/endogeneity-versus-sample-selection-bias/>.

Table 7: Impact of –FFA+ in relation to –FFA on MUAC

group2vs1 – MUAC	0	0	0	0	0
	(1)	(2)	(3)	(4)	(5)
VARIABLES	OLS	FE	Heckman	IV	Heckman IV
time	7.239***	7.010***	7.345***	16.91***	17.23***
	(0.779)	(0.947)	(0.786)	(5.139)	(5.193)
group2vs1	-0.696		-0.712	20.29	20.70
	(0.957)		(0.971)	(16.93)	(17.11)
time_group2vs1	-0.686	-0.356	-0.564	-38.67*	-39.70*
	(1.248)	(1.017)	(1.235)	(20.14)	(20.33)
Observations	1,800	1,800	1,727	1,728	1,727
R-squared	0.117	0.303	0.125		
Control level	level_5	level_5	level_5	level_5	level_5
Number of panel_id		1,054			
P-value Durbin test				.06	.051
Wu-Hausman test				3	3
P-value Wu-Hausman test				.062	.053
Degrees of freedom				2	2
Sargan when overidentified				,	,
	0	0	0	0	0

Note: Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Excludable instruments: km_insecure km_insecure_time

Finally, it is also worth considering the potential impacts of bias that may arise. We see very little difference between the unconditional linear regressions and the Heckman correction, implying that attrition, although large in absolute numbers, does not play an important role in determining outcomes. In turn, this could be taken to imply that despite appearing to be a major limiting factor to this study, attrition is not actually all that problematic. However, we see major differences in both the scale and significance of the coefficients between typical linear approaches and the IV approach. These results imply the bias is positive, reinforcing the notion that WFP's programming may not reach those most in need.

The results in Table 7 broadly support those in Table 6, suggesting that these results are robust to different modelling specifications. Here, unsurprisingly, we see a strong positive impact of time, as children are older in the endline and have grown physically. We see a large but insignificant difference between children in Group 1 and Group 2 this time. Again, however, we find the troubling outcome that MUAC is significantly worse as a consequence of the treatment.

Table 8: Impact of –FFA+ in relation to –FFA on WAZ

group2vs1 – WAZ	0	0	0	0	0
	(1)	(2)	(3)	(4)	(5)
VARIABLES	OLS	FE	Heckman	IV	Heckman IV
Time	-0.196**	-0.0615	-0.195**	0.253	0.267
	(0.0775)	(0.0916)	(0.0777)	(0.458)	(0.461)
group2vs1	-0.0986		-0.0712	0.127	0.142
	(0.0949)		(0.0978)	(1.494)	(1.503)
time_group2vs1	-0.0658	-0.127	-0.0775	-1.794	-1.843
	(0.124)	(0.0984)	(0.124)	(1.788)	(1.797)
Observations	1,794	1,794	1,721	1,722	1,721
R-squared	0.023	0.043	0.024		
Control level	level_5	level_5	level_5	level_5	level_5
Number of panel_id		1,052			
P-value Durbin test				.376	.354
Wu-Hausman test				1	1
P-value Wu-Hausman test				.38	.359
Degrees of freedom				2	2
Sargan when overidentified				,	,
	0	0	0	0	0

Note: Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Excludable instruments: km_insecure km_insecure_time

In Table 8, we again see a negative sign on the coefficient as a result of moving to –FFA+, in relation to –FFA, but for WAZ, the coefficient is insignificant. This implies no real impact of the programme on MAM, according to this indicator. Again, however, we see that the impact of bias is positive, implying that treatment may not necessarily be reaching the correct groups. Taken together, these results imply that prevention programming specifically, and wider –FFA+ programming more generally, are not strongly linked to improvements in the MAM status of those children who receive such assistance. Taken in isolation, this implies an urgent requirement for WFP to revisit this programming modality and its targeting strategies, given that we repeatedly see negative biases resulting from the rollout process. Such biases imply that children who receive this form of assistance actually have better nutrition indicators, *a priori*, than children in households who do not receive the assistance. Either this implies errors in the targeting strategy discussed in this report or that uptake of the assistance is lowest among those who may stand to benefit most from it.

In repeated analyses, where we focus only on a subsample of Group 2 who receive prevention programming (BSF or TFA), we see no major departure in these results. We therefore do not report these results for parsimony, but note that in turn they imply that prevention programming does not appear to be having the impact it was hoped it would have, nor is it necessarily reaching those children with the worst indicators.

In Tables 9–11, we look at a series of similar analyses that compare the impact of moving from FFA-only in the baseline to FFA+ in the endline, in relation to a move from FFA-only to –FFA. As with the previous analysis, we focus these analyses on MAM, MUAC and WAZ.

Generally speaking, the results here are significantly more positive than those presented in Tables 6–8. Firstly, we see that children who fall into Group 3 are significantly more likely to experience MAM, *a priori*, than the children in Group 1. This implies that the targeting of FFA+ treatments is reaching the children with the worst observable nutrition indicators. We also see a strong and positive impact of the programming on the likelihood of experiencing MAM, implying that FFA+ treatment is working to reduce MAM. In this case, were a child to exogenously move from Group 1 to Group 3, he or she would be 19 per cent less likely to experience MAM. Here, too, the biases present are negative, implying that targeting is working well.

The results presented in Table 10 broadly support these findings. Again, as would be expected, MUAC has significantly increased in time as children have become older and are therefore physically larger. A significant negative relationship remains between belonging to Group 3, in relation to Group 1, reinforcing the notion that targeting for the FFA+ group has successfully reached the children with poorer nutrition indicators. Finally, we see a positive and significant effect of receiving FFA+ assistance, implying that FFA+ treatment is successful in reducing the extent and prevalence of MAM. In this case, were a child to exogenously move from Group 1 to Group 3, he or she would, on average, experience an increase of 8.4mm in the size of his or her MUAC. For the median child experiencing MAM in our sample, this would be sufficient to move him or her above the MAM threshold. This is a major positive finding and suggests, certainly, that receiving FFA+ treatment is playing a major role in the battle against MAM in Niger.

