



The Effects of Conflict-Induced Migration on Food Security and Health Related Outcomes in Sudan

From Displacement to Despair

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ABSTRACT

This study investigates the socioeconomic effects of conflict-induced migration in Sudan, focusing on the food security and access to healthcare of displaced households. Triggered by the civil conflict that started in April 2023, the recent widespread displacement of households has intensified vulnerabilities across the country. Using three datasets—the pre-conflict 2022 Sudan Labor Market Panel Survey and two surveys conducted during the conflict, the 2023/24 Sudan Rural Household Survey and the 2024 Sudan Urban Household Survey—the research examines the impacts on household food security and healthcare access of migration driven by conflict. The study employs inverse probability weighting to estimate the causal impacts of migration, leveraging data from over 12,000 households. The key impact indicators at the household level were the Food Insecurity Experience Scale score and, as a measure of healthcare access, any incidence of illness in the household.

Analysis shows that migration induced by conflict exacerbates food insecurity, with over 90 percent of rural households and nearly 80 percent of urban households reporting moderate to severe food insecurity. Rural households face additional challenges as displacement disrupts agricultural livelihoods and access to markets. Migration also worsens healthcare access, particularly in rural areas where displaced households experience a higher likelihood of illness. For urban households, migration fails to alleviate their healthcare challenges due to the collapse of urban healthcare systems. The study calls for urgent policy interventions, including targeted food aid and mobile healthcare services. Restoring healthcare infrastructure, expanding social protection mechanisms, and fostering peacebuilding efforts are critical to mitigating future displacement and supporting socioeconomic recovery. These findings offer valuable insights for policymakers and humanitarian actors to address the immediate and long-term needs of displaced populations in Sudan.

Keywords: conflict, shocks, forced displacement, migration, food security, health

1) INTRODUCTION

Sudan has faced a series of profound challenges in the past few years brought about by political instability, climate adversities, and economic instability. These factors have collectively heightened the vulnerability of its population. The ongoing conflict between the Sudanese Armed Forces (SAF) and the Rapid Support Forces (RSF) that started in April 2023 has led to catastrophe for many Sudanese households, leading to widespread forced displacement both internally and internationally. As households grapple with the repercussions of shocks linked to conflict, migration has emerged as an important coping strategy, allowing households to seek safety and livelihood opportunities elsewhere. Moreover, the implications of shock-induced migration for Sudanese households extend beyond relocation alone, as the food security and health status of migrant households are also affected.

Sudan has experienced decades of civil war and conflict, leading to 3.7 million internally displaced persons (IDPs) and approximately 1.1 million refugees by 2022 (UNHCR 2022). Even prior to the current conflict that began in 2023, Sudan was already a fragile economy, classified as a low-income country where an estimated 66 percent of the population lived below the poverty line (AfDB 2024). This pervasive poverty presents a critical challenge even in the absence of conflict, leaving millions vulnerable and leading precarious lives.

The current conflict between SAF and RSF has resulted in the forced displacement of a large share of the population, increasing food insecurity and reducing their access to critical public services such as healthcare. By early December 2024, more than 12 million Sudanese were displaced, out of which 2.5 million had fled to neighboring countries. The conflict has also led to over 28,800 fatalities (ACLED 2024). The conflict has disrupted lives and livelihoods and destroyed infrastructure and public services (Abushama et al. 2023; Kirui et al. 2023; Siddig et al. 2023) and left almost 25 million people, about half of Sudan's population, in need of humanitarian assistance. In this context, shock-induced migration may sharply reduce households' access to essential resources, including food and healthcare, leading to complex and almost uniformly adverse socioeconomic outcomes. Understanding how such migration worsens household food security and health is necessary for informing effective humanitarian and development interventions.

Answering the research questions addressed in this study will provide a useful understanding of how conflict shocks harm migrant households and the consequent implications for their food security and access to healthcare. By studying the sorts of impacts conflict-related shocks have on Sudanese households, this paper considers whether migration is an effective coping strategy for safeguarding household welfare in the context of conflict. This study contributes to the research literature on access to food and healthcare for refugees and internally displaced persons (IDP). It can also guide policymakers and humanitarian actors in targeting interventions to alleviate the adverse impacts of conflict on the food security and wellbeing of the people of Sudan.

2) LITERATURE REVIEW

Voluntary versus forced migration are two distinctive motivational concepts within the migration literature. The first refers to population movements in search of economic

opportunities, such as employment, business opportunities, or study. Forced displacement is defined as migrations caused by circumstances beyond the individual's control, such as armed conflict, human rights violations, natural disasters, or environmental degradation (Khatiwada 2008; Piguet 2018; Tataru 2020). Based on the cause of displacement, forced migration can be conflict-induced or disaster-induced. Conflict-induced migration refers to the displacement of people in response to incidents of violence or unrest in which the authorities fail to protect the individuals affected (Khatiwada 2008).

Forced displacement, which is the focus of this study, affects millions of people in regions of conflict and instability. The shock of conflict produces a migration shock in each impacted community, resulting in some households choosing to move either within or outside their country of origin. This movement will also result in changes in the migrating households' access to food and healthcare services. In this section the research literature on migration is examined along three dimensions:

- ◆ Conflict-induced and climate-induced migration and the determinants of the household's decision to migrate;
- ◆ The impacts of forced displacement on individuals and communities, and
- ◆ Analytical approaches to assessing the impact on households of shock-induced migration.

2.1 Conflict-induced migration and the determinants of the migration decision

The impact of conflict on migration is a well-established area of study. The literature highlights how wars, civil unrest, or political violence trigger both international refugee flows and internal displacement. Raleigh (2011), in this respect, employed a dynamic threat framework to understand how conflict patterns, poverty, and ecological factors drive migration in developing countries. The findings from this work suggested that conflict impacts migration by influencing the volume, direction, and types of migration. Conflict and poverty were found to be the primary drivers of migration, while ecological and political instabilities are indirect drivers. More recently, Crippa et al. (2022) underscored the influence of internal conflict and external threats on net migration in low-income nations. Their findings demonstrated that violence substantially affects net migration in low-income nations, with an estimated net impact of conflict on migration at 14.7 percent. In high-income countries, the principal determinant of migration was initial GDP, signifying that economic factors are the principal influences on migration patterns in these areas.

