



UNIVERSITY OF AMSTERDAM

Master Thesis

MSc. Economics – Development Economics

How do the multiple faces of poverty lead to high levels of depression? Evidence from Kenya

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15 July 2020

Abstract

While multifaceted poverty affects mental well-being, poor mental health, in turn, affects productivity and income in the longer term. Despite this fact, until recently, mental health prevention has not been included in the goals of poverty alleviation programs. The literature indicates that poverty can lead to worse mental health through multiple channels of poverty in the long run. However, little is known about whether these effects are also valid in the short-term as temporary effects, especially for developing countries. Therefore, this research examines the short-term effects of different poverty channels on depression levels of low-income households in Kenya by using a fixed effect regression. It is found that severe health shocks lay at the core of poverty's psychological tax in the short-term with its temporary effects. Moreover, gifts and precautionary savings are actively used against income and health shocks. The results signal that there is limited credit access for low-income households in Kenya. On the other hand, low-income level and variation in income itself do not explain the monthly changes of the depression level. Also, there is no evidence for the relaxing effect of health insurance in the case of health shocks. Taken together, to reduce the mental burden of poverty in the short-term, increasing health care quality and lowering the risk of health shocks, especially infectious diseases, is paramount.

Fields: *Development Economics, Health Economics, Mental Health*

Keywords: *depression, mental health, income, health shocks, coping mechanisms, health insurance*

Statement of Originality

This document is written by the student Nursena Aksünger, who declares to take full responsibility for the contents of this document. I declare that the text and the work presented in this document are original and that no sources other than those mentioned in the text and its references have been used in creating it. The Faculty of Economics and Business is solely responsible for the supervision of completion of the work, not for the contents.

Acknowledgment

“O Allah benefit me with what you have taught me, teach me that which will benefit me and grant me with knowledge which will benefit me.”

It is difficult to start a new life by changing the country you live in, even the continent. With all these difficulties, I left behind an intense master program at UvA. Fortunately, my path crossed with my supervisors Prof. Dr. Menno Pradhan and Prof. Dr. Wendy Janssens. They supported me to improve my research skills and were always available and willing to answer my queries. I am grateful to them for their excellent guidance and support during this thesis process. Moreover, this research's data is collected in the i-PUSH programme implemented by PharmAccess and Amref Health Africa. Funding for the data collection and research time is provided by the Dutch Postal Code Lottery, Joep Lange Institute, PharmAccess, and the Netherlands Ministry of Foreign Affairs. I am indebted to Richard de Groot from the Amsterdam Institute for Global Health and Development (AIGHD), together with past and present contributors and researchers of the i-PUSH programme, for their effort.

There are several determinants of parental valuation of education. But, none of them are sufficient to explain how my parent's ideals and wise counsel support me in my education. My dear parents Zeynep and Hasan; whenever I look back, thank you for always being with me. I could not have achieved my current level of success without your moral education and support. And, my beloved brothers Abdurrahim, Abdülkadir, and İbrahim; I believe that none of us wasted the effort that our family gave us. I am proud to have diligent and compassionate brothers like you.

Lastly, my dear husband, Selman, deserves a particular note of thanks. I take this opportunity to express my gratitude to him for his love, unfailing encouragement, and unwavering support.

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“One person in every four will be affected by a mental disorder at some stage of life.”
(World Health Organization, 2001)

1. Introduction

According to the World Health Organization (WHO), about 450 million people currently suffer from mental or neurological disorders, placing mental disorders among the leading causes of the number of years lost due to ill-health, disability and early death worldwide (World Health Organization, 2001). The poor often bear the greater burden of mental disorders, both in terms of the risk of having a mental disorder through constant exposure to stressful events and the lack of access to treatment. Likewise, more than 75% of people with mental disorders never seek treatment from a professional in low-and middle-income countries.

In the Kenyan context, despite inadequate data on mental disorders, it is expected that at least a quarter of the Kenyan population would suffer from psychological problems in their life (Bukusi, 2015). Nevertheless, government health expenditure accounts for 2.05% of Kenya's GDP, while the government's total expenditure on mental health is only 0.01% of this already low government health expenditure (World Bank, 2017). Furthermore, the total number of mental health professionals is 92 for the current population of 51 million, including the governmental and non-governmental workforce (Kenya | Institute for Health Metrics and Evaluation, 2017). It can be noted that these low numbers of mental health professionals are mainly concentrated in the capital of Kenya, Nairobi. Therefore, there is an even lower chance of mental health care for the poor in rural areas of Kenya. On account of this, these untreated psychological disorders damage cognitive and physical abilities, which in turn lowers productivity and income in the longer term and perpetuates poverty. Accordingly, statistics show that mental disorders are among the three top causes of disability-adjusted life years (DALYs) for individuals aged 15-49 in Kenya (GBD Compare | IHME Viz Hub, 2017). In order to reduce mental diseases and break the vicious cycle of poverty, a good understanding of the relationship between mental illness and poverty is crucial.

Any attempt to understand this relationship must acknowledge the multi-dimensional nature of both mental health and poverty. The WHO defines mental well-being as “a state of well-being in which the individual realizes his or her abilities, can cope with the normal stresses of life, can work productively and fruitfully, and can make a contribution to his or her community” (World Health Organization, 2005). In this definition, well-being is related to happiness, life

satisfaction, and mood disorders such as depression and anxiety. Moreover, the WHO defines poverty as “not only low income and consumption but also low achievement in education, health, nutrition, and other areas of human development and feelings of powerlessness, voicelessness, vulnerability, and fear” (World Health Organization, 2005).

Despite these facts, until recently, mental health prevention has not been included in the goals of poverty alleviation programs. The literature indicates that poverty can lead to worse mental health through multiple channels of poverty in the long run. Thus, it is considered that once one-shot poverty alleviation programs push the poor in a better material situation, its effect on mental well-being would be long-lasting. However, if the long-term relationship arises with the accumulation of temporary effects, then one-shot poverty alleviation programs’ support would disappear in the short-term, and the poor will suffer from the same mental disorders with the same constraints. Therefore, examining the short-term relation, in addition to the long-lasting relation, is crucial to understand the possible effects of alternative poverty alleviation interventions on mental well-being. Moreover, for this relationship, there is limited evidence from developing countries. This research, thus, aims to answer the research question: ‘How can different aspects of poverty cause high depression levels for low-income households in Kenya?’.

