

# EXPLORING THE IMPACT OF CLIMATE CHANGE ON FOOD SECURITY AND HEALTH

**IN A LAST MILE DISTRICT OF RURAL GHANA**

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**February 2024**



**Suggested citation**

Abubakari B, Boxall J, Abugri BA, Amoo BY, Ayichuru M, Fothergill-Misbah N, Head M, Kunc M, Miah K, Mogre V, Tweneboah E, Wright J, Ziblim S. Exploring the impact of climate change on food insecurity and health in a Last Mile district of rural Ghana. 2024.

<https://doi.org/10.6084/m9.figshare.25245082>







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# EXECUTIVE SUMMARY

THE STUDY WAS CARRIED OUT BY UNIVERSITY FOR DEVELOPMENT STUDIES, GHANA, AND THE UNIVERSITY OF SOUTHAMPTON, UK. THIS INCLUDED SUPPORT FROM THE MION DISTRICT AND NORTHERN REGIONAL HEALTH SERVICE DIRECTORATES, ALONG WITH MION LOCAL ASSEMBLY AND LOCAL RESIDENTS.

**This policy brief reports on mixed-methods research, including an in-person survey (n = 397) and focus group data (n = 16) collected in Mion district, Northern Region, Ghana in May 2023. Data was collected by Mion residents using electronic devices, who were trained by research staff from the University for Development Studies. We measured the prevalence of food insecurity, investigating significant predictors and geospatial clustering. We also explored community perceptions around climate change, food insecurity and health.**

Food insecurity was 100%, all participants were insecure to some level. The prevalence of moderate or severe food insecurity was 61.5% in Mion, with severe food insecurity at 26.4%. Participants had high knowledge of climate change, and suggested their local situation has been getting worse over the last five years. Most participants had, on at least one occasion in the last year, been unable to reach their local health facility due to the climatic conditions such as extreme heat or rainfall.

One strength of the validated food insecurity scale is that it measures a household's experience over 12 months, and is not specifically limited to the time of data collection. So whilst the study was conducted during the 'lean' season (i.e. the planting season) where households may have limited food reserves, the stark levels of insecurity shown here are important year-round observations.

These findings and experiences are likely to be similar in other Ghanaian communities, and across the African continent. As the impact of climate change increases, so do the threats to population health and access to adequate nutrition all year round. The situation needs urgent short- and long-term intervention.



# KEY FINDINGS

- 100% of the Mion respondents were food insecure to some level, and 94% described the situation as getting worse in the last 5 years.
- The prevalence of moderate or severe food insecurity (Pm+s) was 61.5% within this population in Mion, and the prevalence of severe food insecurity (Ps) was 26.4%.
- Mion food insecurity was higher than the equivalent national prevalence Ghana figure (Pm+s= 39.4%, Ps= 6.2%).<sup>1</sup>
- When asked how climate change was affecting household food supply, 99.5% reported this was occurring via a negative facet, including: food shortages (79.1%), higher food prices affecting affordability (10.8%), unavailability of some items (4.8%), or the experience of chronic hunger (4.8%).
- 75.6% felt that climate change has already made a personal difference to their health.
- Participants were asked about occasions where they had the intention to travel to a health centre in the last year, but chose not to because of adverse weather conditions (including heat and rainfall)- 33.3% indicated this happened once or twice, and 45.3% said several times.
- By age groups, 20-29-year-olds were more likely to report greater food insecurity.
- Household size was a significant predictor of food insecurity. Thus, the larger the household, the higher the possibility of food insecurity.
- Unemployment was another significant predictor of worsened food insecurity.
- How knowledgeable participants felt surrounding climate change was also a significant predictor. The more knowledgeable they felt, the less food insecurity they reported.
- The primary causes and effects of climate change identified in the focus groups included bushfires, logging, deforestation for large-scale farming, food scarcity, heavy storms, and decreased crop yield. These activities also contribute to reduced rainfall patterns.
- Participants expressed enthusiasm for ongoing community education and communication around climate change and health.



# RECOMMENDATIONS

**The evidence base linking climate change and food insecurity is strong and highlights significant public health issues. These results are likely to be applicable to some other rural communities in Ghana, despite the presence of food aid programmes.<sup>2</sup>**







## POLICY RECOMMENDATIONS

**Building resilient communities is a global priority for government intervention.<sup>3</sup> Ghana's Country Programming Framework (2018-2022) also focuses on food security, particularly for smallholder farmers, and climate change mitigation.<sup>4</sup> Last Mile communities need greater consideration within national policy, as there are different challenges and priorities in rural areas than in urban, more developed areas of Ghana.**

## SHORT-TERM MEASURES

- **Locally and in the short-term**, food aid programmes should address the issues raised by the Mion population, not just immediate food availability. Current solutions provide an unvaried dietary solution in mostly cereal products which does not encompass sufficient food security, specifically having sustainable access to a varied diet. Poor storage options, especially post-events such as flooding, mean aid packages will last a limited amount of time, especially in large households.