Other research suggests that individuals have a choice in whether to flee their homes as a result of conflict. This choice-centered research assesses the options available for individuals; the determinants of the decisions of individuals and households to remain, leave, and, if left, return; and the coping strategies adopted by those who decided to stay and not migrate. Adhikari (2011) argued that physical threat is a major determinant affecting how long people can cope with conflict and remain in their villages. Other factors affecting whether individuals and households decide to migrate include economic wealth and opportunities. The coping strategies adopted by those who chose not to migrate were found to include more actively supporting one side in the conflict and increasing one's reliance on social networks for welfare support. Ibáñez and Vélez (2008) stressed that direct threats, indirect violence, state presence, and household characteristics are among the determinants

of forced displacement due to civil conflict in Colombia. Their empirical findings showed that 78 percent of displaced households faced direct threats, compared to 9 percent of nondisplaced households. Almost all displaced households reported being victims of indirect violence, compared to 75 percent of nondisplaced households. Landowners who are targeted by armed groups, younger household heads, and generally those with fewer economic resources are more vulnerable to losing their primary income sources and, in turn, are more likely to be displaced.

Several studies show that a threshold level of violence operates to affect people's migration decisions. Williams et al. (2008) examined how specific political events with varying levels of violence during the Maoist insurrection in Nepal significantly influenced individuals' decisions to migrate. High violence intensity events, like gun battles, increase migration by 15 percent for each event, while lower intensity events, like bomb blasts, decrease the odds of outmigration by 5 percent. Generally non-violent events, such as government changes and strikes, can contribute to increased migration due to reduced security and increased economic instability. Erdal et al. (2023) also found that there can be thresholds of violence or socioeconomic collapse that trigger migration. The destruction of infrastructure, loss of livelihoods, and lack of basic services significantly increase decisions to migrate. Moreover, perceived threats and actual experiences of violence both play important roles in whether individuals or households decide to stay or leave.

The literature on migration drivers highlights that climatic and environmental shocks are increasingly recognized as key factors influencing human mobility and migration. For instance, Hossain et al. (2022) analyzed climate change-induced human displacement in Bangladesh and its impact on the livelihoods of displaced riverine island communities. Their findings revealed that displaced households face significant livelihood challenges, including food insecurity, unemployment, income loss, and inadequate housing and sanitation. To cope with these hardships, households in Bangladesh adopted various adaptation strategies such as reducing expenses and food consumption, engaging in livestock rearing, and seeking shelter on government land.

Similarly, Blocher et al. (2024) explored the effects of environmental and non-environmental shocks on livelihoods and migration in Tanzania, focusing on the interplay of these shocks, their timing, and contextual factors in the context of climate change. Their study found that environmental shocks, such as droughts and floods, significantly increase the likelihood of migration, with each additional environmental shock within the past year raising the probability of migration by 0.81%. While the effects of environmental shocks are most pronounced in the short term, they remain significant for up to 36 months post-event. In contrast, non-environmental shocks, such as economic or health-related disruptions, showed inconsistent effects on migration patterns.

2.2 Impact of forced migration on individuals and communities

A broad array of studies explores the economic, cultural, social, political, and environmental impacts of forced displacement on individuals, families, communities, and entire countries. Both natural disaster-induced and conflict-induced migration erode the livelihood and economic status of individuals and households. For example, Ibáñez and Vélez (2008) estimated the welfare losses suffered by displaced households in Colombia as a result of conflict as averaging 37 percent of the net present value of rural lifetime consumption.

George and Adelaja (2022), who examined the impact of armed conflicts and forced displacement on food security in host communities in Nigeria, showed that the inflow of IDPs affects household-level food security outcomes, particularly food consumption scores, in those communities. Insurgency-driven displacements negatively affect food security in host communities. However, they also found that displacements caused by natural disasters and localized communal clashes may result in positive food security impacts. George and Adelaja attribute this as likely being due to more effective humanitarian response to such shocks than is the case with conflict-induced shocks.

In the context of Sudan, displacement due to conflict has been shown to have significant challenging implications for livelihoods. Assal (2011) focused on IDPs in Khartoum, particularly those from southern Sudan, to identify the causes and consequences of conflict-induced migration and to describe their living conditions and coping strategies. The research suggested that protracted conflict, political decay, economic underdevelopment, and religious ideology were important drivers of mass displacement. The specific economic impacts of the conflict and the displacement it caused included declining GDP, rising poverty, and shrinking household resources, all exacerbating several dimensions of the crisis associated with the conflict.

Pre-conflict economic and asset levels are important determinants of the initial impact of conflict on both displaced and nondisplaced households. In Lira district, Uganda, Fiala (2015) highlighted the severity of the initial economic shock of displacement and the varying recovery rates of households based on their level of assets prior to the conflict. The analysis showed that while in IDP camps displaced households experienced a decrease in consumption of between 28 and 35 percent and a loss in the value of their asset of half a standard deviation. Two years after returning home, displaced households still lagged behind nondisplaced households with 20 percent lower consumption and fewer assets. Households in the top quartile for the value of assets pre-displacement showed some recovery in consumption but had significantly reduced wealth levels.

In Sudan, World Bank researchers conducted a study to investigate the challenges faced by households in managing environmental shocks and how social protection programs might support them (Etang and Sering 2022). Forty-five percent of households experienced shocks in 2014/15, with poor and rural households being the most affected—50 percent of poor households, 63 percent of crop farmers, and 50 percent of livestock-owning households. The impact of floods or droughts is significant, leading to a 5.3 percent decrease in per capita consumption and increasing the likelihood of a household being in poverty by 57 percent. Such shocks negatively affect consumption, dietary diversity, and assets, trapping households in “poverty cycles.”

Guo et al. (2023) used satellite data to monitor economic activity in Sudan during the current conflict. A parallel study by Abushama et al. (2023) sought to understand how the conflict in Sudan has affected economic activity and migration patterns. The latter study focused on internal displacement due to the conflict, with some individuals moving toward transitional areas before crossing borders to neighboring countries, such as Saudi Arabia and South Sudan. The findings from both studies showed that key economic sectors, like agriculture and gold mining, faced severe disruptions. The conflict resulted in decreased production capacity, particularly in Khartoum, where the operations of many firms and institutions are centralized, but were unable to function since the conflict started. The disruptions also

impacted trade, notably imports of food and exports of gold and livestock, leading to economic contraction. Prices of basic commodities soared by between 40 and 60 percent in conflict-affected areas, further exacerbating food insecurity and economic challenges for households.