2. Poverty Mechanisms

The relation between poverty and mental well-being can be viewed as a test of the social causation hypothesis, which proposes that the adverse social and economic conditions of poverty increase the risk of mental illnesses. On the other hand, the social selection-drift hypothesis argues that the direction of the causality should be the other way around. From these alternative theories, this study is built on the social causation hypothesis, as research supports the conclusion that this hypothesis is more relevant than the social selection hypothesis in the case of less severe mental disorders such as depression and anxiety (Dohrenwend et al., 1992).

Constant exposure to uncertainty, income fluctuations, limited access to coping mechanisms (i.e., insurance, gifts, loans/credits, savings, assets), and poor health, in general, contribute to the greater vulnerability of the poor to mental health problems. Understanding the underlying mechanisms of poverty and mental health relationships is essential to address the needs of deprived communities through policies. Accordingly, if financial insecurity plays a significant role, cash transfer programs would reduce the adverse effects on mental well-being. However,

it would not offset all of the mental burdens of poverty since the effects of positive and negative income shocks may not be symmetric. At the same time, if limited ability to cope with income and health shocks is the key driver of mental disease, then providing insurance or microcredits would be the appropriate policy response. The relationship between different poverty channels and mental health are explored in the following subsections.

2.1. Income level and fluctuations. There are several ways to measure the effects of income on mental health. Firstly, a low level of income is one of the determinants of worse mental well-being. A systematic literature review concludes that the poorest proportion of the population is 1.5 to 2 times more likely to suffer from a depression and anxiety disorder than the wealthiest portion of the country (Haushofer & Fehr, 2014). Besides, several studies find positive returns on mental well-being with cash transfer programs (Baird et al., 2013; Fernald & Gunnar, 2009; Haushofer & Shapiro, 2016). This suggests that alleviating income constraints and poverty can significantly improve mental well-being.

Secondly, Rohde et al. (2016) show that the deviation in income (income shocks) can also explain poor mental health rather than income level. If this effect dominates the impact of income level, it can be argued that relatively low but stable income will not lead to worse mental health. In line with this hypothesis, it is shown that, for adults in South Africa, income stability has a more significant effect on the CES-D depression score than the level of income (Hamad et al., 2008). Considering the role of income in mental health, one of the research questions in the project asks: How would income level and income shocks affect individuals' depression level?

2.2. Poor health. Poverty is strongly associated with worse physical health, which in turn contributes to mental illnesses through multiple channels (Cutler et al., 2008). Firstly, worse physical health directly affects one's mental well-being through feelings of pain and worries related to health events. This could also explain why physical and mental health problems co-exist in general (Ridley et al., 2020). Secondly, the financial burden of physical diseases may deteriorate mental health by creating unexpected expenditures. To examine these different effects of health shocks on depression levels, this analysis uses weekly health events and health expenditure records of Kenyan individuals.

2.3. Limited access to coping mechanisms. So far, this paper has discussed the effects of income and physical health on mental well-being. However, it is also important to note that the severity of these effects would not be the same for the whole population. Once an economic/health shock occurs, individuals who have limited access to coping mechanisms such as income/health insurance, assets (wealth), gifts, loans, credit, and precautionary savings would suffer more from mental disorders than those who have access to coping mechanisms. These coping mechanisms can be considered a tool to mitigate the effects of income and health shocks by decreasing their magnitude and the mental burden they're attached to. In that way, coping strategies can be useful in safeguarding mental health as mediation or moderator variable. If people can smooth consumption or expenditure through these mechanisms, they can feel more relaxed.

There are several pieces of evidence for this hypothesis in the literature. Fernald et al. (2008) look at the mental outcome of a randomized control trial, which assigns a second look to applicants who had previously been rejected for a loan. In line with the previous hypothesis, it is found that individuals who received a second chance for a cash loan have fewer symptoms of depression than individuals in the control group. Besides, insurance literature agrees with the hypothesis that having health insurance is correlated with improved mental health (Chirwa et al., 2020; Tian et al., 2012). One might think that this effect can be explained by the increased mental health care visits provided with health insurance. However, health insurance and mental healthcare visits are not correlated where people lack access to psychiatric care services, which is also the case in this research (Schurman, 2018). By considering the roles of coping mechanisms, this research will answer the following question: Are coping mechanisms such as gifts, loans/credits, and savings effective in reducing attached depression levels in case of income shock? Are the effects of income shocks different for the poorest half of the sample, which would not be able to sell their accumulated assets? Is there any moderator role of health insurance in the case of health shocks?

To summarize, the literature indicates that poverty can lead to worse mental health through multiple poverty channels in the long-term. However, this long-term relationship between poverty and mental health is interpreted in a way such that one-shot poverty alleviation programs can be used to achieve better mental health for the poor. It is assumed that, once these programs push the poor towards a better material situation, its effect on mental well-being would be long-lasting. For instance, Egger et al. (2019) designed a one-time cash transfer

program which gave roughly USD 1,000 to 10,500 to poor households in 653 randomized villages in rural Kenya. They found positive and significant effects of this one-shot transfer on psychological well-being. However, if the impact of poverty channels on mental health is temporary, then one-shot poverty alleviation programs could only play a temporary role in opposing worse mental health. This effect would disappear in the short-term rather than being long-lasting, and the poor would again suffer from the same mental disorders with the same constraints. Therefore, pushing the poor into a state of better mental health may require comprehensive policies that provide safety nets in different dimensions of deprivation for the long-term rather than one-shot solutions. At this point, examining the short-term relation with high-detail data is crucial for a better understanding of the relationship between poverty and mental well-being.

Moreover, for this relationship, there is limited evidence from developing countries. Therefore, this research project aims to add to the current literature by examining how different poverty mechanisms would affect the depression level of low-income Kenyan households in the short-term. A key strength of the present study is that it provides an in-depth analysis of monthly changes in the depression score accordingly with changes in financial flows and physical health status. This way, the results can inform policymakers about the nature of the relationship and support the critical prioritization of mental health as a part of poverty alleviation programs.

The remaining part of the paper proceeds as follows: Section 3 introduces the methodology employed for this analysis. Section 4 presents the findings of the research. Section 5 discusses the limitations of this research, and the final chapter concludes.