Table 9: Impact of FFA+ on MAM in relation to –FFA on probability of experiencing MAM

group3vs1 – MAM					
	(1)	(2)	(3)	(4)	(5)
VARIABLES	OLS	FE	Heckman	IV	Heckman IV
Time	0.0775***	0.0555**	0.0811***	0.0184	0.0183
	(0.0142)	(0.0249)	(0.0149)	(0.0261)	(0.0260)
group3vs1	0.0258		0.0291	-0.162**	-0.158**
	(0.0176)		(0.0233)	(0.0724)	(0.0723)
time_group3vs1	-0.0348	-0.0405	-0.0386	0.189**	0.192**
	(0.0220)	(0.0262)	(0.0252)	(0.0821)	(0.0818)
size_hh	0.00290	0.00929**	0.00231	0.00372*	0.00344
	(0.00194)	(0.00470)	(0.00167)	(0.00220)	(0.00220)
nb_0_5m	0.0104	0.0328	0.00963	0.0104	0.00985
	(0.0105)	(0.0222)	(0.00882)	(0.0111)	(0.0111)
women_hh_head	-0.0154	-0.0854*	-0.0133	-0.0102	-0.00715
	(0.0161)	(0.0473)	(0.0172)	(0.0172)	(0.0173)
n_wifes	-0.0113	-0.0152	-0.0115	-0.0132	-0.0139
	(0.00990)	(0.0274)	(0.0120)	(0.0108)	(0.0108)
livestock_pc1	-0.000380	0.00634	9.13e-06	0.000214	0.000813
	(0.00358)	(0.00660)	(0.00240)	(0.0038)	(0.00379)
assets_pc1	0.00402	0.00200	0.00409	0.00577	0.00562
	(0.00372)	(0.00750)	(0.00292)	(0.0039)	(0.00392)
Observations	1,909	1,909	1,834	1,839	1,834
R-squared	0.050	0.095	0.052		
Control level	level_5	level_5	level_5	level_5	level_5
Number of panel_id		1,156			
Durbin test				9	9
P-value Durbin test				.012	.009
Wu-Hausman test				4	5
P-value Wu-Hausman test				.012	.009
Degrees of freedom				2	2
Sargan when overidentified				,	,
	0	0	0	0	0

Note: Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Excludable instruments: km_insecure km_insecure_time

hh = households

Table 10: Impact of FFA+ in relation to –FFA on MUAC

group3vs1 – MUAC					
	(1)	(2)	(3)	(4)	(5)
VARIABLES	OLS	FE	Heckman	IV	Heckman IV
Time	7.403***	6.765***	7.592***	5.444***	5.454***
	(0.761)	(0.989)	(0.758)	(1.360)	(1.359)
group3vs1	-0.679		-0.700	-7.305*	-7.284*
	(0.945)		(0.983)	(3.815)	(3.822)
time_group3vs1	0.498	0.515	0.489	8.250*	8.385*
	(1.181)	(1.043)	(1.180)	(4.321)	(4.322)
size_hh	-0.00108	0.168	0.00342	0.0499	0.0439
	(0.104)	(0.186)	(0.0993)	(0.115)	(0.116)
nb_0_5m	0.524	1.909**	0.449	0.490	0.467
	(0.564)	(0.882)	(0.561)	(0.578)	(0.579)
women_hh_head	0.141	-0.485	0.291	0.420	0.522
	(0.860)	(1.877)	(0.906)	(0.893)	(0.902)
n_wifes	-0.600	0.00248	-0.587	-0.630	-0.649
	(0.531)	(1.087)	(0.531)	(0.562)	(0.562)
livestock_pc1	-0.0270	0.125	-0.0427	-0.0334	-0.0162
	(0.192)	(0.262)	(0.182)	(0.198)	(0.198)
assets_pc1	0.721***	0.243	0.760***	0.827***	0.816***
	(0.200)	(0.298)	(0.188)	(0.206)	(0.206)
Observations	1,900	1,900	1,825	1,830	1,825
R-squared	0.121	0.303	0.128	0.105	0.104
Control level	level_5	level_5	level_5	level_5	level_5
Number of panel_id		1,150			
Durbin test				4	4
P-value Durbin test				.155	.142
Wu-Hausman test				2	2
P-value Wu-Hausman test				.158	.145
Degrees of freedom				2	2
Sargan when overidentified				,	,
	0	0	0	0	0

Note: Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Excludable instruments: km_insecure km_insecure_time

hh = households

Finally, as with the impact of –FFA+ assistance, we see little relationship between FFA+ assistance on WAZ. In this setting, although the signs of the coefficients in Table 11 are broadly aligned with those in Tables 9 and 10, the effects are no longer statistically significant. In its way, this is an interesting finding, as it implies that while FFA+ assistance, in relation to –FFA assistance has a strong and positive impact on the prevalence of MAM and on MUAC, these effects do not extend to other nutrition indicators linked to MAM. In turn, this teaches us two important lessons. Firstly, the selection of indicators is incredibly important if one wishes to understand the specific effects of assistance. Secondly, one must therefore strongly reflect on the most suitable or appropriate indicators for measuring outcomes. In this particular case, where one indicator was favoured over another, the outcomes of the study would vary drastically.