## LONG-TERM MEASURES

- **Improving transport infrastructure and technology** to ensure that despite terrain or climate challenges, food is more accessible in harder-to-reach areas. Access could also be improved to irrigation systems, as currently less than 1% of farmers across Ghana can make use of these systems.
- **Improving governmental intervention** to diversify crops, including commercial crops such as soya and shea nuts (and also poultry), to supplement any inadequate supplies.
- **Ensure that the ongoing health system revisions** in Ghana (for example the Network of Practice model) allow best-possible access to health facilities, taking into account worsening and unpredictable weather conditions.
- **Diversifying the economy** would lessen the dependence on agriculture for both income and food, providing alternative options for income if climate conditions hinder any ability to work or farm. Also, those dependent on food for their own sustenance are able to purchase additional food for their households if crops fail.
- **As increasing knowledge of climate change** seems to have a positive effect on food insecurity and is requested from the Mion participants, this should be considered in future interventions, accounting for gender, local languages and illiteracy levels in rural areas.<sup>5</sup> Focus group participants stated that healthcare workers were among those they trusted most, so can potentially be the source of information for community-wide education.

## RESEARCH PRIORITIES

- **Longitudinal research**, to include other similar communities would be beneficial to identify temporal changes, across years and agricultural seasons.
- **Further geospatial research** can identify and explore possible explanations for any clusters of food insecurity at sub-district or neighbourhood level. This can include additional variables such as cultural differences between communities, access to vendors as opposed to reliance on subsistence agriculture, and land use.
- **Further questions** could probe other contributory factors of food insecurity such as water insecurity, poor storage facilities, or specifically focus on access to health facilities and specific diseases (such as mosquito-related conditions).. This knowledge could then tailor future interventions. Research could also explore health and socio-economic impacts of the COVID-19 pandemic on this, and similar, communities, and how they could best adjust to their changing environment.



# BACKGROUND

**Climate change will worsen global health inequalities, with greatest impact seen in the rural populations across sub-Saharan Africa (SSA). Temperatures are becoming warmer, rainfall more erratic and extreme weather events such as floods and droughts, have become more frequent, severe and unpredictable.<sup>6</sup>**

The UN Intergovernmental Panel on Climate Change (IPCC) has also identified that climate change aggravates factors globally which influence food security.<sup>7,8</sup> According to the Food and Agriculture Organisation (FAO), food security is a state where individuals can access sufficient quantity and quality of nutritional foods, at all time.<sup>9</sup> Globally, around 1 in 3 people (2.3 billion) experienced food insecurity in 2021.<sup>10</sup>

SSA countries are largely dependent on rain-fed agricultural production, which is highly vulnerable to the consequences of climate variability and extreme weather events; these include loss of crops and livestock, soil infertility, changes in farming season, pest and disease outbreaks and increase in market prices.

West Africa has been described as a “hotspot” of climate change by the IPCC, and Ghana has been identified as one of the most vulnerable countries (with particular focus on northern parts of Ghana).<sup>8, 11-14</sup> Contributing factors include lower levels of development, higher poverty prevalence, a reliance on subsistence agriculture, and experience of more climatic hazards including extreme heat.<sup>15-17</sup>