3. Methodology

3.1. Study Setting

Kenya is classified as a lower-middle-income country (UNDP Kenya, 2018). The average annual GDP growth is 5.4% in 2019; above the Sub-Saharan Africa average of 2.3% (Kenya National Bureau of Statistics (2020); World Bank (2019)). Although the Kenyan economy has a leading position in Sub-Saharan Africa, there remains a high poverty level. According to the Kenya National Bureau of Statistics, 45.2% of the Kenyan population lives below the national poverty line, where this ratio equals to 21.8% in the capital, Nairobi (2017). While these

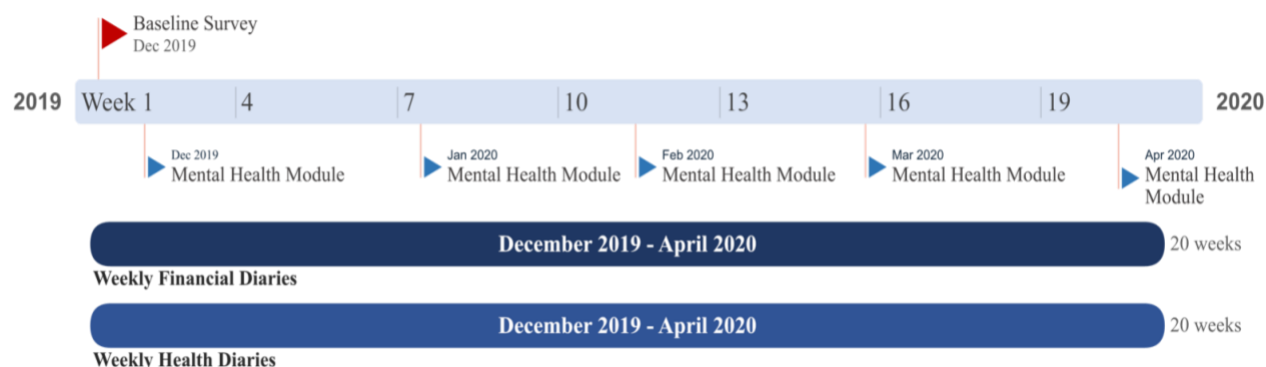
statistics show income inequality within the country, [Appendix A](#) presents the poverty map of Kenya for all counties.

The research data in this thesis are drawn from the innovative Partnership for Sustainable Universal Health (i-PUSH) program, which provides simple, scalable mobile innovation that enables easy enrollment into Kenya's national hospital health insurance fund. The ethical clearance for the research is obtained from the Amref Health Africa Ethics and Scientific Review Committee in 8 August 2019 (with amendment approved at 21st April 2020) with approval number: P679-2019. The participants in this study are recruited from 321 low-income households in 32 villages of Kisumu and Kakamega counties of Kenya, where the headcount ratio is 39.9% and 49.2% respectively. Approximately, from each household, 2 adults participate to perform data collection, where the diaries data of 566 individuals is collected for five months through tablet-based personal interviews. Individuals below age 18 (1%) and those who do not give consent for data collection (0.8%) are excluded from the data.

3.2. Data Construction

The i-PUSH data provides four primary sources of knowledge. A timeline of the data collection can be seen in Figure 1. Firstly, baseline surveys provide information about time-invariant characteristics of individuals, collected in December 2019. Secondly, mental health diaries present information about depression scores of individuals in five pop-up mental health interviews from December 2019 to April 2020. Thirdly, weekly health diaries present all physical health events of the individuals from the baseline survey to the last mental health interview. Data entries of physical symptoms and the severity of symptoms in the health diaries are used in the analysis. Lastly, weekly financial diaries gather information on all financial transactions that occurred in the same interval, including income, gifts, and remittances given and received, loans and credit given and received, and formal and informal savings deposited and withdrawn. Information from financial diaries e.g., direction of the flow (incoming cash) and the amount of money is used in this analysis.

Figure 1. Timeline for Data Collection



All financial transactions are recorded in Kenyan Shillings (KES), and values exceeding the 99th percentile of the distribution are replaced with the 99th percentile to reduce the influence of outliers. Only for the financial diaries, if an individual is present at the interview, the variable's missing values are replaced with 0. These datasets provide an adequate measure of the changes in depression level, financial flows, and physical health for the analysis. The main advantages of weekly data collection are that it significantly reduces recall bias and increases the probability of accurate reporting with a built trust relationship.

3.2.1. Outcome Variables

Depression score is used as an outcome (dependent) variable in the analysis to answer the research question: 'How can different aspects of poverty cause high depression levels for low-income households in Kenya?' The continuous depression score is computed by using the Center for Epidemiologic Studies Depression Scale (CES-D). The CES-D was designed to measure depression symptoms outside of clinical settings based on a 10-item questionnaire. The survey items ask questions about happiness, hope, loss of motivation, loneliness, depression, concentration, sleep, and fear associated with the past seven days. Answers were scaled from 0 to 3, where zero indicates "never" and three refers to "most of the time or all of the time." Then, the total CES-D score is calculated for each individual and week, in which high scores indicate more severe depressive symptoms. Questions in the mental health module can be found in [Appendix B](#).

3.2.2. Shock Variables

Income and health shock variables are used as explanatory variables in the analysis.

Income shocks: Literature states that low-income level and variation in income could lead to worse mental health. To test these hypotheses, income level and variation of income are included in the analysis. The income module in the data aggregates business income (revenue), income from employment (salary), income from farming (crop sales), and other sources of income such as the sale of livestock, casual labor, cleaning, laundry, and transportation services. The income variable does not include gifts, loans/credits, and savings entries. As it is discussed before, there are five waves of mental health interviews, while there are 20 weeks of income entries. Therefore, the average income and variation in income between two adjacent mental health interviews are used to assess income effects on depression scores with monthly aggregates.

Health shocks: It is found in the literature that poor health leads to adverse mental health. To test this hypothesis, health shocks are included in the analysis as a determinant of the depression level. The health diaries ask respondents whether they had a health problem in the week before the interview and, if so, its severity. Answers to these questions are used to create a health shock dummy variable. This dummy variable is equal to 1 if an individual has a relatively severe health shock compared to the sample in the week before the interview. The threshold for being a ‘severe’ health shock is decided based on the number of days lost due to the disease and mean of the disease severity in the sample.

