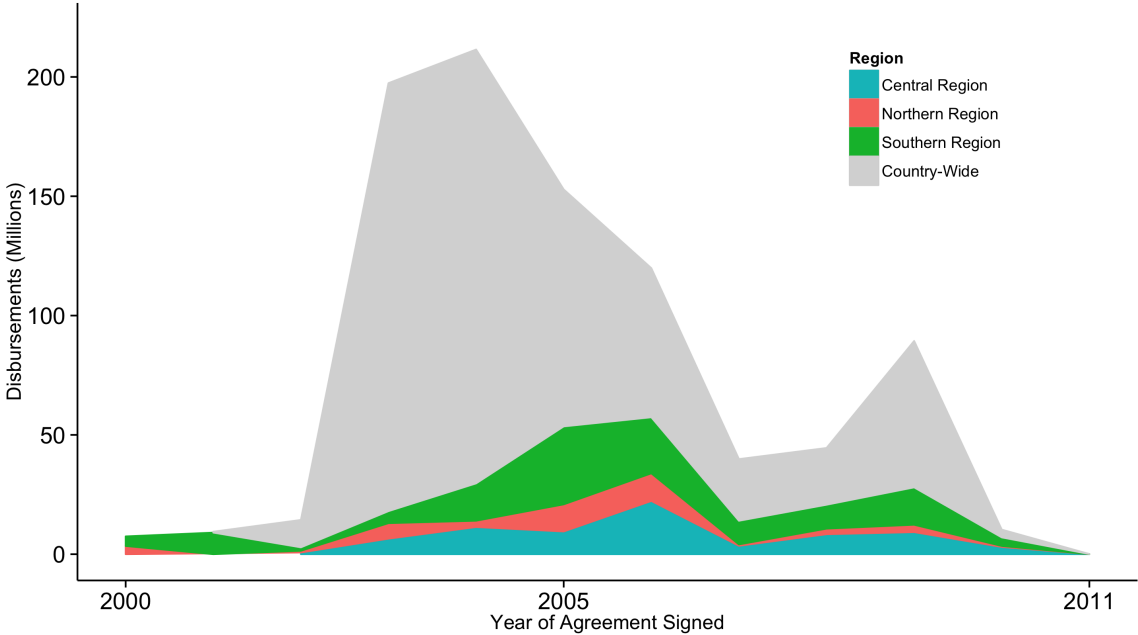


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A. Health Aid Disbursements to Malawi



Note: Data from AidData's Malawi Aid Management Platform Dataset

B. Variable Definitions and Summaries

Table B.1. Variable Definitions and Sources

Variable Name	Description	Source
Health Variables		
Malaria Prevalence	Whether an individual reported falling ill with malaria or a fever in the two weeks prior to being surveyed and did not reporting falling ill with any other illness	IHS 2004/5 and IHS 2010/11
Health Care Quality	How households rate health care they receive (1 = less than adequate; 2 = adequate; 3 = more than adequate)	IHS 2004/5 and IHS 2010/11
Mosquito Net Possession	Whether at least one person in a household sleeps under a mosquito net	IHS 2004/5 and IHS 2010/11
Number of Health Facilities	Number of health facilities in a traditional authority	Malawi Ministry of Health
Disease Ecological Risk Factors		
Temperature	Average annual temperature (standardized as z-score)	IHS 2010/11
Precipitation	Total annual precipitation (standardized as z-score)	IHS 2010/11
Socio-Economic Status		
Wealth Perception	Households rate, on a scale of 1 (poor) to 6 (rich), where they fall	IHS 2004/5 and IHS 2010/11
Urban	Urban versus rural area	IHS 2004/5 and IHS 2010/11
Political Affiliation		
Percent in Ethnic Group	Percent of people in traditional authority that belong to ethnic group (Lomwe, Chewa, Yao, Ngoni)	Malawi 2008 Census
Presidential Birth District	Binary variable indicating whether traditional authority is in the Thyolo District	Encyclopedia Britannica ¹
Additional Controls in Aid Impact Models		
Age	Age of respondent in years	IHS 2004/5 and IHS 2010/11
Education	Highest education level completed by household head (1 = primary year 4 or less; 2 = primary years 5-8; 3 = secondary years 1-3; 4 = secondary years 4-6; 5 some university or technical school and above)	IHS 2004/5 and IHS 2010/11
Drinking Water Source	Piped into dwelling, piped into yard/plot, communal standpipe, open well in yard/plot, open public well, protected well in yard/plot, protected public well, borehole, spring, river/stream, pond/lake, dam, rainwater, tanker truck/bowser, bottled water, other	IHS 2004/5 and IHS 2010/11
Toilet Type	Flush toilet, VIP latrine, traditional latrine with roof, traditional latrine without roof, none, other	IHS 2004/5 and IHS 2010/11
Wall Materials	Grass, mud, compacted earth, mud brick, burnt bricks, concrete, wood, iron sheets, other	IHS 2004/5 and IHS 2010/11
Floor Materials	Sand, smoothed mud, smooth cement, wood, tile, other	IHS 2004/5 and IHS 2010/11
Other		
Population	Population in traditional authorities in 2008	Malawi 2008 Census