Researchers have also analyzed the impact of migration on healthcare access and the consequent health outcomes for households. There is a broad consensus that displacement adversely affects health. For example, Zilic (2015), examining civilian displacement during the war in Croatia in the early 1990s found significant adverse effects of forced displacement on both physical and mental health. Displacement reduced the probability of Croatians rating their health as good or better by 7.2 percentage points. It increased the likelihood of their suffering from systolic hypertension by 27 percentage points and diastolic hypertension by 23 percentage points. Encouragingly, displacement did not significantly change healthy behaviors, such as eating, drinking, and abstaining from smoking.

Lori and Boyle (2015) reported that refugee movements create fragile healthcare systems, leading to challenges in providing adequate care. For example, the researchers found that in the Democratic Republic of the Congo (DRC) 45.3 percent of refugees were unvaccinated for TB and 68.5 percent were unvaccinated for measles. Moreover, the situations that precipitate refugee movements are also associated with human rights violations, including gender-based violence and child soldiers. Among 12,000 internally displaced people in DRC, 53 percent of families reported at least one violent event involving a family member within 100 days prior to the survey.

Migration impacts health outcomes through loss of income and employment and inadequate education and housing. Marceca (2017) highlighted the importance of protecting migrants' health as a public health investment. Migrants often face job insecurity and lower wages, which can lead to poorer health. The education level an individual has attained will influence health literacy and their access to health information, so migrants with low education may struggle to navigate health systems. Moreover, migrants may face barriers access to healthcare services, including those due to language, cultural differences, and lack of legal status.

Beyond the impact on health outcomes, the effect of displacement on the fertility and reproductive health of migrant women has also been examined. For example, Verwimp et al. (2020) explored the impact of conflict-induced displacement on fertility behavior in Burundi during the civil war that ended in 2005. The research distinguished between remaining-in-place, voluntary migration, and forced displacement, as well as periods spent on the move versus in residence at a new site. The study concluded that forced displacement significantly impacts fertility, with forcibly displaced women having less control over their reproductive behavior compared to voluntary migrants. The risk of a woman having her first pregnancy is 41 percent higher in the year of forced displacement and 23 percent higher during residency for forced displacement. In contrast, for those who migrated voluntarily, it is 24 percent lower. Moreover, the risk of subsequent pregnancies increases during forced displacement, while this risk is reduced by 20 percent for voluntary migration.

Márquez-Lameda's (2022) study of female Venezuelan refugees in Peru highlighted significant disparities in access to sexual and reproductive healthcare services based on their socioeconomic status, whether they had any health insurance, and their geographical

location. Women with lower or middle socioeconomic status had reduced access to such services.

2.3 Analytical approaches in studying conflict and migration

Crippa et al. (2022) established a clear empirical link between conflict and migration while also addressing potential endogeneity issues that may arise when considering the effects of migration on conflict and vice versa. Their study employed a cross-country panel analysis that introduces conflict as a key determinant of migration, particularly considering income disparities. The study used several methods to measure conflict variables. For estimation, both three-stage least squares and instrumental variable (IV) approaches were utilized to estimate the impact of conflict on migration while controlling for GDP and other relevant variables. Blocher et al. (2024) applied a fixed effects panel model for a similar study of Tanzanian households. The analysis included interaction models and robustness checks. Hossain et al. (2022), also working in Tanzania using data from 280 IDP households, applied a mixed-method approach that combined qualitative and quantitative methods.

Kosec and Song (2018), for a longitudinal study in Kyrgyzstan over 11 years from 2004 to 2014, employed a fixed effects model with instrumental variables. The fixed effects model was applied to analyze employment outcomes, comparing current and lagged income impacts on employment status over time. George and Adelaja (2022) used an IV approach in their study in Nigeria to address endogeneity concerns related to the non-random assignment of IDPs. The study combined household panel survey data with data on IDPs maintained by humanitarian agencies assisting the IDPs.

To address potential endogeneity in estimating the impact of conflict shocks on household welfare across several countries, Diallo and Tapsoba (2022) constructed instruments using the predicted values of conflict derived from socioeconomic and political determinants. This allows for a clearer estimate of the causal effects of conflict on migration. The analysis focused on low-income countries in Africa and included observations from different time averages (2, 3, 4, and 5 years) for both GDP and conflict variables.

3) DATA AND METHODOLOGY

3.1 Data and sample characteristics

The analysis leverages information from three recent household surveys to evaluate the impact of the conflict in Sudan on the decision of households to migrate and the implications of that decision on their food security and health (Table 1). Each survey provides data that can be used to quantitatively assess the effects of shock-induced migration on Sudanese households. While differences in the survey methodologies pose challenges for direct comparisons of household decisions and the impacts of those decisions between the period before and during the conflict, analysis of each dataset provides valuable insights.

Table 1 Summary of survey data used in the study

Survey	Sudan Labor Market Panel Survey (SLMPS)	Sudan Rural Household Survey (SRHS)	Sudan Urban Household Survey (SUHS)
Coverage	Nationwide, all 18 states	Rural areas nationwide	Urban centers nationwide
Conflict context	Low-level generalized conflict; before April 2023 start of Sudanese Armed Forces (SAF) and Rapid Support Forces (RSF) conflict	During SAF/RSF conflict	During SAF/RSF conflict
Sample unit	Household and individual	Household	Household
Household sample	4,878	4,505	3,000
Urban / Rural	Both rural and urban	Rural	Urban
Data collection modality	In-person	Computer-assisted telephone interviewing	Computer-assisted telephone interviewing
Data collection period	June–September 2022	November 2023—January 2024	May–July 2024

Source: Authors' compilation based on Krafft et al. (2023); Kirui et al. (2024); IFPRI & UNDP (2024b)

2022 Sudan Labor Market Panel Survey (SLMPS). SLMPS provides a detailed snapshot of labor market dynamics in Sudan and is the first nationally representative labor market survey since 2014. Conducted by the Economic Research Forum (ERF) in partnership with Sudan's Central Bureau of Statistics (CBS), the survey sampled 4,878 households nationwide. Despite significant challenges posed by political unrest and economic instability, interviews with SLMPS sample households were conducted in person between June and September 2022. With a particular focus on employment, migration, and socioeconomic conditions, the survey oversampled vulnerable populations, including refugees and IDPs, offering critical insights into labor market disparities in fragile contexts (Krafft et al. 2023). The survey addresses a wide range of topics, including violence and climatic shocks, migration patterns, household demographics, educational attainment, housing conditions, and access to essential services like health and education. These data provide a comprehensive and nationally representative overview of Sudan's socioeconomic landscape prior to the SAF/RSF conflict.