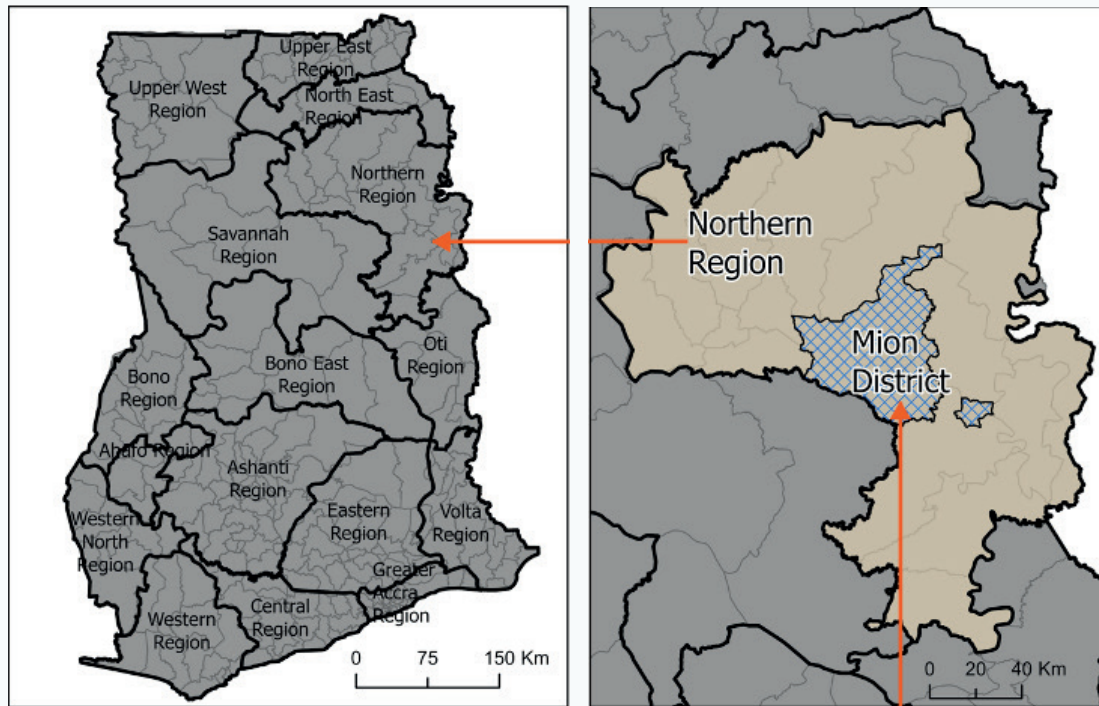
Ghana is also unlikely to meet international targets such as the UN Sustainable Development Goals, that aim to eradicate food insecurity and tackle climate change consequences, and so must consider approaches that appropriately integrate new knowledge within health and environmental systems to support development.





