



## The impact of financial inclusion on mental health

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### ABSTRACT

This paper examines the impact of financial inclusion on the mental health of heads of household in Nigeria. The study employed data from the 2015/2016 Nigerian General Household Survey (GHS), matched with georeferenced data concerning financial services obtained from the Insight2Impact (i2i) GIS interface. The results indicate that financial inclusion has a strong positive impact on mental health. The study used a robust instrumental variable method, in which a household's distance from the nearest financial institution was used as the instrument for financial inclusion. In addition, it identified the potential channels through which financial inclusion can influence mental health, including: (1) food expenditure; (2) remittances; and (3) risk-coping mechanisms. The findings of this study reinforce growing evidence for the benefits of financial inclusion for alleviating depression symptoms.

### 1. Introduction

Mental health conditions (referred to in this study as depressive symptoms) currently constitute an increasing issue for public health. In 2017, it was estimated that approximately 792 million individuals (i.e. about 10% of the global population) suffered from a mental health disorder (Ritchie and Roser, 2018). Furthermore, there is evidence of a greater incidence of mental health conditions among the poor, as a result of their exposure to: (1) stressful events; (2) harmful living conditions; (3) exploitation; and (4) poor health (Adhvaryu et al., 2019; Baird et al., 2013; Lund et al., 2010; Miller et al., 2017). Poverty has therefore been identified as a major driver of poor mental health (Cole & Tembo, 2011; Lund et al., 2011; Patel, 2007).

A growing number of studies have confirmed the nexus between financial inclusion and mental health. This originates from a recognition of the benefits of financial inclusion for improving a household's welfare by firstly, improving financial security and resilience and secondly, through reducing stress (Aguila et al., 2016; Taylor et al., 2009). Financial inclusion also plays a critical role in boosting health and well-being and reducing poverty through: (1) providing improved access to insurance facilities; (2) helping families to avoid reliance on burdensome coping strategies; and (3) offering peace of mind.

Financial inclusion is also of interest in terms of the policies put forward by both governments and health services, particularly as the impact of financial inclusion not only establishes the benefit for health outcomes but also enhances understanding of how to reduce health inequalities. For instance, Nussbaum (2009) indicated that, although being financially capable impacts a wide range of socioeconomic factors, it has been found to exert a greater influence on mental and physical health. However, there remains an ongoing debate over the exact relationship between financial inclusion and health outcomes.

This current paper examines the causal impact of financial inclusion on the mental health of heads of household in Nigeria, in particular through information given in the 2015 Nigerian General Household Survey (GHS), merged with georeferenced data on financial services points obtained from the Insight2Impact (i2i) GIS interface.

Nigeria is the largest economy in West Africa, contributing 41% of the sub-region's Gross Domestic Product (GDP). However, 67.1% (2012) of the population continues to live below the poverty level.<sup>1</sup> Like many other developing countries, the Nigerian Federal Government has prioritised financial inclusion, with the aim of boosting economic growth and reducing poverty. In 2011, the government announced new policy and regulatory reforms relating to financial inclusion, setting a target of 70% (i.e. from a base of 30%) of the population having access to formal

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<sup>1</sup> <http://eprints.covenantuniversity.edu.ng/5426/1/Dr%20Adegbeye%20F.%20B%201.pdf> and <https://www.cia.gov/library/publications/the-world-factbook/geos/ni.html>.

