The impact of food assistance on food insecure populations during conflict in Mali

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Grantee Final Report

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Note to readers

This final impact evaluation grantee report has been submitted in partial fulfilment of the requirements of grant TW6.1039 awarded under Thematic Window 6. 3ie is making it available to the public in this final report version as it was received. This study is a mixed-method attempt to examine the interaction between exposure to varying degrees of conflict, and access to multiple forms of humanitarian aid. This was always an ambitious project, and the end result is a study with some counterintuitive findings that call for additional analysis that was not foreseen in the pre-analysis plan. The team has indicated that they will continue to work on studying underlying mechanisms to explain some of their results. If an improved version is available at a later date, then that will either replace or be added to the current study.

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Abstract

Mali, a vast landlocked country at the heart of West Africa in the Sahel region, is one of the least developed and most food insecure countries in the world. Mali suffered from a series of political, constitutional and military crises since January 2012, including the loss of government control of northern territories from April 2012 until January 2013. A range of humanitarian aid interventions were scaled up in response to these complex crises. In this study, we build on data from a unique pre-crisis baseline to evaluate the impact of food assistance on food security-, nutrition- and education-related outcomes in rural populations. We design a longitudinal, quasi-experimental study based on two survey rounds, five years apart, in the Mopti region in Northern Mali. Data was collected from 66 communities randomly selected from within food-insecure districts. Study outcomes include household expenditures and food consumption (measured through 7-d recall), child nutritional status, and school enrolment, attendance and attainment. We estimate program impact by combining propensity score matching and difference-in-difference. In terms of food security and nutrition, food assistance was found to increase household non-food and food expenditures and micronutrient availability. Disaggregating by degree of conflict exposure showed that effects on expenditures and children's height were mostly concentrated in areas not in the immediate vicinity of the conflict: The effects on height were also concentrated on households in these areas who received at least two forms of food assistance. In villages where armed groups were present, food assistance improved household micronutrient availability from food consumption, including zinc and vitamin A. In terms of education outcomes, school feeding led to increases in enrolment by 11 percentage points, and to about an additional half a year of schooling. Attendance among boys residing in households receiving GFD, however, decreased by about 20% compared to the comparison group. Disaggregating by conflict intensity showed that receipt of any program led to increases in enrolment mostly in higher conflict intensity areas and that the negative effects of GFD on attendance were also concentrated in most affected areas. Conversely, school feeding mostly increased attainment of children residing in areas not in the immediate vicinity of the conflict. Programme receipt triggered adjustments in child labour: school feeding led to lower girls' participation and time spent in work, while GFD increased children's labour, particularly for boys. Evidence from this study suggests that there is scope to improve the design and scale-up of food assistance interventions during conflict. However, humanitarian operations during conflict face important trade-offs involving on the one hand programme scale and effectiveness, and on the other the practicalities of operating in areas under the control of armed groups, including security, governance and transparency.

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1. Introduction

An estimated 700 million people live in extreme poverty (World Bank, 2016). Undernutrition affects 800 million people globally, with most undernourished people living in low- and middle-income countries (FAO, IFAD and WFP, 2015). Despite recent progress, undernutrition causes over 3 million child deaths per year and stunting prevalence in children under 5 affects at least 165 million children (Black et al., 2013). Conflict and political instability are important drivers of undernutrition. Out of the six emergency situations currently listed on the World Food Programme website, five (Iraq, Lake Chad Basin, South Sudan, Syria and Yemen) are directly the result of conflict. Depriving populations from access to food is often an explicit war tactic. Armed conflicts are also responsible for weakening food production and health systems, and undermining the functioning of markets and institutions (Justino, 2012). Armed conflicts have been found to profoundly impact mortality, morbidity and malnutrition, among other health outcomes (Altare and Guha Sapir, 2013). Children exposed to violent conflict at an early age or in utero are found to be more likely to suffer from Moderate or Severe Acute Malnutrition (MAM/SAM), even controlling for household backgrounds and non-randomness of conflict location (Alderman, Hoddinott and Kinsey, 2006; Camacho, 2008; Akresh et al., 2012; Domingues and Barre, 2013; Minoiu and Shemyakina, 2014). The identification of the mechanisms linking conflict exposure to mortality, morbidity and malnutrition, however, remains elusive. Only an estimated 20% of excess mortality stems from direct deaths due to warfare violence (Altare and Guha Sapir, 2013) and while the literature has identified several potential mechanisms underlying the impact of conflict, more systematic evidence is needed, especially in contexts of low to moderate violent conflicts. Conflicts of low to moderate intensity, which do not kill a substantial number of civilians, can still be responsible for catastrophic increase in undernutrition. Tranchant, Justino and Mueller (2014) show that populations living in the shadow of the Naxal insurgency in India do not directly suffer in the long run from the conflict. However, they are unable to cope with income shocks (such as droughts and illness) because of the restriction in mobility due to the conflict, and because of the absence of the state and NGOs. Droughts and illnesses in this environment thus result in catastrophic increase in odds of stunting for young children.

Delivering timely and adequate food assistance to conflict-affected populations is therefore critical to avoid increase in acute malnutrition. Yet, it is challenging for aid actors to reach these populations due to a variety of logistical challenges and because it often means siding with one side. Little is known about the effectiveness of food assistance in conflict areas. While there exists some evidence of the effectiveness of the type of safety net interventions WFP implemented in Mali in 2012-2013, this evidence usually comes from non-emergency, non-conflict contexts. Safety nets, involving either cash or in-kind transfers, are estimated to reach 1.3 billion people globally (Honorati, Gentilini and Yemtsov, 2015). Safety nets program designs are heterogeneous, with important differences in targeting, transfer modality, size and distribution frequency. There is growing evidence that safety net transfers increase food consumption, improving the quantity and quality of food consumed by poor households (Hidrobo et al., 2015; Ruel et al., 2013). Reviews also highlight that though safety nets have potential to improve nutrition, this potential has been to date largely untapped (Ruel et al., 2013). Questions remain on how to improve the cost-effectiveness of safety nets, particularly in resource poor settings. Moreover, there is a dearth of evidence from rigorous studies on the effectiveness of any type of humanitarian aid during conflict. Willibald (2006) and Haider (2011) discuss cash transfers in a conflict setting and Bozzoli, Bruck and Wald (2013) provide a framework for evaluations in conflict settings, but rigorous evaluations tend to focus on peace promotion and conflict resolution initiatives; on interventions to mitigate the psychological costs of

exposed populations and former (child) soldiers; or on development programs in post-conflict settings (Fearon, Humphreys and Weinstein, 2009; Casey, Glennerster and Miguel, 2012). This study contributes to filling this gap by generating evidence of the effectiveness of WFP's food assistance interventions in Mali during the recent conflict.

In this mixed-methods study, we build on data from a unique pre-crisis household survey to evaluate the impact of food assistance during conflict on the nutrition status and food security of rural populations in Mali. This baseline survey, collected in January 2012, provided extensive demographic, economic, consumption, and anthropometric information (among others) on 1,500 households in 66 villages of Mopti region as well as information from teachers and village chiefs. We returned to these same communities and collected a second wave of the household survey in January 2017. In addition to the initial set of questions, the endline survey also included detailed modules on availability of and access to humanitarian aid as well as conflict and exposure and presence of armed groups over the last 5 years. This unique panel dataset allows us to ascertain whether food assistance provision enabled households to better cope with the effects of the political crisis and insecurity, and whether proximity to the conflict influenced the effectiveness of aid. More specifically, we estimate with matched difference-in-difference whether access to different forms of food assistance improved household (food) expenditures, food and consumption and nutrient availability, and nutrition status of children (as captured by anthropometry indices). The existence of a baseline data allows us to match "treatment" households with comparable "control" households, strengthening the internal validity of the study.

The report is structured as follows: in section 2, we provide an overview of the programme theory for the interventions. In section 3 we describe the context in Mali, paying a special attention to how aid and conflict were distributed among the study population. In section 4 we describe the timeline of the study, whilst section 5 includes the methods and data employed in the study. Study findings are presented in section 6; and finally, section 7 discusses the main findings and implications for program design.

2. Programme theory for the interventions

2.1 Nutrition and food security

To understand the program theory for the food assistance interventions we build on the 2013 Lancet Series framework on Maternal and Child Nutrition (Black et al., 2013). This framework describes how optimal nutrition depends on health, dietary, and behavioural determinants, and is influenced by the underlying food security, care-giving resources and environmental conditions (Figure 1).

There is growing, rigorous evidence that safety net transfers increase food consumption, improving the quantity and quality of food consumed by poor households (Hidrobo et al, 2018). Recent reviews also highlight that though safety nets have the potential to improve nutrition, this potential is relatively untapped (Ruel & Alderman, 2013; Hidrobo et al, 2018). Important questions remain on how to improve the effectiveness of program, particularly in resource poor settings. The Lancet Series framework can also be used to identify pathways through which conflict events could affect populations both directly and indirectly. For example, effects on nutrition status could arise by changes in food access and availability (e.g. breakdown of food markets, loss of harvest or stocks due to conflict); or care-giving practices (e.g. death of caregivers, or decrease in women's mental health due to increased insecurity); or health status (e.g. no access to health facilities and medicines, or contamination or loss of water sources due to conflict). In addition, differential effects would be expected on displaced versus host families, in terms of exposure

to new infectious diseases (e.g. malaria in the south of Mali), or on changes in food intake (e.g. different food customs) and care (e.g. no space in health centres and schools). In addition, closure of health centres and schools would not only affect health and education outcomes directly, but as these facilities are often used as distribution points for humanitarian aid these events could also have other negative spill overs on the community.

Conflict may also have long-lasting consequences that affect long-term outcomes. For example, children can be affected at critical growth stages and become stunted or their cognitive ability can be severely impaired. Similarly, farmer households may suffer economic shocks from which they cannot recover and become destitute so that an impact on poverty can be visible even years after conflict has ended. In addition, emerging evidence suggests that conflict can severely undermine the most elaborate coping strategies used by households to face risk and prompt reliance on informal networks for aid to become critical. Conflict may also weaken the effectiveness of these networks (i.e., if people or cash are not able to move because of violence). In addition, while being an ally of or friend to people with access to key resources can be advantageous in times of peace, it can be dangerous during conflict when the same powerful people are targeted for violence. In these contexts, whether humanitarian aid is a complement to or a substitute for basic informal solidarity remains an important question for research.

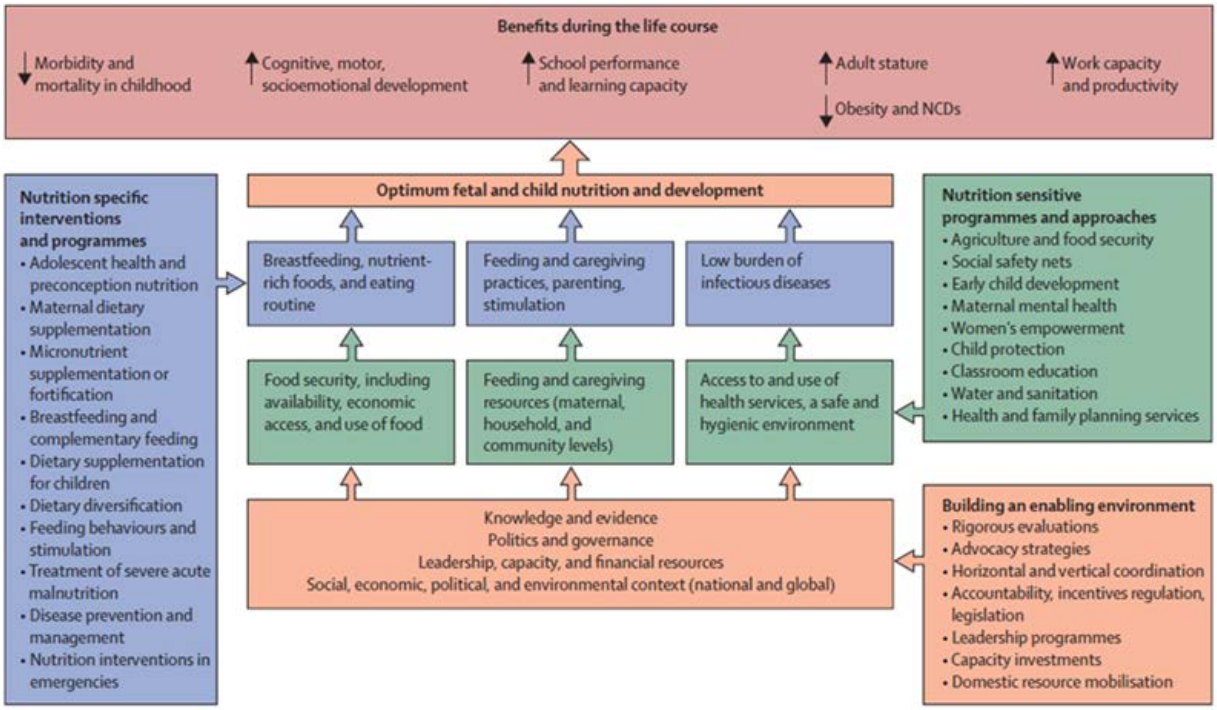


Figure 1: Framework for actions to achieve optimal child nutrition and development (Source: Black et al, 2013).

2.1.1 Study outcomes, nutrition and food security.

We considered two levels of outcomes in the survey population based on the analysis of the program theory for the food assistance interventions (table 1). The first set included alternative measures of household food security estimated from the consumption and expenditure survey modules using adult equivalents. The second focuses on anthropometric measures of nutrition status of young children, including weight-for-height z-score and prevalence of wasting among children 2 to 5 years; height-for-

age z-score and prevalence of stunting among children 2 to 5 years; weight-for-age z-score and prevalence of underweight among children 2 to 5 years; and BMI for age z-score among children 6 to 15 years.

Table 1: Main nutrition and food security outcome variables included in this analysis. (Source: Authors.)

Outcome	Measurement
Total expenditure per Adult Equivalent (AE)	Aggregate from reported consumption of food (7-day recall) and non-food (30-day recall) expenditures
Food expenditure per AE	Aggregate from reported consumption of food (7-day recall)
Daily caloric acquisition in last 7 days (AE)	Reported consumption of foods during the 7 days prior to the survey, converted into calories per day adjusted by adult equivalent
Daily protein acquisition in last 7 days (AE)	Reported consumption of foods during the 7 days prior to the survey, converted into protein available per day adjusted by adult equivalent
Daily iron acquisition in last 7 days (AE)	Reported consumption of foods during the 7 days prior to the survey, converted into iron available per day adjusted by adult equivalent
Daily zinc acquisition in last 7 days (AE)	Reported consumption of foods during the 7 days prior to the survey, converted into zinc available per day adjusted by adult equivalent
Daily vit. A acquisition in last 7 days (AE)	Reported consumption of foods during the 7 days prior to the survey, converted into vit. A available per day adjusted by adult equivalent
WHZ (6-59m)	Weight for height z-score calculated using height and weight measurement by WHO standard
Prevalence of wasting	Dummy variable equal to 1 if WHZ score=<-2 for children aged 6-59m
HAZ (6-59m)	Height for age z-score calculated using height and age in months and WHO standard
Prevalence of stunting	Dummy variable equal to 1 if HAZ score=<-2 for children aged 6-59m
WAZ (6-59m)	Weight for age z-score calculated using weight and age in months and WHO standard
Prevalence of underweight	Dummy variable equal to 1 if WAZ score=<-2 for children aged 6-59m
BAZ (6-15y)	BMI for age z-score calculated using height, weight and age and WHO reference
Height	Height measurement in children aged 2-5 years (only in panel design)
Weight	Weight measurement in children aged 2-5 years (only in panel design)

2.2 Programme theory for the interventions: Education

For rural and food insecure households, investments in child schooling are part of decisions related to time allocation of different household members, poverty and other constraints, perceived returns to education, and social norms. In this context, school feeding can directly benefit children's schooling through two main pathways (Adelman, Alderman, Gilligan, & Lehrer, 2008; Lesley Drake et al., 2017). The first involves increased enrolment and attendance through an income transfer (equivalent to the size of the meal or ration) to households. The transfer is conditional on school attendance, and aims at decreasing the overall opportunity cost of schooling. By subsidising this cost, school feeding can decrease the overall time children spend in productive activities (within or outside the household), and/or promote shifts in time use to activities that can be more compatible with school attendance. The net effect of school feeding on attendance will depend on the ratio between the value of the transfer and the expected differences between the cost and benefits of attending school on a given day (Adelman et al., 2008; Kazianga, de Walque, & Alderman, 2012). The second pathway relates to improved nutritional status and decreased morbidity, which may lead to increased attendance and learning ability (e.g., through enhanced cognition). More generally, the overall effects of school feeding on child schooling in conflict may depend on conflict intensity and its repercussions on availability of educational inputs (e.g. schools can be often closed due to destruction of infrastructure and/or fleeing of teachers) and on programme implementation. Also, as in non-humanitarian contexts, its effectiveness will also depend on demand-side

factors such as household poverty and food insecurity, level of community engagement, etc. Fear and insecurity constitute additional barriers to children's education in conflict, which may exacerbate pre-existing gender inequalities in education when perception of insecurity are aligned with social norms related to views of girls being more likely to be targets of violence (Justino, 2016).

While the positive effects of school feeding on enrolment and attendance are supported by a well-established evidence base in non-humanitarian settings (see Drake et al.,[2017] for a review), the evidence on the effectiveness of school feeding in emergencies is very limited. A field experiment assessed the impact of the World Food Programme (WFP)'s school feeding and take-home rations on school participation in Internally Displaced People camps in Northern Uganda (Alderman, Gilligan, & Lehrer, 2012). The study showed that school feeding had a positive impact on school enrolment and on morning and afternoon attendance. At a more descriptive level, school feeding programmes seem to promote enrolment and attendance during wars and other emergencies (UNICEF, 2012; WFP, 2007).

GFD generally involves the provision of a food ration including cereals, oil and other basic foods to vulnerable households. As a social protection tool, GFD aims at preventing households from adopting detrimental coping strategies in face of food insecurity and other shocks. In the case of education, potential coping mechanisms may entail school drop-out or larger absenteeism due to increased child labour. However, the literature on GFD and education is strikingly limited . On the one hand, the receipt of food aid may positively influence household educational decisions by freeing up labour and financial resources that would otherwise be employed in food production and consumption. For instance, in Ethiopia GFD promoted schooling for younger boys after a drought (Broussard, Poppe, & Tekleselassie, 2016). However, families receiving food aid may use savings from food purchases to invest in productive activities in which children participate, thus reducing school attendance. Similarly, variation in food production or local prices following GFD may lead to increased participation of children in agriculture or other work directly or indirectly related to GFD (e.g. queuing at collection points, reselling food rations, or substituting for farm/care work while other household members are involved in GFD receipt). As noted earlier, most literature focuses on non-conflict settings. During conflict, the opportunity cost of schooling may increase even more, as child labour is a common coping strategy in face of conflict-related shocks, such as loss of productive assets or household labour following armed violence, looting, or recruitment of household members in the army, that compound already poorly-functioning rural labour markets (Akresh & De Walque, 2008; Buvinić et al., 2014; Shemyakina, 2011).

Also, compared with school feeding programmes, the links between GFD and household decisions regarding child schooling are less direct. The school attendance pathway embedded in the design of school feeding may not factor in GFD design decisions, as these programmes do not generally include any explicit attendance conditionality. The health pathway may also be more tenuous than in school feeding, depending on the way households allocate food within the different members.

The overall effects of both forms of food assistance on child schooling in conflict may vary between boys and girls. A large body of literature has documented that wars and violence have differential effects on children's schooling by gender, based on a number of contextual factors (e.g. degree of child participation in education and labour, perceived returns to schooling, prevalence of child enlistment in the army, and social norms) (Buvinić et al., 2014). For instance, depending on gendered time use and child labour patterns, and related gender differentials in the opportunity cost of schooling, food-based social protection may lead to differential impacts on schooling of boys and girls.

The educational effects of school feeding and GFD may also vary with conflict intensity. The literature on the educational impacts of conflict highlighted that children experiencing greater conflict intensity tend to have lower educational outcomes (Akbulut-Yuksel, 2014; Bruck, Maio, & Miaari, 2014; Wald & Bozzoli, 2011). Conflict intensity may mediate the overall educational effects of emergency food-based social protection in forms that, again, are not known a priori. The overall effect will depend on the way emergency responses are targeted (e.g. towards areas that are more or less affected by the conflict events, or whether some form of conditionality is present like distributing take-home rations only to some specific target groups) and actually implemented on the ground (for instance, in occupied villages where schools are closed, school feeding may not be possible). Moreover, additional demand-side factors may affect actual households receipt of food assistance by conflict intensity levels (Wald & Bozzoli, 2011). For instance, if households anticipate that schools will be target of violence because, for instance, they receive food, they may keep children and school participation may increase less in higher conflict areas. On the other hand, if households in higher-conflict areas suffer from larger economic hardships than households in lower-conflict areas, the transfers may lead to increased schooling and, possibly, to additional time spent in school, leading to extra attainment. Again, these factors may vary by child gender: for instance, in the case of school feeding, even if communities are exposed to the same level of conflict intensity, there may be reasons that vary systematically between boys and girls that can hamper programme participation (e.g. fear of sexual violence or abduction in the army may be more relevant to girls and boys respectively).

Using data from Northern Mali before the political crisis, Dillon (2012) documented that households adjusted child labour in response to production shocks, leading to increases in the probability of withdrawal from school by 11% and participation in farm work by 24%. Both school feeding and GFD may protect children from the adverse effects of the productive shocks following the conflict in terms of their schooling and labour participation.

2.1.1 Study outcomes, education.

We included the following outcomes for children of compulsory school-age (7-16 years) in both rounds: school enrolment; attendance (as measured by number of days in which the child has been absent from school in the previous five-day school week, conditional on enrolment); and grade attainment (as measured by the number of years of formal education the child has completed). All these indicators were collected with questions directed to all children in the household during both survey rounds.

3. Country context

Mali is a west-African country of 14 million people classified as a low-income food deficit country by the FAO. In 2016, Mali ranked 175th out of 188 countries by the UNDP human development index, with an average life expectancy at birth of 58 years, an average of 2 years of schooling per person and an annual per capita gross national product of $853. The WFP estimates that 24% of the population is chronically food insecure (WFP, 2016). DHS data collected in 2012-13 report that 38% of children are chronically malnourished (stunted), 13% are acutely malnourished (wasted) and 26% are underweight. Agricultural productivity in Mali is among the lowest in the world (USDA, 2009). In Mali, most farmers are involved in the production of food crops, with the main cereals being millet and sorghum. Production is carried out using a low level of technology: fertiliser use is minimal and access to credit is limited. Crop yields are not only low but also highly variable since most farmers depend on rainfed farming while rainfall fluctuates considerably from year to year and season to season (USDA, 2009).

3.1 Conflict in Mali

Since the independence of Mali, there have been three waves of Tuareg rebellions in the north of the country, in 1962, 1990 and 2006. Persistent feelings of marginalization among the Tuaregs, combined with widespread droughts in the 1970s and the 1980s, and the general failure of the regimes of Modibo Keita (until 1968) and Moussa Traore (between 1968 and 1991) to address core grievances of Tuaregs explained the renewal of the rebellion in 1990 (Lecoq, 2010). This rebellion occurred in a context of growing general dissent against the authoritarian rule of Moussa Traore. The rebellion and the demonstrations contributed to a military coup in 1991, led by the Ltd Colonel Amadou Toumani Toure. Toure then oversaw the creation of a transitional committee that eventually handed power back to democratically elected civilians. On 10 April 1992, a Pacte National was signed between the transitional authorities and the Tuareg insurgents. The belligerents agreed on a cease fire, a reduced military presence in the north, and meaningful local autonomy through decentralization. Despite a strong commitment towards decentralization and democratization from President Konare in the 1990s (Schraeder, 2011), feelings of frustration with the lack of progress in the implementation of the National Pact and continuous marginalization of the north grew. In May 2006, the Tuareg rebellion resumed. The then president Amadou Toumani Toure negotiated with the rebels and the Algiers accords were signed that same year. Core grievances of the Tuaregs were still not addressed though, and in 2010 the MNLA (Mouvement National pour la Liberation de l'Azawad) was founded, partly from elements who took part in the 2006 rebellion. Since the mid to late 1990s, militant Islamist and non-Tuareg armed groups such as the GSPC (which later became AQIM) and transnational criminal groups took a hold in the region, thanks to the dysfunctional situation above mentioned. These groups exploited state weakness to use commercial routes and enmesh themselves in the population (Boas and Torheim, 2013). After the Libya crisis, these groups obtained weaponry, former foreign Libyan Legion soldiers returned to northern Mali, and important remittances networks collapsed, which all contributed to destabilize the region.