1. Bingu wa Mutharika: President of Malawi. Encyclopedia Britannica; 2016 [cited 2016 May 1.] Available from: <http://www.britannica.com/biography/Bingu-wa-Mutharika>

Table B.2. Summary Statistics

Variables	2004	2010	No Aid (2004)	Aid (2004)
Malaria Prevalence	0.081 (0.001)	0.077 (0.001)	0.084 (0.002)	0.079 (0.002)
Health Care Quality (Less than Adequate)	0.597 (0.002)	0.319 (0.002)	0.67 (0.004)	0.554 (0.003)
Health Care Quality (Adequate)	0.369 (0.002)	0.603 (0.002)	0.311 (0.004)	0.404 (0.003)
Health Care Quality (More than Adequate)	0.034 (0.001)	0.078 (0.001)	0.02 (0.001)	0.043 (0.001)
Own Mosquito Net	0.422 (0.002)	0.643 (0.002)	0.409 (0.004)	0.43 (0.003)
Wealth Index	1.784 (0.004)	2.04 (0.004)	1.726 (0.006)	1.818 (0.005)
Urban	0.082 (0.001)	0.128 (0.002)	0.045 (0.002)	0.103 (0.002)
Education	2.031 (0.005)	2.228 (0.006)	1.99 (0.008)	2.056 (0.007)
Age	21.423 (0.088)	21.209 (0.087)	21.671 (0.146)	21.276 (0.111)
Number of Health Facilities	3.781 (0.014)		3.248 (0.025)	4.088 (0.017)
Temperature	217.021 (0.094)		226.169 (0.139)	209.771 (0.109)
Precipitation	1092.71 (1.2)		1108.406 (2.033)	1080.269 (1.421)
Percent Lomwe	0.042 (0.001)		0 (0)	0.066 (0.001)
Percent Chewa	0.158 (0.001)		0.171 (0.002)	0.151 (0.001)
Percent Yao	0.317 (0.002)		0.307 (0.003)	0.323 (0.002)
Percent Ngoni	0.121 (0.001)		0.063 (0.001)	0.154 (0.002)
Presidential Birth District	0.109 (0.001)		0.063 (0.001)	0.135 (0.001)

Means reported with standard errors in parentheses. Summary statistics for No Aid and Aid come from the baseline year (2004).

C. Description of Health Aid Sectors

Sector	Sector-Specific Categories
Medical Services	Laboratories; Specialized clinics and hospitals; Specialized medical equipment and supplies; ambulances; dental services; mental health care; control of non-infectious diseases; drug and substance abuse control and counseling
Basic Health Care	Basic/primary health care programs; Paramedical and nursing care programs; Supply of drugs, medicines and vaccines (basic)
Basic Health Infrastructure	Basic hospitals, clinics and dispensaries; Basic health medical equipment and supplies
Infectious and Parasitic Disease Control	All prevention and control activities; Other infectious and parasitic disease, control; Malaria control; Tuberculosis control; Helminthiasis; Polio; Acute respiratory infections