Table 11: Impact of FFA+ in relation to –FFA on WAZ

group3vs1 – WAZ					
	(1)	(2)	(3)	(4)	(5)
VARIABLES	OLS	FE	Heckman	IV	Heckman and IV
time	-0.161**	-0.0537	-0.157**	-0.198	-0.202
	(0.0745)	(0.0935)	(0.0746)	(0.131)	(0.131)
group3vs1	-0.0171		-0.0145	-0.00597	-0.000556
	(0.0921)		(0.0938)	(0.365)	(0.365)
time_group3vs1	-0.00113	0.0698	-0.00505	0.177	0.174
	(0.115)	(0.0986)	(0.114)	(0.414)	(0.414)
size_hh	0.00158	-0.0143	0.00308	0.000710	0.000746
	(0.0102)	(0.0176)	(0.0102)	(0.0112)	(0.0112)
nb_0_5m	0.00970	0.105	0.0104	0.00207	0.00311
	(0.0551)	(0.0835)	(0.0473)	(0.0563)	(0.0563)
women_hh_head	0.103	0.0924	0.104	0.101	0.0956
	(0.0840)	(0.177)	(0.0836)	(0.0868)	(0.0875)
n_wifes	-0.0263	0.0908	-0.0325	-0.0453	-0.0450
	(0.0519)	(0.103)	(0.0561)	(0.0547)	(0.0547)
livestock_pc1	0.0220	0.0129	0.0200	0.0237	0.0232
	(0.0188)	(0.0248)	(0.0185)	(0.0193)	(0.0193)
assets_pc1	0.0197	-0.0466*	0.0279	0.0294	0.0301
	(0.0196)	(0.0282)	(0.0190)	(0.0200)	(0.0200)
Observations	1,893	1,893	1,818	1,823	1,818
R-squared	0.014	0.030	0.015	0.010	0.011
Control level	level_5	level_5	level_5	level_5	level_5
Number of panel_id		1,147			
P-value Durbin test				.744	.723
Wu-Hausman test				0	0
P-value Wu-Hausman test				.746	.726
Degrees of freedom				2	2
Sargan when overidentified				,	,
	0	0	0	0	0

Note: Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Excludable instruments: km_insecure km_insecure_time
hh = households

A subsequent question, however, arises about why one sees differential outcomes across these two indicators. Given that the coefficients are positive in all three analyses, it seems likely to stem from a significantly wider variation in WAZ in relation to the MUAC and MAM indicators. This implies that the MUAC outcomes are more closely clustered around the mean than the WAZ indicators. Indeed, this particular outcome can be seen in Figure 3. In turn, the statistical 'noise' associated with the analysis of WAZ is therefore likely to account for the insignificant finding on this variable. In turn, we are therefore content to conclude that there is a strong and statistically significant impact of FFA+ treatments on the MAM outcomes of children in Niger.

Table 12: Impact of FFA+ on MAM in relation to –FFA+ on experiencing MAM

group3vs2 – MAM					
VARIABLES	(1) OLS	(2) FE	(3) Heckman	(4) IV	(5) Heckman IV
Time	0.0650***	0.0148	0.0751***	-0.0245	-0.0192
	(0.0227)	(0.0364)	(0.0252)	(0.0449)	(0.0442)
group3vs2	0.0115		0.0184	-0.165**	-0.160**
	(0.0218)		(0.0294)	(0.0688)	(0.0679)
time_group3vs2	-0.00833	-0.0152	-0.0150	0.156**	0.155**
	(0.0273)	(0.0326)	(0.0320)	(0.0763)	(0.0753)
size_hh	-0.000430	0.0133*	-0.00188	0.00189	0.000394
	(0.00260)	(0.00683)	(0.00257)	(0.00313)	(0.00311)
nb_0_5m	0.0134	0.0433	0.0140	0.0150	0.0165
	(0.0129)	(0.0346)	(0.00892)	(0.0138)	(0.0136)
women_hh_head	0.00323	0.0289	0.00663	0.00663	0.0119
	(0.0218)	(0.0712)	(0.0184)	(0.0231)	(0.0230)
n_wifes	0.00274	-0.0318	0.00301	0.00322	0.00404
	(0.0133)	(0.0380)	(0.0143)	(0.0142)	(0.0140)
livestock_pc1	0.00741	0.00809	0.00973**	0.00576	0.00742
	(0.00473)	(0.00764)	(0.00448)	(0.00524)	(0.00518)
assets_pc1	0.00879*	0.00216	0.00806**	0.00965*	0.00896*
	(0.00500)	(0.0102)	(0.00402)	(0.00526)	(0.00520)

Note: Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Excludable instruments: km_insecure km_insecure_time

hh = households

Precisely what these findings imply for our main research hypotheses and research questions must, therefore, also be considered. Most importantly, we provide robust results for answering H_1 and H_2. First of all, we find that recipients of FFA+ assistance experience positive and significant improvements in two major MAM indicators. Recipients are significantly less likely to experience MAM than individuals in Group 1, who in the endline receive no assistance. Such children also have significantly larger MUAC than those in Group 1, although this finding is no longer significant when impact is judged in terms of WAZ. Belonging to Group 2, however, appears to have little effect on a child's nutrition status, even when viewed solely in terms of receiving prevention programming. Indeed, these analyses provide some suggestion that children in Group 2 actually have significantly worse nutrition outcomes than those in Group 1. In this regard, H_1 holds for individuals who fall into Group 3 but not for those in Group 2.

It follows from this that H_2 holds. Children who move from FFA-only in the baseline to FFA+ experience significantly improved nutrition outcomes. This, in turn, implies that the '+' aspect of FFA+ has an impact, over and above the receipt of FFA-only. In some sense, this implies at least one of two things: firstly, that receipt of multiple assistance strands leads to improved outcomes. Additionally, this result arises from a combination of agriculturally sensitive programming and prevention programming, it also seems likely that provision of multiple modalities of assistance, rather than just 'more assistance' is what drives this outcome. In turn, this implies that what is found is likely to be more than simply a scale effect.

Confirmation of such synergies is not empirically possible given the structure of data available to us, but should be the basis of future impact evaluations. Thus, while treatment and prevention programmes do not appear to have major positive impacts in isolation, they do appear to work very well in conjunction with FFA. Similarly, however, given that children who lose FFA have worse outcomes in the endline than those who do not, we can also conclude that we see major positive impacts from FFA on MAM. Given that FFA is not, explicitly, designed to tackle MAM, this result is particularly important and implies that FFA should be further incorporated into MAM strategies.

To provide information on H_3 and H_4, we conduct a final analysis that looks at outcomes of Group 3 in relation to Group 2.

Table 11 shows findings that, broadly speaking, support those in Table 9. As well as Group 3 exhibiting significantly poorer nutrition indicators, *a priori*, than Group 1, children in this group also experience poorer nutrition than those in Group 2. This implies that Group 3 has been well targeted: the children who live in households that receive the greatest number of assistance combinations are those with the poorest nutrition. Again, bias here is negative, further implying this to be the case. Furthermore, we see that, in relation to receiving –FFA+ assistance, receiving FFA+ significantly decreases the likelihood that a child will experience MAM. In this case, an exogenous move from Group 2 to Group 3 reduces the likelihood that a child was experiencing MAM at the time of the survey by 15 per cent. This is a strong and positive impact and reinforces the strong performance of FFA+ treatment combinations.