2023/24 Sudan Rural Household Survey (SRHS). SRHS was conducted by the International Food Policy Research Institute (IFPRI), in collaboration with the United Nations Development Program (UNDP) and the World Food Programme (WFP). Respondents were interviewed using computer-assisted telephone interviewing (CATI) survey administration methods between 09 November 2023 and 05 January 2024, about six months after the onset of the SAF/RSF conflict in April 2023. This survey provided the first nationwide data on rural households following the eruption of conflict. It provides baseline data on the economic activities and food security of rural households, forming part of a planned longitudinal study involving regular rural household survey rounds (IFPRI and UNDP 2024a).

2024 Urban Household Survey (SUHS). IFPRI implemented SUHS in partnership with UNDP. The 3,000 urban households in the survey sample were interviewed between May and July 2024, just over one year after the onset of the conflict. CATI was also used to administer the SUHS questionnaire. The survey sample was designed to provide both national and state-level estimates for urban households across Sudan (IFPRI and UNDP 2024b). As with SRHS, SUHS is also the first round of what is to be a panel survey program to enable longitudinal studies of urban households in Sudan to be done.

SRHS and SUHS both addressed a range of topics, including demographics, income sources, food security, market access, healthcare access, and exposure to shocks, including, but not limited to, health shocks. Questionnaires were developed collaboratively, with sensitivity to local dialects and cultural nuances. Enumerator training emphasized ethical interviewing and data quality, supported by rigorous quality assurance measures (IFPRI and UNDP 2024a; 2024b).

While CATI facilitated data collection under difficult conditions, it introduced some limitations including network connectivity issues, reduced depth of interaction in interviewing, and, perhaps most importantly, disparities in phone ownership in the population potentially introduced bias in the survey estimates—the samples for the both surveys likely underrepresented low-income households, as they are more likely than other household groups to not have telephone access. There also were challenges related to inactive phone numbers and non-responses, but mitigation strategies, such as extended survey periods and repeated call attempts, partly addressed these challenges. Nonetheless, the surveys were completed, and their data provides insights into changes in the welfare of Sudanese households in both rural and urban settings during the conflict.

3.2 Analytical approach

This study employs inverse probability weighting (IPW) to estimate the treatment effects of conflict-induced migration on food insecurity and health outcomes. IPW is a robust statistical technique that adjusts for confounding variables to enable more accurate estimation and understanding of causal effects (Rosenbaum and Rubin 1983; Porth et al. 2021). By utilizing treatment effects models, the analysis captures causal effects for various treatment types, including continuous, binary, fractional, and multivalued treatments. This approach is applied across two distinct periods: pre-conflict before the start of the SAF/RSF conflict in April 2023 and during the ongoing conflict.

The analysis involves running three regressions. The first is used to explore the implications of conflict shocks on migration. The second assesses the impact of migration on household food insecurity, while the third examines the impact of migration on household health status. Each of the three datasets is analyzed separately providing a comprehensive understanding of the causal relationships during pre- and post-conflict periods for both rural and urban households.

Shock-induced migration patterns. The treatment effects model was applied to estimate the binary outcome of household migration. The dependent variable equals 1 if the household moved due to violence or conflict, and 0 otherwise. The reduced form of the equation is:

$$Migration_i = \beta_0 + \beta_1 Shock_i + X_i \beta + \mu_i \quad (1)$$

Where;

- ◆ **Migration_i**: Binary outcome representing whether a household moved inter- or intra-state (1 = moved, 0 = did not move).
- ◆ **Shock_i**: Binary variable equal to 1 if the household experienced shocks, and 0 if no shocks occurred.

- ◆ X_i : Vector of explanatory variables that capture key household characteristics and factors influencing the experience of conflict-related shocks. These variables include the state of residence, with Khartoum state serving as the reference category; female-headed household, which is equal to 1 if the household is female-led, and the age of the household head in years. Other explanatory variables include household size; whether the household has access to electricity, clean water, adequate housing, and whether the household head is employed. These variables both serve to control for household heterogeneity and shed light on how specific household attributes influence migration decisions in response to conflict shocks.
- ◆ μ_i is the error term.

In this study, the shock variable is constructed differently in the two distinct time periods – pre- and during-conflict. The shock variable in the pre-conflict data is composed of a climatic shock variable, whereby the conflict variable is eliminated from the analysis given very few information available about conflict and violence incidents before the eruption of the April 2023 conflict. From the data collected amid conflict, the shock variable is constructed through combining direct and indirect conflict and violence incidents' variables.

Impact of conflict-induced migration on food security and health outcomes. Two models were developed to estimate the effects of conflict-induced migration on socioeconomic outcomes:

- ◆ The indicator for food security is the raw score for the household of the Food Insecurity Experience Scale (FIES).
- ◆ The indicator for health outcomes is a binary variable for which 1 indicates that migration led to a deterioration in health-related outcomes in the household, and 0 otherwise.

The reduced form of the equation for these models is:

$$Outcome_i = \beta_0 + \beta_1 Migration_i + X_i \beta + \mu_i \quad (2)$$

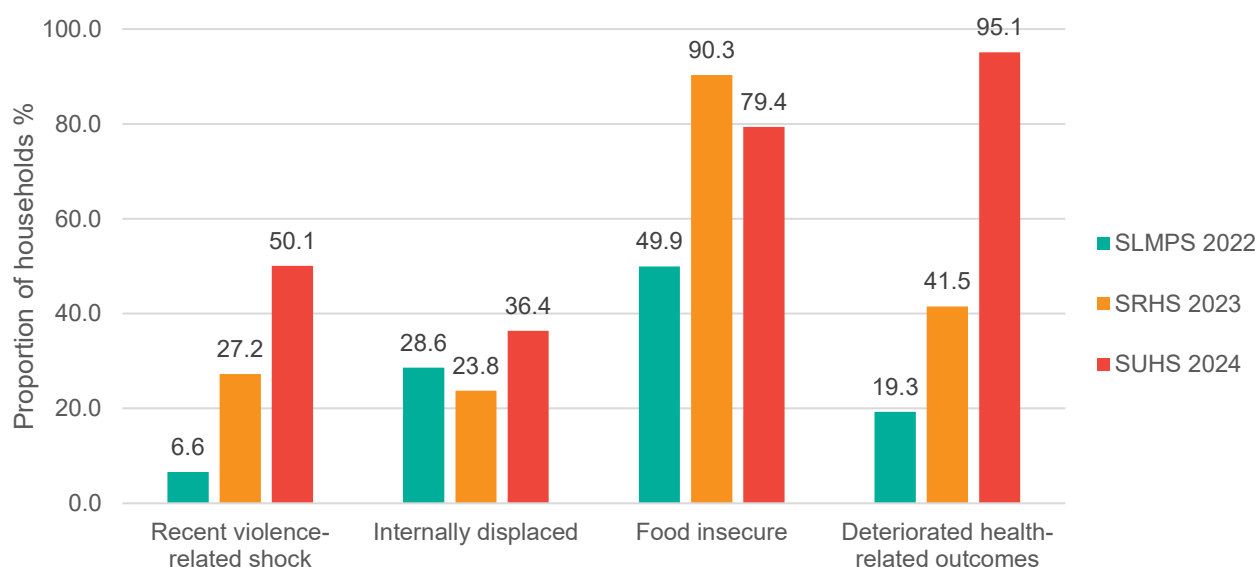
- ◆ **Outcome_i**: The dependent variable representing food security (FIES score) or whether the health-related outcomes of the household have recently deteriorated (0/1).
- ◆ **Migration_i**: Binary variable (0/1) indicating whether the household moved due to conflict-induced shocks.
- ◆ X_i : Vector of explanatory variables similar to X_i in Equation 1, capturing household characteristics and contextual factors that influence socioeconomic outcomes.
- ◆ μ_i is the error term.