Note that individuals who reported health problems related to mental illnesses are dropped from the data to eliminate the risk of endogeneity. Specifically, 12 individuals reported epilepsy as a health shock. These individuals are dropped since epilepsy is a neurological disorder and may have accompanying brain damage, which may cause biased estimates of the outcome variable, depression score. Hereby, the health shock variable in the analysis only includes physical health events.

3.2.3. Mediator Variables

In the analysis, coping mechanisms such as gifts received, loans/credits borrowed, and withdrawn precautionary savings are used to see whether they have a mediator role in income shocks. The average of each coping mechanism between two adjacent mental health interviews is calculated from the entries of financial diaries.

3.2.3. Control Variables

From several baseline characteristics, relative poverty and health insurance ownership are used in the heterogeneity analysis. Health insurance ownership is a dummy variable, which shows whether an individual is currently holding health insurance. It is used to see whether there is a moderator role of health insurance to reduce the attached mental burden in case of health shock. As it is mentioned before, health insurance and mental healthcare visits are not correlated in this research sample where people lack access to psychiatric care services. Therefore, health insurance effects on mental well-being in this study would not suffer from endogeneity through demand-side effects.

In addition, the relative poverty variable is a dummy variable, which is equal to 1 if an individual is in the poorest half of the sample. This variable is used to check whether assets (wealth) have a role in dealing with income shocks. The median wealth for this variable is calculated by principal component analyses (PCA) using data on the household's ownership of selected assets at the baseline survey. Finally, health expenditure used as a control variable, which shows the amount of health expenditure in KES in the week before the interview.

3.3. Descriptive Statistics

Table 1 presents the descriptive statistics for the baseline characteristics of respondents. Table 1 shows that almost three-quarters of participants are from the Kakamega district, while the rest of the population is located in Kisumu county in Kenya. The average age of participants is rounded to 33 years old. 64% of the study population are female. From them, 86% are pregnant or have a child below the age of 4. The average household size is between five to six people, and the majority (60%) of the population were employed. A low proportion (29%) of respondents indicate that they had health insurance at any time in their lives, and 23% of the

population is holding health insurance. About one quarter (27%) of the respondents have at least one chronic disease at the baseline survey.

Table 1. Summary statistics for baseline data

Variables	(1) Mean	(2) SD	(3) Min	(4) Max	(5) n
Region	0.72	0.45	0.0	1.0	566
Age	32.75	10.65	18.0	83.0	562
Sex	0.64	0.48	0.0	1.0	566
Pregnant or with child <age 4	0.86	0.35	0.0	1.0	361
Household size	5.50	2.22	2.0	16.0	566
Employment	0.60	0.49	0.0	1.0	566
Health insurance (ever)	0.29	0.45	0.0	1.0	566
Health insurance (now)	0.23	0.42	0.0	1.0	566
Any chronic disease	0.27	0.44	0.0	1.0	566

Note: Columns (1) and (2) show the mean and standard deviation of the variables. Columns (3) and (4) represent the minimum and maximum value that the variable takes. Column (5) shows the number of individuals per variable.

In addition to the baseline survey, Table 2 presents the descriptive statistics for diaries data. Specifically, the average depression score (CES-D) equals 6.4 on the 30-point scale. Moreover, 10% of the reported health problems counted as severe health shocks, and the weekly health care spending equals 34.4 KES. The average income level between two adjacent waves was 1080 KES. The average money received as a gift from the outside equals 580 KES between two adjacent waves. Also, the average money borrowed as loans/credits is 130 KES during the same interval. The average money withdrawn from savings equals 290 KES between two adjacent waves. The minimum and maximum values of variables show the unbalanced distribution of financial flows in the population.

Table 2. Summary statistics for diaries

Variables	(1) Mean	(2) SD	(3) SD-b/w	(4) SD-w/i	(5) Min	(6) Max	(7) n	(8) Obs.
Depression Score	6.4	5.1	4.0	3.3	0.0	28.0	566	1968
<i>Health Diaries</i>								
Health Shock Dummy	0.1	0.3	0.2	0.2	0.0	1.0	564	1962
Health Expenditure	34.4	273.8	138.8	233.8	0.0	7000.0	557	1843
<i>Financial Diaries in 100 KES</i>								
Avg. Income	10.8	22.1	20.1	10.8	0.0	143.2	546	1778
Avg. Gifts	5.8	10.1	7.1	6.7	0.0	125.5	546	1778
Avg. Loans/credits	1.3	4.8	4.2	3.5	0.0	75.3	546	1778
Avg. Saving	2.9	10.0	8.5	7.1	0.0	141.0	546	1778

Note: Columns (1) and (2) show the mean and standard deviation of the variables for the overall sample. Columns (3) and (4) show the standard deviation between individuals in the sample and within the individual level throughout time. Columns (5) and (6) represent the minimum and maximum value that the variable takes. Column (7) shows the number of individuals per variable, while Column (8). shows the total number of observations for these individuals in different weeks.

The outcome variable CES-D depression score has a cut-off, which indicates diagnosis for depression prevalence after score 10. Table 3 shows the transition probabilities between depression states, which are calculated with this cut-off. According to the table, the overall summary shows that 21.5% of observations had depression prevalence and 78.5% of the observations did not exceed the cut-off 10. The between summary indicates that 43.1% of the individuals had depression prevalence at least once. The total between percentage exceeds 100% with 134.6% because 34.6% of the individuals had a transition between depression states and hence double-counted. The within transition shows the consistency of depression prevalence for individuals. For 518 respondents who did not show depression prevalence (CES-D depression score < 10) at least once, 85.2% of their observations were “not depressed”, and of the 244 respondents who had depression prevalence, 50.1% of their observations are “depressed.”

Table 3. Variation matrix for depression prevalence

Depression Prevalence	Overall			Between	Within
	Freq.	Percent	Freq.	Percent	Percent
Not depressed	1544	78.5	518	91.5	85.2
Depressed	424	21.5	244	43.1	50.1
Total	1968	100%	762	134.6%	74.3%

(n=566)

3.4. Method

The impacts from the various poverty channels such as physical health shocks, income, and coping mechanisms on depression level, are examined in this analysis. The model's parameters are predicted with a fixed effects regression, where there are several advantages of using fixed effects models. Firstly, it establishes a causal relation under weaker assumptions compared to standard ordinary least squares (OLS) regression by using variation within an entity. In addition, while OLS regression leads to omitted variables bias (OVB) with inconsistent estimates of coefficient, the fixed effect model reduces the threat of OVB by controlling for unobserved differences across entities (Cameron & Trivedi, 2005). Moreover, standard errors are clustered at the individual level to allow for serial correlation and heteroscedasticity in error terms within the same entity.