In January 2012, the MNLA attacked a military garrison as part of their call for an independent, secular and plural Azawad. The MNLA joined AQIM, Ansar Dine and the MUJAO (a splinter group from AQIM), and between January and April 2012 they took control of main towns in the three northern administrative regions. The Islamist groups quickly chased the MNLA away from these towns (Boas and Torheim, 2013). Following the Malian army defeat at Aguelhok, unease grew in the south as the government seemed unable to cope with the crisis. This eventually led to the mutiny and then the putsch in March 2012 of junior soldiers under the leadership of Captain Sanogo. Unwittingly, the putsch further weakened the state and the advances of Islamist groups were eventually stopped after the "Serval" military operation. Since then, the groups have retreated from the main towns but are still active, and the international operation is still on the ground (under the new moniker of "Barkhane").

3.2 Humanitarian aid in Mali

Amidst these crises, the complex emergency combining drought throughout the country and the conflict in the north, was the focus of two projects by the U.N. World Food Programme (WFP) in Mali, including: i) emergency operation (EMOP) 200389 "Assistance to drought-affected populations in Mali"; and ii) regional EMOP 200438 "Assistance to Refugees and Internally Displaced Persons Affected by Insecurity in Mali". These two projects reached approximately 100,000 internally displaced and 200,000 vulnerable people in the targeted regions of the country. The EMOP was implemented alongside a country programme (CP) and a protracted relief and recovery operation (PRRO) that humanitarian aid to different areas of the country. The WFP activities including the EMOP were aligned with WFP's Strategic Objective

1, which is "to save lives and protect livelihoods in emergencies", and sought to contribute towards the Millennium Development Goals 1, 2, 4 and 5, respectively on eradicating extreme poverty and hunger, supporting universal education, reducing child mortality and improving maternal health. The EMOP started in late January 2013 and ended in 2014. A subsequent project was implemented to continue to provide assistance during 2015. The project activities were carefully planned to ensure complementarity with the WFP country programme, which targets similar interventions to chronically food-insecure populations in the south of Mali, through food/cash for assets, nutrition and school feeding. The EMOP supported approximately 564,000 vulnerable and food-insecure people across the most affected areas of the country.

Within the broader aid portfolio included in the humanitarian response, the food assistance activities provided by WFP that are the focus of this analysis are summarized in Table 2. These included supplementary feeding to prevent and treat acute malnutrition, general food distribution and school feeding.

Table 2: Interventions included in WFP's food assistance activities in northern Mali from January 2013 onwards. (Source: Authors.)

Intervention	Targets	Objectives	Activities
Blanket supplementary feeding	Children 6-59 months and pregnant and lactating women	Blanket supplementary feeding to help prevent an increase in AM	Provide children half a sachet of Plumpy' Sup per day Providing Super Cereal and vegetable oil to pregnant and lactating women Nutrition and hygiene messages for mothers
Targeted supplementary feeding	Children 6-59 months with MAM and malnourished pregnant and lactating women	Treat moderate acute malnutrition among children 6-59 months and malnourished PLW	Targeted supplementary feeding, providing 92 g of Plumpy'Sup per day Rely on partners and community health workers' screening and referral capacities, as well as the functioning health centres
Targeted food assistance (GFD)	Food-insecure populations, IDPs. Women headed HHs, HHs who have lost income /assets, and HHs with elderly or disabled people	Assist all accessible moderately and severely food-insecure households and non-displaced people, displaced people, and host communities	Provide 2,100 kcal per person per day, consisting of cereals, pulses, vegetable oil and salt, with Super Cereal to increase micronutrient intake
School feeding	Primary school children in areas with high food insecurity	Prevent hunger and provide incentives to arrive on time and attend school until lunchtime; school attendance will also reduce the exposure of children to other risks.	Two daily meals will be provided: a morning porridge of Super Cereal and a midday meal consisting of cereal, pulses, vegetable oil and salt.

3.3 Research objectives

This study is aimed at evaluating the impact of food assistance on household food security and child nutrition status in rural populations affected by conflict in the Mopti region of Mali. This study included two sets of priority research questions. The first set was descriptive, where we employed mixed-methods to characterize exposure to conflict and food assistance in the survey population:

- What are the characteristics of the conflict experienced in the study areas?
- Which population groups were most affected and what coping strategies were adopted?
- What humanitarian interventions were scaled-up, where were they scaled-up, and how were they targeted?

The second set of research questions focused on the evaluation of the impact of conflict and the mitigating effects of food assistance, including:

- What is the impact of conflict on household food security, child malnutrition and other developmental outcomes?
- What are the effects of food assistance on conflict-affected populations?
- What coping strategies were most effective in mitigating the effects of conflict?
- How did humanitarian aid influence the effectiveness of coping strategies at household and community level?

4. Timeline

The study timeline is summarised schematically in Figure 2.

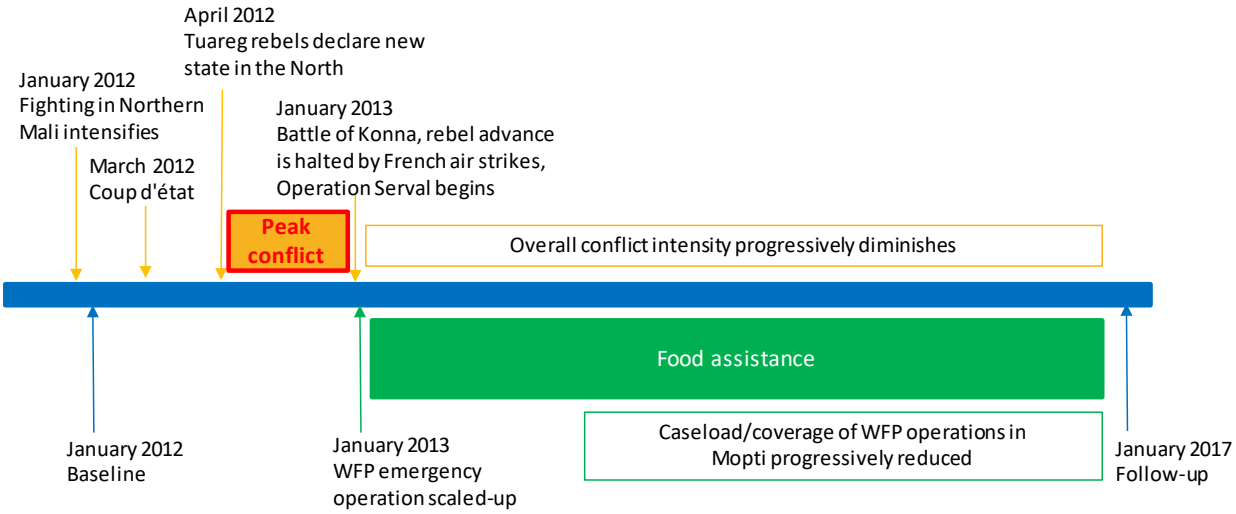


Figure 2: Stylised timeline of the study. (Source: Authors.)

5. Evaluation: Design, methods and implementation

5.1 Study design

The complexity of the environment in Mali is such that the formulation and testing of hypotheses required a deep understanding of the community level context. The details of how conflict affected the area and the nature of food assistance by the government and other donors in the area were largely unknown at the project's inception. We therefore employed a mixed-method approach consisting of two steps: 1) an exploratory component aimed at generating descriptive information on the conflict and the interventions and formulating hypotheses; and 2) an explanatory component, which tested specific hypotheses related to the impact of conflict on dimensions of well-being, particularly nutrition and health.

The first step included qualitative research activities, including:

- Interviews in Bamako with key stakeholders in the provision of humanitarian assistance including the Government of Mali, WFP and international NGOs, followed by interviews at district level with relevant health and education authorities.
- Interviews with mayors, health workers and other community stakeholders for the construction of retrospective conflict timelines at the local level.
- Focus groups with families, mothers and health workers from selected communities in order to understand direct and indirect impact of conflict and coping mechanisms.

The qualitative research informed the detailed survey design and descriptive data analysis, including:

- Analysis and mapping of the intensity of conflict in the study area.
- Identification of the most vulnerable sectors of the population.
- Mapping of extent and characteristics of humanitarian assistance in the area.

- Analysis of the targeting mechanism adopted by the government and NGOs in the provision of humanitarian assistance.

5.2 The data

5.2.1 Secondary data analysis

The descriptive analysis and initial characterization of the conflict drew on data from the ACLED database, including data on the dates and locations of political violence, the types of event, the groups involved, fatalities and changes in territorial control. Information is recorded on battles, killings, riots, and recruitment activities of rebels, governments, militias, armed groups, protesters and civilians (ACLED, 2014). Events are recorded by date, location, actors involved and by type. The type of events classification includes nine categories (see Annex 3 for ACLED event type classification). The ACLED data was downloaded and aggregated by month, including conflict events over a 20-year period from 1997 to 2016. The descriptive analysis compared frequency and intensity (captured through fatalities), firstly across the country, then by region and then within the Mopti region. We first examined trends over the whole 20-year period and then focussed on the five-years coinciding with the main study timeline 2012 to 2016. Data was aggregated using average monthly number of events and fatalities by type of conflict event. Secondary data from WFP humanitarian assistance was also examined to provide evidence on the coverage of aid operations in the study population in Mopti. Data was available from WFP Mali on numbers of beneficiaries (for 2014 and 2015) by operation type (2015) by cercle (the 2nd level administrative region in the country). The number of beneficiaries by WFP was divided by population figures to estimate coverage of food assistance in the study population.

5.2.2 Qualitative research

The qualitative research was undertaken in Bamako and Mopti regions at both the district and community levels. Bamako houses key central-level stakeholders. Mopti contained areas that were both occupied and not occupied by non-governmental forces during the civil conflict. Three tiers of interviews were conducted including:

- In Bamako with key stakeholders who provided humanitarian assistance, including the Government of Mali, WFP, and international nongovernmental organizations (NGOs);
- At the district level in the Mopti region, with mayors, health workers (formal and informal, i.e. traditional health included), and other community stakeholders; and
- In selected communities in same-sex focus groups with adult men and women and individually with the same individuals.

Eight different tools were developed for the qualitative research. Two of the research tools were open-ended and required input from the community, including a timeline of events that defines both the conflict and response of humanitarian aid, and a free list of responses to specific questions posed about individual exposure and reaction to the conflict and presence or absence of humanitarian aid. Two additional tools were pretested for inclusion in the household survey modules to assess the implicit impact of the civil conflict and the effects of humanitarian aid via data on individual emotional and physical states. The tools included the Hopkins Symptoms Checklist (HSCL) and the Short-Form McGill Pain Questionnaire (SF-MPQ). The HSCL measures symptoms of both anxiety and depression. The SF-MPQ measures physical symptoms of pain in the body.

Mayors of communities that were occupied and unoccupied during the civil conflict were assembled to create a timeline of events that defined the conflict and subsequent humanitarian aid and to identify villages located on both sides of the border whose members had diverse experiences during the conflict. The free list questions were posed to them individually; their responses collected by the data collectors. Community members from the villages that were identified by the mayors were assembled in same-sex groups to create a conflict timeline. Subsequently they were interviewed individually to elicit responses to the free list question and complete the two short questionnaires. Questioning ended once no new responses to the free list question were generated.

5.2.3 Household and village survey

The primary data for this longitudinal study involves two rounds of surveys in the Mopti region of Mali. The baseline survey was undertaken as part of cluster-randomized trial of home-grown school feeding that had to be abandoned due to the conflict onset (Masset & Gelli, 2011). Data was collected from communities (villages) randomly selected among food-insecure districts in the region. Twenty-five households with children in the original target 5-15 year age group were randomly selected for interviews within each community. The sampling of households was conducted through interviews with village chiefs and other community level stakeholders, building a list of enlarged households in the villages within the school catchment area. The listing also included an approximation of the size of the enlarged households. In addition, a number of farmer households was oversampled in each village. The community groups were asked to list which farmers they would contact if they were to purchase food within the village for the provision of school meals. This latter information was used to single out the surplus farmers in the area. Enlarged households were randomly selected (with inclusion probability proportional to size) from the list provided by the village chiefs, and listings of the restricted households within each selected enlarged households were then developed through interviews with household heads. A restricted household with children aged 5 to 15 was then randomly selected within each selected enlarged non-farmer household. A similar selection procedure was used for farmer households when these exceeded the numbers of 10 and 5 in the project and control villages, respectively. In farmer households though, no age criteria were used and the household was identified around the main agricultural holding unit of the enlarged household. At baseline, questionnaires collected data at household level and for each relevant household member separately. All children aged 2-15 within each restricted household in the survey sample were selected for anthropometry measures. In addition, all children aged 5-15 also underwent tests of literacy, numeracy and cognition.

A follow-up survey was undertaken in January 2017 including all the 70 villages in the Mopti region in the baseline sample. New survey modules were added to explore conflict exposure, receipt of humanitarian aid, as well as a range of other potential health outcomes not covered at baseline. Data was collected by trained enumerators using paper questionnaires at baseline and electronic tablets with computer-assisted personal interview (CAPI) software at follow-up. The enumerator training for the follow-up survey took place in Bamako from the 28th of November to the 5th of December 2016. The survey was piloted on December 6th in Dialakoroba, a village in the commune of Kati. A 2-day recap was undertaken on December 30th and 31st ahead of the survey start on January 2nd 2017. Data collection was completed on the 6th of February. The study population included 70 villages in 34 communes in the Mopti region of Northern Mali (Figure 3). Because of the precarious security conditions, particular attention was given to planning the fieldwork with local authorities and the WFP sub-office in Mopti. Particular security hotspots were identified and labelled as red zones, including 3 villages where data collection could not be

undertaken. Back checks were undertaken over a sub-sample of the survey population (275 households) to provide quality control throughout the survey.

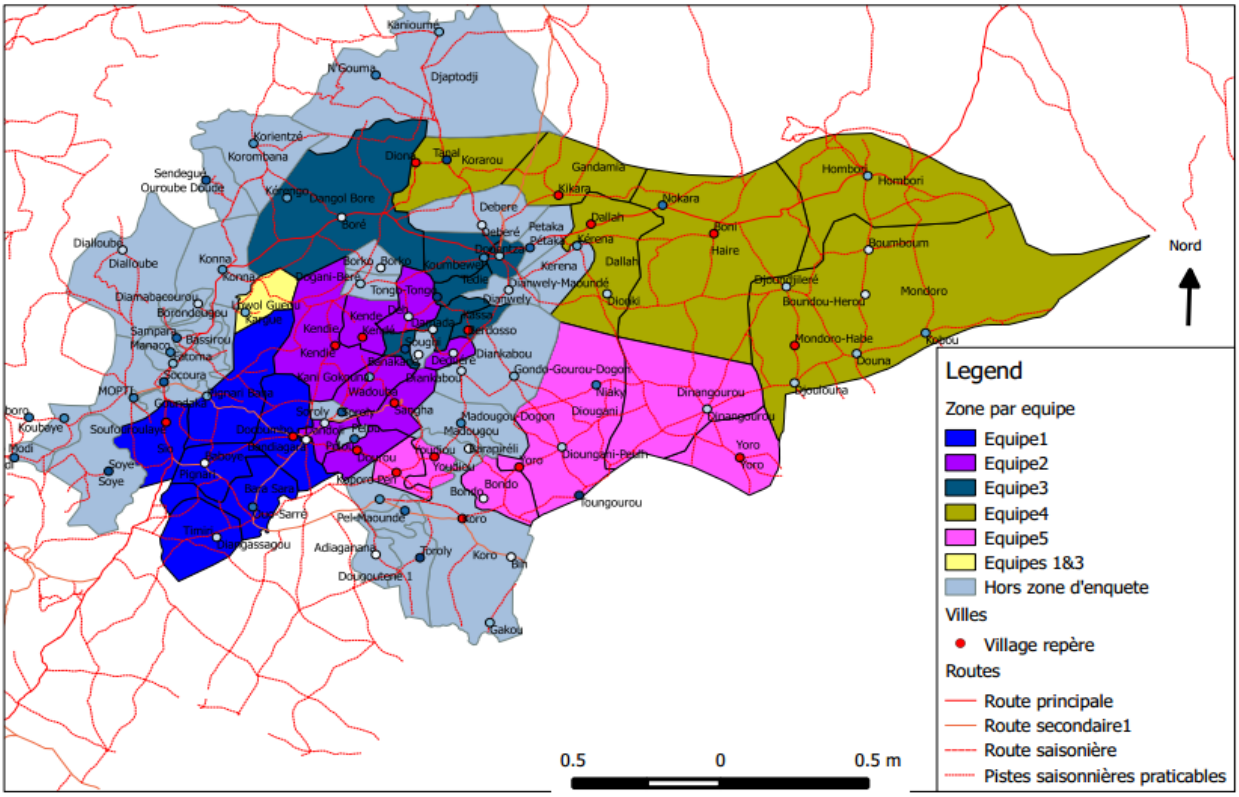


Figure 3: The survey zones and survey team allocations in Mopti. (Source: Authors.)

5.2.4 Survey data processing

We calculated the value (in West African Francs, FCFA) of household food and non-food consumption, and household energy and nutrient consumption from data on the consumption of 52 foods over a 7-day recall period. Quantities were converted from local units to kilograms. Missing units were imputed from commodity-specific unit modes at different aggregation levels: household, village, community, commune, cercle, and region. Net quantities were obtained by multiplying reported quantities by food-specific edible fractions. Energy and nutrient consumption were calculated using a Mali food composition table (Barikmo, Ouattara and Oshaug, 2004). All outcomes were calculated per capita and per adult equivalent (AE) to account for household size and composition differences. AE factors were assigned by dividing household members' age and sex specific recommended daily energy intake by a reference average recommended intake of 2636 kcal. The reference was calculated by taking the average energy needs of men and women aged 18 to 59.9 years. We used a weight of 56.2 kg for women aged 18-29.9, 58.6 kg for women aged 30-59.9, 66.2 kg for men aged 18.29.9, and 68.6 kg for men aged 30-59.9. A moderate physical activity level was assumed. Individual AE units were summed to yield the number of household AE units. We assessed energy and nutrient consumption from 12 food groups: cereals and grains, roots and tubers, legumes, nuts and pulses, fruits, vegetables, meat and poultry, fish and seafood, milk and dairy products, eggs, oils and fats, sweets, and spices, condiments and beverages (Swindale and Bilinsky, 2006). The value of food consumption was also calculated for these 12 groups. In addition, we examined the value of non- food expenditure from 8 non-food groups: energy, tobacco and cigarettes, transportation, hygiene, clothing,

durable goods, housing, and social events. Anthropometry data included measurements of height and weight for all children from 24-months to 15-years of age. Height or length was measured to the nearest 0.1 cm using portable fixed base stadiometers and weight was measured to the nearest 0.1 kg using electronic scales. HAZ and WHZ scores were calculated using the 2006 WHO growth standard for children under 5 years (WHO, 2006). Stunting was defined as HAZ < -2 SD and wasting as WHZ < -2 SD. However, due to issues related to the measurement of dates of birth that are critical for the calculation of anthropometric indices we limited the analysis to measuring changes in height during the 5-year study period in a cohort of children aged 2-5 at baseline.

5.4 Evaluation strategy

We subdivided the study population along two axes: (i) the extent of humanitarian assistance received over the years after the conflict and (ii) the extent to which the area was affected by conflict. Cut-off points will be identified to construct study groups with different levels of exposure to conflict and humanitarian assistance as in figure 4. In the inferential component of the study we will mainly investigate the impact of humanitarian assistance in conflict affected areas (B-A).

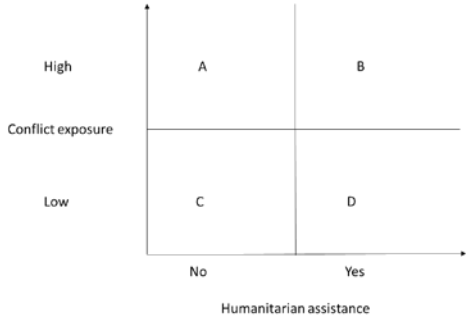


Figure 4: Stylised view of the study comparison groups. (Source: Authors.)

The quadrants in figure 3 involve endogeneity or confounding, as both conflict and assistance are likely to be correlated with area characteristics. Conflicts do not occur at random within a country. Buhaug et al. (2011) show that conflicts tend, in fact, to disproportionately affect poorest areas. Potential and non-mutually exclusive reasons for this are i) that poverty drives young men (and women) to enlist in rebel movements, ii) inequalities and grievances lead disenfranchised people to take up arms or iii) poor and conflict-hit areas are usually characterized by weak state presence, limited infrastructures (notably roads) and rough terrain, which all facilitate the setting-up and continuation of rebel groups. This also applies in Mali. Tuaregs – who are nomadic Berbers – have regularly rebelled against the government in reaction to what they perceive as widespread discriminations and exclusions from economic and political resources. In addition, the poverty, marginalization and failure to address fundamental grievances created a breeding ground for extremist Islamic groups. Another source of endogeneity comes from the fact that the aid programmes were not scaled-up randomly. Their spatial allocation is a function of humanitarian needs (themselves partly linked with conflict) and other logistical and programmatic concerns. As a result of this endogeneity, naïve comparisons across groups (A-C) and (B-A) are not able to distinguish effects produced by conflict and by humanitarian assistance from pre-existing differences between groups. In order to identify causal effects, we will employ quasi-experimental methods consisting of combining difference-in-difference analysis with propensity score matching (by inverse-probability weighting, following Imbens (2004)) as described in the following sections.

We employ quasi-experimental methods to estimate the impact of food assistance in conflict affected areas. Using the classical notation of Dawid (1979), the outcome of interest for household *h* receiving food assistance *A* is Y_h^1 and that the outcome for household *h* not receiving food assistance *A* is Y_h^0. Obviously, household h either receives aid or does not receive aid, so that only one outcome is observed: $Y_{h=}Y_h^1.P(A=1)+Y_h^0.P(A=0)$ where P indicates the probability of receiving aid. The effect of treatment at household level, is $Y_h^1-Y_h^0$, remains therefore unknowable. To estimate the effect of food assistance, we will look at the average treatment effect on the treated (ATT), which is defined as $E(Y^1-Y^0)|A=1$. The ATT can be decomposed as follows:

$$\begin{aligned} ATT &= E(Y_h^1-Y_h^0)|A=1 \\ &= E(Y_h^1|A=1)-E(Y_h^0|A=0) \\ &\quad +\underbrace{[E(Y_h^0|A=1)-E(Y_h^0|A=0)]}_{selectionbias} \end{aligned} \qquad (1)$$

The second part of equation 1 refers to the selection bias, which arises when the potential outcome of treatment subjects in the absence of the treatment differs from that of control subjects. In the case of the evaluation of food assistance, this term can be negative or positive, depending on whether aid successfully targets the most vulnerable populations or not. On the one hand, the mission statement of WFP and the EMOP project documents highlight the need to deliver assistance to the most vulnerable, so that $\left[E\left(Y_h^0|A=1\right)<E\left(Y_h^0|A=0\right)\right]$. On the other hand, the conflict, remoteness and various financial and logistical challenges may have caused food aid to fail to reach the most vulnerable, so that $\left[E\left(Y_h^0|A=1\right)>E\left(Y_h^0|A=0\right)\right]$.

To estimate the impact of food assistance, we must then account for this potential selection bias. We do so through propensity score matching, exploiting our unique pre-crisis baseline. Specifically, we estimate the likelihood to receive aid conditional on a range of covariates X: P (X) = P (A = 1|X). Following the logic of the matching estimator, the covariates included in X are measured before the intervention and are potential confounders, i.e. they are related to both the selection into treatment and the outcome of interest. Rosenbaum and Rubin (1983) have shown that if selection on observable characteristics X is fully controlled for - the unconfoundness assumption - the conditional outcomes are independent of treatment status, or $(Y_h^0,Y_h^1 \perp\!\!\!\perp A|P(X)$, meaning that $E\left(Y_h^0|A=1,P(x)\right)=E\left(Y_h^0|A=0,P(x)\right)$ and that ATT is identified.