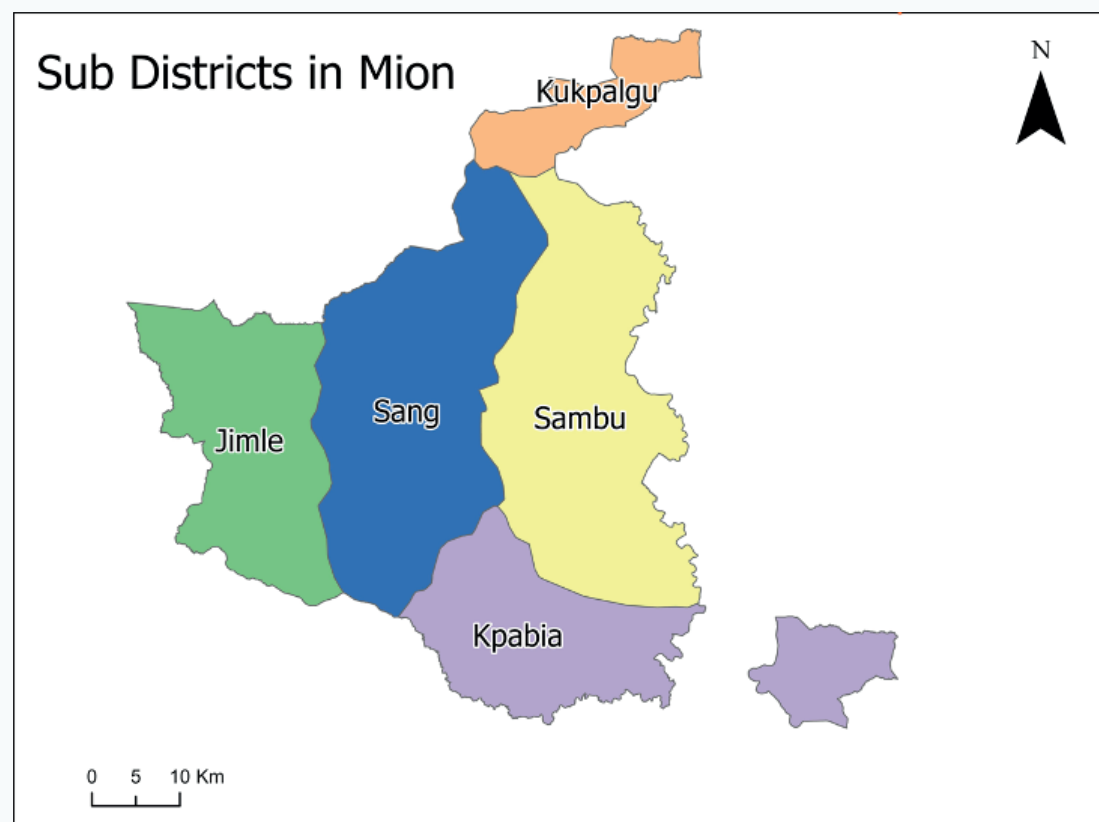
# METHODS

This mixed-methods study used household surveys and focus groups to investigate the knowledge, attitudes and practices surrounding climate change, health and food security of residents in Mion, Northern Region, Ghana (Figure 1). Mion is a rural district with a population of ~95,000. The population is predominantly Muslim, with the major ethnic groups being Mole-Dagbani and Gurma.



**Figure 1.** Map of Ghana (national), Northern Region (regional) and Mion (district).

Map created by  
Dr Winfred  
Dotse-Gborgbortsi





# METHODS (cont'd)

For the household surveys, UDS researchers trained Mion residents to collect data within their own communities using Kobo Toolbox, a secure software that can collect data offline in areas where there is poor network coverage. There were 397 survey respondents (meeting sample size calculations, so study was adequately powered). Participants were recruited via household selection using the random-walk method.<sup>18,19</sup>

Participants were asked basic demographic and socio-economic questions. We also used the Food Insecurity Experience Scale (FIES) from the FAO to describe the

prevalence of food insecurity. Rasch modelling gives the percentage prevalence of food insecurity in ‘moderate or severe’ (Pm+s) and ‘severe’ (Ps), which were then compared to national, West African, and global data, as well as World Bank Development Indicators (GDP per capita, USD). People experiencing moderate food insecurity were deemed to have reduced the quantity or nutritional quality of their intake and are uncertain about the sustainability of their food supply. Households experiencing severe food insecurity have gone without eating for a day or longer.



**Figure 2.** Visual depiction of the different thresholds in the Food Insecurity Experience Scale, from the FAO.<sup>20</sup>

Participants were then asked questions pertaining to their perception of climate change and if and how participants felt these changes affected their health and food security.

## Qualitative research

A total of 16 key individual stakeholders resident in Mion participated in one of 2 focus groups (with male and female attendees, at separate groups). Participants included farmers, pastors, healthcare workers, and tribal Chiefs. They were asked about the impacts of climate change and what their community was experiencing the most. Thematic analyses using NVivo identified themes around appropriate dialogue between policymakers, communities and researchers.

## Geospatial approach

A cluster analysis describes the spatial distribution of food insecurity in Mion.

The method used was a ‘cluster and outlier Analysis’. This can be used to identify specific localized clusters or outliers in neighbourhoods, with assumptions that the cluster could be influenced by homogeneity and proximity.







# FINDINGS

## AND DISCUSSIONS

### HOUSEHOLD SURVEYS

The demographic characteristics of the included 397 participants in the survey included a mean age of 47 years (SD:  $\text{P}13.92$ ) and age range of 20-87 years. The largest age group was 40-49-years: 25.9% of participants. Just over half of participants were male (58.7%). By education status, 81.1% received no formal education. The main income of most participants ( $n=365$ , 91.9%) was from agriculture. With regards to employment, 34.5% were unemployed and 62% were self-employed; the rest were formally employed by others. The mean household size was 11 (SD:  $\text{P}7.06$ ), with the range being 1-35 people. By self-reported health status, 62.9% ranked themselves as very/somewhat healthy or healthy, with 21.7% reporting significant health problems. Overall, 75.6% felt that climate change has already made a personal difference to their health.

### Food Insecurity Experience Scale

The raw FIES scores showed that 100% of the respondents were food insecure. The Rasch model gave  $\text{Pm+s}$  as 61.5% within this population in Mion, and  $\text{Ps}$  as 26.4%. Both percentages are higher than Ghana's equivalent national prevalence of food insecurity ( $\text{Pm+s}=39.4\%$ ,  $\text{Ps}=6.2\%$ ) (Table 1).<sup>1</sup> Mion has a similar prevalence of moderate and severe food insecurity to West Africa (64.1% and 21.2%).

### Impact of Climate Change

Most participants (373, 93.9%) described food insecurity as getting worse over the last 5 years. Overall, 93% were confident in their knowledge of climate change, 91.9% were confident that climate change is real, and 95.7% said that crop yields were decreasing due to climatic factors. When asked how climate change was affecting household food supply, 99.5% reported this was occurring via a negative facet, including: food shortages (79.1%), higher food prices affecting affordability (10.8%), unavailability of some items (4.8%), or the experience of chronic hunger (4.8%).