In this study, health-related outcomes are analyzed through variables constructed differently from the different datasets. Analysis from the SLMPS 2022 and the SUHS 2024 data estimates the deterioration of health-related outcomes through assessing the difficulty in accessing healthcare services. In contrast, in the SRHS 2023/2024 data, the health-related outcome variable is constructed through a sickness variable, in absence of adequate information on access to healthcare.

3.3 Descriptive statistics of key variables

The data from the 2022 SLMPS, 2023/24 SRHS, and 2024 SUHS household surveys provide a comprehensive view of how conflict has altered migration patterns and disrupted the socioeconomic fabric of Sudanese households. Before the onset of the conflict in April 2023, instances of violence and unrest were relatively limited, affecting only 6.6 percent of households. However, with the start of the conflict, particularly in urban centers such as Khartoum and Madani, the scale of displacement increased significantly. By mid-2023, 24 percent of rural households and 36 percent of urban households reported migrating internally (Figure 1).

Figure 1 Conflict-related dependent variables, descriptive statistics by data source



Source: Authors' analysis of SLMPS 2022, SRHS 2023 and SUHS 2024.

Note: SRHS 2023 does not include indicators of educational services.

Rural households, generally more stable in their residence, experienced a rise in internal migration as economic conditions deteriorated after the conflict. Market closures, declining purchasing power, and insecurity drove many rural families to move to what they perceived as safer locations or seek alternative livelihoods. Urban households, however, faced even greater upheaval, as the conflict's epicenter was Khartoum, from where it expanded to other urban centers. The fighting forced significant displacement of urban households. The urban nature of the conflict explains why over 50 percent of urban households reported experiencing conflict and violence during this period, compared to 27 percent of rural households (Table 2).

Table 2 Key analytical variables, descriptive statistics

Variables	2022 SLMPS	Mean 2023/24 SRHS	2024 SUHS
Dependent Variables			
Engaged in internal migration, 0/1	0.286	0.238	0.364
Food Insecurity Experience Scale (FIES score)	2.638	4.085	3.226
Health-related outcomes, 0/1	0.954	0.415	0.049
Independent Variables			
Conflict shocks, 0/1	0.066	0.272	0.501
Climate shocks, 0/1	0.367	0.034	na
SAF/RSF conflict, 0/1	na	0.111	0.139
Age of household head, years	47.07	36.05	45.31
Low Education of HH	63.37	50.84	21.50
Medium Education of HH	29.34	32.24	50.23
High Education of HH	7.30	15.92	28.27
Female-headed household, 0/1	0.231	0.501	0.94
Has adequate housing, 0/1	0.622	0.292	0.529
Household size, number	5.216	10.409	8.852
Experienced recent decline in income, 0/1	0.276	0.879	0.892
Employed household head, 0/1	0.711	0.648	0.830
Access to electricity, 0/1	0.213	0.714	0.089
Access to safe water	10.36	3.58	4.10
Physical security, 0/1	na	0.568	0.201

Source: Authors' analysis of SLMPS 2022, SRHS 2023 and SUHS 2024.

Note: "na" = not applicable

Note: Education of household head is a categorical variable; no or low education = no education or started or only completed primary education, medium education = completed high school, TVET, or undergraduate diploma, and high education = completed higher education degrees (bachelors, master's or PhDs).

Food insecurity, already a pressing issue before the conflict, worsened considerably. Approximately 50 percent of households faced some degree of food insecurity before the start of the SAF/RSF conflict. By mid-2023, this had risen to 90 percent among rural households and 79 percent among urban households. For rural households, disruptions in markets, volatile prices, and diminishing incomes compounded the crisis. Urban households, meanwhile, struggled with reduced food availability and affordability, further amplifying the insecurity.

The conflict has also critically disrupted access to essential services. Healthcare provision has been decimated, with 95 percent of urban households reporting no access to medical care due to the destruction or closure of facilities (Figure 1). Education systems have similarly deteriorated, as schools were destroyed, repurposed, or abandoned, leaving 69 percent of children in urban households unable to attend school. These disruptions highlight the broader implications of the conflict, not only in the immediate loss of services but also in the longer-term consequences for human capital development.

The data also illustrates stark changes in household economic conditions. The proportion of households reporting declines in income rose dramatically from 28 percent in 2022 to nearly 90 percent in both 2023 and 2024. Despite these economic challenges, employment rates showed some recovery in 2024 (83 percent) compared to 2023 (65 percent), potentially reflecting a shift in labor dynamics as households adapted to conflict conditions.

Household composition and characteristics shifted significantly. Average household sizes nearly doubled between 2022 (about 5 members) and 2023/24 (between 8 and 10 members), likely due to families consolidating and sharing resources during the conflict. Housing adequacy also declined, with only 29 percent of rural households reporting adequate conditions in 2023/24 and 53 percent of urban households in 2024, compared to 62 percent of all households in 2022.

The education levels of household heads are closely linked to household migration patterns. However, these levels have shown minimal variation between the pre-conflict and current periods. Among rural household heads, the majority (59 percent before the conflict and 50 percent currently) have no-to-low education levels. In urban areas, the proportions of household heads with medium and high education levels have sharply declined, from 63.3 percent to 50.2 percent and from 80.9 percent to 28.3 percent, respectively. This reduction in the share of highly educated household heads can be attributed to cross-border migration, particularly from Khartoum state, where most high-skill jobs were concentrated. This migration has resulted in a reduced presence of high-skilled household heads within Sudan.