We include in the estimation of the propensity score a range of household and village characteristics measured at baseline. The household and village surveys provide detailed information on household food security, socio-economic background, labour and other economic activities, including a range of characteristics believed to be associated with eligibility to receive food assistance. These are, at the village-level, the presence of a secondary school within 5km, the presence of a market within 5km, and conflict exposure (see below for definition of the latter variable). At the household-level, the variables we control for are whether children were involved in past projects, feelings of safety, age of the household head, expenditures per capita, household expenditures quintiles, the logarithm of value of assets, household size, dependency ratio, number of food groups consumed, whether the household is polygamous, whether the head of household identified as a worker, the amount of cultivated land, and the share of food

expenditures in the household budget. The propensity score was estimated with a Logit estimator and the distributions of the estimated propensity in treatment and control groups score displayed a high degree of overlap across all variables of aid (see figure in Annex 4 for example).

We used the propensity score to weight the treatment and control samples to obtain conduct a kernel propensity score difference-in-difference (Heckman, Hichimura and Todd, 1998; Hirano, Imbens and Ridder, 2003) in the region of common support. The weight, w_h, is calculated as $w_h = \frac{1}{\widehat{p_h}}$ for treatment subjects and as $w_h = \frac{1}{1-\widehat{p_h}}$ for control subjects, where $\widehat{p_h}$ is the estimated propensity score for household h. Applying these weights adjusts for the systematic imbalances in covariates between treatment and control subjects so that the kernel propensity score difference-in-difference estimator provides unbiased estimate of the ATT under the unconfoundness assumption.

The key question in this study was to evaluate the effect of food assistance in conflict-affected contexts. We used a twofold strategy to handle the interactions between conflict and food assistance. In a first set of estimations, we control for the exposure to conflict in the period immediately following the coup (2012-2014). In other words, we estimate the probability for households to receive food assistance over the period 2014-2016 based on baseline characteristics and exposure to conflict in the period 2012- 2014. This provides a benchmark estimate of the average effect of food assistance for treated households in the Mopti area.

In a second set of estimations, we assess whether the impact of food assistance is heterogeneous with respect to exposure to conflict. The goal of these estimations is to ascertain whether food assistance is effective in situations of acute fragility. To do that, we estimate the propensity score separately for the subgroup of conflict-affected areas and the subgroup of non-affected areas.

In a third set of estimations limited to anthropometry indices we attempt to address concerns related to differing age distributions in the two repeated cross sections of children 6-59m highlighted in section 4.8.1 by focussing on a single cross section at endline. In these estimations, the propensity scores were calculated using the same baseline covariates as in the DID analysis, however outcome data was limited to a single cross section at endline.

5.4.1 Operationalising conflict

The endline household and village surveys collected information on a wide range of violent events, some of which were directly linked with the armed conflict. We capture exposure to the armed conflict through questions on the presence of armed groups that were asked in the village questionnaire. Indeed, it is important to note that the notions of violent conflict and control need to be distinguished. As Kalyvas (2006) argues, violent conflict is most likely to occur in contested areas between state and rebel forces and least likely to occur in areas firmly under the control of either factions. As a result, the absence of violent events in the household survey does not necessarily mean that respondents were sheltered from the effects of the armed conflict. In fact, households living in rebel-held territories may suffer from the range of indirect impacts of the conflict even in the absence of exposure to direct violence. Indirect consequences include the withdrawal of the state apparatus (not always replaced by rebel governance), absence of NGOs and aid system, fear and inability to travel to the market or towns. Tranchant, Justino and Mueller (2014) show that these indirect effects exert a very strong adverse effect of households' ability to cope with income shocks for households living in the shadow of the Naxal insurgency in India.

The presence of armed groups was operationalized through: (i) a binary variable "Armed groups in village" with value 1 if the village had ever experienced the presence of an armed group since the beginning of the conflict, and (ii) a binary variable "Armed groups in region" with value 1 if the region in which the village is located had ever experienced the presence of an armed group since the beginning of the conflict.

5.4.2 Operationalising food assistance

We previously described how the WFP operations in northern Mali combined (i) supplementary feeding for children below 5 years of age and pregnant women to prevent (not targeted) and treat malnutrition (targeted), (ii) general food assistance for vulnerable households, and (iii) school feeding in areas of food insecurity. The endline survey included questions on different forms of humanitarian aid, including food assistance, that WFP or other development partners may have provided to the study populations. In terms of food assistance, alongside general food distribution (GFD), targeted supplementary feeding (TSF), and school feeding (SF) we added the modality of food for work (FFW) that was also provided by WFP and partners as part of the Country Programme running in parallel to the EMOP. In the follow-up survey conducted in January 2017, village and household respondents were asked about their experience with food assistance. Based on actual coverage data (see section 4.5), to characterize aid provision and intensity of exposure to aid, we created the following variables: a binary variable "Any aid" with value 1 if the household received any form of aid, a binary variable "GFD" with value 1 if the household received GFD, a binary variable "SF" with value 1 if the household received school feeding and a categorical variable "Types of aid" with value 0 if the household received no aid, value 1 if the household received one form of aid, and the value 2 if the household received two forms of aid or more. Coverage of other forms of food assistance was extremely low.

5.5 Ethical approval

Overall, the study involved minimal risks for participants. The risks related to the potential for both the study participants to relive their traumatic memories from the conflict by answering questions about their exposure and the enumerators to be overwhelmed by the traumatic content that emerged as the study participants responded to their questions. In addition, there is a risk that respondents may be identified in the data and thus be potentially exposed to repercussions. During the formulation of the protocol and interview tools, the research team examined these risks in detail and also identified and tested strategies to minimize these risks operationally, including:

- The focus of the qualitative research was to identify patterns of conflict exposure, versus specific events, utilizing techniques that will allow participants to respond in a non-personal manner.
- The survey questionnaire focussed on capturing symptoms of the effects of trauma rather than describing the trauma itself.
- Enumerators were supported throughout their work and trained carefully to be able to manage potentially difficult situations.

Informed consent was requested from the each of the household heads, parents and community chiefs prior to the interviews using a standardized form. All the survey tools were written in French, and the enumerators spoke both French and the local language. Participants were free to withdraw at any stage of the process by informing the survey enumerators, local authority, programme or ministry staff.

Ethical clearance was obtained from ethical boards at the National Institute of Public Health (INRSP) in Mali (Ref: N01/2016/CE-INRSP), and IFPRI (Ref: 00007490).

6. Impact analysis and results of the key evaluation questions

6.1 Trends in conflict events and fatalities in Mali between 1997 and 2016

The number of conflict events and fatalities by conflict event type by year in Mali during the 20-year period between 1997 and 2016 are summarised in Figures 5 and 6. According the ACLED database, the last 20-year period saw a total of 1,304 conflict related events and 3,071 fatalities in Mali. Thirty-one percent of conflict events and 62 percent of fatalities during the 20-year period were due to battles that did not lead to territorial change. Nineteen percent of events were related to violence against civilians (the corresponding figure for fatalities is 15 percent). The data clearly highlighted the low-key intensity of conflict before 2012 and the surge in conflict events and fatalities from 2012 to 2016. Over 80 percent of the total conflict related events and fatalities are concentrated in the 5-year period between 2012 and 2016.

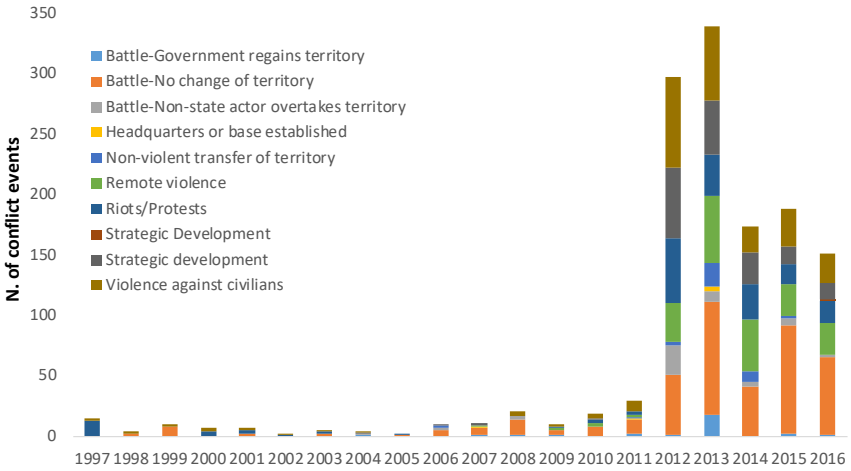


Figure 5: Conflict events in Mali between 1997 and 2016, total by year and event type (Source ACLED).

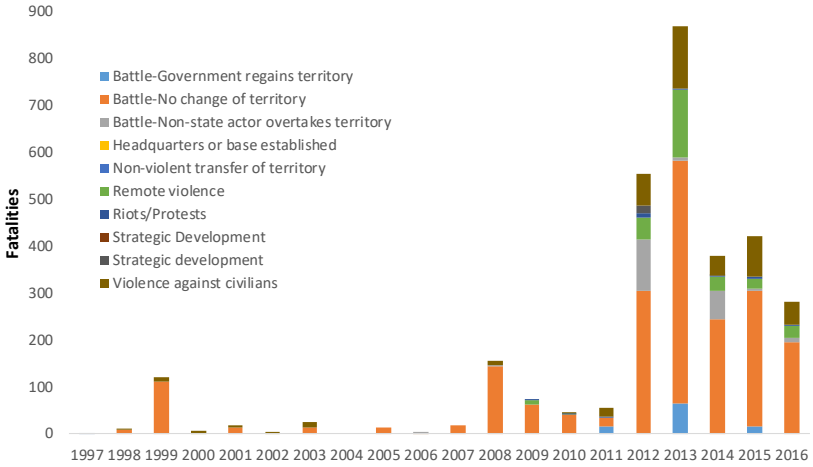


Figure 6: Conflict related fatalities in Mali between 1997 and 2016, total by year and event type (Source ACLED).

6.1.1 Trends in conflict events and fatalities by region in Mali between 1997 and 2016

Figure 7 highlights the trends in conflict events and fatalities by region, confirming the concentration of conflict in the Northern regions of the country. During the last 20 years, about 30 percent of conflict events

and 46 percent of fatalities were in the Kidal region alone. 55 percent of events and fatalities were concentrated in the 3 northern regions of Gao, Kidal and Timbuktu. This increased to over 66 percent between 2012 and 2016. In contrast, Sikasso, in the south of Mali saw only 3 percent of total conflict events and fatalities during the last 20 years, dropping to 1 percent of total conflict events and fatalities from 2012 to 2016.

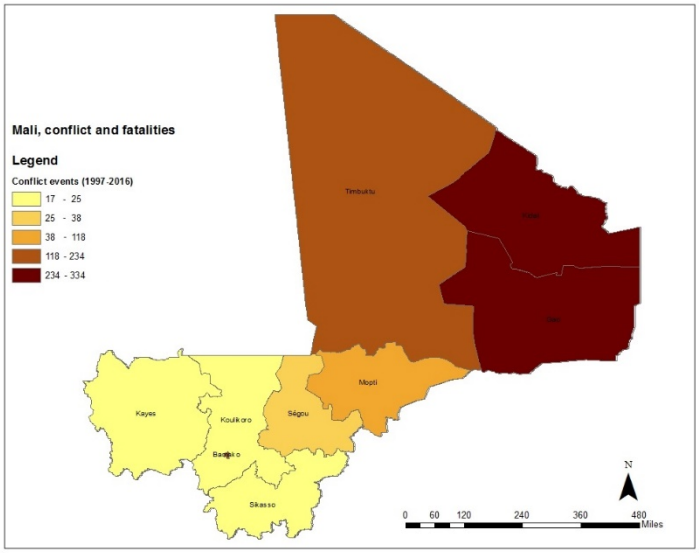


Figure 7: Total conflict events in Mali between 1997 and 2016 by region (Source ACLED).

6.1.2 Trends in conflict events and fatalities in the Mopti region

During the last 20 years 6 percent of total conflict events and 11 percent of total fatalities in Mali took place in the Mopti region, though these percentages doubled during the 2012-2016 period. In Mopti, over 95 percent of conflict events and fatalities over the last 20 years took place between 2012 and 2016. As in the other regions in Northern Mali, conflict peaked in Mopti during 2013. However, unlike Gao, Kidal and Timbuktu regions that experienced general declines in conflict events and fatalities from 2013 onwards, conflict related events and fatalities in Mopti increased by 7 percent and 22 percent respectively in 2015 and 2016 (Figure 8). Between 2012 and 2016, battles between Government and armed groups were the primary cause of conflict related fatalities, and were responsible for 58 percent of total fatalities. Violence against civilians resulted in 34 percent of total fatalities during the same period.

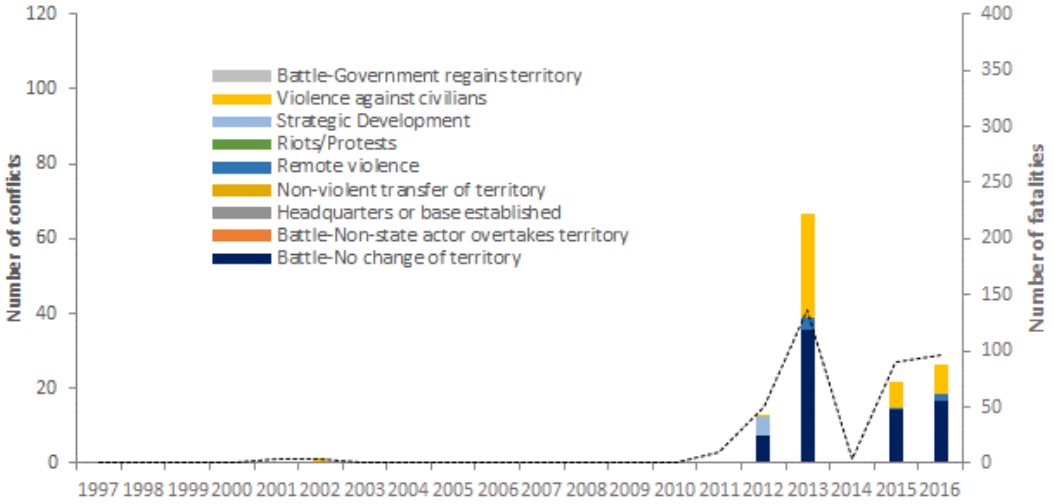


Figure 8: Conflict events and fatalities in Mopti region between 1997 and 2016, total by year and event type (Source ACLED).

Examination of the spatial distribution of the conflict related events in the Mopti region between 2012 and 2016 in Figures 9 and 10 highlighted the concentration of conflict and fatalities in the communes of Mopti, Douentza and Konna (56 percent of conflict events and 64 percent of total fatalities in the region respectively). Konna, the location of the battle that triggered Operation Serval (Shurkin, 2014), saw the largest number of fatalities (140) during the 2012-2016 period. Plots of the study villages overlaid to the conflict related maps suggested that the study populations were exposed to varying degrees of conflict exposure.

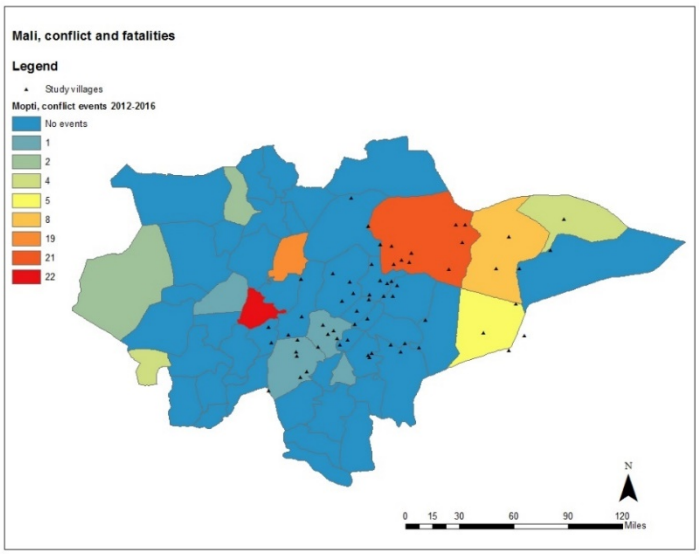


Figure 9: Conflict events in Mopti region between 2012 and 2016 (Source ACLED).

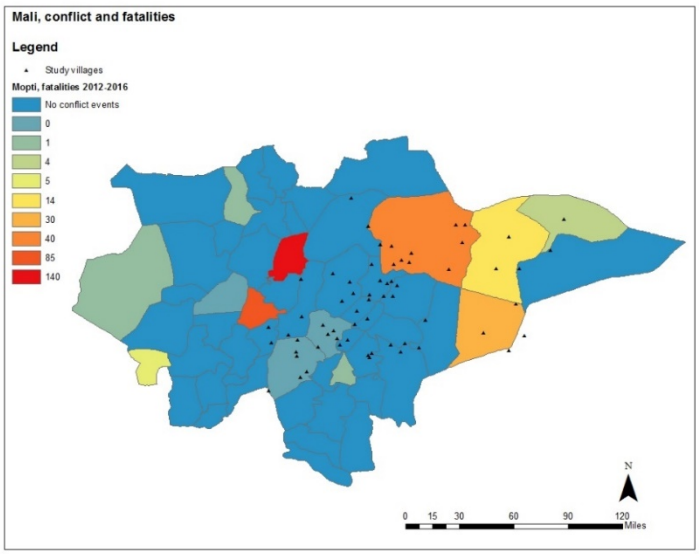


Figure 10: Fatalities in conflict events in Mopti region between 2012 and 2016 (Source ACLED).

6.2 Analysis of food assistance in the Mopti region

Data on WFP beneficiaries were obtained for 2014 and 2015. Aid related activities provided by WFP in the Mopti region included school meals, general food distribution, targeted supplementary feeding and resilience related programming. In Mopti, WFP supported 228,649 beneficiaries in 2014 and 135,456 beneficiaries in 2015 after it scaled-down its operations. The breakdown of beneficiaries and coverage by cercle is summarised in Figure 11.

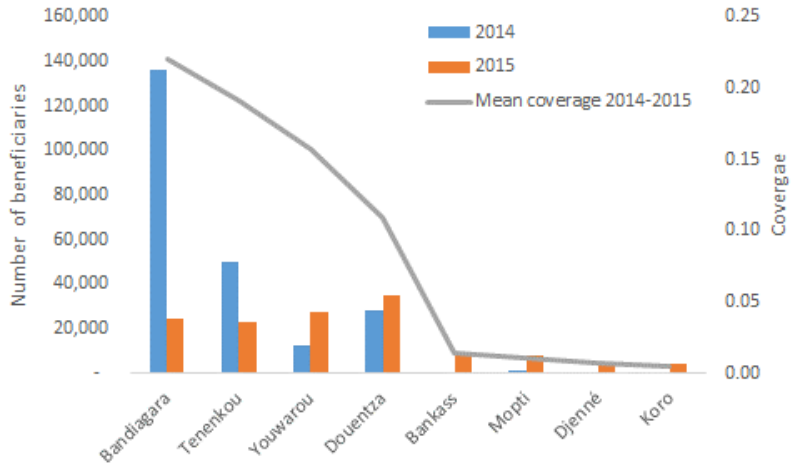


Figure 11: Number of beneficiaries and estimated mean coverage of food assistance activities by WFP in Mopti region by cercle in 2014 and 2015. (Source WFP).

WFP activities covered approximately 10 percent of the Mopti population in 2014 and 6 percent of the population in 2015. Average coverage between 2014 and 2015 appeared to be heterogeneous across the Mopti region, peaking at 22 percent in the cercle of Bandiagara, and at less than one percent was lowest in the cercles of Djenné and Koro. Overlaying the study villages to the maps on coverage suggested that the study population was exposed to varying degrees of humanitarian assistance (Figure 12).

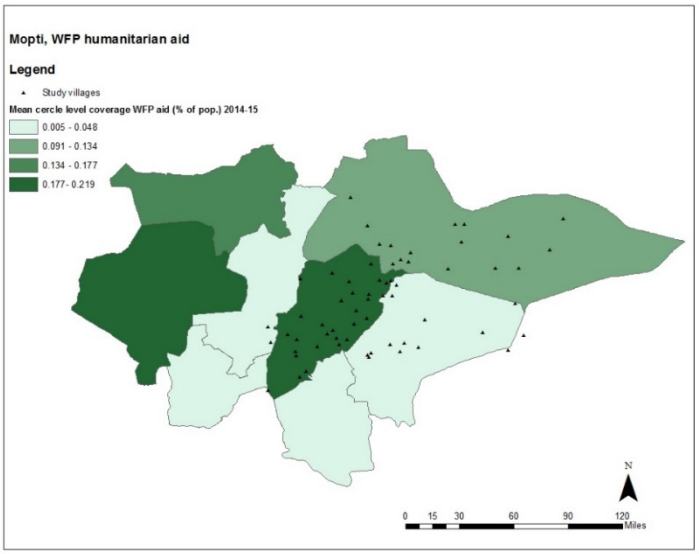


Figure 12: Number of beneficiaries and estimated mean coverage of food assistance activities by WFP in Mopti region in 2014 and 2015. (Source WFP).

The breakdown of beneficiaries by WFP activity highlighted that nearly half of WFP beneficiaries in 2015 received general food distribution, 26 percent received targeted supplementary feeding, 20 percent received school meals and 7 percent benefitted from resilience related programming (figure 13).

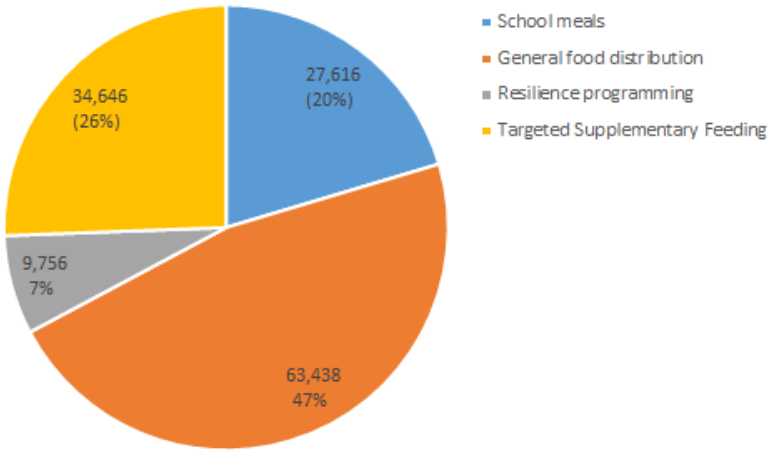


Figure 13: Breakdown of food assistance activities by WFP in Mopti region by programming activity in 2015. (Source WFP).

6.3 Household characteristics in the survey population

The analysis now focuses on the household and village surveys. The baseline survey included a total of 1,717 households in 66 villages across the Mopti region of Northern Mali. The follow-up survey data included 1,422 households, leading to a 17% attrition rate over the 5-year study period between the two surveys. Baseline characteristics in the survey population in are summarized in Table 3. In the study population at baseline, approximately 28% of household were polygamous, with average household size just over 7 individuals, and a dependency ratio (defined as number of people aged zero to 14 and over

the age of 65, divided by the total population, aged 15 to 64) of 1.58. On average, food expenditures were 69% of total expenditures. The prevalence of MAM was 8% and the prevalence of SAM was 5%. Comparing baseline characteristics of households lost to follow-up to those in the full panel (not reported), highlighted that households lost to attrition were generally from less remote villages, were less likely to be in villages that had had a development project in the past, had slightly smaller household sizes, were less likely to be polygamous, were more likely to have wage labour as occupation of the household head and were less likely to be in the highest expenditure quintile.

Table 3: Household characteristics at baseline in Mopti region of Mali. (Source: Household survey).