### Predictors of Food Insecurity

By age groups, 20-29-year-olds were more likely to report higher FIES scores, and thus more food insecurity, than the reference group of 40-49-year-olds in both univariate and multivariate models. FIES scores were significantly different in the 20-29-year-old age group, compared with the older age groups ( $p < 0.001$ ).

Household size was significantly associated with FIES scores; scores increased by 0.08 points on average per household member ( $p < 0.001$ ). Thus, the larger the household, the higher the possibility of food insecurity. Unemployment was a significant predictor ( $p < 0.001$ ) of worsened FIES score. The score for unemployed people on average was 1.12 points higher than employed participants. Additionally, results show that the more knowledgeable participants felt surrounding climate change, the less food insecurity they reported on the FIES scale. Perhaps this knowledge translates into efforts to mitigate unpredictable weather.

	Prevalence of moderate or severe food insecurity (%)	Prevalence of severe food insecurity (%)
Mion	61.5	26.4
Ghana (2020-22)	39.4	6.2
West Africa (2020-22)	64.1	21.2
Global standard (2020-22)	29.5	11.3

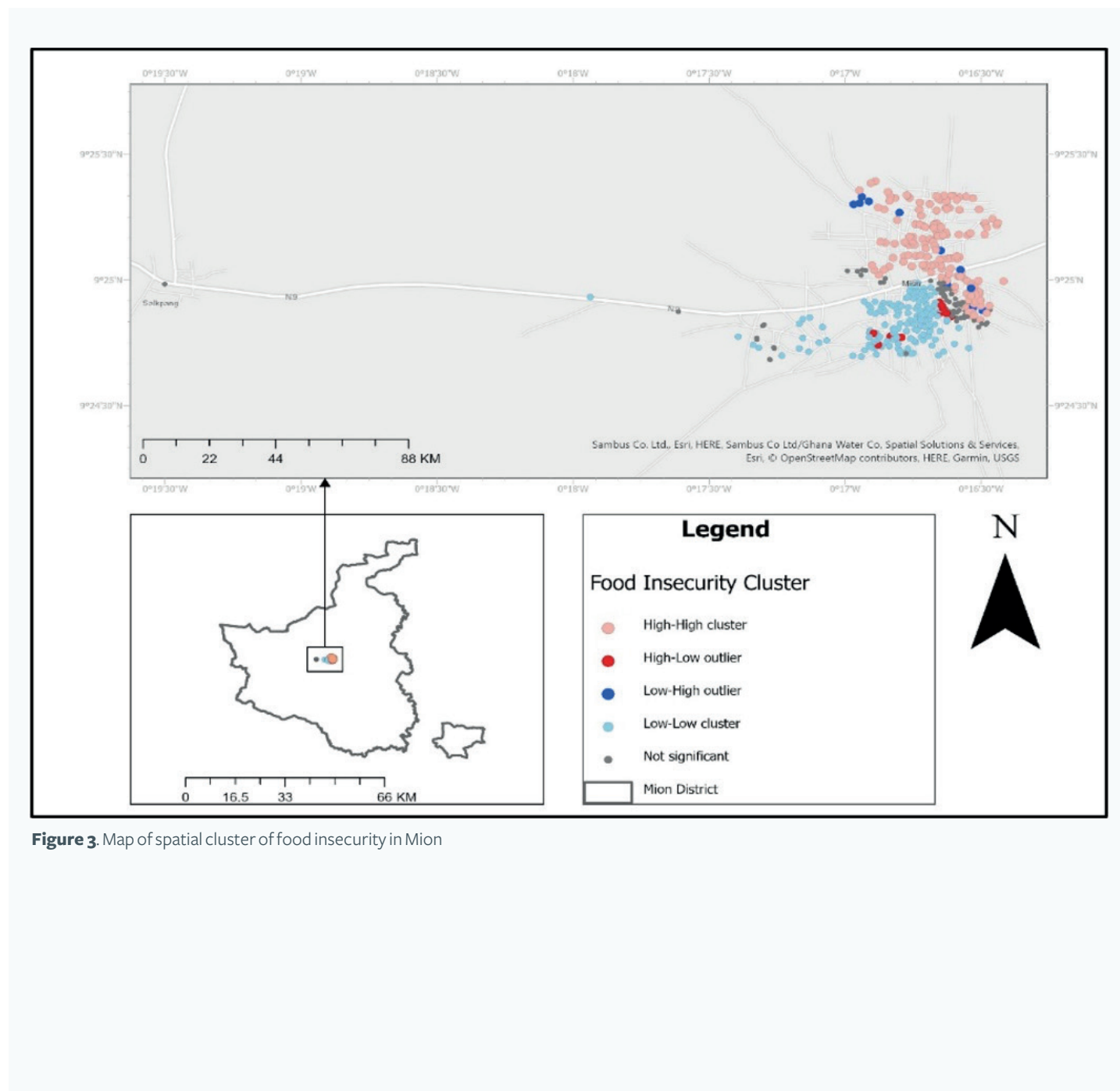
**Table 1.** Prevalence of food insecurity in Mion, compared to Ghana's prevalence and the global standard from the Gallup World Poll 2020-2022.<sup>1</sup>