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financial services by 2020. This implies the inclusion of many chronically impoverished households,<sup>2</sup> providing them with straightforward access to financial services, i.e. a bank account. Current statistics reveal that the banked population increased from 36.9 m (38.3%) in 2016 to 39.5 m (39.7%) in 2018, i.e. a growth rate of 1.4%.<sup>3</sup>

This paper offers a threefold contribution to understanding of the causal impact of financial inclusion on mental health of household heads in Nigeria. Firstly, unlike previous studies citing only ownership of a bank account as a measure for financial inclusion to test its effect on mental health (e.g. [Aguila et al., 2016](#)), this current study constructs a multidimensional financial inclusion index from three dimension of financial inclusion, i.e. ownership of a bank account and access to both credit and insurance.<sup>4</sup>

Secondly, the impact of financial inclusion on health has received limited attention, particularly in the context of developing countries, which are (due to increasing access to technology) currently experiencing rapid economic development, but with a population still suffering from poverty and inequality ([World Bank, 2016](#)). This study focuses on Nigeria, which has made an increased drive for financial inclusion since early 2000s ([Central Bank of Nigeria, 2015](#); [EFInA, 2014](#)). The case study therefore provides a compelling context for an in-depth examination of the influence of financial inclusion on the mental health of heads of household in developing countries.

Thirdly, this research combines geospatial data concerning financial location data points from Insight2Impact (i2i) GIS interface with the Nigerian GHS, using the relevant coordinates to determine each household's proximity to financial services. The study therefore contributes to the existing literature through the use of this measure of proximity to financial services as an instrument for financial inclusion in an instrumental variable framework to address the potential endogeneity arising between financial inclusion and mental health. The choice of the instrument employed for the instrumental variable analysis was based on existing evidence relating to financial inclusion, which has identified one of the major drivers as being an individual's distance from the nearest financial institution ([Allen et al., 2016](#); [Zhao and Evans, 2016](#)).

The findings are summarised as follows. The instrumental variable analysis identified financial inclusion as being causally related with improved mental health, or a reduction in symptoms of depression. The results are found to be consistent for both dependent variables when using the CES-D score, as well as the dummy variable for the cut-off of 10 and above to denote incidence of depressive symptoms. The findings identified a number of potential pathways through which financial inclusion can improve mental health conditions or reduce depressive symptoms, including remittances, food consumption, and risk-coping from negative rainfall shocks. Previous studies have confirmed the relationship of these outcomes with symptoms of depression ([Cole & Tembo, 2011](#); [Gardner & Oswald, 2007](#); [Tachibana et al., 2019](#)).

The relevance of this study is underscored by the health burden associated with poor mental health conditions. The World Health Organisation (WHO) has predicted that, by 2020, depression will prove to be the second leading cause of disease on a global basis ([Dobbie, 2010](#)), resulting in premature mortality, as well as a negative impact on an individual's capacity to function and his/her quality of life ([World Bank, 2020](#)). In recognition of the grave implications of adverse mental health, both substance abuse and mental health have been enshrined in the Sustainable Development Agenda adopted at the United Nations General Assembly in September 2015. In addition, the literature has

recognised the role played by the financial inclusion of households for improving access to healthcare and reducing health inequality ([Singh et al., 2019](#)).

The remainder of the paper is structured as follows. Section 2 discusses the relationship between financial inclusion and mental health; Section 3 discusses the data sources; Section 4 outlines the empirical methodology; Section 5 presents the results; and finally, Section 6 concludes the paper.

## 2. The relationship between financial inclusion and mental health

The theoretical approach to financial inclusion focuses on enhancing the freedom of the poor by offering services for managing their lives and livelihoods taken for granted by more prosperous members of the population ([Nino-Zarazua & Copestake, 2008](#)). The literature related to financial inclusion indicates access to a bank account as a significant measurement for promoting financial capability, and thus health, through: (1) increasing financial stability; (2) reducing stress; and (3) improving health.

[Aguila et al. \(2016\)](#) used ownership of a bank account to examine the impact of financial inclusion on health. Their study focused on Hispanic individuals living in the US, aged between fifty-one and ninety, due to this older age group being more likely to encounter difficulties in accessing primary financial services, i.e. as a result of their cultural background or lack of acculturation. Panel data analyses revealed that ownership of a bank account was positively associated with improved mental (but not physical) health in the older Hispanics. This study provided supportive evidence of a positive association between ownership of a bank account and improved mental health, however their analysis was only a preliminary attempt to uncover a causal link.