D. List of Aid Projects in Analyses

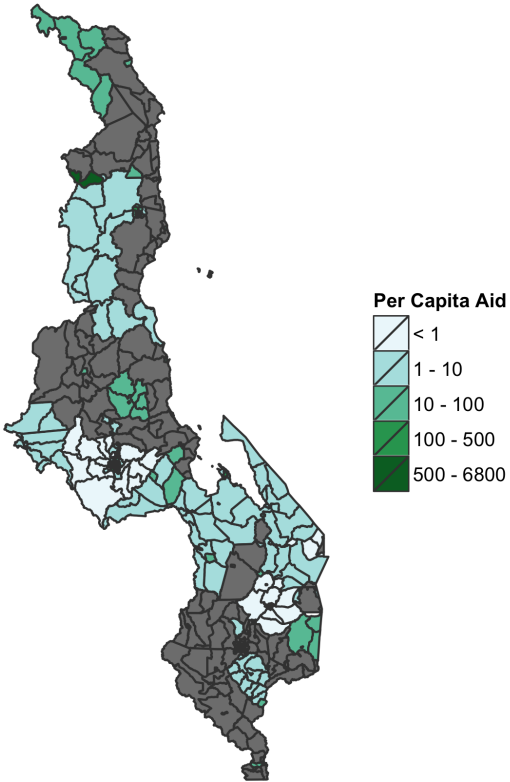
Table D.1. Aid Projects in Aid Allocation Analyses

Donor	Project Name	Disbursement	Agreement Date	Number of Project Locations	Health Aid Sector
NORAD	Disrict-level Implementation of the Malawi HoH PMTCT Programme	\$130,656	2008	13	Medical Services
DfID	Pre - Health SWAP FA	\$13,265	2005	29	Medical Services
USAID	PROJECT HOPE MALAWI	\$439,613	2006	2	Medical Services
DfID	Health Swap 2 Design	\$16,675	2011	4	Medical Services
NORAD	Support to College of Medicine Ph. III	\$3,254,706	2008	3	Medical Services
EU	Malawi National Blood Transfusion Services	\$1,467,686	2004	4	Medical Services
NORAD	Improvement of surgical and orthopedic services in malawi	\$404,921	2008	2	Medical Services
DfID	Support to Banja La Mtsongolo	\$190,649	2009	31	Medical Services
AfDB	EDUCATION V	\$429,401	2006	38	Medical Services
USAID	Capacity Support for Early Childhood Development and Psch-social support	\$255,992	2010	3	Medical Services
GIZ	Promotion of Sustainable Structures for Health Delivery	\$394,647	2004	16	Basic Health Care
USAID	BASICS III - Basic Support for Institutionalizing Child Survival (BASICS) - Strengthened Child Health Care in Malawi	\$899,442	2007	8	Basic Health Care
USAID	IMPROVING LIVELIHOODS THROUGH INCREASING FOOD SECURITY	\$992,220	2004	14	Basic Health Care
USAID	Building the Workforce and Nurse Training Capacity in Malawi	\$48,076	2010	1	Basic Health Care
AfDB	Support to the health sector programme	\$616,640	2006	27	Basic Health Care
NORAD	Disrict-level Implementation of the Malawi HoH PMTCT Programme	\$130,656	2008	13	Basic Health Care
NORAD	NCA - Health and HIV/AIDS Project	\$113,493	2008	32	Basic Health Care
DfID	Pre - Health SWAP FA	\$13,265	2005	29	Basic Health Care
DfID	Health Swap 2 Design	\$16,675	2011	4	Basic Health Care
USAID	Support for Health Systems Strengthening and HIV/AIDS service delivery in Malawi South East Zone	\$115,965	2010	11	Basic Health Care
ICEIDA	Support to Friends of Kamuzu Central Hospital **	\$1,505,123	2006	1	Basic Health Infrastructure
US CDC	Supporting the provision of safe & adequate supply of Blood & Blood products to District level Hospitals	\$148,750	2006	16	Basic Health Infrastructure
AfDB	Support to the health sector programme	\$616,640	2006	27	Basic Health Infrastructure
ICEIDA	Monkey Bay Community Hospital Project *	\$3,595,623	2004	1	Basic Health Infrastructure
NORAD	Disrict-level Implementation of the Malawi HoH PMTCT Programme	\$130,656	2008	13	Basic Health Infrastructure
DfID	Pre - Health SWAP FA	\$13,265	2005	29	Basic Health Infrastructure
DfID	Health Swap 2 Design	\$16,675	2011	4	Basic Health Infrastructure
NORAD	NCA-ACT Food Crisis Emergency snf recovery response program	\$128,888	2010	13	Basic Health Infrastructure
DfID	Support to Banja La Mtsongolo	\$190,649	2009	31	Basic Health Infrastructure
USAID	Extending Quality Improvement for HIV/AIDS in Malawi (EQUIP)	\$983,273	2010	1	Basic Health Infrastructure
AfDB	National Water Development Program (Grant)	\$46,040	2009	19	Basic Health Infrastructure
AfDB	Smallholder crop production and marketing project	\$969,093	2006	19	Parasitic Disease Control
USAID	BASICS III - Basic Support for Institutionalizing Child Survival (BASICS) - Strengthened Child Health Care in Malawi	\$899,442	2007	8	Parasitic Disease Control
World Bank	Education Sector Support Project	\$33,826,485	2005	8	Parasitic Disease Control
DfID	Pre - Health SWAP FA	\$13,265	2005	29	Parasitic Disease Control
USAID	PROJECT HOPE MALAWI	\$439,613	2006	2	Parasitic Disease Control
USAID	In- Door Residual Spraying (IRS)	\$1,015,992	2010	1	Parasitic Disease Control
USAID	Support for Health Systems Strengthening and HIV/AIDS service delivery in Malawi South East Zone	\$115,965	2010	11	Parasitic Disease Control