### Clusters of Food Insecurity

The food insecurity score points exhibit a notable spatial clustering, primarily concentrated within the centre of the area, as illustrated in **Figure 3**.

Currently, no explanation has been found for this distribution. Analysis looking at demographic variables of respondents, or other factors such as number of dependents per household were not significant.



**Figure 3.** Map of spatial cluster of food insecurity in Mion



# FINDINGS AND DISCUSSIONS (cont'd)

## QUALITATIVE RESEARCH – FOCUS GROUPS

**Age range of participants was from 24 to 50 years, with 10 males and 6 females.**

**Participants unanimously agreed that the climate has changed over the years, particularly with noticeable decreases in rainfall and water scarcity. This hurts the environment, farming, and agricultural activities: “About climate change’s effects on our households, rainfall helps us grow crops for food. This time round no rain. Relating to food, there is no rain for us to farm and so there is no food for us to even give to our children to go to school.”**

The primary causes and effects of climate change identified by participants included bushfires, logging, deforestation for large-scale farming, food scarcity, heavy storms, and decreased crop yield.

Participants observed that currently, climate change has affected access, availability and affordability of foods due to erratic rainfalls and other climate change effects. Foods they used to obtain from their farms are now difficult to access.

*“In those days there was a lot of food but now there is no food like that. I know it is the reduced rainfall pattern of because I’m still young. Growing up we used to go to the farm and harvest yam filling a lot of baskets. Know it isn’t that way again.”*

Respondents expressed concerns about the future, fearing that future generations will face severe challenges if climate change is not addressed. Quotes illustrating above include:

*“If climate change is not remedied, our grandchildren to come will face more challenges than we find ourselves today.”*

Participants expressed their trust in local authorities, health workers, and district assembly members. Encouraging tree planting, discouraging deforestation, and addressing storm prevention were identified as comfortable topics for discussion.

Almost all participants expressed the need for knowledge generation and advancement around climate change and its associated effects on the environment, health, and the general population.