Further studies by [Finkelstein et al. \(2012\)](#) and [Gyasi et al. \(2020\)](#) demonstrated a number of further forms of financial inclusion (i.e. access to health insurance) as being important for providing individuals and communities with financial protection. In addition, such protective services are more likely to reduce cognitive stress and improve mental health and general well-being.

[Gyasi et al. \(2019\)](#) evaluated the association in Ghana of overall financial inclusion with older individuals' self-related health, psychological health outcomes and health services. The financial inclusion questionnaire in their study included ownership of a bank account and access to credit, as well as: (1) a recent withdrawal of money from an account; (2) use of automatic teller machines; (3) savings with a local bank; (4) access to loans; and (5) ownership of a mobile money service account. Firstly, a multivariate logistic regression was used to examine the impact of financial inclusion on self-related health and psychological health outcomes, and secondly, a generalized Poisson regression was employed to assess the association between financial inclusion status and the frequency of health service use among older persons. [Gyasi et al. \(2019\)](#) found that the ownership of bank account significantly improved both mental and self-related health outcomes, but that the relationship with the use of health services was not robust.

Furthermore, being a member of credit union and having ownership of a Mobile Money account were associated among older people with an increased use of health services and reduced levels of mental health. Although the findings supported the association between financial inclusion and self-related health outcomes, they identified that members of a specific sub-group (i.e. older individuals) were more likely to experience improved mental health as a result of financial inclusion activities. The paper, however, also demonstrated a number of limitations, particularly as a result of the methodology failing to establish any causal relationship between variables ([Gyasi et al., 2019](#)).

## 3. Data sources

This current study combines data from two separate sources to

<sup>2</sup> <https://www.odi.org/publications/9720-financial-inclusion-nigeria>

<sup>3</sup> [https://www.efina.org.ng/wp-content/uploads/2019/01/A2F-2018-Key-Findings-11\\_01\\_19.pdf](https://www.efina.org.ng/wp-content/uploads/2019/01/A2F-2018-Key-Findings-11_01_19.pdf).

<sup>4</sup> Financial inclusion entails access to financial products that satisfy needs associated with transactions and payments, savings, credit and insurance ([World Bank, 2018](#)).

investigate the causal relationship between financial inclusion and depressive symptoms: (1) the 2015/2016 (third wave) of the Nigerian GHS and (2) geospatial data relating to financial service providers obtained from the i2i GIS interface.

The 2015/2016 Nigerian GHS provides detailed information on household and individual attributes for approximately 4600 households, in relation to: (1) consumption; (2) income; (3) access to a formal financial account; (4) access to a savings account; (5) access to insurance; (6) employment status; and (7) incidence of depression (i.e. using a version of the Center for Epidemiological Studies-Depression or CES-D test).<sup>5</sup> Moreover, in most cases, the CES-D test was administered to the household head or his/her spouse. A higher CES-D score indicates poorer mental health.

The CES-D scale was used to construct two dependent variables. Firstly, the log of the composite score of the ten-item questions from the CES-D test, which ranged from 0 to 30. Secondly, a dummy variable was generated equal to a score of 10 and above or zero (i.e. out of a maximum of 30). This indicator reflects the presence of significant depressive symptoms (Andresen et al., 1994). Moreover, for each household covered in the survey, the Nigerian GHS dataset provided Local Government Area (LGAs) level GPS information, allowing the data to be linked to geo-referenced data on financial service providers obtained from i2i.

The structure of local government is identified as one of the tiers of government in Nigeria, i.e. in addition to the federal government and state governments. The structure of Nigerian local government has evolved over time, beginning in the colonial era and continuing following the democratic dispensation. The number of Local Government Areas (LGAs) increased from 589 in 1991 to 774 in 1996 (Akin-sanya, 2004), although this can vary, depending on the population of the state. The Local Government Area (LGA) forms the administrative sub-unit for the thirty-six Nigeria states, along with the Federal Capital Territory (FCT).