Variable	Mean	Std. Dev.	Min.	Max.	N
Secondary school within 5km	0.33		0	1	1717
Market within 5 km	0.24		0	1	1717
Development project in the past	0.58		0	1	1717
Village perceived as unsafe	0.06		0	1	1592
Age head of household	48.85	13.59	20	101	1709
Household size	7.04	2.99	1	19	1717
Depend ratio	1.58	0.86	0.1	6.5	1655
Food groups consumed	6.74	1.31	2	10	1715
Polygamous household	0.28		0	1	1709
Worker	0.05		0	1	1709
Land size	3.52	3.87	0	80	1717
Log of value of asset capital	11.44	1.49	7.31	15.30	1702
Expenditures (monthly) per AE (FCFA)∗	15559	9571	4295	51874	1583
Food expenditures (monthly) per AE (FCFA)∗	10447	6942	2397	38534	1559
Share of food in budget∗	0.69	0.16	0.33	0.95	1574
Calories consumed daily per AE∗	3342	2216	559	13606	1634
Protein consumed daily per AE∗	97.5	61.7	17.0	377	1644
Iron consumed daily per AE∗	23.2	14.8	3.76	86.0	1643
Zinc consumed daily per AE∗	33.9	23.1	3.41	143.3	1636
Vitamin A consumed daily per AE∗	497	697	0	3967	1715
Height (cm) of children under 5	97.0	12.0	68.0	120.0	1881
Weight (kg) of children under 5	14.4	3.6	5.9	31.6	1881
Prevalence of MAM (%)	7.7				1792
Prevalence of SAM (%)	4.6				1881

6.4 Conflict exposure at household and village level

Overall, 23% of households were exposed to violence linked with the presence of armed groups. Disaggregating by types of violence showed that 17% of households reported that banditry attacks took place in their village over the last 4 years, 7% report terrorist/armed attacks, 5% report political violence, 2% report kidnappings, 1% violence/lynching in presence of armed groups or destruction of infrastructure. Other types of crime and violence were prominent - especially livestock theft (reported by 60% of households) and disputes over resources within (13%) and across villages (8%) - but it is unclear whether these were direct manifestations of the armed conflict or not, and have not been considered in our variable of Violence exposure.

According to the village survey, 11 villages were still experiencing the presence of armed groups during the survey period, 55 villages did not report such a presence, and for 2 villages the information was not known. Out of the 11 villages experiencing the presence of armed groups, 5 villages reported the presence of unnamed "armed bandits", 3 reported the presence of the MUJAO, 3 reported the presence of Ansar Eddine, 1 reported the presence of the MNLA, and 1 reported the presence of AQMI. As is implicit from the above, two villages report multiple armed groups (1 village reported 4 armed groups, and another one two).

There was a high degree of persistence in the presence of armed groups. Out of the 11 villages where armed groups were still present, 9 villages reported the groups were already in the locality between January 2012 and the time of survey. Conversely, 2 villages were experiencing the presence of armed groups during the survey period though the armed groups were not present in the period following the coup. Out of the 55 villages without the presence of armed groups, only 3 had experienced their presence at some point since January 2012. A detailed look at the timing of first arrival of armed groups in the 13 villages which ever reported their presence shows that 5 of these villages were affected in 2012 (3 in April, 1 in June, 1 in September) and 5 others were affected in 2013. The two remaining villages were affected much later, in August 2016 and February 2017, respectively.

The village questionnaire included questions on the behaviours of armed groups. These groups were depicted as violent (12 out 13 villages report the groups attack civilians) and a threat to individuals' livelihoods (in 11 of the 13 villages). However, the groups seemed unwilling or unable to insert themselves in the population and/or to impose order (none of the villages report that the groups relied on the population for food, enforced tax or payments, attempted to solve local conflicts, or offered services to the population). The only exception concerned the imposition of the Sharia law, which 6 villages reported that the groups aimed to enforce (whole or parts of it) at the local level.

Whereas 16% of the villages (11) reported experiencing the presence of armed groups in the locale itself, 77% of them (52) reported that armed groups were present in the region (6 did not provide information). In 34 villages, armed groups arrived in 2012 and in 12 villages they arrived in 2013. 5 villages reported the presence of armed groups before the conflict started, as early as 2009. Finally, and consistent with the notion that insecurity is appearing to spread in the Mopti region, 17 villages respondents declared that their regions were first affected only in 2016 or 2017.

6.5 Receipt of food assistance at household and village level

At village level, general food distribution (GFD) was the most common form of food assistance in the study population, with 51 out of 63 village-level respondents declaring that GFD occurred in their village since 2012. School feeding and TSF were reported to have been implemented in 26 and 24 villages, respectively. Targeted supplementary feeding and SF programs were mostly implemented in villages where general food distribution was also present, consistent with WFP operational principles. Only 3 villages experienced TSF or SF without any GFD program.

According to the household-level information, 67%[1] of households reported not receiving any food assistance, 23% of households reported receiving GFD, 14% of households reported having children who received school feeding, 2% of households reported children or pregnant mothers within households

[1] This is a population-based estimate and not based on eligible individuals. We will be examining issues related to eligibility, inclusion and exclusion errors in future work.

receiving targeted supplementary feeding, and 2% participated in food for work programs. As some of the different programs target individuals within households, the household level responses reported here provide an aggregate measure on the coverage of food assistance within each household. There was a limited overlap between these modalities of aid at household level as only 7% of households received two forms of aid or more. Once again, when overlap existed, it overwhelmingly involved GFD which has been reported by 94% of households who received at least two forms of aid. The low coverage of TSF is important in the context of the original focus of this evaluation: The resulting very low number of children in the "treatment" group for TSF inevitably limited the ability to meaningfully apply the main evaluation strategy to estimate the impact of this type of food assistance.

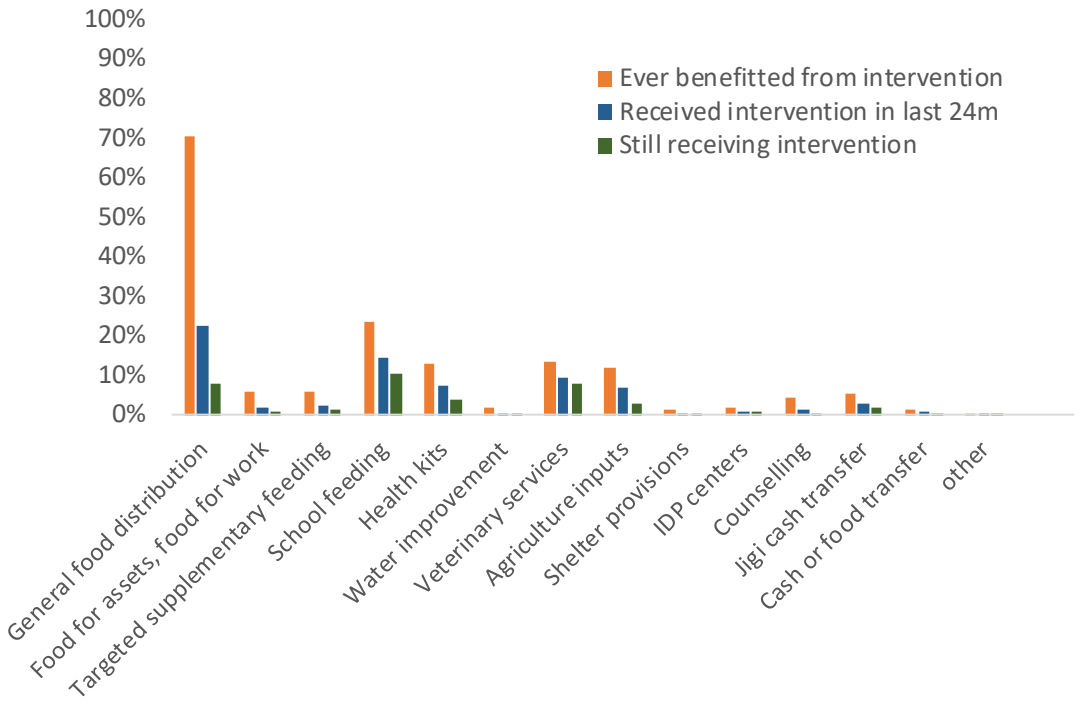


Figure 14: Receipt of food assistance in the study population, Mopti region of Mali. (Source: Household survey).

6.6 Conflict, control and violence in the study population

There was overlap between presence of armed groups and conflict-related violence in our sample. As shown by table 4, whereas 16% of households experienced conflict-related violence in villages free from the presence of armed groups (whether they are present in the region or not), 47% experienced conflict-related violence in villages where armed groups have been present. There was a strong discontinuity between villages where armed groups have been present and other villages on all types of conflict-related violence. However, there was a not a clear demarcation between villages located in areas where armed groups have been present and villages located in areas free from armed groups. Political violence, kidnappings and lynchings were more prevalent in the former, but the differences were not substantive, and there was no difference in terms of banditry or terrorist attacks.

Table 4: Presence of armed groups and conflict-related violence, Mali. (Source: Household survey).

% of households reporting the presence of:	No armed groups	Armed groups in region	Armed groups in village	Pearson Chi-squared Statistic
Banditry	13.3	13	38.9	76.45***
Terrorist attacks	6.2	4.6	22.2	69.12***
Political violence	1	3.5	6.8	9.5***
Destruction of infrastructures	0	0.8	1.5	2.71
Kidnappings	0	1.6	4.4	11.1***
Lynchings	0	0.9	1.5	2.55
Any conflict-related violence	15.9	15.7	46.4	95.3***
Observations	188	738	203	

Notes: Stars represent the p-value associated with the Pearson Chi squared test. ***: p<0.01; **: p<0.05; *: p<0.1.

Apart from its effect on violence, the presence of armed conflict exerted a detrimental impact on households through fear and reduced mobility. Table 5 shows the cross-tabulation between households' self-reported levels of fear of traveling and presence of armed groups. A similar pattern emerged to that shown in table 4. Table 5 shows that households living in villages where armed groups have been present were much more likely to have reduced their travels than households living in villages where armed groups had been absent (irrespective of whether the presence of these armed groups is reported in the wider region). The table also highlights a widespread fear of traveling in conflict-affected villages, that affected over 78% of households. This translated into fewer trips to the market, health centre, job fairs etc. as well as in reduced trips to school for children.

Table 5: Presence of armed groups and mobility, Mali. (Source: Household survey).

Respondent declared fear when traveling to:	No armed groups (%)	Armed groups in region (%)	Armed groups in village (%)	Pearson Chi-squared Statistic
the market to buy food	43	42	67	41.16***
the market to sell food	41	41	66	42.9***
look for work	35	38	68	63.3***
the health centre	29	21	53	79.1***
the aid centre	26	20	44	50.0***
buy/sell agricultural inputs	24	26	46	36.2***
anywhere outside village	47	49	78	59.4***
Less trips of children to school	12	17	34	40.4***
Observations	188	738	203	

Notes: Stars represent the p-value associated with the Pearson Chi squared test. ***: p<0.01; **: p<0.05; *: p<0.1.

Finally, table 6 explores the relationships between presence of armed groups, feelings of safety and social capital in villages. With regards to feelings of safety, the table shows that the presence of armed groups at the regional level was important. Whereas 63% of respondents in regions where no armed groups were present felt safe, only 47% of respondents in regions with armed groups felt similarly safe. Over the last 4 years, there was a monotonic relationship between proximity to armed groups and feelings of safety. 52% of households in regions without armed groups felt safe, 37% of households in regions with armed groups but in villages directly unaffected by armed groups felt safe, and only 20% of households in villages directly affected by armed groups felt safe. The relationship between responses related to social capital and proximity to armed groups was less strong, with the main difference arising between villages with direct presence of armed groups and others.

Table 6: Presence of armed groups, safety and social capital, Mali. (n=1,311). (Source: Household survey).

Response	No armed groups (%)	Armed groups in region (%)	Armed groups in village (%)	Pearson Chi-squared
Feel safe in community	63	48	47	15.8***
Felt safe in community over last 4 years (%)	52	37	20	46.0***
Feel that people in community commonly discuss problems	94	92	88	4.6*
Feel that people in community commonly help each other out	92	86	79	14.0***
Observations	188	738	203	

Notes: Stars represent the p-value associated with the Pearson Chi squared test. ***: p<0.01; **: p<0.05; *: p<0.1.

Table 7: Conflict-related violence, safety and social capital, Mali. (n=1,311). (Source: Household survey).

	No conflict-related violence (%)	Conflict-related violence (%)	Pearson Chi2
Feel safe in community (%)	53	34	35.4***
Felt safe in community over last 4 years (%)	39	19	39.4***
Feel that people in community commonly discuss problems (%)	92	86	11.4*
Feel that people in community commonly help each other out (%)	87	82	4.2**

6.6.1 Insights from the qualitative research

The qualitative data highlighted that security services such as police and the army were largely absent throughout the study period, with services limited to occasional patrols by the Malian army in villages that were un-occupied by armed groups. However, from April 2012 to the French intervention in January 2013, armed groups themselves regularly patrolled the villages in the occupied areas. Though basic social services (schools, health centres, paved roads, agricultural cooperatives) existed before the outbreak of armed conflict, these were heavily impacted in terms of their functioning. For example, respondents reported that activities were disrupted in all schools and health centres, though the extent of the disruption depended on whether armed groups were present or not. In the zones occupied by armed groups, schools and health centres were closed during the full period of occupation, whereas in the non-occupied zone, this period did not exceed three months. The analysis of the qualitative data also suggested that the effects of the presence of armed groups in their municipalities was pervasive. Respondents in their comments indicated that the presence of armed groups caused the fleeing of men, able-bodied household members, as well as entire families. Fear, panic, destruction of government buildings combined with hatred against administrative staff, also caused the health and education staff to flee, thus closing health centres and schools. Postnatal consultations were also interrupted. Many pregnant women who were unable to flee found their antenatal care suspended. This exposed children to higher risks of infection and morbidity. It is in this context that respondents highlighted that malnutrition in children and lactating women increased considerably. As such, the focus groups discussions identified the most vulnerable groups as pregnant women, nursing mothers, the sick, old people, children for whom health care and school services were no longer available.

6.7 Food assistance and conflict

Table 8 shows that the relationships between availability of food assistance programs and presence of conflict were complex. Access to any food assistance program at village level decreased as proximity with armed groups increased. Whereas food assistance was potentially available for all households living in villages unaffected by armed groups, the proportion decreased to 90% in villages indirectly affected (i.e. groups were present in the region but not in the village) and to 76% in villages directly affected by presence of armed groups. Availability of least two forms of food assistance was, however, roughly similar at the extreme of the conflict spectrum (40%) and was highest in villages indirectly affected by armed groups (59%).

Table 8: Availability of food assistance programs and presence of armed groups, Mali. (Source: Household survey).

% Households with access to:	No armed groups	Armed groups in region	Armed groups in village	Pearson Chi-squared
Any type of food assistance	100	90	76	61.7***
No food assistance program	0	10	24	61.8***
1 food assistance program	60	31	35	54.3***
2+ food assistance programs	40	59	41	35.5***
GFD	91	84	76	16.6***
GFD + TSF	31	43	12	69.4***
GFD + SF	20	43	41	37.8***
% Households receiving:				
Any type of food assistance	40	28	33	10.7***
No food assistance	60	71	67	10.5***
1 food assistance program	30	22	29	8.2**
2+ food assistance programs	10	7	4	5.7*
GFD	31	17	26	22.7***
SF	16	13	9	4.5
Observations (n)	475	718	141	

Notes: Stars represent the p-value associated with the Pearson Chi squared test. ***: p<0.01; **: p<0.05; *: p<0.1.

Looking at the modalities of aid, increased proximity with armed groups reduced access to GFD. The likelihood to have access to GFD + TSF, however, was highest in villages indirectly affected (43%), lowest in villages directly affected (12%), and in between in unaffected villages (31%). Finally, the likelihood to have access to GFD and school feeding was twice as high in directly and indirectly affected villages (about 40%) than in unaffected villages (20%). This data suggests that school feeding may have been systematically used as an emergency platform for scaling-up food assistance in conflict-affected areas.

A similar picture emerged when examining access to aid from the household data. The likelihood for households to receive any aid decreased when armed groups were present in the region (from 40% in unaffected villages to 33% in affected villages). Similarly, households were highly less likely to receive 2 forms of aid or more as proximity with armed groups increased (4% versus 10%). There was, however, a much weaker relationship between the presence of armed groups and likelihood to receive one form of aid (and the likelihood was smallest in indirectly affected villages). Examining the modalities of aid revealed that households were most likely to receive GFD in unaffected villages (31%), followed by households in directly affected villages (26%) and households in indirectly affected villages (17%). Finally,

the likelihood of receiving school feeding was twice as low in villages where armed groups were present than elsewhere (despite the above finding on availability of school feeding from the village-level data).

6.7.1 Insights from the qualitative research

The qualitative research provided further insights on aid exposure and conflict. Interview respondents reported that in the occupied zone of Douentza, despite a poor 2011-2012 harvest and the occupation of the area by rebels, all the humanitarian aid was mostly passing through the occupied zones on the way to the regions of Gao, Timbuktu and Kidal. Following the Berkane and Serval operations, and the election of a president in 2013, the local administration in some areas that had been freed from armed groups started to return. Some NGOs even started to intervene in the Douentza area, providing GFD, FFW, and resilience and income generating activities. This process which started at the end of 2013 heralded a gradual return of the population to daily activities.

To summarize, in our study population, access to aid tended to decrease as proximity with armed groups increased, contrary to what a logic of prioritization of conflict-affected populations would imply, though perhaps reflecting the practicalities of operations during conflict. This manifested itself in a higher likelihood for conflict-affected households in villages without any access to aid, and a lower likelihood for conflict affected populations in villages with one form of food assistance. However, villages where armed groups were present were as likely to have access to 2 forms of aid than villages in peaceful environments. The relationship between proximity to armed groups and access to aid is not as marked at the household-level. The strongest effect of conflict was to reduce the likelihood of receiving two forms of aid and of obtaining school feeding, in contrast to the village level information.

6.8 Changes in outcomes during the study period

Table 9 summarises the mean changes in the nutrition and food security related study outcomes between 2012 and 2017 in the overall sample, and in the three subgroups defined by proximity of the respondents with the armed groups. The crisis in Mopti is manifest in that households only increased average expenditures per adult equivalent by approximately FCFA 1200 over the whole period, corresponding to less than $0.4 per year. It is unsurprising, then, that calories intake per adult equivalent decreased by 136 calories per day on average. Daily consumption of protein, iron and zinc also tended to decrease in the study population. In contrast, consumption of vitamin A increased by 430 micrograms, a near doubling of the baseline value.

Insights from the qualitative research confirmed that households had been exposed to a range of shocks and stresses throughout the 5-year survey period, including erratic rainfall, drought, flash flooding, poor harvests, loss of harvest due to pests, and migration to the south in search of employment in the mining sector.

Table 9: Mean change in study outcomes at household-level, full panel sample and by exposure to armed groups, Mali. (Source: Household survey).

Variable	Full Sample	No armed groups	Armed groups in region	Armed groups in village
ΔExpenditures per AE (FCFA)∗	1219	196.1	1839	3042
	[1213]	[416]	[584]	[128]
ΔFood expenditures per AE (FCFA)∗	833.3	-21.23	1277	1929
	[1210]	[414]	[582]	[130]
ΔShare of food in budget∗	0.03	0.02	0.04	0.07
	[1279]	[430]	[639]	[130]

ΔCalories consumed daily per AE∗	-12.7	-17.5	-71.51	144.6
	[1216]	[404]	[604]	[130]
ΔProtein consumed daily per AE∗	-9.62	-10.1	-10.8	-8.89
	[1213]	[405]	[599]	[132]
ΔIron consumed daily per AE∗	-2.46	-2.75	-2.70	-1.79
	[1214]	[405]	[603]	[127]
ΔZinc consumed daily per AE∗	-1.09	-2.57	-1.63	2.75
	[1216]	[402]	[613]	[125]
ΔVitamin A consumed daily per AE∗	363	308	356	494
	[1282]	[475]	[717]	[141]
ΔHeight (cm) panel children under 5 in 2012	24.3	24.7	24.3	22.6
	[2449]	[807]	[1199]	[176]

Notes: Sample size in square brackets. The ∗ indicates that the variable has been trimmed to exclude values below the 5th percentile and above the 95th percentile of the distribution. AE refers to Adult Equivalent.

Surprisingly, households located nearer to the armed groups increased their (food) expenditures substantially more than households living in localities free from their presence. Intake of calories, iron and zinc tended to decrease the most in villages indirectly affected by the presence of armed groups and to decrease the least in villages directly affected by the presence of armed groups. This pattern could signal that the presence of armed groups was rather innocuous and/or that food assistance was more effective in areas directly concerned by the conflict. Decreasing calories coupled with increased expenditures may also suggest that the increases in expenditures in household in proximity to rebels were driven by increases in prices. The increase in vitamin A consumption was equally stronger when armed groups were present in the village or region Examining child growth, however, reveals that children in directly affected villages grew by about 2cm less than their counterparts in villages indirectly or unaffected by the presence of armed groups.

We examined the evolution of the study outcomes by receipt of different forms of food assistance[2]. Households who received any food assistance (and especially SF) increased their (food) expenditures more than household without access to food assistance. The opposite holds true for GFD, however, and households who received two forms of aid had the smallest increase in expenditures. The share of food expenditures in the budget did not vary significantly with aid categories. Caloric intake decreased the most in households that received GFD and two forms of food assistance, which may suggest that aid prioritized the most vulnerable. Consumption of protein, iron and zinc did not significantly change over the period, and no strong pattern emerged with respect to aid. Consumption of vitamin A increased the most in recipients of food assistance (in any form). Finally, there was no obvious relationship between child growth and aid status.

6.8.1 Anthropometry and measurement error in dates of birth

Figure 15 presents the distribution of age in months in the two survey rounds for children under 5 years of age, showing a clear tendency of heaping at specific ages. Analysis of the distributions of the months of birth showed evidence heaping during the months of January and December. Similarly, analysis of the distributions of the day of birth found heaping on the first and last days of the month. Heaping was far more pronounced at baseline, suggesting that the measurement and/or recording of dates of birth had

[2] The findings in this section are descriptive and not causal.

improved during the survey period, and that the measurement error on dates of birth at endline was likely lower than at baseline.

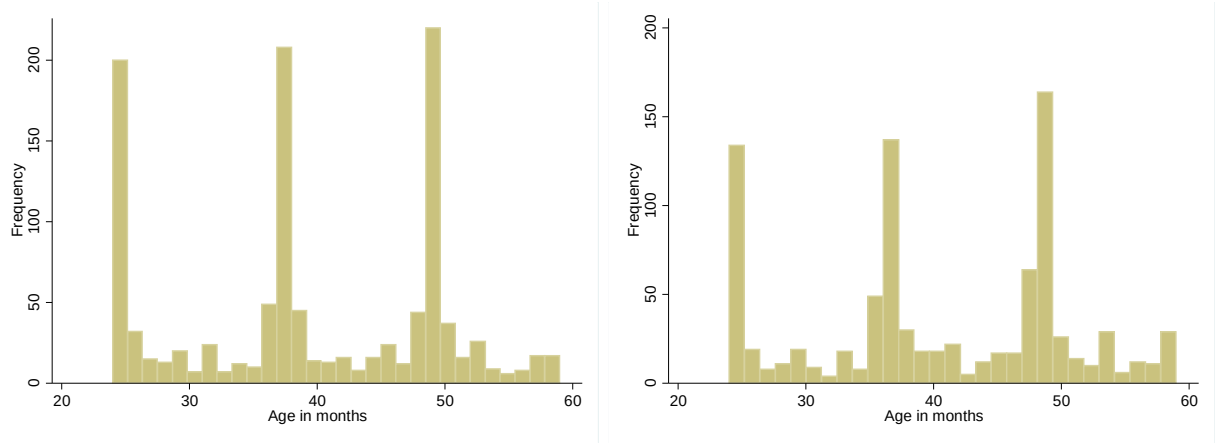


Figure 15: Distributions of child age in months at baseline (left) and endline (right), children 2-5 years of age, Mali. (Source: Household survey).

The analysis of the nutrition status of young children was therefore constrained by this well documented issue related to the misreporting in the measurement of dates of birth in areas of low parental education like Mali (Oshaug et al., 1994; Grellety and Golden, 2016; Larsen, Headey and Masters, 2017). We therefore limited the scope of the analysis of anthropometric data to weight for height (repeated cross-sections of children aged 2-5 years) and to changes in height within the youngest cohort in the panel study population, only including the panel of children aged 2-5 at baseline. We also examined treatment effects using a single cross-section at endline as part of the sensitivity analysis.

Table 10 provides summary statistics on age in months, weight for height z-score (WHZ) and the prevalence of acute malnutrition (WHZ<-2) in children under 5 years for the two surveys. Considering the age distributions for the two cross-sections (Figure 15), the differences observed during the study period should be interpreted with extreme caution. At follow-up, the prevalence of MAM was 7% and the prevalence of SAM was 6% (not reported). MAM prevalence was unchanged over the 5 year study period, whilst SAM increased by approximately 2% from baseline levels.

Table 10: Mean child age in months, weight for height (WHZ) and prevalence of acute malnutrition, Mali. (Source: Household survey).