Table D.2. Aid Projects in Aid Impact Analyses

Donor	Project Name	Disbursement	Completion Date	Number of Project Locations	Health Aid Sector
EU	Malawi National Blood Transfusion Services	\$7,338,431	2006	4	Medical Services
NORAD	Disrict-level Implementation of the Malawi HoH PMTCT Programme	\$1,829,181	2009	13	Medical Services
NORAD	Support to College of Medicine Ph. III	\$9,764,118	2008	3	Medical Services
DfID	Support to Banja La Mtsongolo	\$6,291,428	2009	31	Medical Services
AfDB	Rural health care project III	\$9,048,007	2005	4	Basic Health Care
GIZ	Promotion of Sustainable Structures for Health Delivery	\$6,314,358	2008	16	Basic Health Care
KFW	Zomba Integrated Health Care	\$4,018,889	2006	2	Basic Health Care
KFW	Improvement of Health Services Chitipa District	\$3,447,944	2006	1	Basic Health Care
NORAD	Disrict-level Implementation of the Malawi HoH PMTCT Programme	\$1,829,181	2009	13	Basic Health Care
USAID	IMPROVING LIVELIHOODS THROUGH INCREASING FOOD SECURITY	\$13,891,083	2009	14	Basic Health Care
USAID	BEHAVIOURS ADOPTED THAT REDUCE FERTILITY AND RISK OF HIV/AIDS	\$3,580,000	2007	4	Basic Health Care
AfDB	Integrated water supply and sanitation for central and northern region	\$13,012,899	2007	2	Basic Infrastructure
ICEIDA	Support to Friends of Kamuzu Central Hospital **	\$1,505,123	2009	1	Basic Infrastructure
KFW	Zomba Integrated Health Care	\$4,018,889	2006	2	Basic Infrastructure
NORAD	Disrict-level Implementation of the Malawi HoH PMTCT Programme	\$1,829,181	2009	13	Basic Infrastructure
DfID	Support to Banja La Mtsongolo	\$ 6,291,428	2009	31	Basic Infrastructure
AfDB	Integrated water supply and sanitation for central and northern region	\$13,012,899	2007	2	Parasitic Control
World Bank	Education Sector Support Project	\$33,826,485	2006	8	Parasitic Control

E. Spatial Distribution of Aid Disbursements



Map shows spatial distribution of aid projects included in the aid impact analyses; specifically, health aid projects with a spatial precision at or below the district level and projects completed from 2005 to 2009.

E. Sensitivity Analysis of Difference-in-Difference Estimates: Different Model Specifications

As a sensitivity analysis to difference-in-difference models, we examine models with all covariates, models without health related variables as these could be endogenous with aid, and models without health or socio-economic covariates. Tables report average marginal effects from logistic models.