When it comes to the GHS data, the geocode captures the centroid of LGAs for a household and, in the case of i2i, also identifies the location of financial institutions. The two data sources (i.e. GHS and i2i) were therefore linked using this geocode. The i2i uses GIS to provide information on household's financial inclusion through the smarter use of data. This data also has a geographic component, providing locational information for each financial institution in the form of coordinates.<sup>6</sup> In addition, i2i uses financial service provider maps and Geographic Information Systems (GIS) to provide comprehensive information on financial institutions, including their nature and density within a given kilometre radius. The geo-spatial mapping by i2i provides geocode information in the form of the longitudes and latitudes of each location, as well as allowing data to be combined with other surveys using identical coordinates.

This data enabled the current researcher to exploit both within-village and between-household's variations in proximity and density of financial institutions, in order to provide an objective measure of the proximities and densities of financial institutions.<sup>7</sup>

Table 1 provides the descriptive statistics of the key variables used in this analysis. It demonstrates that, based on the financial inclusion score

<sup>5</sup> This study was unable to use the wave 1 and wave 2 of the GHS because they do not contain information on depressive symptoms.

<sup>6</sup> Based on information from financial service provider maps by (i2i), this study considers proximity to the following financial institutions: commercial banks, microfinance banks, primary mortgage banks, mobile money agents, off site Automated Teller Machines (ATMs), and development finance institutions.

<sup>7</sup> The proximity of financial institution measured in meters reflects how close the nearest financial institution is situated to a household. The availability of financial institution in an LGA does not mean zero distance to the households in that LGA, but the analysis is based on distance relative to the households locations within an LGA.

of 0.5, approximately 10% of households can be considered financially inclusive, with the average financial inclusion score being approximately 20. For the disaggregate financial inclusion indicators, 38% reported possessing a bank account, 18% reported having a formal loan or credit, and 3% reported having formal insurance. The dependent variables CES-D score and CES-D dummy were used in separate regressions, with 29% reporting a CES-D score of between 0 and 10. The average score was found to be 7.

The financial inclusion indicator shows that 10% of these households were financially inclusive, having an index score of above 50%, with the average financial inclusion score being about 20. An average of 38% of households owned a bank account, 18% had a loan from a formal institution and 3% reported having access to formal insurance. The mean difference of the descriptive statistics in relation to rural and urban status or residents can be seen in Table A1 of the Appendix. Using the multidimensional financial inclusion index, these results show more urban than rural residents being financially inclusive. The results are consistent for disaggregated indicators of financial inclusion, such as formal account ownership as well as being able to use formal forms of loan and insurance. Moreover, rural residents reported experiencing more depressive symptoms in comparison to urban residents.

### 3.1. Measuring financial inclusion

In accordance with Zhang and Posso (2019), this current study created a multidimensional financial inclusion index considering three dimensions of financial inclusion: (1) ownership of a bank account; (2) access to credit; and (3) access to insurance. Each dimension was designated a weight of 1/3 each, while a financial inclusion score was developed for each household.

This study adopted a cut-off of 0.5, thus indicating a household as being financially inclusive if the financial inclusion score was greater than (or equal to) 0.5. A dummy variable equal to one was also created if the household financial inclusion score was found to be greater than 0.5,

**Table 1**  
Descriptive statistics.

Variable	Observations	Mean	Standard Deviation
$F_i$ (Financial inclusion)	4551	0.103	0.304
Financial inclusion score	4551	0.196	0.230
Bank account	4554	0.380	0.485
Loan from formal institution	4558	0.178	0.382
Formal insurance	4553	0.031	0.173
Household size	4560	5.709	3.287
Male head household	4560	0.796	0.403
Household head married	4560	0.743	0.437
Age of household head	4560	52.832	14.594
Head is literate	4560	0.839	0.367
Household head employed	4560	0.817	0.386
Log. dist. nearest financial inst. (m)	4560	8.377	1.515
Log. dist. nearest road (km)	4560	1.389	1.017
Log. population density	4560	6.345	2.013
Average annual rainfall	4560	7.095	0.360
Household income	4560	167,026.3	1,628,882.00
Total value of assets	4560	26959.54	249,215.60
Dependent variable			
CES-D-dummy	4560	0.287	0.452
CES-D-score	4560	7.125	5.252