		All		Prev. of	Girls			Boys		Prev. of
		Age (m)	WHZ	Wasting	Age (m)	WHZ	Wasting	Age (m)	WHZ	Wasting
Baseline	Mean	39.4	-0.43	12%	39.0	-0.51	12%	39.8	-0.36	12%
	S.D.	14.5	1.43		14.6	1.40		14.4	1.45	
	Obs.	1,443	1,881	1,879	703	899	898	740	982	981
Follow-up	Mean	35.9	-0.39	13%	35.5	-0.47	13%	36.2	-0.32	14%
	S.D.	17.3	1.54		17.9	1.49		16.7	1.57	
	Obs.	1,289	1,316	1,315	631	646	645	658	670	670

6.8.1 Education

Table 11 presents descriptive statistics of educational outcomes of the sample of children of compulsory school-age at both rounds. Overall, school enrolment was 48% at baseline, and decreased to 40% at

endline, with the largest reductions among boys (from 48% to 36%). This rate is well below the national average of 57% in 2015 (The World Bank, 2017). The proportion of school days missed in the previous week doubled from baseline to endline, with boys having the largest increases in absenteeism. Grade attainment increased slightly at follow-up, though overall levels remained extremely low, with the average child in both surveys not having completed two years of education. No marked differences between boys and girls were present. In both rounds, the most common reasons mentioned for being out-of-school included: labour (baseline: 28%, endline: 12%); child's young age (baseline: 8% respondents; endline: 5%); lack of interest in education (baseline: 17%, endline: 28%), and parental refusal to send children to school (baseline: 11%; endline: 23%). Poor school quality or distance to school were not mentioned often (less than 1% and 3% respectively in both rounds). At follow-up, 11% of children stated that they were not able to get back to school after the conflict events in 2012/13. In both rounds, there were gender differences in the reasons for non-participation in school: agricultural labour and animal-rearing were mentioned more often by boys (e.g. at endline, 13.5% boys viz. 10% girls), while early marriage and social norms keeping families from sending girls to school were mentioned only by girls. Boys had the largest levels of parental refusal to attend school (25% viz. 20.5% of girls). In focus groups, it emerged that the feeling of being abandoned by the state (especially prevalent in occupied villages) led some of the boys to join the rebel groups.

Table 11. Descriptive statistics of child enrolment, grade attainment and absenteeism, by survey round and child gender, Mali. (Source: Household survey).

	Baseline	Endline	Difference[a]
Enrolment			
Full sample	0.49	0.40	0.09*** (7.39)
	(0.50)	(0.49)	
	[3373]	[3556]	
Girls	0.50	0.43	0.07*** (4.11)
	(0.50)	(0.50)	
	[1577]	[1702]	
Boys	0.48	0.36	0.11*** (6.38)
	(0.50)	(0.48)	
	[1800]	[1854]	
Absenteeism			
Full sample	0.39	0.67	-0.27*** (-5.62)
	(1.21)	(1.38)	
	[1453]	[1430]	
Girls	0.35	0.61	-0.26*** (-4.07)
	(1.13)	(1.32)	
	[709]	[733]	
Boys	0.42	0.67	-0.29*** (-3.95)
	(1.28)	(1.43)	
	[744]	[697]	
Grade attainment			

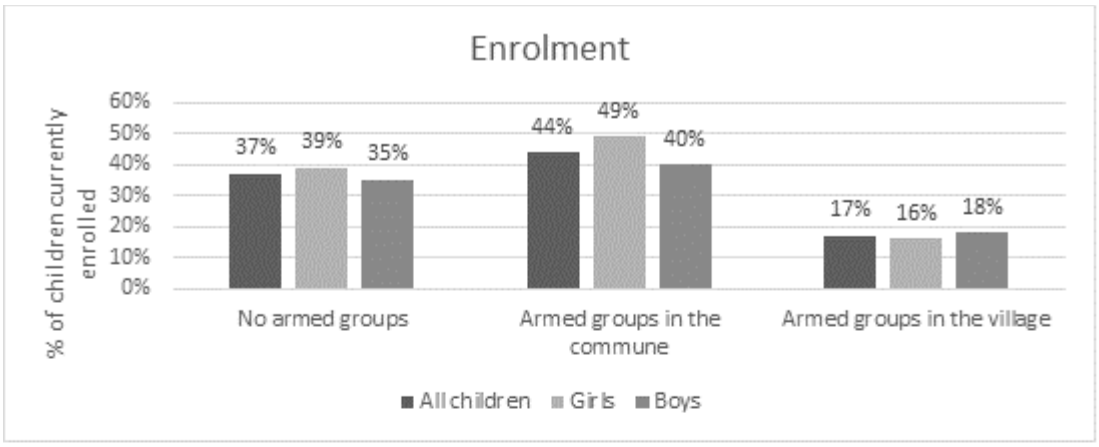
Full sample	1.46	1.79	-0.30*** (-5.65)
	(2.02)	(2.37)	
	[3373]	[3546]	
Girls	1.41	1.78	-0.355*** (-4.75)
	(1.98)	(2.26)	
	[1577]	[1701]	
Boys	1.51	1.71	-0.253*** (-3.34)
	(2.06)	(2.40)	
	[1800]	[1845]	

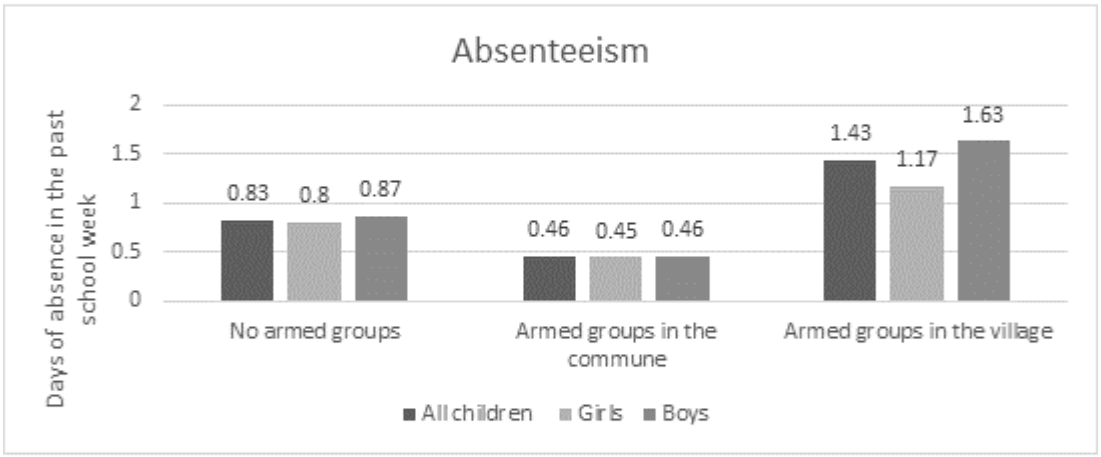
Notes: Children aged 7-16 years. Enrolment is a binary indicator indicating whether the child was currently enrolled in school; absenteeism is measured as number of days in the past five-day school week in which the child was absent (conditional on enrolment); grade attained is measured as number of years of education completed. Means and standard deviation in parentheses, observations in squared brackets. Differences in means and t-statistics in parentheses.

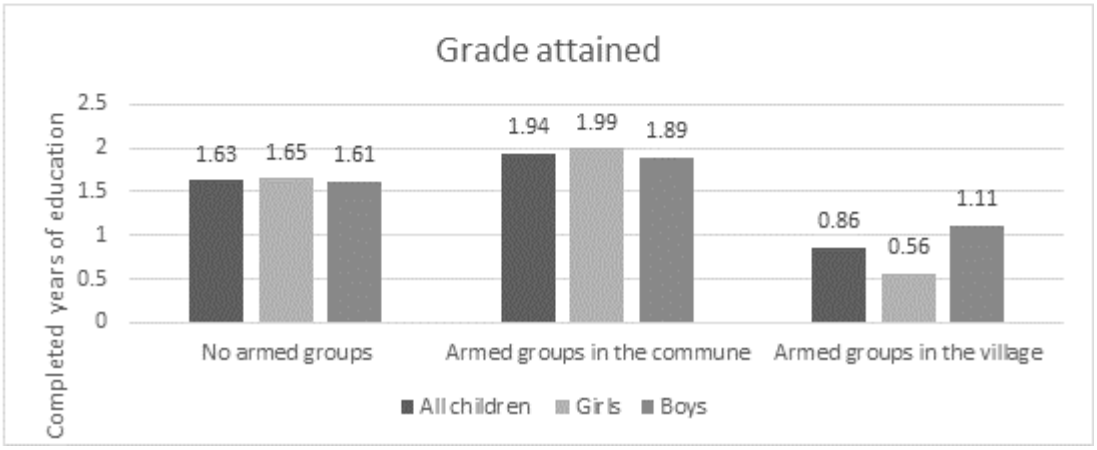
Figure 16 presents mean school-age children's education outcomes by conflict intensity and gender. As in previous research (e.g., Wald & Bozzoli, 2011), children in areas characterised by greater conflict levels had the lowest educational indicators in the sample. Only 17% of children in occupied villages were enrolled, as compared to 44% of children residing in villages where armed groups were present at the *commune* level, and 37% of children living in villages without armed groups. Grade attainment in occupied villages was also very low, with the average child not even completing a year of education. However, surprisingly, children living in areas without the presence of armed groups had lower outcomes than peers from areas where rebels occupied *communes* ($p<0.05$ across all indicators). In separate qualitative analysis, households in those areas reported widespread school dropout due to food shortages, which may contribute to explain this finding. There were no marked differences between boys and girls in areas indirectly affected by conflict and in areas where rebels were present at the *commune*-level. The only exception was enrolment in occupied *communes*, with only 40% of boys against 49% of girls being enrolled. In villages where armed groups were present, boys had completed on average an additional year of schooling than girls, but they were also more likely than girls to be absent from school.

Figure 17 presents educational outcomes by household receipt of food assistance. Children living in households receiving school feeding were more likely to be enrolled than children from households receiving any type of food assistance and GFD. They were also more likely to spend more years in school and to be absent from school less often than their peers not receiving school feeding. Girls from households receiving any type of food assistance were more likely to be enrolled than boys.

Figure 16. School-age children's mean educational outcomes at endline, by gender and conflict intensity. (Source: Household survey).

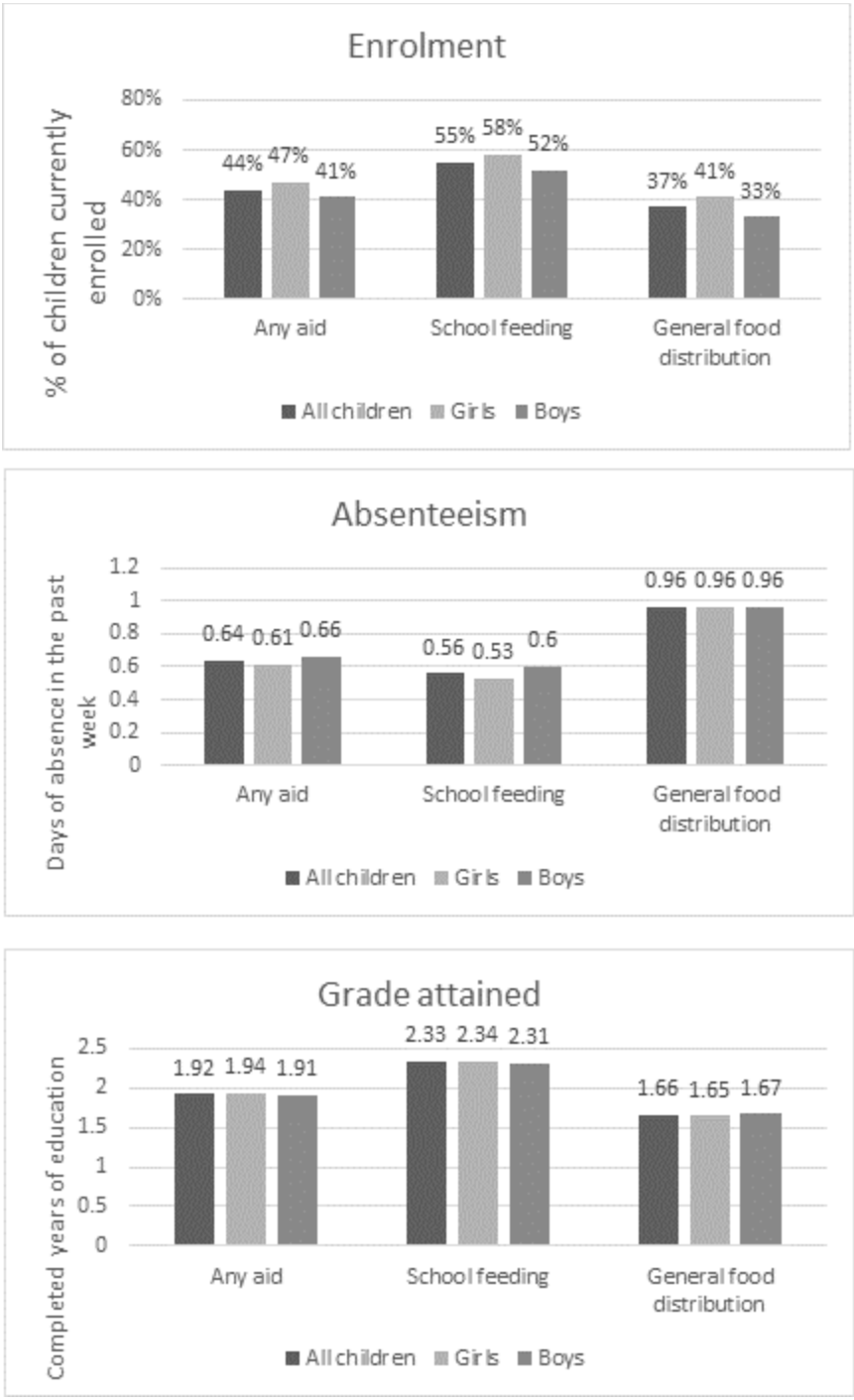






Notes: Children aged 7-16 years. Enrolment is a binary indicator indicating whether the child was currently enrolled in school; absenteeism is measured as number of days in the past five-day school week in which the child was absent; grade attained is measured as number of years of education completed. Conflict intensity is a categorical variable ranging from absence of armed groups; armed groups in the commune; armed groups in the village.

Figure 17. School-age children's mean educational outcomes at endline, by gender and type of food aid, Mali. (Source: Household survey).



Notes: Children aged 7-16 years. Enrolment is a binary indicator indicating whether the child was currently enrolled in school; absenteeism is measured as number of days in the past five-day school week in which the child was absent; grade attained is measured as number of years of education completed. Any aid, school feeding and food aid are dichotomous variables related to receipt of any food aid type; school feeding and food aid respectively in the previous 24 months.

6.9 Estimating the impact of food assistance on food security and nutrition outcomes

In the first set of estimations, we assume that the whole study population was affected by the conflict, whether directly or indirectly. Such a view is consistent with insights from tables 5 and 6. In areas where armed groups were absent, almost half (47%) of households reported fearing travel outside their village. Such a high proportion indicates widespread insecurity and fear, even in areas that are supposedly out of the direct reach of armed groups. In addition, the proportion of households that feared traveling outside their village was virtually the same in villages not directly affected by armed groups, but where armed groups were present in the wider region. This suggests that the demarcation between areas not affected and areas indirectly affected may not be very clear (unlike the distinction between indirectly and directly affected villages). Household respondents tended to feel more safe in areas supposedly out of reach of armed groups than in villages indirectly affected by armed groups (63% versus 48%) but the very high proportion of respondents who felt unsafe in either area further justified considering the whole study population as affected by insecurity.

Table 12 shows that few household-level covariates predict the likelihood to receive aid[3]. Household heads who identified as workers were more likely to receive GFD (but marginally less likely to receive any form of aid) and households who dedicated a larger share of their budget to food were less likely to participate in school feeding programs. Households with a higher value of assets were also more likely to participate in school feeding programs. Village-level covariates were more important in terms of allocation of aid than household level ones. Aid was less likely to be received in villages with access to a nearby market (remote areas seem to have been prioritized), in villages perceived to be very unsafe at baseline (although this did not appear to affect school feeding) and in villages where armed groups were present (for GFD and school feeding). The likelihood of receiving any aid or GFD was also lower in villages located in regions where armed groups are present. Finally, the existence of past development projects before the baseline explains the access to food aid in subsequent years. Columns 4 and 5, which show the results of a multinomial logit regression of the number of forms of aid received by the household, broadly confirm these findings.

Table 12: Example of logit model for aid participation for the estimation of treatment effects, Mali. (Source: Household survey).

				N. of forms of food assistance received	
	Any aid	GFD	SF	1	2
	(1)	(2)	(3)	(4)	(5)
Secondary school within 5km	-0.056	0.019	-0.31	0.070	-0.49
	(0.17)	(0.20)	(0.24)	(0.18)	(0.32)
Market within 5km	-0.85***	-0.95***	-0.64**	-0.68***	-1.92***
	(0.21)	(0.25)	(0.30)	(0.22)	(0.54)
Past project	0.74***	0.76***	0.73***	0.63***	1.16***
	(0.17)	(0.20)	(0.24)	(0.19)	(0.32)
Very unsafe	-0.62**	-0.91**	-0.16	-0.52	-1.10*
	(0.29)	(0.41)	(0.34)	(0.32)	(0.57)
Age household head	-0.0021	-0.00045	-0.0025	-0.0022	-0.0062
	(0.0061)	(0.0069)	(0.0084)	(0.0066)	(0.011)

[3] Further work is planned to better understand these mechanisms.

Expenditures per capita	2.1E-06	6.9E-07	3.3E-06	1.7E-06	3.0E-06
	(1.7E-06)	(1.9E-06)	(2.2E-06)	(1.8E-06)	(2.8E-06)
Household size	0.040	-0.014	0.052	0.040	0.059
	(0.044)	(0.053)	(0.058)	(0.048)	(0.079)
Dependency ratio	0.033	0.0016	0.16	-0.016	0.0083
	(0.10)	(0.12)	(0.14)	(0.11)	(0.18)
Food groups consumed	-0.0018	0.034	-0.057	-0.0022	0.046
	(0.063)	(0.072)	(0.088)	(0.068)	(0.011)
Polygamous household	-0.18	-0.12	-0.17	-0.13	-0.45
	(0.19)	(0.23)	(0.27)	(0.21)	(0.37)
Worker	0.73*	1.06***	-0.12	0.71*	1.39**
	(0.38)	(0.39)	(0.65)	(0.41)	(0.58)
Land cultivated	-0.0059	-0.030	0.024	-0.0047	-0.015
	(0.024)	(0.030)	(0.030)	(0.026)	(0.045)
1st quintile expenditures	0.47	-0.19	1.14	0.42	0.69
	(0.59)	(0.67)	(0.82)	(0.63)	(1.06)
2nd quintile expenditures	0.68	0.19	1.00	0.62	0.71
	(0.50)	(0.57)	(0.70)	(0.54)	(0.91)
3rd quintile expenditures	0.15	0.062	-0.19	0.15	0.22
	(0.43)	(0.49)	(0.64)	(0.47)	(0.80)
4th quintile expenditures	0.33	0.18	0.31	0.27	0.56
	(0.38)	(0.42)	(0.54)	(0.41)	(0.68)
% of food in budget	0.043	0.90	-1.77**	0.013	-0.52
	(0.55)	(0.66)	(0.71)	(0.60)	(0.99)
Logarithm of value of assets	0.042	-0.075	0.23***	0.014	0.067
	(0.053)	(0.060)	(0.076)	(0.058)	(0.095)
Armed groups in village	0.14	0.60**	-0.73**	0.28	-0.46
	(0.21)	(0.24)	(0.36)	(0.23)	(0.44)
Armed groups in region	-0.41**	-0.53**	-0.34	-0.45**	-0.25
	(0.21)	(0.23)	(0.27)	(0.23)	(0.35)
Observations (n)	981	975	975	981	975

Notes: Standard errors in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$

Tables 13 and 14 show how balanced the covariates used in the PSM are before and after weighting the treatment and control samples with the estimated propensity score. Austin (2009) recognizes that standardized differences below 10% do not manifest problematic imbalances in the distribution of covariates. With this threshold in mind, no less than 7 covariates are imbalanced in the raw sample for "Any aid" (column 1). In the weighted sample, however, standardized differences are below 10% for all covariates considered. For the dummy variable on the distance to secondary school for which the standardized difference was highest in absolute terms, the difference (-0.042) was well below the critical threshold. Similarly, for GFD, SF and "Types of aid" (when equal to 1), the imbalances in the raw sample are eliminated in the weighted sample (although the standardized difference for past village safety is 10% for GFD). When "Types of aid" equals 2, however, two covariates remain imbalanced after the weighting. Specifically, treated households are less likely to have access to a market within 5km and they are less likely to be polygamous. Nevertheless, we have a strong degree of confidence that the matched DID estimations can eliminate observable sources of selection bias for each treatment variable, at least for 4 out of 5 aid categories.

Table 13: Standardized differences in raw and weighted samples, Mali. (Source: Household survey).

	(1)	(2)	(3)	(4)	(5)	(6)
Sample:	**Raw**	**Weighted**	**Raw**	**Weighted**	**Raw**	**Weighted**

Treatment:	Any aid	Any aid	GFD	GFD	SF	SF
Secondary school within 5km	-0.013	-0.042	-0.029	0.056	-0.08	-0.007
Market within 5km	**-0.248**	-0.003	**-0.284**	0.013	**-0.209**	-0.012
Past project in village	**0.268**	-0.034	**0.21**	0.034	**0.349**	-0.011
Very unsafe	**-0.127**	0.03	**-0.23**	**-0.1**	**0.1**	-0.004
Age household head	-0.007	-0.006	-0.014	-0.018	-0.022	0.015
Expenditures per capita	0.073	0.007	**0.16**	-0.022	-0.073	0.017
Household size	-0.009	-0.029	**-0.128**	0.036	0.068	-0.013
Dependency ratio	0.053	-0.002	0.01	0.014	**0.121**	-0.029
food groups	0.002	-0.0004	0.03	0.003	-0.089	-0.024
Polygamous	-0.081	-0.0098	**-0.126**	0.023	-0.044	-0.0001
Worker	**0.147**	-0.01	**0.242**	-0.005	-0.067	-0.007
Land cultivated	0.018	-0.026	**-0.119**	-0.003	**0.197**	-0.022
1st quintile expenditures	-0.084	0.011	**-0.123**	-0.008	0.076	0.017
2nd quintile expenditures	**0.125**	-0.011	0.075	0.018	**0.16**	-0.01
3rd quintile expenditures	**-0.104**	-0.015	-0.016	-0.002	**-0.291**	-0.005
4th quintile expenditures	0.06	0.014	0.066	-0.012	-0.008	-0.01
Food % in budget	0.029	0.002	**0.182**	-0.029	**-0.269**	0.019
Logarithm of assets value	0.059	-0.022	-0.092	-0.004	**0.261**	-0.001
Armed groups in village	0.01	0.012	**0.171**	0.0002	**-0.293**	-0.004
Armed groups in region	**-0.181**	0.001	**-0.221**	-0.012	**-0.172**	0.002
Observations (n)	1024	1024	1012	1012	1012	1012

Note: Numbers in bold highlight when standardised differences are greater than 10%.

Table 14: Standardized differences in raw and weighted samples for types of food assistance, Mali. (Source: Household survey).

Sample	(1) Raw	(2) Weighted	(3) Raw	(4) Weighted
Types of aid =	1	1	2	2
Secondary school within 5km	0.074	0.024	-0.04	-0.067
Market within 5km	**-0.181**	-0.005	**-0.472**	**-0.193**
Past project	**0.147**	0.027	**0.356**	-0.023
Very unsafe	**-0.107**	-0.013	**-0.1**	0.038
Age household head	-0.049	-0.001	0.035	0.001
Expenditures per capita	0.074	-0.02	0.091	0.099
Household size	0.059	0.028	-0.096	-0.08
Dependency ratio	0.059	0.014	0.022	0.013
Food groups consumed	-0.032	-0.014	**0.135**	-0.003
Polygamous household	-0.058	0.009	**-0.188**	**-0.126**
Worker	**0.149**	0.026	**0.221**	0.03
Land cultivated	-0.012	0.018	-0.088	-0.03
1st quintile expenditures	-0.137	0.003	**-0.148**	0.029
2nd quintile expenditures	**0.133**	0.016	0.078	-0.019
3rd quintile expenditures	-0.032	-0.006	0.043	0.011
4th quintile expenditures	0.04	-0.025	0.087	-0.051
Food % in budget	-0.002	0.011	0.014	0.043
Logarithm of assets value	0.029	0.014	0.017	0.063
Armed groups in village	0.087	0.019	-0.088	0.059
Armed groups in region	0.081	0.005	**-0.107**	0.055
Observations (n)	1024	1024	1024	1024

Note: Numbers in bold highlight when standardised differences are greater than 10%.