Table F.1. Sensitivity Analysis, Different Model Specifications: Malaria Prevalence as Outcome

	Dependent Variable: Individual Reporting Falling Ill with Malaria/Fever				
	All Health Aid	Medical Services Aid	Basic Health Care Aid	Basic Health Infrastructure Aid	Parasitic Disease Control Aid
	No Health-Related Controls				
Health Aid × Year	−0.009 (0.007)	−0.003 (0.009)	0.00042 (0.009)	−0.013* (0.007)	−0.022** (0.009)
Observations	68,765	68,765	68,765	68,765	68,765
Moran's I (p-value)	0.513	0.478	0.479	0.477	0.571
Health-Related and Wealth Index Controls	No	No	No	No	No
Other Controls	Yes	Yes	Yes	Yes	Yes
Other Health Aid Control	N/A	Yes	Yes	Yes	Yes
TA Fixed Effects	Yes	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes
	No Health or other Socio-Economic Controls				
Health Aid × Year	−0.005 (0.007)	−0.006 (0.008)	0.001 (0.007)	−0.011 (0.007)	−0.013 (0.009)
Observations	90,088	90,088	90,088	90,088	90,088
Moran's I (p-value)	0.71	0.908	0.812	0.611	0.406
Health-Related and Wealth Index Controls	No	No	No	No	No
Other Controls	No	No	No	No	No
Other Health Aid Control	N/A	Yes	Yes	Yes	Yes
TA Fixed Effects	Yes	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Average marginal effects reported with standard errors in parentheses. Standard errors clustered on traditional authorities. N/A refers to not applicable. TA refers to traditional authorities. The health aid variable reflects the aid sector listed in the column heading.

Table F.2. Sensitivity Analysis, Different Model Specifications: Health Care Quality as Outcome

	Dependent Variable: Individual Reporting Above Average Health Care Quality				
	All Health Aid	Medical Services Aid	Basic Health Care Aid	Basic Health Infrastructure Aid	Parasitic Disease Control Aid
No Health-Related Controls					
Health Aid × Year	0.011 (0.027)	0.038 (0.058)	−0.021 (0.021)	0.119** (0.054)	0.141** (0.07)
Observations	69,200	69,200	69,200	69,200	69,200
Moran's I (p-value)	0.499	0.528	0.723	0.731	0.956
Health-Related and Wealth Index Controls	No	No	No	No	No
Other Controls	Yes	Yes	Yes	Yes	Yes
Other Health Aid Control	N/A	Yes	Yes	Yes	Yes
TA Fixed Effects	Yes	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes
No Health or other Socio-Economic Controls					
Health Aid × Year	−0.018 (0.023)	0.035 (0.06)	−0.042** (0.019)	0.119** (0.058)	0.11* (0.059)
Observations	81,174	81,174	81,174	81,174	81,174
Moran's I (p-value)	0.967	0.774	0.873	0.524	0.907
Health-Related and Wealth Index Controls	No	No	No	No	No
Other Controls	No	No	No	No	No
Other Health Aid Control	N/A	Yes	Yes	Yes	Yes
TA Fixed Effects	Yes	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Average marginal effects reported with standard errors in parentheses. Standard errors clustered on traditional authorities. N/A refers to not applicable. TA refers to traditional authorities. The health aid variable reflects the aid sector listed in the column heading.

G. Difference-in-Difference Placebo Tests

This section uses difference-in-difference models to examine the impact of aid on variables that should not be related to aid. Consequently, we expect to find aid not having a significant relation with these variables; aid having a significant relation would indicate issues with model specification.

We use the following variables as placebo outcomes: interview day, defined as the day of the month the individual was interviewed; whether the individual's spouse lives in the household (versus living in another household); whether the individual works for a private employer, whether the household reported experiencing unusually high prices for food, whether the household reported experiencing a large fall in the sales prices for crops, whether the individual could read and write in Chichewa, whether the individual could read and write in English. We use an ordinary-least squares model when using interview day as the dependent variable, and logistic models to explain the other dependent variables.