Authors' calculations using the Nigerian 2015/16 GHS data for Nigeria.

and zero otherwise. See Table 2 for the description of the financial inclusion indicators used and the weight assigned to each indicator. These variables, along with the assigned weighting, were used to construct a multidimensional index of financial inclusion.

#### 4. Empirical methodology

Financial inclusion can potentially prove endogenous for the following reasons. Firstly, poor mental health can influence financial inclusion. Secondly, there may have been an omission of a number of factors impacting on both financial inclusion and mental health. This study addresses endogeneity associated with financial inclusion. Two-stage Least Squares regression (2SLS) was employed as an instrument for financial inclusion, using the distance to the nearest financial institution. The choice of instrument was influenced by evidence concerning the relationship between financial inclusion and distance to the nearest bank, thus proposing that an individual’s distance from the nearest financial institutions constitutes one of the barriers for his/her financial inclusiveness (Demirgüç-Kunt & Klapper, 2012).

The model for the 2SLS estimation is described as follows:

$$H_j = \alpha + \beta FI_j + \gamma X_j + \phi_j + \varepsilon_j \tag{1}$$

where  $H_j$  is the mental health score (or dummy) for household head  $j$ ,  $FI_j$  is a measure of financial inclusion for the household  $j$ ,  $X_j$  is a vector of household covariates,  $\phi_j$  denotes a regional-level dummy variable that controls for unobserved regional-level fixed effects, and  $\varepsilon_j$  is an error term. Standard errors are clustered at the household level.

The first-stage regression for the impact of distance to the nearest financial institution in relation to financial inclusion is presented as:

$$FI_j = \alpha_0 + \alpha_1 dist_j + \alpha_2 Z_j + \omega_j + v_j \tag{2}$$

where  $dist_j$  is household distance to the nearest financial institution. Estimates from the first-stage regression are presented in Table 2. Using the 2SLS approach,  $\beta$  is the parameter of interest that captures the impact of financial inclusion on mental health.

##### 4.1. Choice of instrument

This study adopted an Instrumental Variable (IV) estimation approach to circumvent the endogeneity associated with the use of financial inclusion as the main regressor in the analysis. The 2SLS-IV estimation approach identifies a potential instrument likely to satisfy the two conditions required (Cameron and Trivedi, 2009).

The instrument establishing financial inclusion in this study consisted of the distance to the nearest financial institution, in accordance with previous studies (Brown et al., 2016; Demirgüç-Kunt & Klapper, 2012). The validity assumption asserted that distance to the nearest financial institution was correlated with financial inclusion but was not likely to be correlated with other unobserved variables potentially impacting on mental health, i.e.  $E(\mu|Z) = 0$ . The second condition stemmed from the result of the first-stage regression, which revealed a correlation between financial inclusion and distance to the nearest financial institution, implying that  $E(X|Z) \neq 0$ .

The first-stage results, as shown in Table 4, reveal a statistically significant negative association between financial inclusion and distance to the nearest financial institution. This indicates that an increase in the distance to the nearest financial institution generally leads to a decline in the likelihood of financial inclusion.

One potential concern to the validity of the instrument is that

**Table 2**  
Dimensions, indicators and weights for multidimensional financial inclusion.

Dimension (weight)	Financially non-deprived if ...
Bank (1/3)	Household has a bank account (i.e. savings, current, fixed deposit or microfinance account).
Loan/Credit (1/3)	Household has access to loan/credit from a bank, microfinance institution or other formal institution.
Insurance (1/3)	Household has access to medical, life, property, unemployment/income or family insurance.

locations of financial institutions may be correlated with neighbourhood characteristics. For instance, financial centres are more likely to set up in affluent neighbourhoods than in poor neighbourhoods. If it is the case, the estimated effects could reflect the effect of neighbourhood affluence, rather than the effect of financial inclusion on mental health. To mitigate this concern, in addition to controlling for the regional dummies, we control for total household income and assets respectively in the regressions.