The impact estimates of food assistance are summarized in Table 15 for the full sample. Any food assistance and GFD were found to increase total and food expenditures, whereas school feeding the receipt of just one form of aid were found to increase food expenditures. These effects were strongly statistically significant (at the 1% level for GFD and at least the 5% level for any aid and 1 form of aid). In terms of total expenditures, the effect of the GFD was estimated at 2962 CFA/month per AE, corresponding to an increase of 19% from baseline. For food expenditures, the impact of school feeding was 2475 CFA/month per AE, equivalent to an increase of 24% from baseline values. There were also positive effects on micro-nutrient availability from household food consumption during the 7-day recall period. Consumption of vitamin A strongly increased for recipients of food assistance (of any type, except for recipients of 2 forms of aid). A marginally significant negative effect of 2 forms of aid was found for WHZ scores, however no effects were found on the prevalence of MAM (both results not reported).

Table 15: Estimations of the impact of food assistance on household food expenditures, food consumption and on children's height. Full sample, Mali. (Source: Household survey).

	Any aid	GFD	SF	1 form	2 forms
	(1)	(2)	(3)	(4)	(5)
ΔMonthly expenditures (FCFA)	2328.07**	2962.79***	2209.93*	2717.05**	941.582
	(975.81)	(963.93)	(1264.09)	(1118.31)	(1692.89)
	[1940]	[1926]	[1916]	[1938]	[1424]
ΔMonthly food expenditures (FCFA)	1797.33**	2475.14***	1462.27	2040.29***	988.35
	(724.76)	(717.18)	(1016.51)	(702.66)	(1258.22)
	[1942]	[1936]	[1915]	[1942]	[1574]
ΔFood expenditure as % of budget	0.014	0.007	0.026	0.010	0.026
	(0.017)	(0.019)	(0.020)	(0.018)	(0.032)
	[1843]	[1837]	[1815]	[1843]	[1373]
ΔCalories (kcal) consumed daily	50.54	124.72	58.58	68.59	-17.51
	(215.125)	(219.75)	(245.09)	(205.57)	(261.36)
	[1971]	[1971]	[1938]	[1971]	[1606]
ΔProtein (gram) consumed daily	4.36	7.951	3.04	5.52	3.40
	(5.23)	(4.97)	(6.68)	(5.142)	(8.30)
	[1955]	[1948]	[1902]	[1952]	[1593]
ΔIron (mg) consumed daily	0.95	1.68	-0.09	1.54	-0.67
	(1.08)	(1.41)	(1.50)	(1.11)	(2.01)
	[1950]	[1937]	[1898]	[1947]	[1582]
ΔZinc (mg) consumed daily	1.43	1.23	-1.08	1.87	-2.38
	(1.74)	(2.23)	(2.15)	(1.97)	(2.69)
	[1954]	[1946]	[1911]	[1954]	[1573]
ΔVitamin A (mcg) consumed daily	189.32***	295.78***	156.70**	166.87**	178.21
	(59.16)	(94.85)	(67.53)	(81.58)	(137.8)
	[2024]	[2012]	[2013]	[2018]	[1685]
ΔDietary diversity score	0.026	0.291	-0.231	0.051	-0.251
	(0.157)	(0.195)	(0.252)	(0.189)	(0.274)
	[2290]	[2294]	[2282]	[2288]	[1920]
ΔHeight (cm)	-0.107	-0.652	0.045	-0.305	0.818
	(1.444)	(1.784)	(1.529)	(1.445)	(3.201)

	[1947]	[1953]	[1960]	[1956]	[1866]

Note: Bootstrapped standard errors in parentheses. Number of observations in square brackets. All expenses are scaled per adult equivalent (AE). The variables "1 form" and "2 forms" refer to the number of forms of aid received by the household, as indicated by the Types of aid variables. Estimations for Height restricted to children under 5 years of age at baseline. $*$ p < 0.1, $**$ p < 0.05, $***$ p < 0.01.

6.9.1 Heterogeneity analysis by level of conflict exposure

The treatment effects reported above were estimated under the assumption that the whole sample was affected by insecurity. In what follows, we investigated whether stronger, or more direct, exposure to armed conflict influenced the impact of food assistance. Specifically, we estimated the impact on aid on three subgroups: i) villages unaffected by the presence of armed groups, ii) villages indirectly affected by the presence of armed groups (they were present in the region but not in the village), and iii) villages directly affected by the presence of armed groups. The number of observations was small for estimations on the subsample of directly affected villages. We dropped from the table of results all the estimations that were based on fewer than 30 observations in either the treatment or control group at baseline and/or endline. This condition was always met on the subsamples of unaffected and indirectly affected villages. For directly affected villages, however, the condition was systematically violated for school feeding and when types of aid equal 2. There were also an insufficient number of observations to estimate the impact of any treatment variable on children's height. To ensure that the covariates were balanced in these subsamples, we re-ran the estimations of the propensity score at the level of the subgroups. Even within the three subgroups, the kernel propensity score DID estimator was effective at balancing covariates between treatment and control groups.

Table 16 summarizes the impact estimates in the sub-sample of the study population living in villages with no armed groups in the region. While food assistance in the form of SF had a positive impact on food expenditures, the estimated effects of aid tended to be lower in magnitude and less precisely estimated than in table 15. The effect of any aid, GFD, SF and two forms of aid were very large on consumption of vitamin A but the previous effects on zinc and iron do not manifest in table 16. A marginally significant negative effect of GFD was found for WHZ scores in children under 5 years of age (not reported).

Table 16: Estimations of the impact of food assistance on households' food expenditures, food consumption and children's height. Sample: No armed groups in the region, Mali. (Source: Household survey).

	Any aid	**GFD**	**SF**	**1 form**	**2 forms**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
ΔMonthly expenditures (FCFA)	876.21	1798.46	2732.25*	1192.37	1892.68
	(1377.90)	(1850.86)	(1492.06)	(1533.26)	(2389.04)
	[687]	[689]	[692]	[651]	[620]
ΔMonthly food expenditures (FCFA)	760.65	1207.64	362.85	986.41	173.09
	(1042.68)	(1229.36)	(1274.98)	(987.15)	(1632.73)
	[690]	[672]	[703]	[661]	[550]
ΔFood expenditure as % of budget	-0.009	0.006	0.001	-0.004	-0.009
	(0.031)	(0.034)	(0.038)	(0.033)	(0.043)
	[659]	[660]	[652]	[604]	[579]
ΔCalories (kcal) consumed daily	63.59	-14.64	-255.99	22.86	-330.42
	(314.97)	(337.84)	(388.76)	(336.55)	(516.48)

	[697]	[686]	[694]	[642]	[640]
ΔProtein (gram) consumed daily	0.55	-0.91	-8.50	3.11	-11.22
	(9.59)	(10.33)	(9.88)	(10.29)	(11.35)
	[685]	[684]	[689]	[659]	[631]
ΔIron (mg) consumed daily	-0.74	-0.61	-3.80	0.21	-6.15**
	(1.81)	(2.39)	(2.83)	(2.33)	(2.45)
	[686]	[678]	[681]	[646]	[629]
ΔZinc (mg) consumed daily	-0.40	-0.55	-4.94	1.20	-5.92
	(2.98)	(3.93)	(3.43)	(3.54)	(3.98)
	[675]	[661]	[668]	[619]	[581]
ΔVitamin A (mcg) consumed daily	166.96*	353.94***	202.93	67.39	499.97***
	(94.314)	(121.40)	(155.49)	(121.63)	(161.57)
	[704]	[706]	[710]	[691]	[658]
ΔDietary diversity score	-0.03	0.386	-0.236	-0.171	0.14
	-0.247	-0.33	-0.413	-0.338	-0.466
	[806]	[790]	[810]	[798]	[744]
ΔHeight (cm)	-2.222	-3.813	-1.302	-0.837	-5.609
	-2.817	-2.798	-3.204	-2.215	-4.45
	[745]	[669]	[699]	[706]	[725]

Note: Bootstrapped standard errors in parentheses. Number of observations in square brackets. All expenses are scaled per adult equivalent (AE). The variables "1 form" and "2 forms" refer to the number of forms of aid received by the household, as indicated by the Types of aid variables. Estimations for Height restricted to children under 5 years of age at baseline. * p < 0.1, ** p < 0.05, *** p < 0.01.

Table 17 summarizes the impact estimates in the sub-sample of the study population living where armed groups were found in the region but not in their village. Total and food expenditures tended to be higher for aid recipients than for other households. The standard errors of the estimates were quite large but most of these effects were statistically distinguishable from zero at the 10% level. Receiving two forms of aid was associated with an increase in the availability of calories, protein, iron and zinc, but these effects were not statistically significant. Interestingly, the provision of two forms of aid increased the height of children aged 2-5 years at baseline by approximately 7cm in the intervention households compared to controls, equivalent to an increase of about 8% from baseline. A marginally significant negative effect of GFD was found for WHZ scores in children under 5 years of age (not reported).

Table 17: Estimations of the impact of food assistance on households' food expenditures, food consumption and children's height. Sample: Armed groups in the region but not in the village, Mali. (Source: Household survey).

	Any aid	**GFD**	**SF**	**1 form**	**2 forms**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
ΔMonthly expenditures (FCFA)	2706.035*	2329.867*	1206.558	3853.847*	-660.763
	(1468.077)	(1195.530)	(2399.214)	(2095.634)	(2330.847)
	[1024]	[1003]	[963]	[1017]	[664]
ΔMonthly food expenditures (FCFA)	2120.149	2294.578*	1908.581	2629.890*	608.109
	(1293.003)	(1223.865)	(1306.020)	(1365.013)	(2078.216)
	[1019]	[1010]	[962]	[1014]	[708]
ΔFood expenditure as % of budget	0.039	0.025	0.048	0.036	0.050

	(0.026)	(0.032)	(0.041)	(0.033)	(0.042)
	[959]	[951]	[922]	[954]	[640]
ΔCalories (kcal) consumed daily	10.510	172.764	151.985	69.074	52.239
	(279.948)	(302.399)	(346.446)	(358.342)	(489.835)
	[1048]	[1024]	[963]	[1044]	[768]
ΔProtein (gram) consumed daily	6.314	11.640	5.627	5.059	9.563
	(6.564)	(7.176)	(10.648)	(7.919)	(12.226)
	[1038]	[1021]	[977]	[1031]	[764]
ΔIron (mg) consumed daily	1.283	2.673	1.006	1.003	1.098
	(1.573)	(1.877)	(2.230)	(1.565)	(3.207)
	[1044]	[1028]	[980]	[1037]	[763]
ΔZinc (mg) consumed daily	1.737	1.197	-0.947	1.367	-1.635
	(2.897)	(3.127)	(3.780)	(3.433)	(4.121)
	[1052]	[1027]	[975]	[1043]	[775]
ΔVitamin A (mcg) consumed daily	100.134	75.209	115.514	93.368	-17.939
	(121.279)	(128.168)	(116.573)	(124.989)	(189.667)
	[1096]	[1086]	[1024]	[1090]	[847]
ΔDietary diversity score	-0.179	-0.004	-0.326	-0.04	-0.904*
	-0.23	-0.355	-0.357	-0.28	-0.498
	[1238]	[1218]	[1164]	[1230]	[924]
ΔHeight (cm)	2.265	3.273	-0.07	0.829	7.244***
	-1.791	-2.286	-1.842	-1.645	-2.661
	[1002]	[979]	[965]	[1006]	[961]

Note: Bootstrapped standard errors in parentheses. Number of observations in square brackets. All expenses are scaled per adult equivalent (AE). The variables "1 form" and "2 forms" refer to the number of forms of aid received by the household, as indicated by the Types of aid variables. Estimations for Height restricted to children under 5 years of age at baseline. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 18 displays the impact estimates in the sub-sample of the study population living in villages with armed groups present. No significant positive impact was identified on food expenditures in households receiving any aid, GFD, or one form of aid. Consumption of zinc, iron and vitamin A however, was significantly increased for recipients of any food aid (zinc, iron) and GFD (vitamin A). No statistically significant results were found for the other outcomes.

Table 18: Estimations of the impact of food assistance on households' food expenditures, food consumption and children's height. Sample: Armed groups in village, Mali. (Source: Household survey).

	Any aid	**GFD**	**SF**	**1 form**	**2 forms**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
ΔMonthly expenditures (FCFA)	-515.278	-3.5e+03	.	-5.4e+03	.
	(4951.504)	(8375.032)	.	(6272.746)	.
	[181]	[158]	[44]	[191]	[54]
ΔMonthly food expenditures (FCFA)	39.041	-1.4e+03	.	-2.6e+03	.
	(2846.860)	(3770.774)	.	(3441.452)	.
	[185]	[172]	[44]	[195]	[53]
ΔFood expenditure as % of budget	-0.000	0.013	.	-0.014	.

	(0.068)	(0.074)	.	(0.069)	.
	[183]	[158]	[44]	[193]	[53]
ΔCalories (kcal) consumed daily	662.249	236.542	.	568.159	.
	(786.700)	(765.111)	.	(840.465)	.
	[227]	[231]	[44]	[221]	[44]
ΔProtein (gram) consumed daily	15.810	13.633	.	18.612	.
	(18.494)	(15.663)	.	(15.621)	.
	[232]	[232]	[43]	[228]	[46]
ΔIron (mg) consumed daily	6.328*	5.064	.	4.965*	.
	(3.529)	(3.671)	.	(2.968)	.
	[222]	[192]	[42]	[210]	[42]
ΔZinc (mg) consumed daily	19.440***	14.770***	.	16.667**	.
	(6.194)	(7.302)	.	(6.711)	.
	[223]	[225]	[43]	[219]	[37]
ΔVitamin A (mcg) consumed daily	350.518	546***	.	548.845***	.
	(227.941)	(196.062)	.	(188.670)	.
	[187]	[181]	[47]	[167]	[33]
ΔDietary diversity score	0.203	0.226	.	0.122	.
	-0.621	-0.549	.	-0.605	.
	[242]	[238]	[44]	[226]	[54]

Note: Bootstrapped standard errors in parentheses. Number of observations in square brackets. All expenses are scaled per adult equivalent (AE). The variables "1 form" and "2 forms" refer to the number of forms of aid received by the household, as indicated by the Types of aid variables. Estimations for Height restricted to children under 5 years of age at baseline. $*$ p < 0.1, $**$ p < 0.05, $***$ p < 0.01.

6.9.2 Estimating the impact of food assistance on anthropometry indices for children aged 6-59m using a single-cross section at endline

As a part of the sensitivity analysis for the age-distribution related constraints described in section 4.8.1, we undertook additional analysis of treatment effects for anthropometry outcome data using the single cross section at endline only (including HAZ, WHZ, WAZ and the prevalence of stunting, wasting and underweight). The propensity scores used to develop the kernel weights were estimated using the same specifications used in the DID analysis with the baseline data, with added controls in the regression models for child gender and age at follow-up. In essence, we use baseline characteristics to match households and then run the regressions on outcomes at endline only. The results found no evidence of the impact of food assistance on the anthropometry-related indices at follow-up, including both in the whole sample and in the different subgroups (involving no armed group presence, presence of armed group in the region and presence of armed groups in the village). Unlike the main treatment effect estimations presented in this study that employ both PSM and DID, by using a single cross-section we lose the ability to control for time-invariant unobserved characteristics in the study population, so the internal validity of these estimates is expected to be not as strong as the main treatment effect estimations presented in this analysis.

6.10 Estimating the impact of food assistance on education outcomes

In the full sample, the estimated densities of propensity scores between treatment and comparison groups score displayed a high degree of overlap across all food assistance modalities. Table A5.1 reports the baseline characteristics between treated and untreated households at baseline in the original unmatched samples. Treated and untreated households were different in a number of household and village characteristics. Table A5.2 presents the comparison of baseline characteristics between treated and untreated households in the matched sample. After applying the propensity score weights in the matching, all the standardised differences in the baseline covariates were below 10%, which is the usual threshold for potentially-problematic imbalances in the distribution of baseline characteristics (Austin, 2009). We conclude that the propensity-score matching was fairly effective in eliminating observable sources of selection bias. We also conducted separate balance analyses for the sub-samples of boys and girls and in both cases found no differences above the threshold for unbalanced covariates (available upon request).

The impact estimates for child education are reported in Table 19. Panels A, B and C report treatment effects for enrolment, absenteeism and grade attainment respectively. School feeding had a positive impact on children's enrolment, with an increase of about 11 percentage points in the probability of enrolment for treatment children as compared to children in the comparison group. This is a large increase, particularly in light of the very low enrolment levels in Mali, and was equivalent to a fifth of a standard deviation in the endline enrolment rate. No gender differences in the effect of school feeding on enrolment were evident. School feeding also positively affected grade attainment, with treated children achieving, on average, more than half additional years of education than comparison peers. The school feeding effect was slightly larger for girls, who achieved additional 0.6 years than for boys. School feeding treatment effect on absenteeism was negative, but the coefficient was fairly small and not significant.

In contrast, the receipt of GFD did not affect enrolment nor grade attainment. Importantly, the receipt of GFD increased absenteeism by more than half a school-day per week for both boys and girls. This result was driven by boys: those from households receiving GFD were absent, on average, an additional day per week (an increase of 20% over boys in the control group), while for girls the point estimate was positive but not statistically different from zero. A similar finding was found in rural Burkina Faso by Kazianga et al. (2012), who documented increased absenteeism from receiving take-home rations. Though GFD and take-home rations are not equivalent programmatically, and are designed with different goals, both are transfers that involve household food rations and emerging evidence suggests that they may in fact operate similar impact pathways.

Overall, these findings highlight that the two programmes had diverging impacts in terms of children's schooling, with school feeding having a large effect on enrolment rates and attainment, and GFD appearing to increase absenteeism. The impacts of both programmes on education also varied by child gender. Robustness checks are reported in Appendix 6.

Table 19. Impact of food assistance on child education, full sample and stratified by gender, Mali. (Source: Household survey).

	Any aid	SF	GFD
	Enrolment		
Full sample	0.051	0.101**	0.031
	(0.035)	(0.040)	(0.044)

	[4,296]	[4,219]	[4,267]
Girls	0.033	0.112*	-0.000
	(0.048)	(0.066)	(0.063)
	[1,885]	[1,827]	[1,869]
Boys	0.086*	0.113**	0.029
	(0.049)	(0.052)	(0.052)
	[2,104]	[2,101]	[2,063]
	Absenteeism		
Full sample	-0.071	-0.089	0.529***
	(0.169)	(0.157)	(0.190)
	[1,403]	[1,293]	[1,321]
Girls	-0.101	-0.117	0.430
	(0.197)	(0.251)	(0.273)
	[667]	[654]	[613]
Boys	0.066	0.359	0.982***
	(0.238)	(0.226)	(0.303)
	[649]	[636]	[628]
	Grade attainment		
Full sample	0.040	0.551***	-0.222
	(0.126)	(0.176)	(0.142)
	[4,283]	[4,194]	[4,261]
Girls	0.067	0.628***	-0.229
	(0.201)	(0.232)	(0.249)
	[1,884]	[1,825]	[1,867]
Boys	0.124	0.523**	-0.272
	(0.193)	(0.215)	(0.290)
	[2,098]	[2,093]	[2,057]

Notes: * p<0.1; ** p <0.05; *** p<0.01. Difference-in-difference estimates with propensity score. Estimates include child age, gender, a dichotomous variable for child first-born and whether the first-born was male. Bootstrapped standard errors in parentheses. Enrolment is a binary indicator indicating whether the child was currently enrolled in school (conditional on enrolment); absenteeism is measured as number of days in the past five-day school week in which the child was absent; grade attained is measured as number of years of education completed.

6.10.1 Heterogeneity by conflict exposure

The propensity scores estimation and balance tests were repeated separately in the three conflict intensity subgroups (available upon request). All weighted baseline covariates for the different forms of food assistance were balanced in the subgroup of villages indirectly affected by the conflict and in villages where armed groups were only present at *commune* level[4]. However, there were numerous unbalanced covariates in the subgroup of villages occupied by armed groups, most likely due to the small number of observations involved. This subgroup was therefore excluded from the estimations. To avoid losing this information, we merged the two conflict affected subgroups into a single group with villages where rebels were present at either the commune or the village level, for which balance of matched covariates was satisfying. Subgroup analysis by degree of conflict exposure and gender was not possible due to the small sample sizes and additional unbalances in matched covariates.

Table 20 presents treatment effects by conflict intensity. As in Table 19, Panels A, B and C report treatment effects for enrolment, absenteeism and grade attainment respectively for each three groups of conflict intensity (e.g. no armed groups; armed groups in the *commune*; armed groups in the *commune* or in the village). Overall, any type of aid received had a positive effect on enrolment only in the case of households residing in occupied communes, with a 12 percentage point increase in the chances of being enrolled. School feeding had a positive impact on enrolment in all three groups, but none of the point estimates were statistically significant from zero. School feeding, again, had no statistically significant effects on absenteeism in conflict-affected subgroups, but it increased grade attainment in villages indirectly affected by conflict events, with an average increase of about 0.6 additional school years.

The negative effect of food aid on school attendance observed in the full sample was mostly driven by villages most directly affected by conflict: while GFD had no effect on child absenteeism in villages where no armed groups were present, receipt of GFD led to increases of 0.4 and about 0.8 additional absentee days in villages where armed groups were present at the *commune*-level, and in villages where they were present at the *commune* or village-level respectively.

Table 20. Impact of food assistance on child education by intensity of exposure to conflict in Mali. (Source: Household survey).

	Any aid	SF	GFD
Panel A. Enrolment			
No armed groups	0.016	0.037	-0.087
	(0.043)	(0.070)	(0.080)
	[1,765]	[1,754	[1,560
Armed groups in the commune	0.118**	0.110	0.098
	(0.048)	(0.070)	(0.060)
	[2,056	[1,924	[1,797
Armed groups in the commune or in the village	0.083	0.091	0.012
	(0.055)	(0.063)	(0.055)
	[2,519	[2,219	[2,553
Panel B. Absenteeism			
No armed groups	-0.032	0.492	-0.043

[4] One exception was the index of school governance in the case of communities indirectly affected by conflict, for which the difference in the case of any aid and food aid was 0.12. This was only marginally higher the critical threshold of 0.1, therefore we do not take this as an evidence of strong imbalances in the matched samples.

	(0.254)	(0.299)	(0.309)
	[589	[521	[486
Armed groups in the commune	0.276	-0.148	0.419**
	(0.211)	(0.245)	(0.199)
	[773	[621	[591
Armed groups in the commune or in the village	0.200	0.100	0.773***
	(0.194)	(0.221)	(0.249)
	[856	[745	[790
Panel C. Grade attainment			
No armed groups	0.050	0.609***	-0.125
	(0.242)	(0.210)	(0.351)
	[1,756	[1,746	[1,551
Armed groups in the commune	0.079	0.339	-0.124
	(0.216)	(0.293)	(0.232)
	[2,056	[1,918	[1,793
Armed groups in the commune or in the village	0.040	0.365	-0.262
	(0.171)	(0.305)	(0.225)
	[2,517	[2,217	[2,545

Notes: * p<0.1; ** p <0.05; *** p<0.01. Difference-in-difference estimates with propensity score. Estimates include child age, gender, a dichotomous variable for child first-born and whether the first-born was male. Number of observations in square brackets. Enrolment is a binary indicator indicating whether the child was currently enrolled in school; absenteeism is measured as number of days in the past five-day school week in which the child was absent(conditional on enrolment); grade attained is measured as number of years of education completed. Conflict intensity was defined by three dichotomous indicators: household residing where no armed groups were present at either village or commune ("district") level; household residing where armed groups were present at commune-level only; household residing where armed groups where present either at commune or village. It was not possible to estimate the effect of aid in villages directly occupied by armed groups as there were not enough observations that ensured balance in the propensity score between treatment and comparison groups.