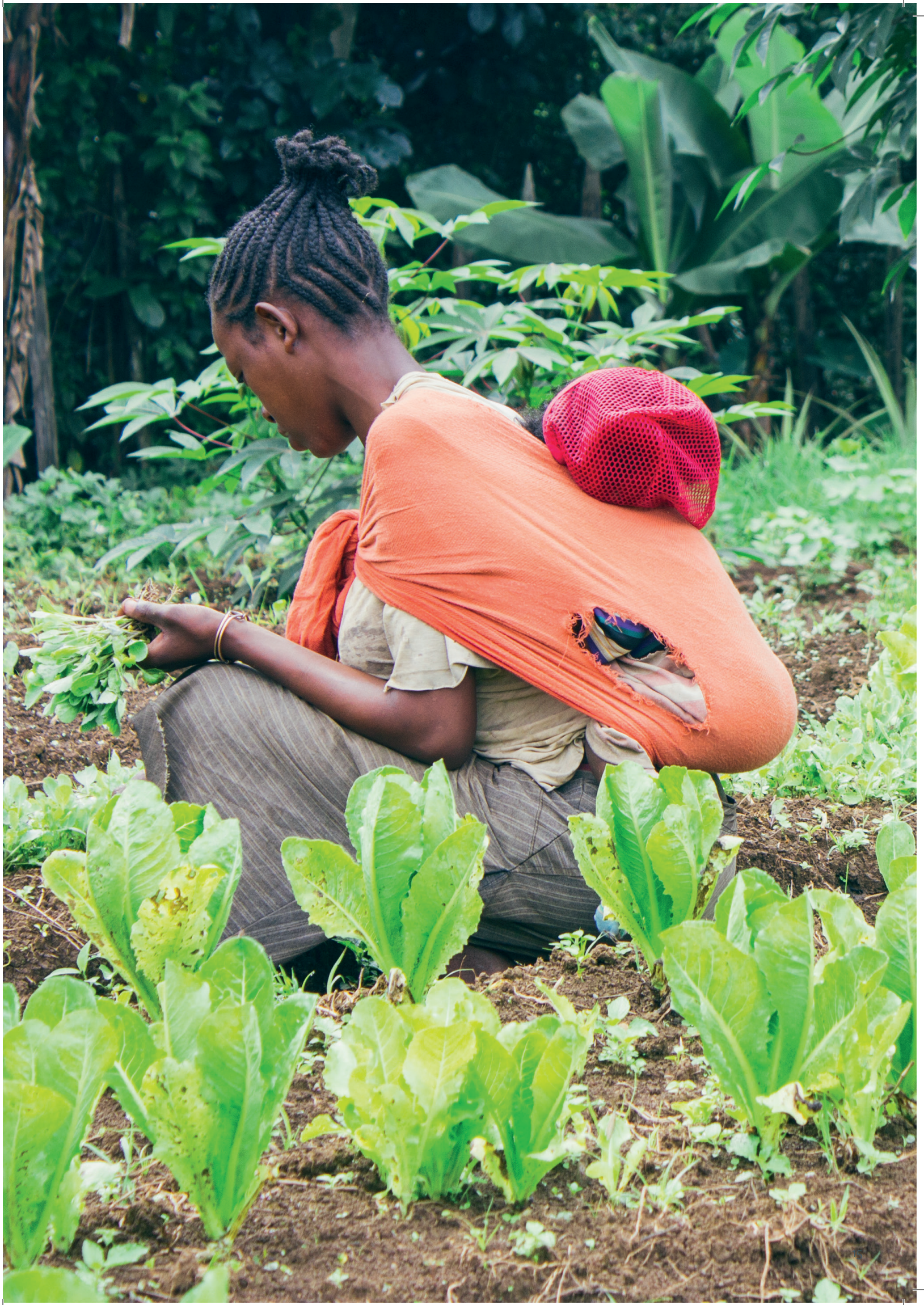
*“Knowledge is the key to everything so I suggest we can have a routine or monthly education on climate change and health...”*

The higher prevalence of food insecurity in Mion compared with national data, demonstrates there is likely wide sub-national variation across different communities. Districts such as Mion are harder to reach, with less developed infrastructure, meaning essential resources like markets and healthcare are difficult to access.<sup>21,22</sup> The geospatial element of this analysis showed clear clusters of food insecurity around the main road through Mion, though currently the reasoning was this distinction is unclear.

The study was conducted during the ‘lean’ season (i.e. the planting season) where households may have limited food reserves. This could be one contributory factor to the extremely high levels of food insecurity. However, one strength of the validated food insecurity scale does measure a household’s experience over 12 months, and is not specifically limited to the time of data collection. Therefore, although multiple surveys over time would undoubtedly be useful, the stark findings presented here provide important year-round observations.

Malnutrition is the primary cause of immunodeficiency globally, and the malnutrition-infection cycle means that any increase in food insecurity, and thus undernutrition, leads to an increase in morbidity.<sup>7,23</sup> There are also other health impacts of food insecurity in Ghana due to reducing nutrient levels in plant foods as a result of climate change, particularly in cereals, and low availability of animal-based foods.<sup>7</sup> As a result, vitamin A deficiency and anaemia are prevalent in Ghana due to poor bioavailability in the diet, and malaria and parasitic diseases which cause depletion of micronutrients such as iron.<sup>15</sup> Not only is climate change impacting vulnerability through malnutrition, but it is exacerbating vector, food and water-borne diseases, thus worsening the malnutrition-infection cycle.<sup>24,25</sup>







A photograph of a person wearing a bright yellow patterned garment, bent over and working in a field of tall green corn plants. The person is in the middle ground, slightly to the right. The foreground is filled with large, green corn leaves, some of which are out of focus. The background shows a line of trees and a clear blue sky with some white clouds. A green rectangular box is overlaid on the upper left portion of the image, containing white text.

## CONCLUDING STATEMENT

Climate change is becoming a higher-profile international conversation, as higher-income countries begin to increasingly notice the local impacts. However, countries such as Ghana, and the African continent more widely, have been experiencing the effects of climate change for many years.

The conversation must be sustained, with implementation of preventive measures and mitigation. Our global health very much depends upon this action.