Taken in isolation, this result confirms H_3, although this should be unsurprising, given the previous results discussed in this section. Not only, therefore, does FFA+ have a strong and positive impact on nutrition, but it also has a strong and positive impact over and above receiving other forms of assistance. More generally, however, this result also shows the impact that FFA can be expected to have in isolation. If we assume (naively, at least) that the '+' components received by Groups 2 and 3 neutralise each other, what this result really implies is that receiving FFA-only reduces the probability of experiencing MAM by 15 per cent. As before, given that FFA is not explicitly a counter-MAM strategy, this is an impressive and important finding and calls for a rethink of the role that FFA interventions play in WFP's counter-MAM programming.

The results shown in Table 13 strongly support those in Table 12. Here, an exogenous move from Group 2 to Group 3 leads to an average increase in MUAC of almost 7mm, all other things considered. Once again, this implies that FFA, in isolation, is having

strong impacts on recipients' nutritional status, not least because this would be sufficient to move a median child experiencing MAM out of this classification.

In Table 14, as with previous analyses using WAZ, we find that although the sign of the coefficients remains the same, these findings are not statistically significant. However, taken in combination with the results from the MAM and MUAC analyses, we can conclude strongly that the receipt of FFA+ not only has a strong and positive impact on MAM, but that these effects stem from both the FFA and the '+' components. In turn, this allows us to pass comment on H_4, which deals specifically with programme synergies.

Table 13: Impact of FFA+ in relation to –FFA+ on MUAC

group3vs2 – MUAC	0	0	0	0	0
	(1)	(2)	(3)	(4)	(5)
VARIABLES	OLS	FE	Heckman	IV	Heckman IV
Time	5.710***	6.105***	6.072***	2.453	2.612
	(1.187)	(1.435)	(1.210)	(2.332)	(2.329)
group3vs2	0.0779		0.00670	-9.723***	-9.651***
	(1.140)		(1.221)	(3.598)	(3.592)
time_group3vs2	1.090	1.187	1.088	6.824*	6.858*
	(1.430)	(1.287)	(1.470)	(3.994)	(3.993)
size_hh	0.266*	0.238	0.243*	0.480***	0.445***
	(0.136)	(0.270)	(0.147)	(0.163)	(0.165)
nb_0_5m	0.0709	0.992	0.0822	0.389	0.416
	(0.672)	(1.365)	(0.805)	(0.716)	(0.717)
women_hh_head	1.406	2.542	1.928*	2.190*	2.375**
	(1.139)	(2.807)	(1.074)	(1.197)	(1.205)
n_wifes	-1.103	-2.736*	-1.078	-0.913	-0.883
	(0.696)	(1.500)	(0.725)	(0.736)	(0.735)
livestock_pc1	-0.196	0.143	-0.240	-0.484*	-0.445
	(0.248)	(0.302)	(0.246)	(0.273)	(0.273)
assets_pc1	0.393	0.151	0.341	0.385	0.360
	(0.263)	(0.404)	(0.248)	(0.275)	(0.275)

Note: Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Excludable instruments: km_insecure km_insecure_time
hh = households

We note, for example, that receiving FFA+ means that a child is 19 per cent less likely to experience MAM than a child who, in the endline, receives no assistance. We also note that a child receiving FFA+ is 15.5 per cent less likely to experience MAM than a child in the –FFA+ group. Taken together, this implies two things. Firstly, that receiving FFA-only accounts for a large proportion of the drop in the likelihood of experiencing MAM. Over and above this, however, the '+' component accounts for an additional 4 percentage point drop in the likelihood of experiencing MAM.

Given that we see a negative coefficient in the –FFA+ analyses, this implies that the impact of FFA+ is significantly greater than the sum of the impacts of FFA and the '+' component in isolation. In turn, this implies strong synergies between differing modalities of assistance provision. Consequently, this strongly implies that benefits are maximised,

not only through the provision of FFA, but also through the provision of prevention and treatment programmes alongside FFA.

Table 14: Impact of FFA+ in relation to –FFA+ on WAZ

group3vs2 – WAZ	0	0	0	0	0
	(1)	(2)	(3)	(4)	(5)
VARIABLES	OLS	FE	Heckman	IV	Heckman IV
time	-0.265**	-0.160	-0.287**	-0.478**	-0.485**
	(0.116)	(0.136)	(0.123)	(0.220)	(0.219)
group3vs2	0.112		0.0849	-0.415	-0.409
	(0.111)		(0.118)	(0.338)	(0.337)
time_group3vs2	0.0393	0.240**	0.0553	0.396	0.391
	(0.139)	(0.122)	(0.144)	(0.375)	(0.375)
size_hh	0.0151	-0.0261	0.0176	0.0263*	0.0272*
	(0.0133)	(0.0256)	(0.0145)	(0.0155)	(0.0156)
nb_0_5m	-0.0557	-0.267**	-0.0373	-0.0236	-0.0227
	(0.0654)	(0.129)	(0.0590)	(0.0679)	(0.0678)
women_hh_head	0.291***	0.251	0.326***	0.356***	0.347***
	(0.111)	(0.266)	(0.101)	(0.114)	(0.114)
n_wifes	-0.0282	0.188	-0.0227	-0.0129	-0.0143
	(0.0678)	(0.142)	(0.0689)	(0.0698)	(0.0696)
livestock_pc1	0.00954	0.0200	0.00118	-0.00813	-0.00881
	(0.0243)	(0.0287)	(0.0248)	(0.0261)	(0.0261)
assets_pc1	0.0219	-0.0503	0.0224	0.0221	0.0236
	(0.0257)	(0.0383)	(0.0253)	(0.0261)	(0.0261)

Note: Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Excludable instruments: km_insecure km_insecure_time

hh = households

Taken jointly, FFA+ forms of programming, therefore, deliver larger impacts than can be isolated from FFA-only treatments, which in turn also deliver positive impacts on MAM and MAM indicators. The latter of these findings, in particular, seem uncontroversial. Land rehabilitation seems likely to boost a household's food production capacity in the long term, which in turn has associated impacts on the nutrition status of members of that household.