6.10.2 Exploring pathways of impact: Child labour

As discussed in Section 3, child labour is an important response strategy in face of shocks such as conflict, potentially leading to increased absenteeism and drop-out. In this section, we test whether changes in child labour by type of food assistance could explain the differential effects of school feeding and GFD on schooling, as well as the observed gender differences in attendance induced by GFD. The household surveys collected information on labour of all members older than 5 years during the previous calendar year. Three dichotomous indicators of participation in labour for children of mandatory school-age were developed: participation in any work (including farm work, housework and waged/business work); participation in farm-work (including agriculture and animal-rearing activities) and participation in housework (household chores and care). Participation in waged/business work was not included as a separate outcome as its prevalence was extremely low (about 2% in both survey rounds). The household survey included follow-up questions on the number of months in which children were involved in any specific activity, which enabled the generation of three additional indicators on the duration (in months) of participation in any work activity. For the category related to duration of any type of work, we summed the months spent in all activity types for each child, for a maximum of 12 months. Descriptive statistics show that coherently with the expectations of increased participation following the multiple shocks of conflict and drought, and the noted decreases in school participation, involvement in child labour activities increased markedly between survey rounds. Also, they highlight a gendered pattern of

participation in labour, with boys being more involved in farm-related activities and girls tending to work more within the household.

Table 21 presents treatment effects of food assistance on both participation in labour (Panels A1-C1) and duration of work (Panels A2-C2) for school-age children. We report three main findings. First, consistently with the educational findings, receipt of GFD led to marked increases in the probability of participating in any type of activity by about 12 percentage points for the full sample. This translated in about an additional month of work in any activity in the previous year (Panel A2). Though the coefficients for the treatment effects for school feeding were suggestive of a protective effect (i.e. decrease in participation and time spent in labour) the impacts were not statistically significant for the full sample.

Second, important gender heterogeneities were present: although GFD increased chances of any work involvement in the full sample, these effects appeared to be driven by boys (Panel A1). These had a 20-percentage point increase (significant at the 1% level) in the likelihood of being involved in any work activities over comparison peers. The treatment effect for girls in GFD was also positive, but the point estimate was smaller than for boys and only significant at 10%. In terms of average time spent in labour, receiving GFD translated in about 1.5 additional months boys spent in all work activities considered (panel A2). Conversely, school feeding decreased girls' participation in any labour activities by about 10 percentage points, which accounted to a reduction in work time of about a month per year.

Further, the indicators related to participation in farm-related labour and housework moved in opposite directions for boys and girls. In the case of girls, school feeding led to a decrease in time spent on farming and animal-rearing by nearly a month, while no significant changes in housework were evident. By contrast, for boys the probability of participating in farm work increased across all food assistance types and for GFD by about 13 percentage points. Also, boys receiving GFD had 9 percentage points higher likelihood of working in household chores and care, leading to an increase of about one additional month spent in these activities as compared to comparison peers. We disaggregated the estimates by exposure to conflict intensity to test whether the shifts in child work were larger in areas that were most affected by conflict events. The results (not reported) showed that this seemed to be the case, especially for any work and farm activities. This is coherent with the fact that child labour may increase especially where the conflict-related shocks were larger.

Overall, these results corroborate the gendered division of work observed in the descriptive statistics and related gender differences in the opportunity costs of schooling, which may also explain the differences in attendance between boys and girls. For girls, school feeding led to a shift away from farm work, as these activities may be less compatible with schooling. A similar finding was reported by Kazianga and co-authors (2012). However, for boys, receipt of any programme, and GFD in particular, led to increases in any type of work. We can speculate that if the opportunity cost of schooling was higher for boys (e.g. due to their greater involvement in farm and animal-rearing activities), and particularly so in areas characterised by higher conflict intensity, it may be plausible that the income effect stemming from the receipt of either food programmes was not sufficient to shield boys from the increased demand for their labour following the multiple shocks generated by the conflict and drought. As noted, the largest increases in boys' participation in work were among children in the GFD group: this may provide a plausible mechanism for the documented increases in school absenteeism for boys living in households receiving this type of food assistance.

Table 21. Impact of food assistance on child labour participation and duration, full sample and stratified by gender in Mali. (Source: Household survey).

	Any aid	SF	GFD	Any aid	SF	GFD
	A1. Participation in any work			**A2. Months spent in any work**		
Full sample	0.078**	-0.023	0.123***	0.538	-0.553	0.976**
	(0.032)	(0.037)	(0.030)	(0.358)	(0.456)	(0.407)
	[4,084]	[4,024]	[4,043]	[4,083]	[4,017]	[4,053]
Girls	0.004	-0.098*	0.081*	0.256	-1.039*	0.893
	(0.056)	(0.059)	(0.045)	(0.552)	(0.552)	(0.622)
	[1,793]	[1,717]	[1,773]	[1,794]	[1,717]	[1,774]
Boys	0.142***	0.070	0.200***	0.878*	0.414	1.537***
	(0.047)	(0.050)	(0.055)	(0.510)	(0.580)	(0.541)
	[2,036]	[2,032]	[1,990]	[2,036]	[2,032]	[1,990]
	B1. Participation in farm labour			**B2. Months spent in farm labour**		
Full sample	0.029	-0.035	0.047	-0.166	-0.889***	-0.243
	(0.026)	(0.036)	(0.037)	(0.245)	(0.270)	(0.261)
	[4,078]	[4,023]	[4,052]	[4,080]	[4,026]	[4,049]
Girls	-0.052	-0.102	-0.039	-0.511	-0.975*	-0.658
	(0.053)	(0.064)	(0.060)	(0.335)	(0.510)	(0.415)
	[1,793]	[1,716]	[1,773]	[1,794]	[1,716]	[1,774]
Boys	0.130***	0.078	0.133***	0.105	-0.445	-0.119
	(0.044)	(0.063)	(0.046)	(0.499)	(0.543)	(0.534)
	[2,036]	[2,030]	[1,994]	[2,036]	[2,032]	[1,994]
	C1. Participation in housework			**C2. Months spent in housework**		
Full sample	0.049	0.028	0.048	0.348	-0.099	0.512
	(0.031)	(0.037)	(0.039)	(0.366)	(0.482)	(0.418)
	[4,079]	[4,019]	[4,048]	[4,074]	[4,027]	[4,044]
Girls	0.044	-0.022	0.089	0.237	-0.807	0.775
	(0.052)	(0.058)	(0.061)	(0.555)	(0.698)	(0.538)
	[1,794]	[1,716]	[1,773]	[1,794]	[1,716]	[1,774]
Boys	0.053	0.072	0.083*	0.493	0.643	0.964*
	(0.039)	(0.051)	(0.046)	(0.459)	(0.607)	(0.572)
	[2,036]	[2,034]	[1,994]	[2,036]	[2,030]	[1,994]

Notes: * p<0.1; ** p <0.05; *** p<0.01. Difference-in-difference estimates with propensity score. Estimates include child age, gender, a dichotomous variable for child first-born and whether the first-born is male. Bootstrapped standard errors in parentheses. Panels A1-C1 are binary indicators equal to 1 if the child reported being involved in any type of work (including farm, housework and waged/business work), farm work and housework respectively.

Panels A2-C2 report estimates where the outcomes related to months spent in any work, farm work and housework in the past 12 months.

7. Discussion

In this mixed-methods study, we examined new survey data to assess the impact of food assistance on food security-, nutrition- and education-related outcomes during conflict in Northern Mali. The findings presented in this study highlight a number of important considerations. Firstly, the survey data showed that during the 5 years since the conflict peaked, households experienced continued food insecurity, as evidenced by the modest increases in average expenditures per adult equivalent (less than FCFA 1250 over the whole period, corresponding to less than a 1% increase), as well as decreases in overall food consumption and micronutrient availability.

Secondly, the survey data highlighted the extent and intensity of conflict exposure in the study population. Over one in five households in our study were exposed to violence linked to the presence of armed groups, including episodes of banditry, terrorist/armed attacks, political violence, kidnappings, and destruction of infrastructure, amongst others. Out of the 68 villages included in the survey, 11 (16%) were still experiencing the presence of armed groups at the time of the follow-up survey in January 2017, with most of these villages reporting that the presence of armed groups had persisted following the coup in 2012. Only 3 of the 55 without the presence of armed groups during the follow-up survey had experienced their presence since 2012. These groups were violent and were perceived as threats by the population. The data also indicated that the presence of armed groups overlapped with conflict-related violence, as well as with fear and reduced mobility in the communities, including visits to farms, markets, health centres and schools. These findings confirm the potential for conflict to affect household's food security and nutrition through a range of direct and indirect channels, as also highlighted in the focus groups and individual interviews. Respondents described how the fleeing of government staff and subsequent closing of health centres had important consequences in terms of the provision of basic health services for pregnant women, infants and young children. Though coverage of these services was by no means pervasive before the conflict peaked in 2013, the interruptions in the few services that were available at the community level were likely to have directly affected the nutrition and health in these vulnerable age groups. Moreover, the data also suggested that the resulting limited mobility had indirectly exacerbated the negative effects of conflict on households more broadly, including limited visits to farms and markets, affecting the food environment and food security in an already highly food-insecure context.

Thirdly, the household and village surveys suggested that a range of humanitarian aid had been scaled-up in the study areas during the 5-year period following the 2012 coup, including food assistance in the form of GFD, SF, and other modalities. Of the different forms of food assistance, GFD was more common, followed by SF. The coverage of TSF (targeted supplementary feeding), a key intervention to prevent and treat acute malnutrition, was extremely low in the study population. Moreover, survey data also indicates that access to aid tended to decrease as proximity with armed groups increased, as highlighted by the higher likelihood for conflict-affected households to live in villages without any access to aid, though this relationship was not as marked at the household level. These findings suggest that the logistics of safely scaling-up aid in conflict areas may override the necessity to reach most vulnerable populations. Of

particular relevance to this study is the very low coverage[5] of TSF, thus reducing the likelihood of identifying possible effects of WFP food assistance on malnutrition in infants and young children. Insights from the qualitative data and follow-up discussions with WFP in Mali highlight the complexities involved in providing food-assistance during conflict (see annex 7). For example, WFP staff reported that armed groups blocked trucks providing food-assistance from accessing roads in the Mopti region, causing some delays in the delivery of food assistance. To overcome these challenges, WFP had to resort to different, longer and more expensive routes to bypass problematic areas. A strategy based on stakeholder engagement and strengthening community involvement was established between WFP and its partners that enabled beneficiaries to be reached. WFP also worked with local NGOs to allow access in areas where international NGOs couldn't operate.

Fourthly, the analysis of treatment effects suggests that the scaling-up of food assistance by WFP and development partners in Mali had important positive impacts on the food security of the targeted population. We find evidence of protective effects on household total expenditures and food expenditures, as well as on food consumption and on changes in height in children aged to 2-5 years at baseline. The effects on food consumption were comparable with those in the literature on social assistance in development settings. A recent meta-analysis of social assistance programs including 48 studies of 39 social protection programs found that transfers increase monthly food expenditure by 17% on average (Hidrobo et al., 2015), compared to the 24% estimate found in our study.

The analysis of the nutrition status of young children was hampered by the well documented issue related to the measurement of dates of birth in areas of low parental education like Mali (Oshaug et al., 1994; Grellety and Golden, 2016; Larsen, Headey and Masters, 2017). This measurement error is of a particular concern when calculating height-for-age indicators for young children. To minimise the bias from measurement error, in this report we therefore limited the scope of the analysis of anthropometric data to changes in height within the youngest cohort in our study population, as well as on weight-for-height in repeated cross-sections for children aged 2-5 years. The analysis of the panel data identified a large protective effect of aid on the height of children in the cohort aged 2-5 at baseline (of the order of 0.5 SDs), where armed groups were present near the targeted communities, though not present in the communities themselves. The effect was concentrated on households receiving at least two forms of aid (usually GFD with school feeding). In the repeated cross-sectional study in children aged 2-5 years, we found evidence of a marginally significant negative impact on weight-for-height, and no effects on acute malnutrition. However, this finding should be interpreted with caution as the age distributions in the two cross-sections was substantially different, thus making meaningful comparisons difficult across the two time points. Sensitivity analysis, including outcomes from the single cross section at follow-up (using PSM but not DID), found no evidence of impacts on anthropometry. Further sensitivity analysis focussing on measurement of the dates of birth is currently underway to allow for a more detailed assessment of child nutrition in the study population.

In terms of effects on schooling, school feeding had a positive impact on school enrolment and grade attainment: children in households receiving school meals were 10 percentage points more likely to be enrolled in school, and on average, they had completed nearly half of an additional year of education compared to children in the comparison group. There were some unintended effects of GFD by contrast:

[5] This is a population-based estimate of coverage and not based on eligible individuals. We will be exploring further issues related to coverage, inclusion and exclusion errors in future.

This form of food assistance had no significant effects on enrolment and attainment, but led to lower school attendance (about an additional half absentee day per week). Important gender differences were present: school feeding led to slightly larger gains in attainments for girls, while boys in households receiving GFD drove the decreases in attendance by missing about an additional day of school per week than comparison boys. These remarkable, and unintended, results can be explained by how these programmes were able to offset the opportunity costs of education viz. participation in child labour. These costs were already high in a setting characterised by structural food insecurity and protracted fragility, such as in Mopti, and were further compounded by conflict. Treatment effects on child labour by aid type mirrored the findings for education: school feeding led to marked decreases in participation and time spent in any work activity, and especially farm labour, in the case of girls. Decreases in girls' farm labour may be more compatible with school attendance, the key condition to receive the free meal. On the other hand, GFD did not appear to offset the benefits of child labour for boys, for which the opportunity cost of schooling can be higher due to their higher involvement in farm-related activities. Boys increased their participation in any work, particularly in higher-intensity conflict areas and for those living in GFD households. These results highlight that labour constraints matter in the decisions between schooling and productive activities of different household members.

5.1.1 Limitations

These findings are limited by several important considerations. Firstly, as allocation of treatment was not random, a potential limitation of these findings results from selection bias related to any unobserved characteristics that are correlated to both selection into food assistance and the study outcomes. However, the panel structure of this dataset allows the estimation of impact as the DID in the outcomes between the treatment and control groups, removing the effect of unobserved time-invariant differences between the treatment and comparison groups.

Secondly, another potential limitation involves selection bias from attrition during the follow-up, as important differences were found in the baseline characteristics between households lost to follow-up and households included in the analysis. Households lost to attrition were generally from less remote villages, were less likely to be in villages that had had a development project in the past, had slightly smaller household sizes, were less likely to be polygamous, were more likely to have wage labour as occupation of the household head and were less likely to be in the highest expenditure quintile. Whereas most of these differences suggest that attrited households may have been less economically vulnerable than non-attrited households, the data on expenditures point to a reverse situation. Attrition rates were however similar in both treatment and control groups for all forms of aid except for 2 forms of aid, where attrition rates were substantially higher in the treatment group compared to controls. Attrition is thus more likely to threaten external validity than internal validity. A related point is that 4 villages were excluded from data collection at endline due to security reasons. While it is unclear from our analysis whether these villages were more or less vulnerable than others in the sample, to drop these villages from the estimations would modify the scope of the study as it restricts our coverage of the areas recently most affected by the conflict.

A third limitation stems from the sample size, which is quite low due to a combination of the attrition rate and missing observations for key variables of interest (or control variables). This contributes to reduce the scope of the study and to limit our ability to conduct sub-group analyses (drilling down our analysis on types of aid or types of contexts). In particular, the sub-sample of households being directly affected by the conflict is quite small so that results for this group should be taken with caution. However, we still

have enough observations to meaningfully compare the effect of aid across aid modalities for the general population as well as to compare the effect of aid in non-conflict-affected versus indirectly affected areas.

A fourth, more general, limitation is simply due to the challenge of conducting household surveys in a context such as Mali. The ongoing conflict situation has restricted our ability to travel to all our survey sites and has put a strain on the data collection team. For security reasons, the teams could not travel at night and thus had to complete the interviews in a short span of time. We believe that the relatively high rate of missing observations is mostly due to this constraint, as enumerators could not afford to wait for additional respondents to return home and undertake lengthy interviews.

Another limitation specific to the education-related results, is that we do not have data to study the impacts of food assistance on learning, which is the ultimate goal of any educational system and the priority in the Sustainable Development Goal educational agenda. However, in absence of complimentary supply-side interventions and given the very low quality of the Mali educational system (particularly during the crisis), we would expect little or no effects. Nonetheless, incentivising school participation, attendance, and attainment can contribute to other important dimensions of child development in conflict, such as feelings of normalcy and safety, as well as, especially for girls, may delay child marriage and lead to positive outcomes for the girls and their children. This is particularly relevant for Mali, where recent estimates have documented that about one in two women aged 18-22 had a child before 18 years, and 13% of them had a child before 15 years (Malé & Wodon, 2016). In contrast to other countries, the share of early childbirth has been increasing, particularly among rural and uneducated girls. Accordingly, by keeping girls in school for longer, school feeding may also contribute to this additional goal.

Another limitation involves the qualitative research component. The aim of the qualitative analysis was to provide key insights on the design of the household survey and was completed 6 months prior to the household survey. Ideally, additional qualitative work undertaken alongside the household survey would have provided important insights to better understand the nuances of the study results.

8. Specific findings for policy and practice

1. In settings characterized by chronic food insecurity and conflict, food assistance may have a protective effect on food security, nutrition and education of vulnerable populations. Furthermore, there is emerging evidence that in these particular contexts providing two forms of food assistance may be more effective than one form of transfer alone.
2. The findings on changes in linear growth in children aged 2-5 at baseline in populations indirectly affected by conflict suggest that, in these contexts, food assistance may also provide a platform to improve children's growth outside the priority age group for nutrition interventions during the first 1000 days. These findings will require further detailed investigation.
3. Considering that the coverage of TSF was extremely low (around 2%) in the study population, the null results on MAM in the repeated cross-sections and single cross-section at follow-up are not surprising. This finding is consistent with the literature on social transfers, highlighting that the provision of household food transfers, or GFD alone without specific complementary foods targeting young children, generally does not result in improvements on nutrition outcomes of young children.
4. The effects of food assistance on education during conflict are nuanced and modality specific. Evidence suggests that school feeding can have important benefits in terms of schooling during

conflict, unlike GFD that may in fact have negative effects on school attendance, likely due to the different ways in which the food assistance transfers affect child labour.

5. Combining the findings from the food security and education dimensions suggests that there are important trade-offs to consider when examining the potential for providing food assistance during conflict. These trade-offs not only depend on costs and feasibility of providing assistance to conflict-affected areas, but also on the multi-dimensional risks that vulnerable households, and their individual members, face during conflict.
6. Evidence from this study suggests that there is scope to improve the design and scale-up of food assistance during conflict.
    - Increasing the coverage of nutrition specific interventions during conflict, including specialised complementary foods as supplementary feeding, appears to be a critical gap. This coverage gap may also be due to the need to have elements of the health system working at community level to ensure adequate service provision. As health systems are often targeted by conflict actors, this may pose a critical constraint on operations in conflict settings.
    - In terms of intervention design, systematically bundling different forms of food assistance alongside general food distribution, may be an effective strategy to support vulnerable populations during conflict. This is likely to be particularly important in terms of inclusion of nutrition specific interventions that are essential to support nutrition of vulnerable groups (see point above). The education results also highlight the opportunity provided by joint programming of school feeding and GFD as part of a coherent approach to designing and delivering emergency food assistance that may help in addressing important trade-offs and complementarities within and across programmes during conflict. However, joint programming may also have implications in terms of lower beneficiary coverage, which is another important trade-off faced by humanitarian assistance providers.
7. Providing evidence on how to optimise the cost-effectiveness of food assistance packages is an important area for further research. The evidence presented in this study highlights some of the critical trade-offs that humanitarian operations face in conflict-affected settings, involving on the one hand programme scale and cost-effectiveness, and on the other the practicalities of operating in areas under the control of armed groups, including security, governance and transparency. There is clearly no silver bullet in terms of addressing these trade-offs during operations. Understanding the political economy of food assistance in these contexts is clearly a critical starting point to improve the effectiveness of operations.
8. Though the 3ie project is now closed, the in-depth analysis of the rich data set collected in this study is continuing and is expected to provide further insights to policy and programmes in this rapidly evolving field.

Acronyms

ACLED The Armed Conflict Location & Event Data Project

AE Adult Equivalent

ATT Average Treatment on the Treated

BAZ BMI for age z-scores

BMI Body Mass Index

EMOP Emergency Operations

FAO Food and Agriculture Organisation

FCFA CFA Franc

FFW Food for Work

GFD General Food Distribution

HAZ Height for Age z-score

IFAD International Fund for Agriculture Development

MAM Moderate Acute Malnutrition

PLW Pregnant and Lactating Women

PRRO Protracted Relief and Recovery Operation

SF School Feeding

TSF Targeted Supplementary Feeding

WAZ Weight for Age z-score

WFP World Food Programme

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Annex 1: Calendar of conflict related events in the Mopti region.

Events / Context	Date/Period
Food insecurity • Poor rainfall, presence of seed-eating birds, poor crops, food deficit	2011-2012 crop loss
Presence of armed groups in the occupied zone	
Presence of rebel groups in the community • Widespread insecurity, rebels' base set up in crop fields. • Widespread fear even in mosques	From April 2012 to January 2013 (Serval operation)
Episodes of violence such as beatings, rapes, murders • Robbery, extortion of property, equipment, • Fear at all times, limitations of travel, movements, frequent thefts, physical torture, • Theft of motorcycles, grains, goods, hold-ups, road block, • constant or sporadic attacks on shopkeepers, itinerants, since 2012, etc.; • Attacks are common on roads. For example, less than 10 days ago, on the road to Youna, a local councilor and a livestock dealer were murdered. Kidnapping of persons on the road to Gana.	April 2012 to March 2016
Confiscation of crops/animals by rebels • Looting of cereal banks • Fear to attend fairs where grain supplies are available • Trade decline, • Wdespread hunger, poverty of population • End of activities in two village tontines, etc.	Since arrival of armed groups in May/June 2012 to January 2013.
Families leaving the community • The MNLA offered communities to either join the rebellion or leave the villages. • Prohibition of demonstrations, of hair braiding, mandatory wear of headscarf, • Slow economic activities and ONG assistance. General social malaise. Some families have left to join parents in non-occupied areas.	Since arrival of armed groups in May/June 2012 to January 2013.
Imposition of rules of conduct such as curfews and Sharia • Ban on entertainment, demonstrations, recreation (baptism, marriage, entertainment, simple recreation activities for people, customary events, etc.) in villages. • Mandatory veil for women • Prohibition for men to transport a woman who is not his own wife on his motorcycle, bicycle, car, donkey, etc.	Since arrival of armed groups in May/June 2012 to January 2013.
School closing • Fleeing of teachers • Interruption of classes, even school closings. Schools abandoned by students.	April 2012 to October 2013.
Closing of local markets • Slowdown in trade (livestock, grains, and other commodities) mobility problems (business activities). • Difficulty to buy clothes, food. • Access problem in Douentza (grain supply city) with blocking of the main road. • Trade exchanges impossible with neighboring villages. In some villages there is a slowdown in produce gardening due to the lack of opportunities for marketing the products. • Freedom of movement is compromised • Difficulty to supply food.	April 4, 2012 presence of armed groups to date
Food seized by rebels • Crops seized	October to December 2012

Events / Context	Date/Period
• Looting by armed groups of grain banks in many villages.	
Inability to communicate by phone or mail • **In the field of communication**, the telephone network was down, travel issues. Visits between communities ended with the presence of armed groups. Difficulty of communication (travel, telephone).	April 2012 to April- May 2014
Humanitarian aid and development • Departure of NGOs and other development agencies' staff. All activities stopped, Sale of village fountain water prohibited.	April 2012
Local administration • Local administration no longer operational. Departure of staff families, brief government absence. • Issues with civil status documents. For example, the ID card which costs CFAF 2,000 to produce now costs CFAF 6,000-7,500.	April 2012 to October 2013 April 2012 to May 2015.
Health Center closing • **In the health sector:** We note a slow-down of activities in the health structure, insufficient medical care, departure of health personnel, lack of child vaccinations, widespread malaria (no NIDs). • Elsewhere, children became ill after eating cookies left over by fleeing armed groups after the Serval operation.	November 2012 to October 2013 January, February, March 2013
Environment and ecology • Forest destruction by rebels (they cut any kind of wood for their cooking), • Destruction of the prairie by bushfires started by armed groups (rebels). • Lack of agricultural equipment, • High cost of animal feed (CFAF 30.000 for a wagon load of straw) • With the intervention of the Serval operation fields were mined by fleeing rebels. Discovery of dead people in the bush. With minefields few people were able to lead agricultural activities in their fields due to fear.	April 2012 to February 2013 May to December 2013
Recreation • Ban village animations, sale, purchase, search for firewood, fear to go alone in the field, people were hiding at home, etc. • Slowdown the mobility of women, prohibition of sale of water from the fountain.	From April 2012 to January 2013 May 2012 to March 2013
Return of the administration and basic social services • Government presence and claim of 3 years of taxes. Example: The administration has required people to pay taxes for 2012-2013-2014. • Schools reopen, return of health workers and NGOs.	Early 2014.

