

# The Income Gradient in Health: New Evidence from Kenya

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# Outline

Introduction and Motivation

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# Understanding the income gradient on health: Why it matters, especially in low income countries?

- ▶ Country differences in health outcomes is striking: For instance, maternal mortality is 500 (90)times higher in South Soudan (Kenya) compared to Sweden
- ▶ Africa has the highest disease burden in the world, the health outcomes are inefficient and healthcare access remains am important issue

# Understanding the income gradient on health: Why it matters, especially in low income countries?

- ▶ Low income  $\leftrightarrow$  *poor health*  $\rightarrow$  *less education*  $\rightarrow$  *low earnings*
- ▶ Exploring mechanisms to attenuate gradient to reduce the health outcomes discrepancies that depend on income level

# Background

- ▶ Two levels of studies: micro and macro levels
- ▶ Developed countries exhibit an income gradient on health that steepens as children get older, Case et al (2002), Chen, Martin and Matthews (2006), Currie et al (2007), Currie (2003)
- ▶ But evidence for the gradient of young adults is mixed, either decreasing or increasing, Case, et al (2002), Chen, Martin and Matthews (2006)
- ▶ Education reduces the gradient significantly in developed countries, Case, et al (2002)

# Background

- ▶ Other social economic status components have limited effect if at all. (Case et al, 2002)
- ▶ Chronic disease conditions (Asthma for example) matter to the behavior of the gradient. (Case et al, 2002)
- ▶ Income does not protect against health shock but attenuates it, Currie (2003)
- ▶ At aggregate level, neither the within group income inequality nor the between groups income inequality has an effect on average health, but their ratio does, Deaton (1999)

# Research questions

- ▶ Is there a statistically significant income gradient on health in Kenya?
- ▶ What is the slope and magnitude of the income gradient
- ▶ Do household characteristics impact the income gradient on health?
- ▶ Are there other mechanisms that impact the income gradient on health?
- ▶ How do our results differ from published studies in developed countries?

# Contributions

- ▶ Examines the income gradient in health in a developing country context
- ▶ Evidence from a unique panel data set from Kenya
- ▶ Explores new mechanisms, such as nutrition, breastfeeding, water, and sanitation
- ▶ Uses actual symptoms to construct health status instead of parent-reported children's health status ordered on a scale



# Methods

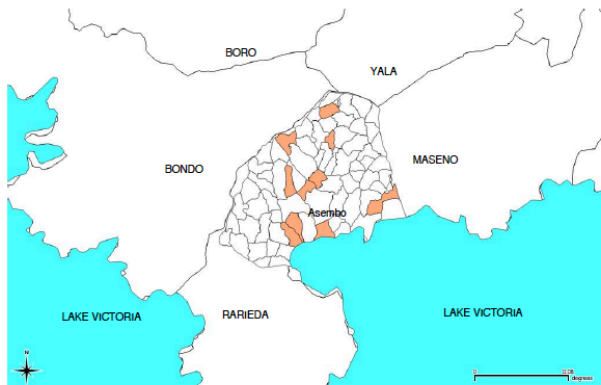
- ▶ We follow Case et al (2002)
- ▶ We use stepwise regression approach to test the effect of new included variables on the slope of the relationship between "children's syndromes" and parental income
- ▶ We then compare the estimates to the baseline model results

# Specification test and standard errors computation

- ▶ Random vs fixed effects: Hausman's test
- ▶ Use robust standard errors (computed by sandwich covariance estimation using score functions)

# Study area

## Western Kenya

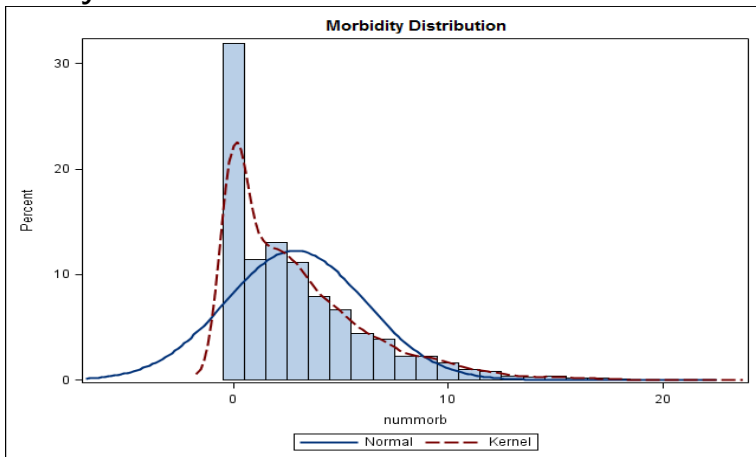


# Kenya data

- ▶ Data are from two sources in western Kenya: the Human Population-Based Infectious Disease Surveillance (PBIDS) and the Socio-Economic Survey (SES). See Thumbi et al (2015).
- ▶ About 7,700 observations on 1,600 households collected quarterly from 2013 to 2015
- ▶ Descriptive stats [▶ table1](#)