#### 5. Results

Table 3 presents the Ordinary Least Squares (OLS) results from the relationship between financial inclusion and mental health. This research considered both the continuous measure and score for mental health and a binary dependent variable for mental health score, using a cut-off of 10 and above to reflect an incidence of depressive symptoms. Column 1 presents the results of the aggregate mental health score and Column 2 is a dummy variable for mental health status. Both regressions reveal a lack of any statistically significant impact of the relationship between financial inclusion and depressive symptoms. Table 3 does not present the main estimation results, however the OLS results are used in comparison to the 2SLS-IV results presented in Tables 4–8.

Table 4 presents the results of the 2SLS estimation approach, with distance to the nearest financial institution being the instrument indicating financial inclusion. Columns 1 and 2 demonstrate that the 2SLS estimates suggest a statistically significant negative relationship between financial inclusion and depressive symptoms, indicating financial inclusion to be causally associated with a reduction in depressive symptoms or improved mental health, i.e. financial inclusion leads to a 96% reduction in the depressive score, as well as a decline in the probability of reporting depressive symptoms by 63%.

This result is consistent with that of Aguila et al. (2016), who used the ownership of a bank account as a proxy for financial inclusion. However, Aguila et al.’s (2016) regression analysis was based on a fixed effect model rather than 2SLS. The third row of Table 4 shows the first-stage results from the 2SLS regression, which (consistent with expectations) reveals an increase in the distance to the nearest financial institution as being associated with a decline in financial inclusion.

Table 5 presents the disaggregated results of the three indicators of financial inclusion. The results show that possession of a formal bank account leads to a decline in the depressive symptoms score by 32%, relative to a head of household lacking ownership of any formal bank account. When the CESD-dummy was employed as an indicator of depressive symptoms, it revealed that having formal bank account leads to a 21% decline in depressive symptoms. Furthermore, access to formal insurance was found to result in a decline of 136% in depressive symptoms relative to households without formal insurance. In addition, the use of the CESD-dummy as dependent variable found that access to formal insurance leads to a 90% decline in depressive symptoms.

**Table 3**  
Financial inclusion and depressive symptoms (OLS).

	CES-D Score (1)	CESD-Dummy (2)
Financial inclusion	0.054 (0.046)	0.037 (0.024)
Region Dummies	Yes	Yes
Observations	4551	4551

All regressions control for household size, age of household head, household head married, household head literate, household head employed, household head had illness or injury in the past four weeks, distance to nearest road, total income, total value of household assets, and population density. Standard errors in parenthesis. \*, \*\*, and \*\*\* indicate significance at 10%, 5%, and 1%, respectively. Standard errors are clustered at the enumeration area.

**Table 4**  
Financial inclusion and depressive symptoms (2LS).

	CES-D Score (1)	CESD-Dummy (2)
Financial inclusion	-0.962** (0.433)	-0.633** (0.256)
Region Dummies	Yes	Yes
First-stage Regression	Financial Inclusion	
Distance to nearest financial institution	-0.026*** (0.004)	
<i>Weak identification test:</i>	43.507	
Cragg-Donald Wald F statistic:	34.366	
Kleibergen-Paap rk Wald F statistic	16.380	
Stock-Yogo weak ID test critical values:		
10% maximal IV size		
Observations	4551	4551

All regressions control for household size, age of household head, household head married, household head literate, household head employed, household head had illness or injury in the past four weeks, distance to nearest road, total income, value of household assets, and population density. Standard errors in parenthesis. \*, \*\*, and \*\*\* indicate significance at 10%, 5%, and 1%, respectively. Standard errors are clustered at the enumeration area.