In this context, the larger impacts of FFA+ are also intuitive. Here, receiving treatment and/or prevention programmes can act as a 'one time' exogenous boost to recipients' MAM indicators. In the absence of FFA, it may be difficult for a household to sustain this boost in the longer term, especially if it falls out of receiving assistance for any reason. The provision of FFA, however, through its impact on food production capacity, ensures that households may be able to sustain these positive impacts in addition to its more general impact on food availability. The precise internal mechanisms of such outcomes, however, require further investigation and new data sources designed specifically to answer such questions.

7.6 Impact heterogeneities

In our proposal and pre-analysis plan, we noted our desire to study various levels of outcome heterogeneity:

- Gender of household head;
- School attendance of children;
- Remoteness of household;
- Displacement status of household;
- Source of household income; and
- Location of household by agronomic zone.

Due to the small size of our panel sample, conducting such analyses has proved statistically impossible. Given the low statistical power and high probability of statistical errors implicit in such low power, the likelihood that false inference could be drawn from such analyses outweighs any interest or benefit from doing so. As these findings would be highly unreliable, significant damage is likely to arise from any presentation of their results.

We conduct the analyses presented in Tables 7–14 with such heterogeneities in mind, however, and at least seek to control for variables related to these bands of heterogeneity. Although this cannot allow us to understand whether or not the assistance programmes themselves have differential impacts, it certainly helps to understand how these heterogeneities interact with and help determine MAM and malnutrition more generally.

Perhaps surprisingly, none of these control variables are routinely statistically significant determinants of nutrition status across the analyses presented in Tables 6–14. We see that the size of the household positively predicts better nutrition status; and that households that identified themselves as having a female head exhibit significantly better nutrition status than those that identified themselves as having a male head in our preferred specifications.

Neither of these results should be particularly surprising. A long line of literature notes that children in female-headed households see more investment in their upbringing and wellbeing; while a larger household, *ceteris paribus*, can be taken to include more adults who can feasibly contribute to the economic and associated nutritional welfare of the household. However, not being given clear trends across the multiple analyses we conduct, it is difficult to draw stronger conclusions than those presented.

We note that if WFP were to conduct another wave of panel data collection in 2018, tracking the same households and children, we could thus attempt to conduct more detailed analyses, including more subtle analyses of impact heterogeneity.

7.7 Practical concerns from the estimates

There are two major practical takeaways that can serve useful purpose from the results of our estimations.

The first is that, despite not being specifically designed to target MAM, **FFA is the strongest and most effective form of assistance, in terms of improving nutrition**

indicators. This in turn shows two things: firstly, that WFP programmes are having positive and significant impacts on MAM in Niger; and, secondly, that the largest proportion of these effects is being driven by agriculturally sensitive programmes that, among other strategies, include land rehabilitation. Over and above this, we find that prevention and treatment programmes alone do not deliver positive impacts on MAM (and, indeed, may actually make matters worse), yet the provision of these forms of assistance along with FFA improves outcomes in relation to receiving FFA-only.

For WFP, this implies two major practical and actionable recommendations. Firstly, that the availability of FFA should be extended significantly, given its strong and positive impact on MAM-related indicators. Secondly, that these positive effects can be further enhanced by the joint provision of FFA and prevention programming (specifically) and of prevention and treatment programmes generally. The joint provision of FFA with treatment and prevention programming has the largest impact on MAM-related indicators. Given the strong impacts that stem from receiving FFA, however, WFP should prioritise extending the reach of this form of assistance in Niger.

The second major takeaway is the evidence that **success in the targeting of WFP programming is decidedly mixed**. FFA+ programmes, generally, are well targeted and reach children with the worst nutrition indicators. –FFA+ assistance, on the other hand, tends to reach children with better nutrition indicators than those in the –FFA group. In some ways it is difficult to understand these mixed findings, as some forms of assistance are well targeted and others are not. WFP, therefore, should revisit the targeting processes used in delivering non-FFA forms of assistance and invest in ensuring these forms of assistance reach those most in need.

7.8 Qualitative and mixed-methods findings

The specific contribution of the qualitative research in this project is to ‘give meaning’ to statistical data (quantitative findings) and to highlight the determinants of household social choices or behaviours. The sampling of villages in this qualitative study is based on the representativeness of the agro-ecological zones (‘agricultural’, ‘agropastoral’, ‘pastoral and desert’); the distance of the villages from the regional capital (less than 250 km – which was imposed due to budgetary restrictions); and the household attrition rate in the villages during the last data collection operation (attrition rate between 15% and 50%). This work was based around focus group interviews with groups of beneficiaries, groups of non-beneficiaries and stakeholders (WFP partners).

The research conducted (Moussa 2018) indicates that the interventions led to men and women changing their behaviour in a positive way. The diets of children became enriched with vegetables and fruits through WFP interventions. However, negative practices are also common. For example, handouts for malnutrition treatment are sometimes sold in the markets and mothers occasionally give substances to their children to provoke diarrhoea to make them fall back into malnutrition. This is done to maintain eligibility for further support.

WFP's agriculturally sensitive intervention has enabled the most vulnerable households in some villages to meet their food needs and even make financial savings. The interventions allowed households to mitigate food crises and malnutrition, and to create

productive assets. However, several reasons make the impacts of these interventions on the ground difficult to perceive. For instance, the Rift Valley Fever epidemic in 2016 decimated livestock in some desert areas and led to the abandonment of good practices by some beneficiary households from the wave of WFP's interventions in 2013.

There is significant migration in various villages after the harvests, given the significant needs of families. Nearly 60 per cent of the population in some villages visited are ‘at risk’ of migration, especially young people, who migrate to Libya, Algeria or Nigeria. This migration has high risks. Recently, nine migrants died in an attempt to cross the Sahara desert. Sometimes, entire families go missing.

The qualitative study shows that WFP interventions on the ground are known. However, in areas that last received assistance in 2013, most beneficiaries seem to have forgotten the operation and have simultaneously abandoned the good practices learnt from the WFP interventions. This implies effects may be perceptible only in the shorter term.