# Kenya data

**Distribution of the aggregate symptoms of most common diseases in the area for the age group 0-14 years old**



# Regression analysis

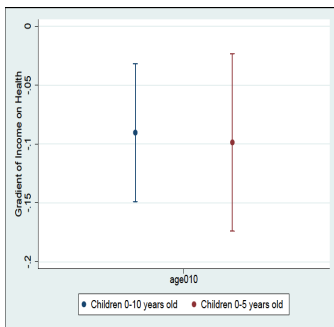
- ▶  $H_{it} = \alpha + \theta_i + \beta_1 \text{Income}_{it} + \sum_{i=2}^n \beta_i Z_{it} + \epsilon_{it}$
- ▶  $E(\epsilon_{it}) = 0$ ,  $E(\epsilon_{it} \epsilon'_{jt}) = 0$ ,  $\text{Cov}(\text{Income}_{it}, \theta_i) = 0$  and  $\text{Cov}(\epsilon_{it}, \theta_i) = 0$

Children's heterogeneity is uncorrelated with parental income and with the residuals

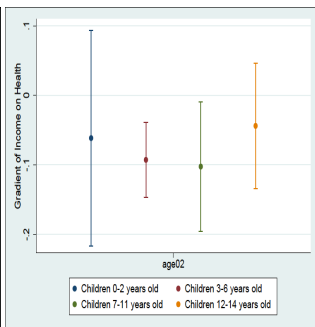
# Results

- ▶ The slope of the relationship between the parental income and the "children's syndromes" is statistically significant

Income Gradient on Health of Children (policy-targeted ages)



Income Gradient on Health of Children (gradual age groups)



# Results (continued)

▶ tablea

▶ tablea

- ▶ As children get older the gradient steepens up to age 11
- ▶ The gradient drops in most case after 11 years old, compared to 17 or 18 years old in the US, Canada and UK
- ▶ "Child labor" or earlier independence of children in Kenya compared to children in US, Canada and UK may be at play in this result



## Results (continued): Parental education effect

▶ tablea

- ▶ Parental education reduces the gradient by 17 percent
- ▶ Parental education effect on the gradient is statistically significant, even though the magnitude is lower than the 50 percent estimated in the US (Case et al, 2002)

## Results (continued): Parental occupation effect

▶ tablea

- ▶ Father's occupation outside of agriculture has a statistically significant reduction effect on the gradient
- ▶ The magnitude of the result is about 20 percent
- ▶ Conditioned on being educated (at least high school), parental occupation reduces the gradient by 3 percent only

# Results (continued): Parental social status effect

▶ tablea

- ▶ The father 's status in the community significantly reduces the income gradient on " children's syndromes" by 16 percent
- ▶ Conditioned on being educated (at least high school), parental status actually increases the gradient by 1 percent

# Results (continued): Parental wealth level effect

▶ tablea

- ▶ There is a statistically significant effect of the parental wealth on "children's syndromes"
- ▶ Parental wealth level significantly increases the income gradient on "children's syndromes" by about 5 percent
- ▶ Wealth and income are not necessarily collinear

# Results (continued): Food and nutrients intake effect

▶ tablea

▶ tablea

- ▶ No nutrient individually affects the gradient
- ▶ Combined, carb, fat and protein have a statistically significant effect on the gradient
- ▶ If energy intake is associated with the above nutrients, the effect on the gradient is 25 percent in reduction
- ▶ Conditioned on going to at least high school, children exposes to balanced diet have 9 percent gradient reduction
- ▶ Testing jointly the difference in estimates, we find that a **including carb, fat and protein** estimates are different from the estimates of the energy intake only

# Results (continued): Water and sanitation effect

▶ tablea

- ▶ Decent water consumption and sanitation has statistically significant reduction effect on the gradient the gradient
- ▶ Decent water consumption and sanitation decrease the gradient by about 12 percent

# Results (continued): Community aggregate income effect

▶ tablea

- ▶ Community aggregate income has a statistically significant reduction effect on the gradient
- ▶ Community aggregate income reduces the gradient by about 12 percent

# Conclusions

- ▶ Kenyan data exhibit income gradient on health that steepens up to 11 years old
- ▶ None of tested mechanisms downsize the gradient in the proportion estimated by Case et al (2002) with US data
- ▶ **Education, social status and occupation** have limited effect of different magnitude on the gradient, suggesting that social economic status might not be a unified concept



# Conclusions

- ▶ Nutrition is more effective at reducing the gradient in Kenya
- ▶ **Energy intake combined with nutrients** has a larger effect, but does not remove the gradient
- ▶ **Community aggregate income effect** is limited and should not be conducive to a transfer policy to correct for the gradient

Questions?