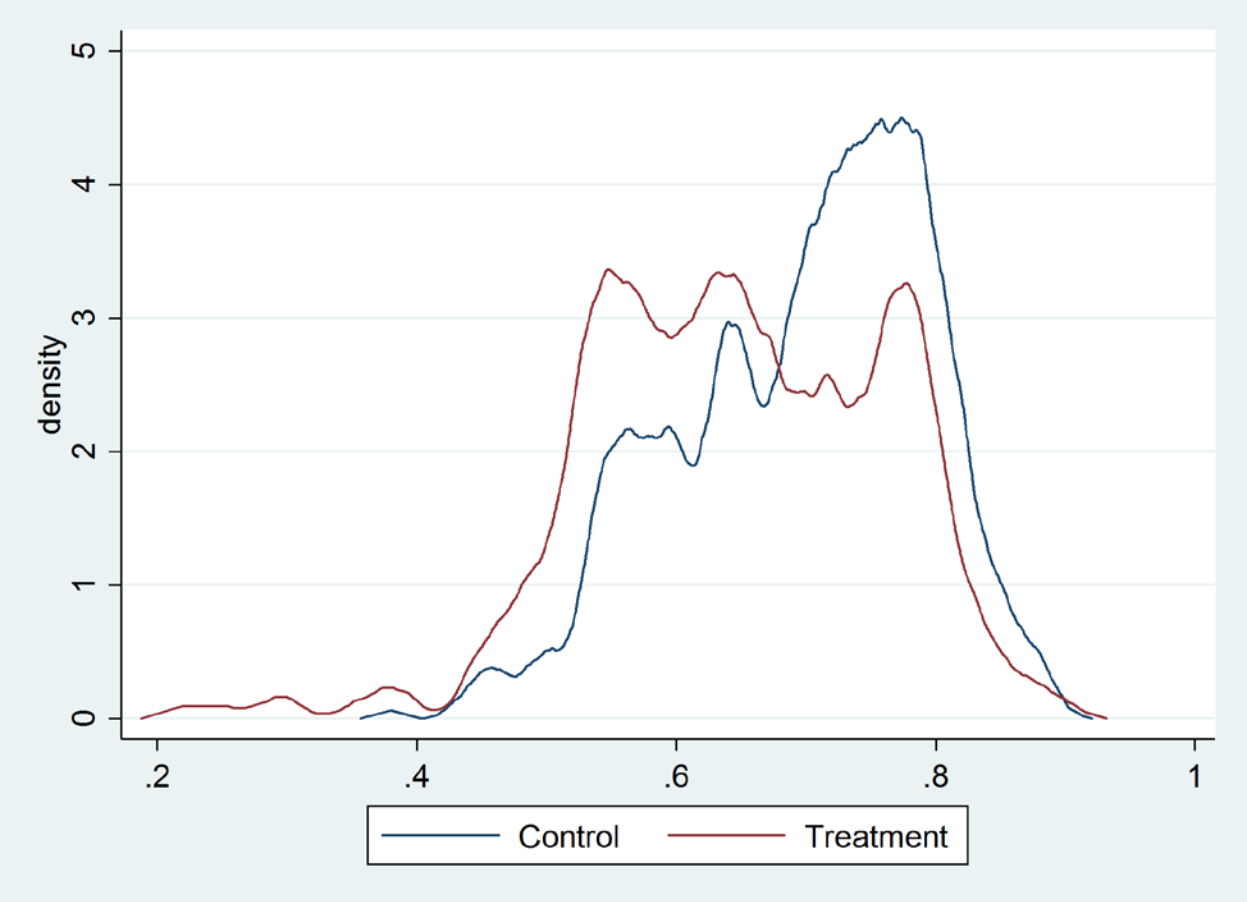
Annex 2: Calendar of "transverse" events in the Mopti region.

Events	Date
Rainfall deficit / Poor harvest	2011-2012 crops recurrent
Water shortage and lack of grass	Mar to Jul 2012 recurrent
Water scarcity due to drying up of wells	Mar-April 2012 recurrent
Malnutrition (children, pregnant women)	2012 to date
Rainfall deficit, food insecurity	Recurrent
Water shortage	Recurrent
Malnutrition of pregnant and breastfeeding women, children	Year round
Death of livestock	Apr–May –Jun 2012
Crop failure following poor rainfall (flooding and early cessation of rains)	2012-2013 crops
Dam destroyed by the flood	Jul-Aug 2013
Deterioration of produce garden boundaries (agricultural developed land washed away)	Jul –Aug 2013
Destruction of dikes following heavy rains (developed areas destroyed, land washed away)	Jul –Aug 2013
Diarrhea outbreak	Dec 2012- Jan 2013
Dam destroyed by flood	2013
Deteriorating of produce garden boundaries	2013
Low rainfall, poor harvest, food deficit	2013-2014 crops
Water scarcity (recurrent)	Mar to end Jun 2014
Malaria outbreak	Oct 2014
Malnutrition (recurrent)	2014
Food deficit (recurrent)	2014
Ebola	Oct 2014 to Feb 2015.
Crop rainfall deficit, drinking water, (recurrent)	2014-2015 crops
Sudden death of children	Sept-Oct 2015
Rainfall deficit, crop, drinking water	Recurrent
Poverty	Recurrent

Annex 3: Definitions of ACLED Event types

Event type	Definition
Battle-No change of territory	A battle between two violent armed groups where control of the contested location does not change. This is the correct event type if the government controls an area, fights with rebels and wins; if rebels control a location and maintain control after fighting with government forces; or if two militia groups are fighting. These battles are the most common activity and take place across a range of actors, including rebels, militias, and government forces, communal groups.
Battle-Non-state actor overtakes territory	A battle where non-state actors win control of location. If, after fighting with another force, a non-state group acquires control, or if two non-state groups fight and the group that did not begin with control acquires it, this is the correct code. There are few cases where opposition groups other than rebels acquire territory.
Battle-Government regains territory	A battle in which the government regains control of a location. This event type is used solely for government re-acquisition of control. A small number of events of this type include militias operating on behalf of the government to regain territory outside of areas of a government's direct control (for example, proxy militias in Somalia which hold territory independently but are allied with the Federal Government).
Headquarters or base established	A non-state group establishes a base or headquarters. This event is non-violent, and coded when a permanent or semi-permanent base is established. There are few if any cases where opposition groups other than rebels acquire territory. These events are coded as one-sided events without a second actor involved.
Strategic development	This event records activity by rebel groups/militia/governments that does not involve active fighting but is within the context of the war/dispute. For example: recruitment drives, incursions or rallies qualify for inclusion. It also records the location and date of peace talks and arrests of high-ranking officials. The inclusion of such events is limited, as its purpose is to capture pivotal events within campaigns of political violence. The notes column contains information on the specifics of the event. This category can also refer to failed attempts at remote violence, for example the disarming and defusing of improvised explosive devices by security forces.
Riots/Protests	A protest describes a non-violent, group public demonstration, often against a government institution. Rioting is a violent form of demonstration. These can be coded as one-sided events. All rioters and protesters are noted by generic terms (e.g. Protester (Country)), but if representing a group, the name of that group is recorded in the 'ally' column.
Violence against civilians	Violence against civilians occurs when any armed/violent group attacks civilians. By definition, civilians are unarmed and not engaged in political violence, Rebels, governments, militias, rioters can all commit violence against civilians.
Non-violent transfer of territory	This event describes situations in which rebels or governments acquire control of a location without engaging in a violent act.
Remote violence	Remote violence refers to events in which the tool for engaging in conflict did not require the physical presence of the perpetrator. Remote violence notes that the main characteristic of an event is that a spatially removed group determines the time, place and target of the attack. These include bombings, IED attacks, mortar and missile attacks, etc. Remote violence can be waged on both armed agents (e.g. an active rebel group; a military garrison), civilians (e.g. a roadside bombing) and infrastructure/property (e.g. the bombing of oil facilities).

Annex 4: Example of estimated propensity score distributions (*any aid*).



Annex 5: Baseline characteristics comparisons across treatment groups.

Table A5.1. Comparison of mean baseline characteristics between treated and untreated households, by type of food assistance programme

	Any aid				School Feeding				Food aid			
	Control	Treated	Diff.	Pr(T>t)	Control	Treated	Diff.	Pr(T>t)	Control	Treated	Diff.	Pr(T>t)
Household size	9.565	9.771	0.206	0.3353	9.55	10.093	0.543	0.0498**	9.689	9.465	-0.224	0.3574
Dependency ratio	1.711	1.768	0.057	0.2817	1.712	1.827	0.115	0.0935*	1.724	1.754	0.03	0.6194
Number of school-age children in the household	2.641	2.641	0	0.9975	2.636	2.667	0.031	0.7923	2.674	2.527	-0.147	0.153
Household is of main ethnic group	0.86	0.814	-0.046	0.0429**	0.841	0.857	0.016	0.5845	0.862	0.781	-0.081	0.0018***
Age of the household	49.788	49.456	-0.332	0.6653	49.844	48.773	-1.07	0.283	49.65	49.741	0.091	0.9171
First expenditure quartile	0.253	0.251	-0.002	0.9459	0.243	0.301	0.057	0.1018	0.261	0.223	-0.039	0.2123
Second expenditure quartile	0.246	0.244	-0.002	0.9259	0.246	0.24	-0.006	0.8666	0.252	0.223	-0.029	0.3378
Third expenditure quartile	0.256	0.226	-0.03	0.2685	0.256	0.191	-0.065	0.0633*	0.242	0.258	0.016	0.5979
Fourth expenditure quartile	0.245	0.279	0.034	0.2117	0.255	0.268	0.013	0.7133	0.245	0.297	0.052	0.0959*
Proportion of budget for food	0.743	0.741	-0.001	0.8767	0.745	0.729	-0.016	0.1654	0.741	0.746	0.004	0.6518
Number of food groups	6.8	6.771	-0.029	0.7198	6.797	6.753	-0.044	0.6781	6.789	6.793	0.004	0.9656
Household is polygamous	0.35	0.327	-0.023	0.4328	0.346	0.32	-0.025	0.5114	0.348	0.322	-0.026	0.442
Household head is a worker	0.029	0.063	0.034	0.0056***	0.041	0.039	-0.003	0.8614	0.029	0.082	0.053	0.0001***
Land size	3.762	3.723	-0.039	0.8781	3.657	4.217	0.56	0.0928*	3.86	3.369	-0.491	0.0941*
Household owns cattle	3.104	3.141	0.036	0.8426	3.124	3.083	-0.041	0.8618	3.07	3.278	0.208	0.3176
Armed groups in village	0.098	0.102	0.004	0.8563	0.111	0.041	-0.07	0.0054***	0.087	0.145	0.058	0.0102**
Armed groups In reguion	0.677	0.597	-0.08	0.0093***	0.662	0.58	-0.083	0.0393**	0.667	0.59	-0.077	0.0290**
Secondary school within 5km	0.345	0.384	0.039	0.1907	0.352	0.393	0.041	0.2905	0.354	0.375	0.021	0.547
Market within 5km	0.285	0.241	-0.044	0.1158	0.273	0.251	-0.021	0.5497	0.281	0.23	-0.05	0.1109
Past development	0.563	0.663	0.101	0.0010***	0.572	0.732	0.16	0.0001***	0.589	0.629	0.04	0.2549

project in village												
Village very unsafe	0.075	0.049	-0.026	0.0978*	0.062	0.087	0.025	0.2216	0.076	0.029	-0.047	0.0098***
School infrastructure index	-0.04	0.119	0.159	0.0150**	-0.015	0.178	0.193	0.0220**	-0.017	0.13	0.147	0.0473**
School governance index	-0.04	0.093	0.133	0.0458**	-0.003	0.074	0.077	0.3701	-0.035	0.145	0.18	0.0155**

*Notes: ***p<0.01, ** p< 0.05, * p<0.1*

Table 5.22. Comparison of baseline characteristics between treated and untreated households in the propensity-score matched sample

	Any aid			School Feeding			Food aid		
	Control	Treated	Standardised diff.	Control	Treated	Standardised diff.	Control	Treated	Standardised diff.
Household size	9.57	9.37	0.057	9.87	9.85	0.006	9.26	9.12	0.042
Dependency ratio	1.74	1.76	-0.029	1.8	1.78	0.026	1.7	1.7	0.007
Number of school-age children in the household	2.59	2.58	0.013	2.58	2.58	0.002	2.49	2.45	0.026
Household is of main ethnic group	0.83	0.82	0.002	0.87	0.89	-0.046	0.79	0.79	0
Age of the household	49.92	49.97	-0.005	49.61	49.38	0.019	49.94	49.97	-0.002
First expenditure quartile	0.32	0.31	0.037	0.41	0.41	0.009	0.26	0.25	0.034
Second expenditure quartile	0.23	0.23	-0.001	0.2	0.21	-0.018	0.22	0.21	0.016
Third expenditure quartile	0.21	0.21	-0.005	0.17	0.16	0.004	0.24	0.24	-0.002
Fourth expenditure quartile	0.24	0.25	-0.035	0.22	0.22	0.004	0.27	0.3	-0.051
Proportion of budget for food	0.74	0.74	-0.006	0.72	0.72	0.038	0.75	0.76	-0.039
Number of food groups	6.71	6.75	-0.031	6.62	6.65	-0.025	6.79	6.83	-0.029
Household is polygamous	0.34	0.33	0.022	0.35	0.35	0.005	0.31	0.29	0.034
Household head is a worker	0.06	0.05	0.011	0.03	0.04	-0.033	0.08	0.07	0.059
Land size	3.65	3.58	0.021	4.22	4	0.067	3.26	3.19	0.024
Household owns cattle	3.18	3.2	-0.008	3.34	3.32	0.005	3.22	3.23	-0.004
Armed groups in village	0.11	0.1	0.055	0.04	0.04	-0.006	0.15	0.13	0.055
Armed groups In reguion	0.61	0.58	0.055	0.54	0.56	-0.024	0.63	0.63	0.005

Secondary school within 5km	0.33	0.3	0.052	0.3	0.3	-0.004	0.33	0.33	-0.006
Market within 5km	0.15	0.16	-0.028	0.17	0.2	-0.076	0.13	0.14	-0.038
Past development project in village	0.68	0.68	-0.004	0.74	0.73	0.011	0.67	0.66	0.01
Village very unsafe	0.06	0.06	0.028	0.12	0.11	0.037	0.04	0.04	-0.015
School infrastructure index	-0.03	0	-0.028	-0.03	-0.01	-0.028	0	0.07	-0.065
School governance index	-0.01	0.01	-0.022	-0.07	-0.07	0.002	0.06	0.09	-0.025

Notes: ***p<0.01, ** p< 0.05, * p<0.1

Annex 6: Example of robustness checks for education analysis.

As mentioned in Section 5.2, we ran robustness checks. In all of them, we controlled for the balance of the covariates and common support (available upon request). First, we included all baseline villages in the estimation of the propensity score, and re-ran all estimates. Table E1 reports that there were no substantial changes to our main results. Second, we investigated whether bias from overlap from the receipt of different forms of aid changed our results. Findings are presented in Table E2. The inclusion of school feeding receipt in the propensity score led to slightly larger treatment effects for GFD in the case of absenteeism. Also the coefficient related to grade attained became statistically significant at 10%. In the case of school feeding, the inclusion of GFD receipt in the estimation of the propensity score did not affect the results. Finally, we restricted the sample to the longitudinal sample of children aged 7-10 years at baseline, which, at endline, were still of compulsory school-age. Again, treatment effects estimates on this restricted sample were qualitative the same as in the cross-section of children aged 7-16 at both survey rounds (available upon request)

Table A6.1. Treatment effects on education outcomes including all baseline households in the estimation of the propensity score

	Any aid	SF	GFD
	Enrolment		
Treatment effect	0.052	0.101***	0.029
	(0.036)	(0.037)	(0.033)
N	[4,294]	[4,199]	[4,267]
	Absenteism		
Treatment effect	-0.037	0.068	0.590***
	(0.152)	(0.167)	(0.179)
N	[1,393]	[1,326]	[1,297]
	Grade attainment		
Treatment effect	0.029	0.537***	-0.221
	(0.149)	(0.166)	(0.136)
N	[4,287]	[4,197]	[4,258]

Notes: * p<0.1; ** p <0.05; *** p<0.01. Difference-in-difference estimates with propensity score. Estimates include child age, gender, a dichotomous variable for child first-born and whether the first-born was male. Bootstrapped standard errors in parentheses. Enrolment is a binary indicator indicating whether the child was currently enrolled in school; absenteeism is measured as number of days in the past five-day school week in which the child was absent; grade attained is measured as number of years of education completed.

Table A6.2. Robustness check. Treatment effects including receipt of the alternative programme in the propensity scores

	Enrolment		Absenteism		Grade attainment	
	SF	GFD	SF	GFD	SF?	GFD

Treatment effect	0.090**	0.011	0.098	0.710***	0.562***	-0.319*
	(0.042)	(0.041)	(0.174)	(0.209)	(0.178)	(0.178)
	[4,191]	[4,282]	[1,285]	[1,330]	[4,198]	[4,280]

Notes: * p<0.1; ** p <0.05; *** p<0.01. Difference-in-difference estimates with propensity score. The propensity score includes the receipt of general food distribution in the case of school feeding, and the receipt of school feeding in the case of general food distribution. Estimates include child age, gender, a dichotomous variable for child first-born and whether the first-born was male. Bootstrapped standard errors in parentheses. Enrolment is a binary indicator indicating whether the child was currently enrolled in school; absenteeism is measured as number of days in the past five-day school week in which the child was absent; grade attained is measured as number of years of education completed.

Annex 7: Feedback from WFP operational issues related to aid delivery during conflict, and responses form qualitative reserach

Logistics of delivering food assistance during conflict: WFP Country Office responses

WFP staff reported that access by trucks transporting WFP food was sometimes prevented by armed groups from continuing to access to roads in the Mopti region, causing some delays in the delivery of food assistance in certain areas of Teninkou, Youwarou and Douentza. WFP's cooperating partner for the implementation of seasonal assistance in Mopti and Gao was denied access to part of the Teninkou, Ménaka and Ansongo circle by armed groups, resulting in a delay in delivery of assistance. For example, WFP partner in Ansongo was not able to delivery in Tin-Hamma and Talataye Communes in earlier 2017.

To overcome these challenges, WFP had to resort to different, longer and more expensive routes to bypass certain areas. An access strategy based on discussions and strengthening community involvement was established between WFP and its cooperating partner and enabled beneficiaries to be. WFP also worked with local NGO in Ansongo to allow access in areas where international NGOs can't operate.

Qualitative research findings: Humanitarian aid activities during conflict in Mopti

Respondents reported that different actors were involved in the provision of humanitarian aid, including the Government, the United Nations Agencies, international and national NGOs, associations, private sector, etc. In occupied zones, the presence of armed groups caused the population to cease all economic and social activities, resulting in a food and health crisis.

The interviews with humanitarian aid stakeholders identified that the Government of Mali established a steering committee for humanitarian aid in the Mopti region. This committee was responsible for the identification of IDPs in host families and in IDP camps. A list of all the recipients of humanitarian aid was prepared. This committee comprised a state administrator, local elected officials, and civil society organizations to ensure transparency. In addition to extraordinary meetings, regular meetings were held once a week.

Many United Nations agencies and international and national NGOs did not have a survey to identify reduced households and IDPs. However, many have also referred to the data from the Early Warning System (EWS), particularly HEA results, which is the food security identification tool specifically in the food-insecure areas. EWS gives updates every year on both the security situation and the food insecurity in Mali.

General food distributions (GFD) were present in both occupied and non-occupied zones, but prioritized in the non-occupied zones for IDPs and host families, widows and orphans, the disabled, old people, pregnant and nursing women, i.e. vulnerable people. Moreover, the towns between the city of Mopti and the town of Douentza, such as Boré received humanitarian aid after the attack on Konna in January 2013. Income-generating activities (IGA) in occupied zones were rare because of the insecurity in Douentza district, unlike in non-occupied zones. In both the occupied and non-occupied zones, respondents reported that schools with canteens were supported to provide school feeding.

Qualitative research findings: Participation in humanitarian programs

Respondents reported that humanitarian aid related activities took place openly in villages. All residents were informed of what was given or being done. Community stakeholders were involved in the selection of beneficiaries. The food assistance activities were known to respondents in both occupied and non-

occupied zones. Respondents had difficulty in determining the names of donors and the precise date when the operations took place. When asked: "Do you already have experience with this program?" All our interviewees in both areas, without exception, responded in the affirmative. All were at least beneficiaries of one humanitarian activity. For example, all respondents had recived GFD. In terms of identifying organizations or NGOs responsible for the distribution of food, we noticed that the beneficiaries had trouble remembering their names and the exact time of distribution, especially among women and this applies to both survey areas. Also, we found that the distribution of NGOs or organizations was different in both areas. For example in the occupied area of Douentza, organisations included: WFP, Islamic Relief, Stop Sahel, and NEF which were regularly cited. However, in the area of Bandiagara that was not occupied, GAAS / Mali and YAG-TU were active.

In the occupied zones, it appears from interviews that the general food distribution began after the occupation by armed groups. This is when the SERVAL operation took place and humanitarian aid began to be scaled-up in the form of GFD. Thus, respondents cited the years 2014 and 2015 as the years of GFD trceipt without specifying the months. Some still managed to give the months of February 2014 and August 2015 in the village of Boré.

In the non-occupied zone of Bandiagara, the GFD began long before the occupation. The 2011-2012 harvest year was poor throughout the country. Humanitarian aid organizations were assisting the populations in heavily affected areas such as Bandiagara when the conflict erupted. At the level of municipalities surveyed, out of the 16 group meetings and 64 individual interviews, it appears that all surveyed villages have suffered from food shortages. Respondents confirmed they stayed because of the GFD organized by WFP and partners. The grain deficit in this zone is recurrent. In addition to the grain deficit, there is water shortage. Among villages, the years 2012, 2013, 2014 and 2015 are cited as years when they received food from humanitarian aid. Organizations or NGOs such as GAAS / Mali and YAG-TU were recognized.

For the frequency of distribution, quarterly was the most often used term. When asked "how many times did your household participate in the general food distribution?" Most respondents said once per quarter. The answer to the question: "do you think the quantity/quality of food distributed was right for you" by the majority of respondents was positive.

The results of the interviews highlighted that men, heads of households, mainly participated in the general food distribution. Women participated when men were absent. It is accepted that the woman receives food for the household instead.

None of the qualitative research study participants were directly exposed to violence. The question is whether future survey participants living in the occupied areas were exposed to a greater degree to violence than these participants.

Quotes on benfetis from food assistance from the qualitative research preceding the household survey

« *J'ai bénéficié de la DAG, des semences parce que je n'avais pas les moyens à l'époque et je n'avais du travail. Elle m'a permis d'assurer partiellement l'alimentation de ma famille. Elle a permis à la communauté de rester sur place. Elle a permis aux jeunes de ne pas fuir ou abandonner le village.* » (**52 ans Cultivateur à Boré)**

"I benefitted from the GFD…because at the time I didn't have any means and had no work. GFD allowed me to assure in part the feeding of my family. It helped keeping the community to remain in place. It allowed young people not to flee or abandon the village" (smallholder farmer in Bore village).

« *J'ai bénéficié de la DAG cela m'a permis de faire des économies. L'aide m'a permis de subvenir aux besoins alimentaires de mon ménage. L'aide a permis à la communauté de vivre ensemble.* **56 ans Cultivateur à Falembougou)**

"I benefitted from the GFD as it allowed me to economise. Aid allowed me to meet the food needs of my household. Aid allowed the community to live together" (smallholder farmer in Falembougou village).

« *Les femmes étaient les plus affectées parce qu'elles ne pouvaient pas sortir de peur d'être violées par les rebelles. Les filles étaient obligées d'abandonner l'école. » (***Ménagère 38 ans Kikara)**

"Women were most affected [by conflict] because they couldn't leave the compound because of fear of being raped by the rebels. Girls were forced to drop-out of school" (housewife from Kikara village)