Findings also show that attendance at health facilities is related to the distance of communities from health centres and mobility/means of transport. It is noted that women are not primarily responsible for making decisions in the family, the majority of whom must wait until their spouse or parents decide that a child should be taken to the health facility or not. This situation also limits women’s attendance at health facilities with malnourished children. The following testimonial illustrates the situation:

> Here, everything I do, I wait for my husband to come, as he is the head of the family. I always ask permission, if he says yes, I do. Everything we do, we ask permission from our husband. We cannot make a decision like this without his permission. It is he who is responsible for decision-making.
> — A married woman, aged 32.

7.9 Contrasts and comparisons between empirical and qualitative results

The qualitative research largely reinforces the quantitative findings obtained. Indeed, the qualitative work seems to deepen our understanding of the quantitative results by presenting critical insights into beneficiaries’ perceptions and by revealing hidden causes of certain findings observed in our quantitative analysis.

The qualitative research suggests that the behaviour of men and women is changed positively, thanks to the WFP interventions. Through the agriculturally sensitive interventions, men practise cultural advice at field-level and at vegetable garden sites, which enables the most vulnerable households in the villages to meet their food needs (reducing nutritional crises) and to have a more varied diet. Mothers appear to practise the lessons received at culinary demonstrations at the level of the health facilities and on the spot during cash transfer distributions. This learning process has allowed women to understand that many diseases and conditions such as malnutrition, that they once considered inevitable or supernatural, are not in fact so. They are beginning to realise that, for a long time, they have wrongly considered some cases of child mortality to be inevitable. Therefore, the combination of activities that include men and women from the household in WFP interventions can now enrich children's diets, all of which contribute to improving the nutritional situation of children and reducing malnutrition in villages.

In addition, some local knowledge, attitudes and practices in relation to child nutrition have helped to improve the impacts of WFP interventions in Niger. In some localities, malnutrition is considered to be the result of a deficiency of nutritious foods and people know how to feed infants and young children, in addition to PLW. In Alhazai (an agricultural village), for example, it is forbidden to give meat to children aged under two years. The reason is that people believe that as an adult he will become someone who has a fondness for meat (*Maikodey* in Haoussa, a local language).

In Boukou-Peulh (an agricultural village), children are never given water before they are two years old. This is to give them the chance to breastfeed longer and also to drink enough cow's milk. Children will only drink water from the wells when they can walk to the wells by themselves.

This practice is illustrated in the following two testimonials:

> At the breeders, children have priority for food. Not at the farmers. I do not make value judgments, the two choices have their logic: to favour the adult who is a productive force necessary for the family or to favour the children who represent the future potential, the destiny of the community. In any case, if you find malnourished children in breeders, it is because the situation is very serious.
> — A breeder in a pastoral and desert village.

> Milk to the Touareg pastoralists plays an essential role: it nourishes, quenches, heals... At the creation of the world, a single camel nourished the whole of humanity. She was killed by men. Milk is the major food, both in terms of nutritional quality and symbolic value.
> — A Touareg chief.

However, the qualitative research also reveals that, although some mothers have been educated about the use of nutritional products and their effectiveness, it is unfortunate to know that these products are at times sold for profit. It was also found that when some children are declared cured, their mothers, in order to plunge them into malnutrition, feed them on tamarind to trigger diarrhoea. These practices are unfortunately very common, despite awareness-raising, and this has reduced the positive impacts of the WFP interventions. In other words, the only WFP intervention associated with the treatment of malnutrition may seem ineffective or produce undesirable effects with regard to such practices.

7.10 Cost-effectiveness analysis

The cost-effectiveness was assessed following two steps: (1) impact estimation; and (2) programme cost estimation. After these estimations, the different items were included in an Excel file document to calculate the cost-effectiveness. The results of the impact estimation on MAM presented in section 7.5.4 were used for cost-effectiveness analysis. As collecting quality cost data is crucial for conducting cost-effectiveness analysis, we used an approach to generate cost estimations consisting of listing all different cost categories that are included in the PRRO programme.

The following reports and official documents illustrating the cost values were collected:

- The final decision adopted by the WFP Board approving the proposed PRRO;

- The budget revision for the approval of the regional director;
- The WFP standard project (PRRO) reports for 2014, 2015 and 2016; and
- The budgetary results established by the WFP finance section.

Within each category, to assess the costs, various details about the items were collected, such as unit cost, number of units, currency and year. Under the current WFP system, data are provided by broad category. This system does not allow you to disaggregate the costs per activity. Thus, an estimate of the costs per activity is proposed based on the beneficiaries and tonnage reached for commodity distribution. However, commodity distribution varies by activity. For each type of activity, a fixed food intake is defined by days and over time (months). For cash and voucher transfers, two activities are involved (FFA and TFA), for which, the rates (amounts), number of days and duration in months were collected.

Table 15: Cost estimation by intervention

	Total (US$)
Implementation cost	**198,365,892**
Treatment assistance	**37,339,389**
Nutrition: treatment of acute malnutrition	*37,339,389*
Prevention assistance	**52,589,329**
Nutrition: prevention of acute malnutrition	*2,492,434*
Targeted food assistance (TFA)	*50,096,895*
Agriculturally sensitive	**55,342,712**
Food/cash for asset (FFA)	*55,342,712*
School feeding	**34,889,450**
Other direct operational cost	**18,205,012**
Direct and indirect support cost	**36,514,024**
Direct support cost	**24,056,409**
Indirect support cost	**12,457,615**
Capacity development and augmentation	**1,286,119**