Thank You 😊

Table1: Descriptive Statistics of main variables

Variables	N	Mean	Std. Dev.	Min	Max
Morbidity(Bundle of Symptoms)	2985	2.89	3.25	0	22
Fever Symptoms (Counts)	2985	0.71	1.01	0	6
Gastric Disorder Symptoms (Counts)	2985	0.069	0.31	0	4
Children's Age(Years)	2985	7.62	4.07	0	14
Parental Agricultural Income(\$)	2975	35.93	136.97	-341.11	3111.11
Log Parental Agricultural Income(\$)	1420	3.69	1.44	-5.01	8.04
Parental Agricultural Income <sup>1</sup> (\$)	2975	24.04	141.82	-662.98	3110
Household Off Farm Earnings(\$)	2974	111.66	233.57	0	1733.33
Parental Off Farm Earnings(\$)	2974	102.89	222.03	0	1666.67
Full Income <sup>2</sup> (\$)	2975	24.04	141.82	-662.98	3110.00
Full Income(\$)	2983	138.41	268.25	-341.11	3277.78
Household Wealth(\$)	2985	6715.73	7319.27	0	55938.89
Livestock Production Income <sup>3</sup> (\$)	2974	-9.22	46.45	-810.67	558.667
Livestock Production Income(\$)	2974	2.67	14.19	-50	566.667
Crop Production Income(\$)	2247	44.04	155.06	-333.33	3111.11
Energy Intake	2979	1298.39	1244.53	0	24499.47
Fat Intake	2979	32.94	86.34	0	2517.48
Carb Intake	2979	196.51	183.38	0	5585.52
Protein Intake	2979	43.35	69.58	0	3296.94
Gender	2985	0.5	0.50	0	1
Sibling	2985	0.02	0.15	0	1
Father's Age(Years)	2585	48.28	13.39	17	88
Mother's Age(Years)	2898	41.15	13.30	15	88
Maternal Education(>= Secondary School)	2985	0.13	0.33	0	1
Father's Education(>= Secondary School)	2985	0.19	0.40	0	1
Father's Occupation(Salaried)	2985	0.07	0.25	0	1
Mother's Occupation(Salaried)	2985	0.03	0.16	0	1
Father's Social Status(Noble/High Social Status)	2985	0.17	0.37	0	1
Mother's Social Status(Noble/High Social Status)	2985	0.05	0.22	0	1
In-door Toilet	2974	0.005	0.07	0	1
Decent Drinkable Water (Tap Water)	2985	0.32	0.47	0	1
Community Average Income <sup>4</sup> (\$)	2985	22.07	21.38	-10.15	165.47
Community Average Income(\$)	1104	25.65	0.001	25.650	25.66
Breastfeed	2985	0.26	0.44	0	1
Vaccination	2985	0.006	0.078	0	1
Reporting same illness as in last quarter	2985	0.043	0.20	0	1

# Estimates

← Gradient

## Income Gradient on Children's Health and effects of other Household Characteristics on the Gradient

Age groups (Years)	Income gradient	Parental education effect on the income gradient on health	Parental occupation effect on the income gradient on health	Parental social status effect on the income gradient on health	Parental wealth effect on the income gradient on health	Nutrition effect on the income gradient on health	Nutrition and energy intake effect on the income gradient on health	Breastfeeding effect on the income gradient on health	Sanitation effect on the income gradient on health	Average income effect on the income gradient on health
Policy targeted age										
0-10	-0.0903***	-0.0957***	-0.0943***	-0.0943**	-0.0822*	-0.0928**	-0.0929**	-0.115***	-0.0969***	-0.0979***
0-5	-0.0986**	-0.0825*	-0.0846*	-0.0851*	-0.0788	-0.0817*	-0.0845*	-0.0937**	-0.0858*	-0.0842*
0-2	-0.0615	-0.0373	-0.0464	-0.041	-0.064	-0.0433	-0.0587	-0.0854	-0.0319	-0.0389
Gradual age										
3-6	-0.0928***	-0.0766**	-0.0746**	-0.0774**	-0.0979*	-0.0702**	-0.0701**	-0.0939**	-0.0812**	-0.0812**
7-11	-0.102**	-0.128**	-0.125**	-0.119**	-0.113*	-0.131**	-0.130**	-0.150***	-0.128**	-0.130**
12-14	-0.0439	0.0221	0.029	0.0147	-0.0672	0.000937	-0.00559	0.044	0.0348	0.0212

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