**Table 5**  
Disaggregated financial inclusion and depressive symptoms (2LS).

Variable	CES-D Score	CESD-Dummy
Formal bank account	-0.317** (0.131)	-0.208*** (0.075)
Loan/credit	22.721 (98.816)	14.840 (64.446)
Insurance	-1.367** (0.614)	-0.899** (0.361)
Region Dummies	Yes	Yes
Observations	4551	4551

All regressions control for household size, age of household head, household head married, household head literate, household head employed, household head had illness or injury in the past four weeks, distance to nearest road, total income, value of household assets, and population density. Standard errors in parenthesis. \*, \*\*, and \*\*\* indicate significance at 10%, 5%, and 1%, respectively. Standard errors are clustered at the enumeration area.

**Table 6**  
Financial inclusion, mental health and drought.

	CES-D Score (1)	CESD-Dummy (2)
Negative rain shock	0.663** (0.342)	0.146 (0.210)
Financial inclusion*Neg. rain shock	-6.589** (3.266)	-3.668* (1.998)
Financial inclusion	-0.521 (0.502)	-0.400 (0.296)
Region Dummies	Yes	Yes
Observations	4551	4551

All regressions control for household size, age of household head, household head married, household head literate, household head employed, household head had illness or injury in the past four weeks, distance to nearest road, total income, value of household assets, and population density. Standard errors in parenthesis. \*, \*\*, and \*\*\* indicate significance at 10%, 5%, and 1%, respectively. Standard errors are clustered at the enumeration area.

5.1. Potential pathways

Table 6 presents the result of the potential pathways through which financial inclusion impacts on mental health. Table 6 demonstrates a negative rainfall shock using rainfall data provided by the 2016 GHS to examine the influence of negative shock on depressive symptoms. In addition, this examines the mitigating impact of financial inclusions Column 1 indicates that exposure to negative rainfall shock increases the depressive score. However, the coefficient of the interaction of negative rainfall shock with financial inclusion shows a reduction in depressive symptoms. This result is similar to that reported in Column 2, despite the coefficient of negative rainfall shock being seen as lacking in

**Table 7**  
Mechanisms through Financial Inclusion affect Mental Health (2SLS).

Variable	Food expenditure	Remittances
Financial inclusion	3.828*** (0.763)	0.330** (0.128)
Region Dummies	Yes	Yes
Observations	4551	4551

All regressions control for household size, age of household head, household head married, household head literate, household head employed, household head had illness or injury in the past four weeks, distance to nearest road, total income, value of household assets, and population density. Standard errors in parenthesis. \*, \*\*, and \*\*\* indicate significance at 10%, 5%, and 1%, respectively. Standard errors are clustered at the enumeration area.

**Table 8**  
Heterogeneous impact of financial inclusion on mental health (2SLS).

Dependent variable: CES-D Score	Urban	Rural
Financial inclusion	1.585* (0.979)	-4.776*** (1.829)
Region dummies	Yes	Yes
Observations	1445	3106

All regressions control for household size, age of household head, household head married, household head literate, household head employed, household head had illness or injury in the past four weeks, distance to nearest road, total income, value of household assets, and population density. Standard errors in parenthesis. \*, \*\*, and \*\*\* indicate significance at 10%, 5%, and 1%, respectively. Standard errors are clustered at the enumeration area.

significance.

Table 7 reports various mechanisms through which financial inclusion can indirectly influence mental health. The results accord with previous studies demonstrating that financial inclusion increases both food consumption and the receipt of remittances. In addition, these outcomes are likely to be positively correlated with improved mental health (Zhang and Posso, 2019; Tachibana et al., 2019).