3.4.1. Main Analysis

Firstly, the impacts of income and health shock on depression are estimated by the following equation:

$$\text{Depression}_{it} = \alpha_i + \beta_1 \text{Avg_Income}_{it} + \beta_2 \text{Var_Income}_{it} + \beta_3 \text{Health_Shock}_{it} + \beta_4 \text{Health_Exp}_{it} + u_{it} \quad (1)$$

Where the subscript i indicates the individual and t indicates the wave of the interview. Depression_{it} is the dependent variable and refers to the continuous CES-D depression score. Avg_Income_{it} refers to the average income between two adjacent mental health interviews (in 100 KES). Var_Income_{it} is a continuous variable that shows the variance of income between

two adjacent mental health interviews (within wave). *Health_Shock_{it}* is a dummy variable, and it refers to the prevalence of severe health shocks, and *Health_Exp_{it}* is a continuous variable that shows health expenditure in KES in the week before the interview. Finally, α_i is an individual fixed effect that captures all unobserved time-invariant factors for individual *i* and *u_{it}* is the error term.

One might think that the reverse causality between mental health and physical health could lead to bias estimates in the analysis. However, physical health changes due to poor mental health may manifest over a long time. Since this research focuses on the monthly changes of these variables, this short-term analysis would not suffer from the proposed endogeneity problem. In equation (1) β_1 refers to the effect of average income level on depression score. β_2 explains whether variation in income increases depression level as an income shock. β_3 can be interpreted as the effects of feelings of pain and worries related to severe health events on mental well-being since the changes in income and health expenditure are controlled in the analysis with β_1 , β_2 , and β_4 .

3.4.2. Heterogeneity Analysis

Despite the advantages of the fixed effects model in panel data analysis, it also has several drawbacks. One of the disadvantages is that it is not possible to estimate the effect of time-invariant characteristics on the dependent variable. Since α_i in the equation (1) absorbs the effects of any baseline characteristics on depression level, their effect cannot be computed with the main model. Therefore, this research uses a heterogeneity analysis to look at the moderator role of wealth status and health insurance ownership on the relationship between shock variables and depression level with the following equations:

$$\text{Depression}_{it} = \alpha_i + \beta_1 \text{Avg_Income}_{it} + \beta_2 \text{Var_Income}_{it} + \beta_3 \text{Wealth}_i + \beta_4 \text{Var_Income}_{it} * \text{Wealth}_i + \beta_5 \text{Health_Shock}_{it} + \beta_6 \text{Health_Exp}_{it} + u_{it} \quad (2)$$

$$\text{Depression}_{it} = \alpha_i + \beta_1 \text{Avg_Income}_{it} + \beta_2 \text{Var_Income}_{it} + \beta_3 \text{Health_Shock}_{it} + \beta_4 \text{Health_Insurance}_i + \beta_5 \text{Health_Shock}_{it} * \text{Health_Insurance}_i + \beta_6 \text{Health_Exp}_{it} + u_{it} \quad (3)$$

Where *Wealth_i* equals 1 if an individual is in the poorest half of the sample. *Health_Insurance_i* is equal to 1 if an individual has health insurance at the baseline. In equation (3) and (4), the

interpretation of the coefficients for the variables that are used in equation (1) stays the same. Moreover, β_4 in equation (2) controls for the wealth status of an individual to see whether the effect of accumulated assets moderates the effect of income shocks on depression. Lastly, β_5 in equation (3) examines whether health insurance has a moderator role in reducing depression level in case of a severe health shock.

3.4.3. Mediation Analysis

Finally, mediation analyses are run to understand the role of coping mechanisms such as gifts, loans/credits, and precautionary savings in the case of income and health shocks with the following equations:

$$\text{Avg_Gifts}_{it} = \alpha_i + \beta_1 \text{Avg_Income}_{it} + \beta_2 \text{Var_Income}_{it} + \beta_3 \text{Health_Shock}_{it} + \beta_4 \text{Health_Exp}_{it} + u_{it} \quad (4)$$

$$\text{Avg_Loans_Credits}_{it} = \alpha_i + \beta_1 \text{Avg_Income}_{it} + \beta_2 \text{Var_Income}_{it} + \beta_3 \text{Health_Shock}_{it} + \beta_4 \text{Health_Exp}_{it} + u_{it} \quad (5)$$

$$\text{Avg_Savings}_{it} = \alpha_i + \beta_1 \text{Avg_Income}_{it} + \beta_2 \text{Var_Income}_{it} + \beta_3 \text{Health_Shock}_{it} + \beta_4 \text{Health_Exp}_{it} + u_{it} \quad (6)$$

Where Avg_Gifts_{it} is the average money received as a gift between two adjacent waves. $\text{Avg_Loans_Credits}_{it}$ is the average money borrowed as a loan/credit in the same time interval. Avg_Savings_{it} refers to the average cash withdrawn from precautionary savings in the same time interval. β_2 in equation (4)-(6), shows the moderator role of different coping mechanisms on mental well-being in the case of variation in income. Lastly, β_4 in equation (4)-(6) implies whether coping mechanisms actively used in case of severe health shocks.

4. Results

By using a fixed effects regression, coefficients are calculated based on deviations from each variable's average over five interviews. Therefore, each coefficient in the regression tables shows the contribution of explanatory variables to the changes in the depression score from the previous period.

Regression results of the main analysis suggest that severe health shocks have an adverse effect on depression while income shocks are not effective. Moreover, heterogeneous analysis shows that health insurance does not have relaxing effects. Mediation analyses state that gifts and precautionary savings are actively used in the occurrence of income and health shocks. Finally, the results signal that there is limited credit access for low-income households in Kenya.

4.1. Main Analysis

Table 4 shows that having a severe health shock increases the depression score from the previous period by at least 3.10 points on the 30-point scale. Data shows that 62.5% of these recorded health shocks are infectious diseases like fever/malaria or flu/cold. The effect of health shocks can be interpreted as the pure effect of disease-related feelings, such as fatigue or worries since changes in income and health expenditure that are associated with health events are controlled for in the analysis. This result seems to be consistent with other findings from Tonga, India, Mexico, Bosnia and Herzegovina, Indonesia, and the Netherlands, which indicates poor physical health is an important determinant of worse mental health (Das et al., 2007; Koster et al., 2006). Moreover, the coefficients of income variables are insignificant in the main analysis. Therefore, variation in income and low-income levels do not have a significant effect on depression level. This finding may be interpreted as the mental burden of low- or unstable-income manifest over the long-term with constant exposure, which may not be captured by these short-run studies.