Given the variation in survey methodologies used between the datasets, slight adjustments were made to the selection of independent variables for each model estimation to better align with the distinct outcomes and treatment equations (Table 2). Despite this caveat, the IPW methodology remains robust in the estimation of treatment effects, allowing us to measure the impact of shock-induced migration on food security and health outcomes. This approach also provides insights into the likelihood of households experiencing changes in socioeconomic outcomes across different time periods, influenced by varying magnitudes of shocks.

4) REGRESSION RESULTS AND DISCUSSIONS

4.1 Conflict-induced migration—the drivers of internal displacement

The analysis of the data on households' experience of conflict underscores its critical role in driving internal migration. Before the outbreak of the SAF/RSF conflict in April 2023, 6.6 percent of households reported experiencing violence, unrest, or conflict. However, the escalation of violence in 2023 resulted in 27 percent of rural households and 50 percent of urban households reporting having been affected by violent incidents or unrest. These findings highlight the significant impact of conflict on household security and economic wellbeing, particularly in urban areas like Khartoum, (Kirui et al. 2023, Guo et al. 2023).

To analyze pre-conflict dynamics using the SLMPS 2022 data, we included a climate shocks variable and excluded conflict shocks due to limited information on conflict and violence incidents during 2021–2022 (Table 3). Only 6.58 percent of households reported experiencing conflict incidents, suggesting their negligible scale and impact. The relative political stability in Sudan during 2022 can largely be attributed to the Juba Peace Agreement of October 2020 and subsequent efforts by the transitional government to resolve conflicts. Consequently, in the period preceding April 2023, while climatic shocks showed a negative coefficient, they did not significantly influence household migration decisions.

The escalation of the SAF/RSF conflict in 2023 resulted in widespread displacement across Sudan's 18 states. Our analysis shows a significant likelihood of migration among both urban

and rural households due to conflict. Urban centers, in particular, emerged as hotspots of conflict, with most urban households reporting negative impacts from conflict shocks. Using 2024 SUHS data, the states of White Nile, Al Jazira, Blue Nile, Gedaref, Kassala, and Red Sea recorded the highest levels of migration relative to Khartoum. While Khartoum and Al Jazira experienced direct violent incidents, the other states were impacted primarily through their role as transit or host regions for displaced populations. Although rural households were also affected, the impact of conflict on their migration decisions was less pronounced compared to urban households. This disparity reflects the concentration of conflict in urban regions and its slower spillover into rural areas.

Household socioeconomic factors significantly influenced migration patterns during the conflict. Employment status deterioration among household heads was more acute in urban households, particularly in Khartoum, where the pre-conflict economy centralized there employed millions. Household size also played a role, with larger rural households showing a higher likelihood of migrating. However, in urban areas, household size was insignificant in influencing migration, underscoring the direct and immediate threat of violence in cities regardless of family size.

Table 3 Treatment effects model results for impact of shocks on migration

Variables	SLMPS 2022		SRHS 2023		SUHS 2024	
	Coefficient	Std. err.	Coefficient	Std. err.	Coefficient	Std. err.
Shock	-0.011	0.015	0.229***	0.016	0.177***	0.030
Age of household head	-0.027***	0.011	-0.002	0.023	0.037	0.037
Female-headed household	-0.055	0.081	-0.156	0.152	0.650**	0.268
Health	-0.120	0.172	na	na	-0.250***	0.081
Employed household head	0.272***	0.084	-0.178*	0.108	-0.765***	0.139
Electricity access	1.428***	0.085	-0.172	0.142	0.019	0.202
Safe water access	0.010***	0.002	-0.147***	0.033	0.006	0.015
Household size	0.041***	0.014	-0.189***	0.060	-0.029	0.071
Physical security	na	na	-1.117***	0.119	-0.934***	0.126
Aj Jazirah	0.320	0.221	-0.408**	0.166	-1.565***	0.320
Blue Nile	1.058***	0.229	-0.618*	0.344	-1.725***	0.402
Central Darfur	1.227***	0.229	-0.234	0.321	-1.381***	0.483
East Darfur	1.487***	0.247	-0.882***	0.331	-0.506*	0.288
Gedaref	0.281	0.258	-1.462***	0.440	-2.036***	0.246
Kassala	0.886***	0.253	-2.244***	0.601	-1.601***	0.366
North Darfur	2.199***	0.254	-0.942***	0.240	-0.412**	0.206
North Kordofan	0.760***	0.237	-0.608***	0.219	-1.686***	0.292
Northern	1.038***	0.237	-0.093	0.313	-0.963**	0.377
Red Sea	0.607**	0.251	-0.151	0.309	-1.499***	0.403
River Nile	1.536***	0.246	-0.786**	0.329	-0.658**	0.272
Sennar	0.763***	0.243	-3.064***	1.017	-0.945***	0.299
South Darfur	0.588**	0.251	-0.403**	0.196	-0.640***	0.205
South Kordofan	1.199***	0.236	-1.064***	0.371	-0.741**	0.327
West Darfur	-1.177***	0.386	-1.087***	0.317	-1.121***	0.329
West Kordofan	0.640***	0.238	-2.257***	0.447	-1.439***	0.294
White Nile	2.852***	0.253	-1.560***	0.434	-2.120***	0.404
Constant	-1.529***	0.372	0.714	0.492	-1.835**	0.914
Observations analyzed	4,794		4,456		2,999	

Source: Authors' analysis of SLMPS 2022, SRHS 2023 and SUHS 2024.

Note: "na" = not applicable.

Note: Health variable is defined in the SPLMS 2022 data as binary variable of health status of respondent (0/1). In SUHS 2024 the variable measures distance to healthcare center.
Note: State base category: Khartoum.

Finally, a key factor influencing migration is the households' experience of physical security and exposure to incidents of violence. Our analysis reveals that perceptions by the household deterioration in physical security in response to conflict shocks significantly increase the likelihood of households migrating, both in urban and rural areas.

4.2 Effect of conflict-induced migration on household food security

The conflict in Sudan has severely impacted household food security. Before the conflict, about half of Sudanese households were classified as food insecure. However, during the conflict, food insecurity escalated dramatically—more than 90 percent of rural households and almost 80 percent of urban households experienced moderate to severe food insecurity in 2023 and 2024. This highlights the profound impact of the current conflict on agricultural productivity and household livelihoods, especially in rural food production areas.