# ETHICS, PEER REVIEW, ACKNOWLEDGEMENTS AND REFERENCES

## Ethics

Ethical approvals for the original study were granted by University of Southampton (ERGO: 79159) and University for Development Studies (Ref: UDS/RB/013/23).

## Peer Review

At time of writing, a manuscript is being prepared for submission to a peer-reviewed journal.

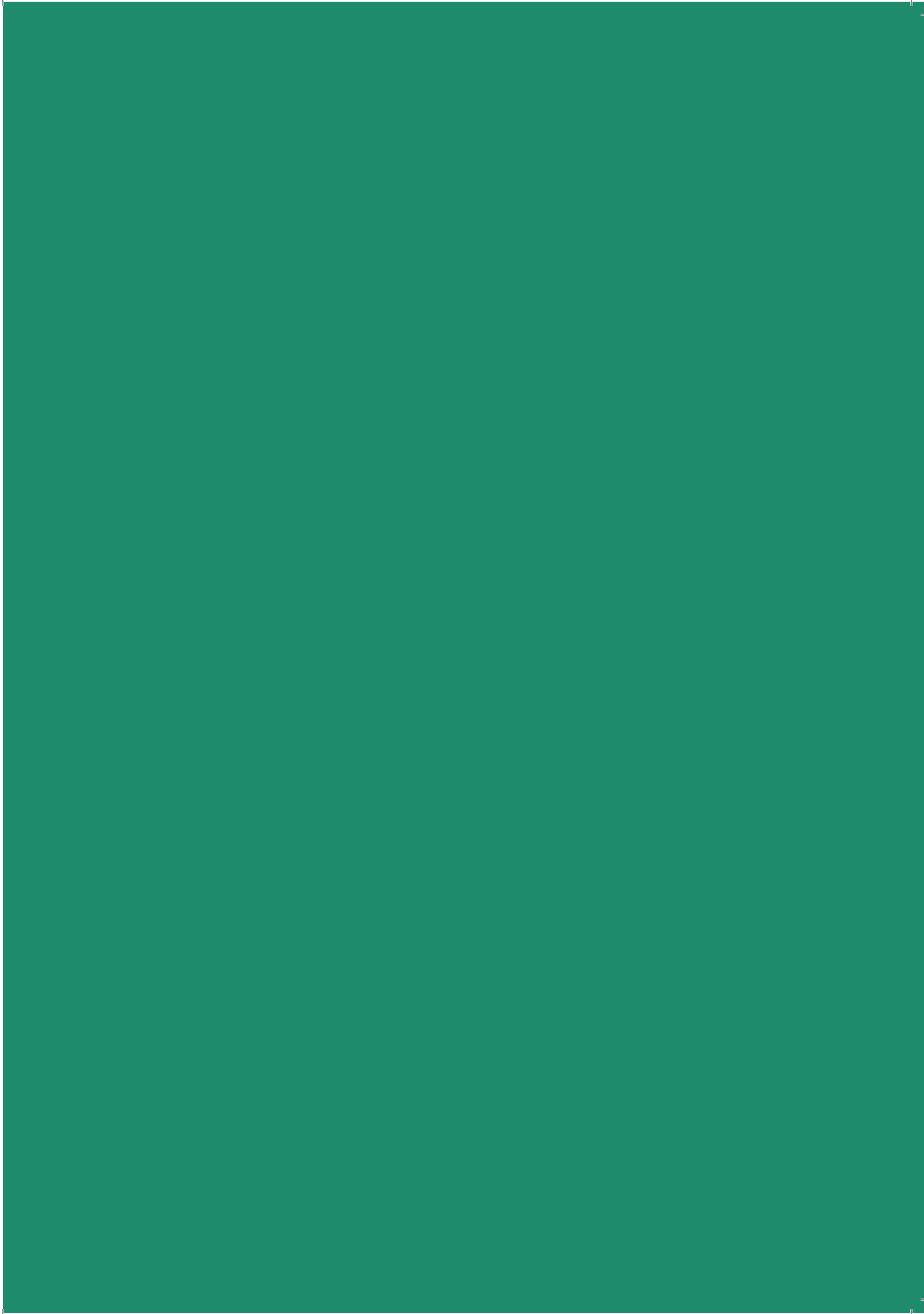
## Acknowledgements

Thank you to the data collectors and Mion Health Directorate and Local Assembly for their support and permissions to carry out this research. We are also grateful to the University of Southampton for the funding provided for this pilot study. We also acknowledge the statistical input of Dr Ashley Heinson and Dr Ken Brackstone, from the University of Southampton.

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