4.2. Heterogeneity Analysis

As mentioned before, the fixed effects model does not allow for the estimation of the coefficients of baseline characteristics as they are time-invariant and absorbed into the individual-specific effect. To overcome this limitation, this research runs heterogeneity analyses to see whether previous findings of the main model differ according to baseline characteristics. Regression results for heterogeneity analysis shown in the Column (3) and (4) of the Table 4, note that coefficients of wealth status and health insurance are omitted in the table due to zero within variation. The interaction coefficient of variation in income and low wealth status is not statistically significant. However, the positive sign of the coefficient shows that the variation in income tends to affect the depression score of the poor more negatively. Lastly, the insignificant coefficient of health insurance implies that health insurance does not have a moderator role in the relationship between health shocks and depression symptoms.

This result can be explained by a low number of insured individuals in the sample (23%), with the common use of health insurance the result may differ. Note that the explanatory power of the main model in Column (2) is 3.5%, which speaks for the fact that there are many other additional factors that influence the depression level. This observation is also confirmed by high rho statistics in Table 4.

Table 4. Regression results for the main analysis

Dependent Variable: Depression Score	(1)	(2)	(3)	(4)
VARIABLES	f (Income)	f (Health Shock, Income)	Wealth Interaction	Health Insurance interaction
Average income between two adjacent waves (in 100 KES)	-0.00485 (0.0146)	0.000740 (0.0147)	-0.00383 (0.0160)	0.00152 (0.0145)
Variance in income within wave	1.35e-09 (1.12e-09)	6.70e-10 (2.57e-09)	-4.96e-11 (2.83e-09)	5.81e-10 (2.55e-09)
Severe Health Shock		3.101*** (0.674)	3.139*** (0.675)	3.445*** (0.742)
Variance in income*Wealth			9.21e-09 (7.50e-09)	
Severe Health Shock*Health Insurance				-1.873 (1.436)
Total health expenditure		0.000297 (0.000473)	0.000256 (0.000484)	0.000340 (0.000425)
Constant	6.477*** (0.157)	6.298*** (0.150)	6.348*** (0.162)	6.291*** (0.147)
SD of individual fixed effect α_i	4.09	4.16	4.17	4.17
SD of the idiosyncratic error u_{it}	4.01	3.90	3.90	3.90
Rho (fraction of variance due to α_i)	0.50	0.53	0.53	0.53
Observations	1,658	1,658	1,646	1,658
R-squared	0.001	0.035	0.032	0.037
Number of individuals	527	527	524	527

Robust standard errors in parentheses

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

4.3. Mediation Analysis

Table 5 presents the regression results for the mediating role of coping mechanisms. Column (2) shows that high average income hardly increases average money received as gifts. Surprisingly, severe health shocks increase average money received as gifts between two adjacent waves by nearly 400 KES. Moreover, variation in income and high health expenditure slightly increase the money withdrawn from precautionary savings. These results suggest that, once an individual has a health shock, they receive gifts from other individuals in the society. However, if high financial cost accompanies to the health shock then they are compelled to use savings as coping mechanisms. These findings also signal high out-of-pocket expenses in case

of severe health events. Lastly, individuals are not actively using loans/credits for income and health shocks. This may be due to limited credit access for low-income households in Kenya.

Table 5. Regression results for mediation analysis

VARIABLES	Main Model	Mediation Analysis (in 100 KES)		
	(1) Y=Depression Score	(2) Y=Avg Gifts	(3) Y=Avg Loans/Credits	(4) Y=Avg Savings
Average income between two adjacent waves (in 100 KES)	0.000740 (0.0147)	0.0714** (0.0342)	0.00714 (0.0190)	0.0161 (0.0810)
Variance in income within wave	6.70e-10 (2.57e-09)	-4.64e-09 (5.44e-09)	-2.11e-09 (2.57e-09)	7.08e-08*** (2.61e-08)
Severe Health Shock	3.101*** (0.674)	4.003** (1.689)	0.664 (0.951)	1.789 (1.934)
Total health expenditure	0.000297 (0.000473)	0.00195 (0.00120)	-9.29e-05 (0.000490)	0.00397** (0.00173)
Constant	6.182*** (0.154)	4.906*** (0.327)	1.273*** (0.184)	1.926** (0.858)
SD of individual fixed effect α_i	4.16	7.40	3.95	5.09
SD of the idiosyncratic error u_{it}	3.90	7.40	4.23	7.77
Rho (fraction of variance due to α_i)	0.53	0.49	0.46	0.30
Observations	1,557	1,557	1,557	1,557
R-squared	0.033	0.038	0.002	0.186
Number of individuals	516	516	516	516

Robust standard errors in parentheses

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

5. Limitations

Although this study has successfully demonstrated the relationship between poverty channels and mental health on a short-term level, it has at least four limitations. Firstly, the effects of the health status of other individuals in the household cannot be captured in this analysis due to a high correlation (0.64) between reported individual health shocks and other health shocks in the family. As it is mentioned before, data shows that 62.5% of recorded health shocks are infectious diseases, which explains the high correlation. This can be interpreted as family members being vulnerable to the same health shocks in general.

Secondly, section 2.2. discusses the role of health insurance as a coping mechanism in case of health shocks. However, not only is it the occurrence of health shocks, but their anticipation may also cause poor mental health. In such a situation, someone with few means to protect themselves against health expenditures could be depressed with feelings of insecurity rather than realized high out of the pocket expenditure. These coping mechanisms can be called a

“peace of mind” effect. Peace of mind effect in this analysis can be tested by comparing the depression level of healthy individuals who have health insurance and who do not. However, health insurance ownership is a time-invariant variable and can be included in the fixed effect regression only as an interaction term. Also, health shock prevalence becomes a time-invariant variable when comparing depression levels of healthy individuals who do not have a health shock. Therefore, individual fixed effect absorbs their effects, and it is not possible to test peace of mind effect in this analysis.