Table G.1. Placebo Test Results

	All Health Aid	Medical Services Aid	Basic Health Care Aid	Basic Health Infrastructure Aid	Parasitic Disease Control Aid
Interview Day					
Health Aid \times Year	-4.83×10^{-5} (7.30×10^{-5})	-2.53×10^{-4} (3.35×10^{-4})	-1.25×10^{-4} (1.17×10^{-4})	9.56×10^{-6} (1.07×10^{-4})	1.76×10^{-4} (1.63×10^{-4})
Observations	68,719	68,719	68,719	68,719	68,719
Moran's I (p-value)	0.042	0.91	0.002	0	0
Socio-Economic and Health Controls	Yes	Yes	Yes	Yes	Yes
Other Health Aid Control	Yes	Yes	Yes	Yes	Yes
TA Fixed Effects	Yes	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes
Spouse Lives in Household					
Health Aid \times Year	0.003 (0.007)	-0.005 (0.014)	-0.005 (0.008)	0.011 (0.006)	0.011 (0.007)
Observations	23,979	23,979	23,979	23,979	23,979
Moran's I (p-value)	0.004	0.003	0.004	0.012	0.005
Socio-Economic and Health Controls	Yes	Yes	Yes	Yes	Yes
Other Health Aid Control	Yes	Yes	Yes	Yes	Yes
TA Fixed Effects	Yes	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes
Works for Private Employer					
Health Aid \times Year	0.029 (0.045)	0.041 (0.087)	0.032 (0.043)	0.008 (0.059)	-0.029 (0.055)
Observations	4,911	4,911	4,911	4,911	4,911
Moran's I (p-value)	0.041	0.041	0.035	0.038	0.036
Socio-Economic and Health Controls	Yes	Yes	Yes	Yes	Yes
Other Health Aid Control	Yes	Yes	Yes	Yes	Yes
TA Fixed Effects	Yes	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes

G.1. Placebo Test Results (Continued...)

	All Health Aid	Medical Services Aid	Basic Health Care Aid	Basic Health Infrastructure Aid	Parasitic Disease Control Aid
Household Experienced Unusually High Prices for Food					
Health Aid × Year	0.034 (1.09×10 ⁷)	0.15 (6.4×10 ⁶)	-0.052 (5.3×10 ⁶)	0.09 (1.9×10 ⁷)	0.045 (3.3×10 ⁶)
Observations	68,715	68,715	68,715	68,715	68,715
Moran's I (p-value)	0.001	0	0	0	0
Socio-Economic and Health Controls	Yes	Yes	Yes	Yes	Yes
Other Health Aid Control	Yes	Yes	Yes	Yes	Yes
TA Fixed Effects	Yes	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes
Household Experienced Large Fall in Sales Prices for Crops					
Health Aid × Year	-0.027 (9.6×10 ⁶)	0.055 (2.2×10 ⁷)	-0.073 (6.5×10 ⁶)	0.008 (1.01×10 ⁶)	0.005 (6.7×10 ⁵)
Observations	68,712	68,712	68,712	68,712	68,712
Moran's I (p-value)	0.192	0.146	0.478	0.096	0.123
Socio-Economic and Health Controls	Yes	Yes	Yes	Yes	Yes
Other Health Aid Control	Yes	Yes	Yes	Yes	Yes
TA Fixed Effects	Yes	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes
Can Read and Write in English					
Health Aid × Year	0.001 (9.03×10 ⁴)	-0.029 (3.3×10 ⁶)	-0.039 (3.9×10 ⁶)	0.017 (2.3×10 ⁶)	0.034 (2.9×10 ⁶)
Observations	51,982	51,982	51,982	51,982	51,982
Moran's I (p-value)	0.066	0.065	0.049	0.075	0.048
Socio-Economic and Health Controls	Yes	Yes	Yes	Yes	Yes
Other Health Aid Control	Yes	Yes	Yes	Yes	Yes
TA Fixed Effects	Yes	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes
Can Read and Write in Chichewa					
Health Aid × Year	4.93 × 10 ⁻⁴ (1.2×10 ⁶)	-0.037 (4.7×10 ⁷)	-0.069 (1.6×10 ⁸)	0.055 (5.01×10 ⁷)	0.073 (2.9×10 ⁸)
Observations	65,082	65,082	65,082	65,082	65,082
Moran's I (p-value)	0.303	0.334	0.259	0.568	0.535
Socio-Economic and Health Controls	Yes	Yes	Yes	Yes	Yes
Other Health Aid Control	Yes	Yes	Yes	Yes	Yes
TA Fixed Effects	Yes	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes

H. Sensitivity Analysis of Difference-in-Difference Estimates: Excluding Urban Areas

Table H.1. Sensitivity Analysis, Excluding Urban Areas: Malaria Prevalence as Outcome

	Dependent Variable: Individual Reporting Falling Ill with Malaria/Fever				
	All Health Aid	Medical Services Aid	Basic Health Care Aid	Basic Health Infrastructure Aid	Parasitic Disease Control Aid
	Rural Areas Only				
Health Aid × Year	−0.01 (0.008)	0.003 (0.01)	−0.003 (0.01)	−0.011 (0.009)	−0.026** (0.01)
Observations	59,978	59,978	59,978	59,978	59,978
Moran's I (p-value)	0.99	0.983	0.976	0.977	0.875
Socio-economic and Health Controls	Yes	Yes	Yes	Yes	Yes
Other Health Aid Control	N/A	Yes	Yes	Yes	Yes
TA Fixed Effects	Yes	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Average marginal effects reported with standard errors in parentheses. Standard errors clustered on traditional authorities. N/A refers to not applicable. TA refers to traditional authorities. The health aid variable reflects the aid sector listed in the column heading.