Prior to the conflict, households that migrated internally reported higher food insecurity scores. This indicates that migration, even in response to shocks other than conflict, such as those that are climate-induced, tends to exacerbate household food insecurity. The worsening food security among migrating households may be attributed to their pre-existing vulnerabilities or that migration itself is often a response to existential threats, such as violence.

During the conflict, rural households that migrated were significantly more likely to experience food insecurity, with a positive and significant coefficient on their FIES—a higher FIES score indicates greater experience of food insecurity. Migrant rural households also demonstrated a notable reduction in food consumption, as reflected by a decrease in their Food Consumption Scores (FCS). This suggests that migration, driven by conflict, disrupts access to food and livelihoods, further deepening food insecurity for displaced rural households.

Urban households, on the other hand, did not experience improved food security or food consumption following migration. Their movement was often driven by immediate threats such as violence, theft, and looting. These existential risks push urban households to migrate, but the lack of preparation or resources to sustain themselves at their destination will likely result in little improvement in their food security. The analysis also reveals that urban households lose a greater ability to absorb shocks or maintain consumption compared to rural households. The coefficient on FCS for urban households that moved is not statistically significant. This may suggest that urban households migrated out of necessity, without knowing how their food security would be influenced at their destination.

The effects of conflict-induced migration on food security vary slightly between rural and urban households (Table 4). For urban households, housing conditions and electricity access are significant factors influencing food security. Conversely, in rural areas, the loss of employment plays a more pronounced role in worsening food security. A reduction in income emerges as a common factor driving food insecurity in both urban and rural households. Additionally, our analysis highlights regional disparities in food security impacts. States such as Aj Jazirah, Blue Nile, Gedaref, Kassala, and White Nile show significant declines in food

security, reflecting their role as both key agricultural hubs and major transit or host areas for displaced populations.

Table 4 Treatment effects model results for conflict-induced migration on food insecurity

Variables	SLMPS 2022		SRHS 2023		SUHS 2024	
	Coefficient	Std. err.	Coefficient	Std. err.	Coefficient	Std. err.
Migration (moved internally)	0.437***	0.118	0.260***	0.093	0.146	0.097
Age of household head	0.046***	0.013	-0.001	0.020	-0.041*	0.023
Female-headed household	0.508***	0.087	-0.308**	0.126	-0.048	0.185
Household size	0.001	0.016	0.133**	0.049	-0.059	0.054
Employed household head	0.109	0.093	-0.038	0.080	-0.893***	0.115
Adequate housing	-0.260***	0.093	0.054	0.094	-0.334***	0.090
Safe water access	-0.001	0.002	-0.031	0.021	0.017	0.011
Access to electricity	-0.282***	0.096	-0.124	0.101	-0.433***	0.152
Medium Education of HH	0.046	0.086	0.624***	0.089	0.682***	0.114
High Education of HH	0.065	0.157	0.875***	0.113	1.309***	0.130
Reduction in income	0.190**	0.089	0.551***	0.090	0.274***	0.073
Physical security	na	na	0.074	0.099	0.097	0.107
Aj Jazirah	4.105***	0.431	1.389***	0.145	1.484***	0.221
Blue Nile	1.712***	0.445	0.657***	0.244	1.423***	0.255
Central Darfur	2.624***	0.442	-0.172	0.389	1.040***	0.323
East Darfur	3.472***	0.449	0.175	0.284	0.726**	0.283
Gedaref	2.452***	0.442	0.556**	0.230	1.321***	0.185
Kassala	0.885*	0.503	0.229	0.250	1.649***	0.249
North Darfur	2.096***	0.462	0.504**	0.202	1.016***	0.225
North Kordofan	3.442***	0.442	0.338	0.206	1.186***	0.215
Northern	1.807***	0.461	2.081***	0.230	2.806***	0.314
Red Sea	2.937***	0.439	0.719***	0.235	1.500***	0.258
River Nile	2.916***	0.442	1.454***	0.201	2.095***	0.255
Sennar	1.812***	0.454	1.174***	0.224	1.639***	0.245
South Darfur	0.379	0.544	0.394**	0.198	0.812***	0.224
South Kordofan	2.022***	0.449	0.081	0.305	0.906***	0.299
West Darfur	1.526***	0.477	0.330	0.272	0.840***	0.275
West Kordofan	1.609***	0.475	0.242	0.232	1.064***	0.231
White Nile	1.347***	0.473	1.169***	0.204	1.381***	0.225
Constant	-4.925***	0.541	-2.520***	0.428	-0.933***	0.578
Observations analyzed	4,794		4,456		2,999	

Source: Authors' analysis of SLMPS 2022, SRHS 2023 and SUHS 2024.

Note: "na" = not applicable.

Note: State base category: Khartoum. Education of HH base category = no or low level.

4.3 Effect of conflict-induced migration on health outcomes

Prior to the 2023 conflict, accessing healthcare was already a challenge for internally migrating households. Migrant households in the 2022 SLMPS showed a higher likelihood (0.035) of facing health difficulties compared to non-migrant households. Following the outbreak of the SAF/RSF conflict, rural households experienced more severe barriers to healthcare. Using a sickness variable as a proxy for healthcare access for our analysis, we show that conflict-induced migration significantly increases the likelihood of health deterioration or illness among rural households. This underscores how displacement

exacerbates pre-existing health vulnerabilities, as migrant households often struggle to find accessible and functional healthcare services in their new locations.

For urban households, the regression results indicate that migration does not improve healthcare access, as the relationship is statistically insignificant (Table 5). Whether urban households migrate or not, they face no measurable improvement in healthcare access due to the widespread collapse of healthcare systems during the conflict. This reflects the dire state of healthcare services in urban areas, compounded by the destruction and dysfunction caused by ongoing violence.