Thirdly, because the expenditure variable in the i-PUSH data does not include health-related expenditures, it is assumed individuals could control their weekly personal expenses. Therefore, expenditure is not included in the analysis as a financial shock. As an alternative, one might think of using net money available in the pocket of the individual after subtracting expenses from income. However, this would not capture the actual effect of financial fluctuations because income and expenditure are differently linked to mental well-being.

Fourthly, depression incidence, and out of depression as a dependent variable could be separately modeled since they are not symmetric events. However, the analysis couldn’t be restricted with two types of individuals according to depression prevalence at the first mental health interview, since there are the multiple ins and outs for depression prevalence. Therefore, it is reasonable to use all available data rather than restricting data with individuals who have only one jump between depression states. Additionally, time duration and the number of waves is not enough to study determinants of recurrent depressive symptoms or duration of symptoms with survival and count models. Therefore, further research with more extensive datasets is essential to solving these issues for a better understanding of the changes in mental well-being states.

6. Conclusion

Poor mental health has been identified by the World Health Organization as one of the five major non-communicable diseases worldwide. Moreover, it is expected that at least a quarter of the Kenyan population would suffer from psychological problems in their life and resources devoted to mental health care is limited in Kenya. While poverty affects mental well-being through multiple channels, poor mental health, in turn, affects by perpetuating poverty in the long-term. The literature shows that poverty channels such as low-income, poor physical health, and limited access to coping mechanisms have adverse effects on mental well-being in

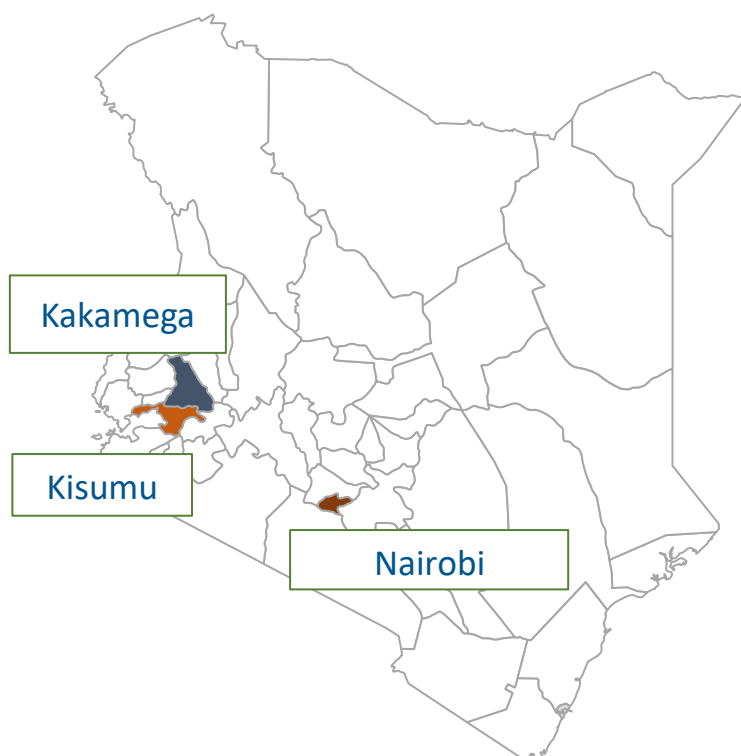
the long-term. However, little is known about the acute relationship of these channels with mental well-being, especially from developing countries. Analyzing the short-term relationship is essential to address the needs of deprived communities by means of well-suited poverty alleviation policies. Therefore, this study aims to provide a deeper understanding of the relationship between mental illness and poverty mechanisms in the short-term, for low-income Kenyan households with detailed data from weekly and monthly diaries.

This research shows that multiple faces of poverty cause high depression levels in the short-term for low-income adults in Kenya. Specifically, severe health shocks lie at the core of poverty's psychological tax in the short-term. Gifts are used in health shocks effectively, but they have a small mediator role on income shocks. Moreover, variation in income and high health expenditure increases the amount of money withdrawn from savings. On the other hand, income shocks and income levels are not significant determinants of depression level in the short-term. Finally, health insurance does not have a relaxing effect in case of severe health shocks.

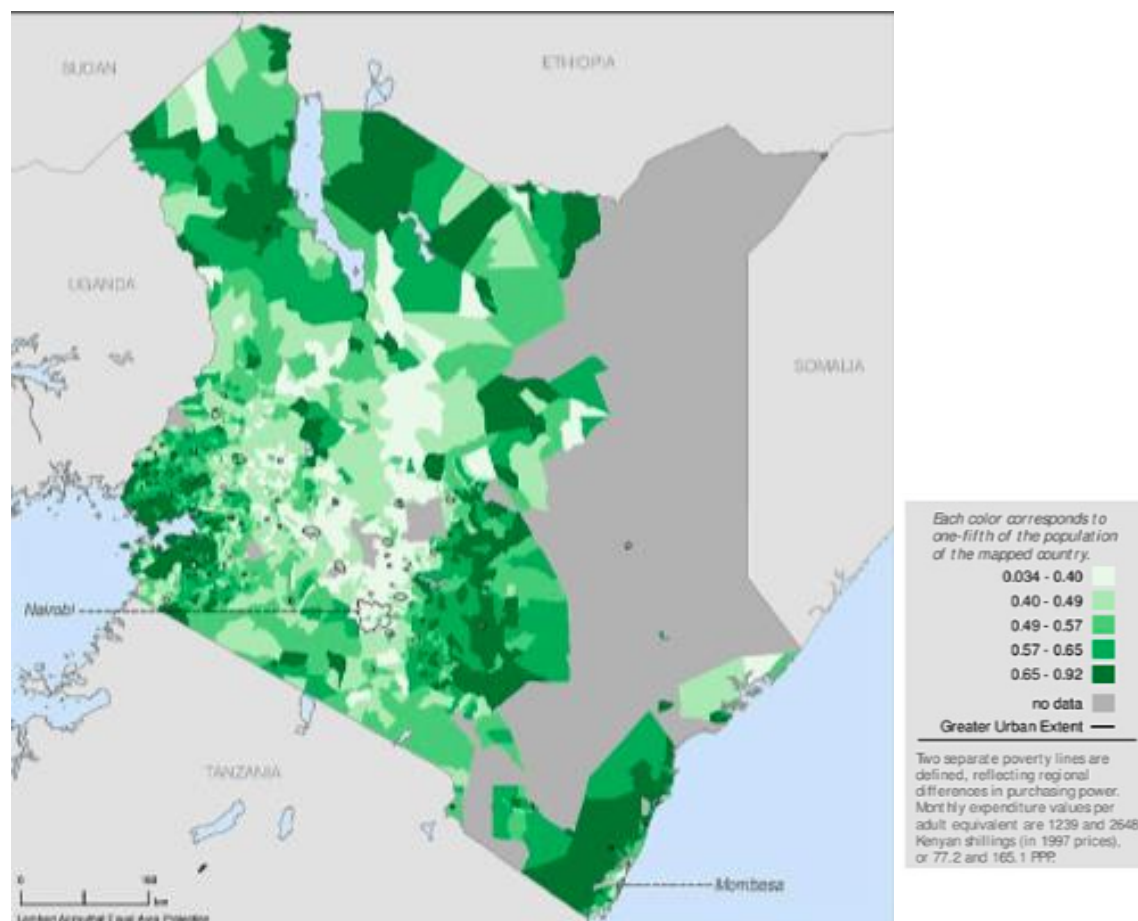
Taken together, to push the poor into a state of better mental health, prolonged interventions are a necessary step rather than a one-shot solution, especially for people who are vulnerable to health shock. Therefore, continued efforts are needed to support affordable and quality health care. Specifically, increasing health care quality and lowering the risk of infectious diseases would help to reduce the mental burden of poverty. Banerjee & Duflo (2007) states that people living in poverty usually pay most of their health costs out of pocket. Furthermore, this study finds that health expenditure is depleting their savings. Thus, providing low-cost health care to poor households and preventing catastrophic health expenditure is crucial. Also, with wider health care coverage, true diagnosis, and appropriate treatment on time would reduce the risk of infectious diseases. Finally, low usage of loans/credits draws attention to policies that enable poor households to access credit.