5.2. Heterogeneities

Table 8 identifies heterogeneities in the impact of financial inclusion on mental health, focussing on the differences between urban and rural residents. Use of the CES-D score as the dependent variable revealed the significant impact of financial inclusion on the improved mental health of rural dwellers as compared to urban dwellers. The results were found to be quantitatively similar when the dummy variable was used as the depressive score. The results imply that financial inclusion leads to a statistically greater significant reduction in the depressive symptoms of rural households as opposed to those in urban areas.

6. Conclusion

This study indicates a growing recognition, from both policymakers and academics, of the deleterious effects of poor mental health conditions. This has therefore resulted in such conditions being now considered one of the pressing development concerns of contemporary society. A number of previous studies have investigated the determinants of mental health, however, there remains little causal evidence establishing a relationship between financial inclusion and mental health in the context of developing countries. This lack of evidence is largely due to a dearth of data capturing the mental health of households in developing countries. Therefore, to the best of the current researcher's knowledge, this current paper is the first to investigate the causal impact of financial inclusion on mental health of household heads in Nigeria.

The results of this study reveal that financial inclusion leads to an improvement in the level of mental health and/or a decline in the likelihood of reporting depressive symptoms. In addition, further evidence has identified a number of potential pathways through which financial inclusion can impact on mental health.

This empirical analysis has been disaggregated to show the heterogeneous influence on mental health of financial inclusion for those living in both rural and urban environments. The results of this study imply that financial inclusion exerts a particularly significant impact on rural dwellers and households. An important implication of this study is that, based on its findings, financial inclusion can be considered a vital policy in addressing or curbing the incidence of depressive symptoms in Nigeria, particularly when it comes to rural households.

**Ethical statement**

There is no ethical approval required for the dataset used in the paper. We used data from two secondary sources: (i) Survey data

collected from the Nigerian General Household Surveys and Financial Services for the Poor (FSP).

**Authors statement**

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See the revised manuscript and other documents for details of the revisions.

**Appendix**

**Table A1**  
Mean difference by rural and urban households

Variable	Rural	Urban	Difference
$F_i$ (Financial inclusion)	0.069 (0.005)	0.176 (0.010)	0.107*** (0.009)
Financial inclusion score	0.151 (0.003)	0.293 (0.006)	0.142*** (0.007)
Bank account	0.266 (0.007)	0.624 (0.012)	0.357*** (0.014)
Loan from formal institution	0.173 (0.006)	0.188 (0.010)	0.015 (0.012)
Formal insurance	0.014 (0.002)	0.067 (0.006)	0.052*** (0.005)
Household size	6.026 (0.060)	5.029 (0.079)	-0.997*** (0.103)
Male head household	0.815 (0.006)	0.753*** (0.011)	-0.062*** (0.012)
Household head married	0.764 (0.007)	0.695 (0.012)	-0.069*** (0.013)
Age of household head	52.832 (0.262)	52.830 (0.381)	-0.002 (0.464)
Head is literate	0.796 (0.007)	0.930 (0.006)	0.134*** (0.011)
Household head employed	0.821 (0.006)	0.808 (0.010)	-0.013 (0.012)
Log. dist. nearest financial inst. (m)	9.015 (0.020)	7.006 (0.033)	-2.009*** (0.037)
Log. dist. nearest road (km)	1.627 (0.018)	0.878 (0.019)	-0.749*** (0.030)
Log. population density	5.617 (0.029)	7.908 (0.047)	2.290*** (0.054)
Average annual rainfall	1190.165 (7.845)	1264.989 (9.488)	74.824*** (13.197)
Total value of assets	94327.81 (7459.617)	323267.7 (74103.29)	228939.9*** (51711.11)
Household income	18927.89 (4836.486)	44220.92 (5172.403)	25293.03*** (7919.83)
CES-D-dummy	0.301 (0.008)	0.256 (0.011)	-0.045*** (0.014)
CES-D-score	7.352 (0.095)	6.636 (0.134)	-0.716*** (0.166)

\*, \*\*, and \*\*\* indicate significance at 10%, 5%, and 1%, respectively.

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