Table 5 Treatment effects model results for conflict-induced migration on health-related outcomes

Variables	SLMPS 2022		SRHS 2023		SUHS 2024	
	Coefficient	Std. err.	Coefficient	Std. err.	Coefficient	Std. err.
Migration (moved internally)	0.036**	0.016	0.079***	0.020	-0.001	0.009
Age of household head	0.046***	0.013	-0.002	0.020	-0.044*	0.023
Female-headed household	0.508***	0.087	-0.308**	0.126	-0.088	0.188
Household size	0.001	0.016	0.127**	0.049	-0.059	0.054
Adequate housing	-0.260***	0.093	0.045	0.094	-0.325***	0.090
Access to safe water	-0.001	0.002	-0.031	0.021	0.017	0.011
Access to electricity	-0.282***	0.096	-0.124	0.101	0.439***	0.150
Medium Education of HH	0.046	0.086	0.624***	0.089	0.681***	0.114
High Education of HH	0.065	0.157	0.875***	0.113	1.288***	0.131
Reduction in income	0.190**	0.089	0.551***	0.090	0.266***	0.073
Physical security	na	na	0.074	0.099	0.033	0.109
Aj Jazirah	4.105***	0.431	1.389***	0.145	1.596***	0.227
Blue Nile	1.712***	0.445	0.657***	0.244	1.529***	0.259
Central Darfur	2.624***	0.442	-0.172	0.389	1.131***	0.327
East Darfur	3.472***	0.449	0.175	0.284	0.756***	0.288
Gedaref	2.452***	0.442	0.556**	0.230	1.435***	0.192
Kassala	0.885*	0.503	0.229	0.250	1.758***	0.252
North Darfur	2.096***	0.462	0.504**	0.202	1.052***	0.230
North Kordofan	3.442***	0.442	0.338	0.206	1.293***	0.221
Northern	1.807***	0.461	2.081***	0.230	2.890***	0.312
Red Sea	2.937***	0.439	0.719***	0.235	1.604***	0.262
River Nile	2.916***	0.442	1.454***	0.201	2.165***	0.255
Sennar	1.812***	0.454	1.174***	0.224	1.718***	0.247
South Darfur	0.379	0.544	0.394**	0.198	0.860***	0.228
South Kordofan	2.022***	0.449	0.081	0.305	0.968***	0.302
West Darfur	1.526***	0.477	0.330	0.272	0.923***	0.280
West Kordofan	1.609***	0.475	0.242	0.232	1.160***	0.237
White Nile	1.347***	0.473	1.169***	0.204	1.498***	0.230
Constant	-4.925***	0.541	-2.520***	0.428	-0.999*	0.580
Observations analyzed	4,794		4,456		2,999	

Source: Authors' analysis of SLMPS 2022, SRHS 2023 and SUHS 2024.

Note: "na" = not applicable.

Note: State base category: Khartoum. Education of HH base category = no or low level.

The findings reveal that conflict-induced migration significantly impacts health outcomes through systemic barriers to healthcare access, particularly for rural households. Migrant households in rural areas are disproportionately affected, as displacement amplifies their

existing challenges, leaving them more vulnerable to health deterioration. For urban households, the lack of improvement in healthcare access highlights the widespread destruction of critical services, which renders migration an ineffective solution to address health needs. Overall, the analysis reflects the systemic collapse of Sudan's healthcare system during the SAF/RSF conflict, with pre-existing vulnerabilities especially in rural areas, being magnified by conflict, displacement, and the breakdown in physical and social infrastructure. These results underscore the urgent need to restore and strengthen healthcare systems in both rural and urban areas to address the health crises faced by displaced populations across Sudan.

5) CONCLUSION AND POLICY IMPLICATIONS

The ongoing armed conflict between the SAF and RSF has significantly disrupted the lives of Sudanese households, leading to widespread displacement and a sharp increase in socioeconomic vulnerabilities. This study, leveraging pre-conflict data from the 2022 SLMPs and data collected during the conflict from the 2023 SRHS and 2024 SUHS, provides a comprehensive analysis of the effects of conflict-induced migration on food security and healthcare access. The findings underscore the critical role of conflict in driving internal migration and highlight the divergent impacts on rural and urban households.

Our results reveal that prior to the beginning of the SAF/RSF conflict in April 2023, the compounded effect of climatic and conflict shocks had not been a significant driver of internal migration of households in Sudan. In comparison with the results of the analysis from data collected during the conflict in 2023 and 2024, we find that conflict shocks significantly influence the migration decision of households. We also find that conflict-induced migration exacerbates food insecurity, particularly for rural households, as displacement disrupts their agricultural activities and access to livelihoods. Urban households, while facing less impact on their food security status, often migrate due to existential threats, including violence, theft, and looting, rather than food security concerns. Additionally, our findings are that migration of urban households does not have a positive impact on their food security, which reflects the complex interplay in conflict settings between their physical security and their basic needs.

Healthcare access has deteriorated sharply due to the ongoing conflict. Rural households that have moved because of conflict have a high likelihood of experiencing sickness and deterioration in the health status of their members in light of significant barriers that they now face to access healthcare services. For urban households, migration does not alleviate their healthcare challenges, as the conflict has led to the widespread collapse of urban healthcare systems across Sudan. It is estimated that in the states most impacted by the SAF/RSF conflict, such as Aj Jazirah, Kordofan, Darfur, and Khartoum, between 70 and 80 percent of health facilities are now either barely operational or completely closed (WHO 2024). Similarly, education services in Sudan have also been critically affected, with schools destroyed or repurposed as shelters for IDPs, leaving approximately 17 million children out of school (UNICEF 2024). These findings highlight the compounded vulnerabilities of displaced populations in accessing essential social services.

The findings from this study underscore the importance of integrating conflict-sensitive approaches into humanitarian interventions and development planning to mitigate the adverse impacts of these conflict-induced crises. There is a need for coordinated and sustainable interventions that target internally displaced individuals in host communities,

provide social assistance, whether in-kind food or cash transfers; and rehabilitate healthcare facilities and provide medical staff to address the immediate health needs of displaced populations while laying the groundwork for long-term recovery and resilience-building.

Specific policy recommendations and implications include:

- ◆ **Strengthening humanitarian assistance for displaced households:** Targeted food or cash assistance, healthcare services and medical supplies, and shelter provision are urgently needed for displaced populations, particularly in rural areas where food insecurity is most acute. Additionally, host populations should also be included in development planning interventions to promote more resilient communities.
- ◆ **Rebuilding and reinforcing healthcare systems:** Immediate efforts should focus on restoring healthcare infrastructure, with mobile clinics and emergency health services deployed to both rural and urban areas to address critical gaps. Ensuring the delivery of medical supplies and life-saving medications to conflict-affected communities, as well as host communities, is equally significant in reducing the pressure on the already deteriorating healthcare system.
- ◆ **Enhancing and up-scaling social protection mechanisms:** Programs aimed at mitigating income losses and improving employment opportunities for displaced households and enhancing economic activities in host communities are essential to support recovery and reduce the long-term vulnerability of households adversely affected by the conflict.
- ◆ **Promoting conflict resolution and stability:** Long-term solutions to mitigate further displacement and dampen the adverse impacts of the conflict on socioeconomic outcomes hinge on addressing the root causes of conflict and fostering peacebuilding efforts.

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