Appendix A.

1. Kenya Map



2. Kenya Poverty Map – Head Count Index FGT(0)



Source: The Center for International Earth Science Information Network (CIESIN)

Appendix B: Mental Health Questionnaire

A. Mental Health

<p><i>Now I am going to read to you a series of statements about how often you have certain feelings. If you uncomfortable, let me know</i></p> <p>[ENUMERATOR] CHECK FOR PRESENCE OF OTHERS BEFORE CONTINUING. ENSURE PRIVACY. MOVE TO SECLUDED OR PRIVATE PLACE IF NECESSARY</p>		
Over the last 7 days ...		
(13.01)		
Did you sleep well?	NEVER	1
	A LITTLE OF THE TIME (1 - 2 DAYS DURING THE PAST WEEK)	2
	A MODERATE AMOUNT OF TIME (3 - 4 DAYS DURING THE PAST WEEK)	3
	MOST OR ALL OF THE TIME (5 - 7 DAYS DURING THE PAST WEEK)	4
(13.02)		
Were you happy	NEVER	1
	A LITTLE OF THE TIME (1 - 2 DAYS DURING THE PAST WEEK)	2
	A MODERATE AMOUNT OF TIME (3 - 4 DAYS DURING THE PAST WEEK)	3
	MOST OR ALL OF THE TIME (5 - 7 DAYS DURING THE PAST WEEK)	4
(13.03)		
Did you have trouble concentrating?	NEVER	1
	A LITTLE OF THE TIME (1 - 2 DAYS DURING THE PAST WEEK)	2
	A MODERATE AMOUNT OF TIME (3 - 4 DAYS DURING THE PAST WEEK)	3
	MOST OR ALL OF THE TIME (5 - 7 DAYS DURING THE PAST WEEK)	4
(13.04)		
Do you feel hopeful about the future?	NEVER	1
	A LITTLE OF THE TIME (1 - 2 DAYS DURING THE PAST WEEK)	2
	A MODERATE AMOUNT OF TIME (3 - 4 DAYS DURING THE PAST WEEK)	3
	MOST OR ALL OF THE TIME (5 - 7 DAYS DURING THE PAST WEEK)	4
(13.05)		
Did you feel that everything you did was an effort?	NEVER	1
	A LITTLE OF THE TIME (1 - 2 DAYS DURING THE PAST WEEK)	2
	A MODERATE AMOUNT OF TIME (3 - 4 DAYS DURING THE PAST WEEK)	3
	MOST OR ALL OF THE TIME (5 - 7 DAYS DURING THE PAST WEEK)	4
(13.06)		
Did you feel lonely?	NEVER	1
	A LITTLE OF THE TIME (1 - 2 DAYS DURING THE PAST WEEK)	2
	A MODERATE AMOUNT OF TIME (3 - 4 DAYS DURING THE PAST WEEK)	3
	MOST OR ALL OF THE TIME (5 - 7 DAYS DURING THE PAST WEEK)	4
(13.07)		
Did you feel depressed/STRESSED?	NEVER	1
	A LITTLE OF THE TIME (1 - 2 DAYS DURING THE PAST WEEK)	2
	A MODERATE AMOUNT OF TIME (3 - 4 DAYS DURING THE PAST WEEK)	3
	MOST OR ALL OF THE TIME (5 - 7 DAYS DURING THE PAST WEEK)	4
(13.08)		
Did you feel that you could not 'get going'?	NEVER	1
	A LITTLE OF THE TIME (1 - 2 DAYS DURING THE PAST WEEK)	2
	A MODERATE AMOUNT OF TIME (3 - 4 DAYS DURING THE PAST WEEK)	3
	MOST OR ALL OF THE TIME (5 - 7 DAYS DURING THE PAST WEEK)	4
(13.09)		
Were you bothered by things that don't usually bother you?	NEVER	1
	A LITTLE OF THE TIME (1 - 2 DAYS DURING THE PAST WEEK)	2
	A MODERATE AMOUNT OF TIME (3 - 4 DAYS DURING THE PAST WEEK)	3
	MOST OR ALL OF THE TIME (5 - 7 DAYS DURING THE PAST WEEK)	4
(13.10)		
Did you feel fearful?	NEVER	1
	A LITTLE OF THE TIME (1 - 2 DAYS DURING THE PAST WEEK)	2
	A MODERATE AMOUNT OF TIME (3 - 4 DAYS DURING THE PAST WEEK)	3
	MOST OR ALL OF THE TIME (5 - 7 DAYS DURING THE PAST WEEK)	4

Source: The Amsterdam Institute of Global Health and Development (AIGHD)

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