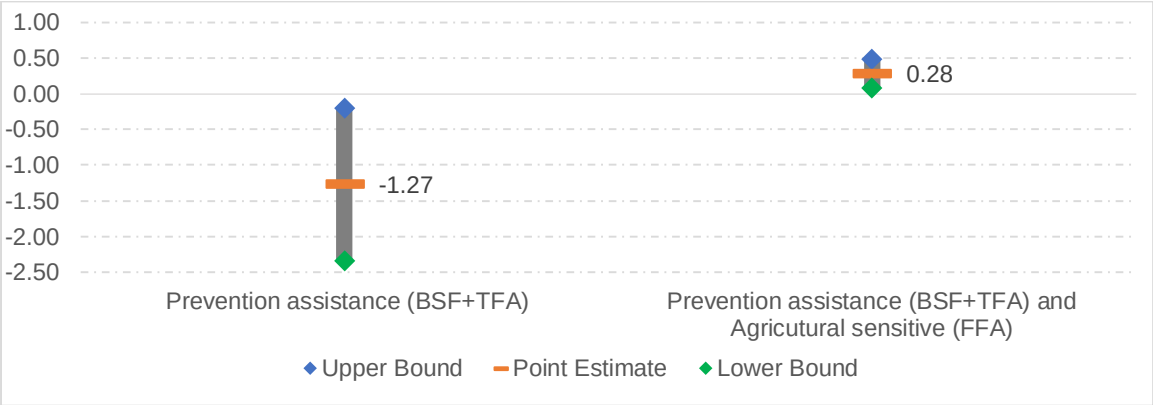
Source: Authors' construction from WFP reports and official documents

Based on the number of beneficiaries of commodity distribution for each type of intervention and commodity distribution rates, we calculate tonnage reached and determine the different shares for each activity. The total amount for cash and voucher transfers collected in 2014 and 2015 permitted us to estimate the number of beneficiaries and the shares according to the two interventions involved (FFA and TFA) for the two years. The total amount for cash and voucher transfers in 2016 was estimated using the number of beneficiaries (for cash and voucher transfers) in the case of FFA and TFA interventions.

Based on estimated costs and impacts, the cost-effectiveness analysis shows that combined prevention and agriculturally sensitive WFP assistance improves the nutritional status of children by between 0.08 SD and 0.48 SD per US$100 spent (Figure 5). In other words, it would be necessary to spend between US$207.3 and US$1,178.6 an additional SD for such assistance. Interventions combining BSF, TFA and FFA activities in the implementation of the PRRO leads to improved nutrition indicators in the

range of 0.28 SD per US$100 spent. The average cost of bringing a MAM child to non-MAM status is estimated at US$352.6, combining prevention and agriculturally sensitive assistance.

Figure 5: Additional SD per US$100 spent



Source: Authors' calculations

This analysis shows also that the combined approach in WFP intervention has been the most cost-effective compared to single interventions. This approach should be recommended for any new intervention deployment in existing programmes.

8. Discussion

8.1 Internal validity

There are two main challenges to the internal validity of this project, both of which relate to the problems that arose during the endline data collection at the beginning of the study period. The first relates to the impacts of attrition bias; the second to WFP's non-randomised rollout methodology.[13]

As discussed at length in this report, either of these concerns could lead to critical weaknesses in the quality of statistical outputs based on the data collection process. While we present methodologies that overcome these two sources of bias, we note that these strategies are not uncontroversial. This is particularly the case given that the instrument we use is only marginally strong for one of the groups we analyse. At present, we have dealt with these concerns as robustly as possible and believe the results presented here to be the best available causal analysis for this project.

8.2 External validity

The research team is confident that the results are relevant for the context of other countries in the Sahel. We urge two cautions, nevertheless.

First, WFP used a very specific set of priorities to target the neighbourhoods that received treatment. These priority neighbourhoods shared overlaps with those targeted

[13] We report dispassionately on the implications this has for the empirical components of this study and pass no judgement on the desirability (or lack of desirability) of such methodologies from a programmatic perspective.

as priorities by the government of Niger. The research team is familiar only with how WFP defines its priority regions, but has been unable to determine retrospectively precisely how the government determined the target areas. In turn, it is difficult to understand the extent to which targeting interacts with the government's priorities. We do not present this concern in terms of attribution, but rather about how realistic it is to expect that these rollout methodologies could be used elsewhere. Particularly as we note the success of targeting of FFA+ forms of assistance, this may stand to temper the positive effects we find in Niger if the same programmes were rolled out elsewhere. More generally, however, it is not guaranteed that these priority overlaps would exist in other regions or locations, which in turn implies that a certain level of caution should be urged when considering the external validity of these findings.

Secondly, in the absence of research that takes into consideration specifically the relationship between programme combinations and different nutrition outcomes, it is unclear whether or not one could expect the same combinations to have the same effects in other locations. There is a lack of understanding, for example, about how these particular assistance combinations interact with the situation on the ground in Niger and whether this influenced the findings we present in this report. In the absence of such research, we cannot be sure that these findings are not a product of the specific environment in Niger.

8.3 Relationship between expectations and outcome

Broadly speaking, the findings that arose during this research process matched the expectations of the field staff with whom we interacted, at least in a very general sense. Furthermore, quantitative and qualitative research efforts reinforced each other's findings. WFP's field staff remained confident that their work was having a positive impact on the people who received assistance in Niger and, broadly, our results confirm that this is the case, at least for certain forms of assistance. That said, the point that prevention assistance, in particular, has no positive impact (and may have a negative impact) defies prior expectations, which suggested that prevention programming offers the greatest possibility for countering MAM. This raises a number of questions, which are discussed in section 9.

9. Specific findings for policy and practice

9.1 Introduction

In this impact evaluation, we study the impact of WFP MAM programmes in the challenging environment of Niger. Our headline finding reports positive impacts from certain assistance combinations, and notes the presence of synergies when multiple forms of assistance are provided together. At the same time, these results, at least in a certain sense, appear to defy WFP's priors. Prevention programming, for example, most certainly does not lead to improvements in nutrition status and may, in fact, make things worse.

Counter to this, however, FFA (particularly when provided in conjunction with treatment and prevention programming) has a strong and significant positive effect on MAM, despite not being specifically designed to do so. That such findings have arisen shows

the importance of the impact evaluation that has been undertaken. These results provide the basis to believe that at least some of WFP's activities are having positive impacts in Niger, but that the assistance modalities used in subsequent waves of programming should change focus from treatment and prevention assistance to agriculturally sensitive programming.

We present these results as the strongest currently available. Despite significant sample attrition between baseline and endline, we see little impact on the statistical outputs, even when we perform Heckman-style correction for the determinants of remaining in the sample. This jointly implies that any biases arising from attrition are unlikely to have meaningful impacts on the outcomes we discuss and that they have been accounted for.

We see stronger bias from the rollout methodologies used by WFP, but generate a plausible instrumental variable to account for this bias from the spatial lag of the security situation. As this relates to insecurity events elsewhere in Niger, it is a valid instrument. We are therefore content to make strong recommendations based on these results. We discuss these recommendations in the following two sections.

9.2 Implications for policymakers

The results presented in this report indicate a strong and robust positive impact of FFA and FFA+ forms of assistance in combatting MAM in Niger. These results show that children in households that receive FFA+ treatment combinations are better off than those in both households that receive no assistance at the endline and those that receive only treatment and/or prevention programming.

Our key finding has two important implications. Firstly, the provision of FFA should be extended as far as possible in Niger, given its strong impact on combatting MAM. Secondly, the impact of this assistance grows when it is provided jointly with treatment and/or prevention programming. These synergies should be explored fully by WFP.

At the same time, however, we find a negative impact from the provision of treatment and/or prevention programmes in the absence of FFA. We offer two plausible explanations for this outcome. Firstly, households that do not receive food assistance use other coping mechanisms that are actually more successful than the provision of treatment and/or prevention programming. Secondly, intra-household decisions on nutrition may, in fact, change in response to receiving these forms of assistance.

Given the potential harm from these forms of assistance in their current guise, we urge WFP and other stakeholders to invest in research that aims to understand how and why this outcome arises.

Accordingly, in this context, we urge WFP to provide FFA alongside treatment and prevention programming to the maximum extent possible, particularly until the reasons for our results are fully understood and incorporated into ongoing programming.

9.3 Implications for programme implementation

A major concern arising during the research conducted for this report relates to evaluation capacity that has been developed. Specifically, while a large baseline was

collected at the beginning of the PRRO period, this was never designed to be followed up. In part, this explains the extent of attrition we found; it proved impossible to track households that had migrated, for example. Rather, the built-in follow-ups were based on continuous resamples, such that after three midline surveys fewer than 100 out of almost 6,000 initial households remained in the sample pool. An important lesson can be learned from this: a large initial investment in the collection of the baseline data did not lead to optimal M&E due to the poor design of the follow-ups. In future, programmes such as this should design all M&E activity around the collection of panel data, with the specific aim to follow up all households in the baseline.

Similar data problems exist at the field-level. At field facilities, incredibly rich child-level data exists in large hardcopy ledgers. Yet, two major problems confront any attempts to use these data. Firstly, the data have not been collated for research purposes. Secondly, it is impossible to track multiple entries for the same child. Efforts should be made to digitise this data collection and to track children between periods of receipt of assistance. The data in question are collected as a necessary condition of the programme taking place, but currently cannot be used in the research process.

Therefore, to help overcome these challenges and to build more detailed evidence on our findings, **we make the specific recommendation that a third wave of panel data be collected in 2018** that would attempt to resample the entire baseline.

This would accrue a number of benefits:

1. It would further involve the research team in the M&E process, building necessary capacity in the collection of panel data.
2. It would significantly enhance the sample size.
3. In turn, this would enhance the research capacity and analytical power to answer a number of the outstanding questions raised in this report.
4. It would facilitate the analysis of households and children who appeared in the baseline but not in the 2016 endline (which would then be the new midline).

On a similar note, collecting a second endline dataset in 2018 would facilitate the collection of information on what those children and households have been doing since the baseline, which would add rich nuance to the research questions that could be asked. Such work is particularly important in the context of the findings that we present here, as a number of questions arise about households' response to receiving assistance, which seems a likely driver of some of the outcomes we present.

Capacity to more directly analyse these responses and how they relate to outcomes would provide significant new knowledge on what can be done to mitigate negative behavioural responses and to further maximise the impacts of the programmes conducted. In that sense, this research project is the beginning of an important and valuable learning process for WFP and its stakeholders in Niger and beyond – but hopefully not the end.

Online appendixes

Note to the readers: These appendixes are available online and can be accessed using the links below

Online Appendix A: Additional questions for questionnaire

http://www.3ieimpact.org/media/filer_public/2018/05/08/tw61023-niger-malnutrition-appendix-a.pdf

Online Appendix B: Qualitative survey questionnaire

http://www.3ieimpact.org/media/filer_public/2018/05/08/tw61023-niger-malnutrition-appendix-b.pdf

Online Appendix C: Pre-analysis plan

http://www.3ieimpact.org/media/filer_public/2018/05/08/tw61023-niger-malnutrition-appendix-c.pdf

Online Appendix D: Summary statistics for all main variables in analysis

http://www.3ieimpact.org/media/filer_public/2018/05/08/tw61023-niger-malnutrition-appendix-d.pdf

Online Appendix E: Summary statistics for all main variables in analysis for Group 1

http://www.3ieimpact.org/media/filer_public/2018/05/08/tw61023-niger-malnutrition-appendix-e.pdf

Online Appendix F: Summary statistics for all main variables in analysis for Group 2

http://www.3ieimpact.org/media/filer_public/2018/05/08/tw61023-niger-malnutrition-appendix-f.pdf

Online Appendix G: Summary statistics for all main variables in analysis for Group 3

http://www.3ieimpact.org/media/filer_public/2018/05/08/tw61023-niger-malnutrition-appendix-g.pdf

Online Appendix H: Summary statistics for all main variables in analysis for male-headed households

http://www.3ieimpact.org/media/filer_public/2018/05/08/tw61023-niger-malnutrition-appendix-h.pdf

Online Appendix I: Summary statistics for all main variables in analysis for baseline survey

http://www.3ieimpact.org/media/filer_public/2018/05/08/tw61023-niger-malnutrition-appendix-i.pdf

Online Appendix J: Summary statistics for all main variables in analysis for endline survey

http://www.3ieimpact.org/media/filer_public/2018/05/08/tw61023-niger-malnutrition-appendix-j.pdf

Online Appendix K: Programme costs by category

http://www.3ieimpact.org/media/filer_public/2018/05/08/tw61023-niger-malnutrition-appendix-k.pdf

Online Appendix L: Programme cost

http://www.3ieimpact.org/media/filer_public/2018/05/08/tw61023-niger-malnutrition-appendix-l.pdf

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