Table H.2. Sensitivity Analysis, Excluding Urban Areas: Health Care Quality as Outcome

	Dependent Variable: Individual Reporting Above Average Health Care Quality				
	All Health Aid	Medical Services Aid	Basic Health Care Aid	Basic Health Infrastructure Aid	Parasitic Disease Control Aid
	Rural Areas Only				
Health Aid × Year	0.006 (0.027)	0.128* (0.068)	−0.026 (0.022)	0.187*** (0.071)	0.205* (0.108)
Observations	59,978	59,978	59,978	59,978	59,978
Moran's I (p-value)	0.548	0.502	0.812	0.768	0.911
Socio-economic and Health Controls	Yes	Yes	Yes	Yes	Yes
Other Health Aid Control	N/A	Yes	Yes	Yes	Yes
TA Fixed Effects	Yes	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Average marginal effects reported with standard errors in parentheses. Standard errors clustered on traditional authorities. N/A refers to not applicable. TA refers to traditional authorities. The health aid variable reflects the aid sector listed in the column heading.

I. Sensitivity Analysis of Difference-in-Difference Estimates: Survey Weights

Table I.1. Sensitivity Analysis, Survey Weights: Malaria Prevalence as Outcome

	Dependent Variable: Individual Reporting Falling Ill with Malaria/Fever				
	All Health Aid	Medical Services Aid	Basic Health Care Aid	Basic Health Infrastructure Aid	Parasitic Disease Control Aid
No Interaction Term					
Health Aid × Year	−0.006 (0.006)	−0.007 (0.007)	0.005 (0.006)	−0.013** (0.007)	−0.021** (0.01)
Observations	68,719	68,719	68,719	68,719	68,719
Moran's I (p-value)	0.321	0.307	0.258	0.239	0.306
Socio-Economic and Health Controls	Yes	Yes	Yes	Yes	Yes
Other Health Aid Control	N/A	Yes	Yes	Yes	Yes
TA Fixed Effects	Yes	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes
Health Aid Impact Interacted with Wealth					
Health Aid × Year	−0.006 (0.009)	−0.01 (0.01)	0.006 (0.012)	−0.022*** (0.008)	−0.026** (0.011)
Health Aid × Year × Wealth	0.00025 (0.003)	0.002 (0.004)	−0.001 (0.004)	0.006 (0.004)	0.005 (0.008)
Observations	68,719	68,719	68,719	68,719	68,719
Moran's I (p-value)	0.329	0.305	0.277	0.318	0.369
Socio-Economic and Health Controls	Yes	Yes	Yes	Yes	Yes
Other Health Aid Control	N/A	Yes	Yes	Yes	Yes
TA Fixed Effects	Yes	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes
Health Aid Impact Interacted with Number of Health Facilities					
Health Aid × Year	−0.005 (0.008)	−0.012 (0.01)	0.005 (0.01)	−0.011 (0.01)	0.021 (0.031)
Health Aid × Year × Health Facilities	−0.026 (0.086)	0.107 (0.137)	0.012 (0.12)	−0.055 (0.151)	−0.855** (0.416)
Observations	68,719	68,719	68,719	68,719	68,719
Moran's I (p-value)	0.32	0.298	0.253	0.243	0.336
Socio-Economic and Health Controls	Yes	Yes	Yes	Yes	Yes
Other Health Aid Control	N/A	Yes	Yes	Yes	Yes
TA Fixed Effects	Yes	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes
Health Aid Impact Interacted with Urban					
Health Aid × Year	−0.006 (0.006)	−0.002 (0.008)	0.003 (0.007)	−0.011 (0.007)	−0.021** (0.011)
Health Aid × Year × Urban	0.006 (0.011)	−0.02 (0.013)	0.018 (0.014)	−0.011 (0.013)	0.021 (0.024)
Observations	68,719	68,719	68,719	68,719	68,719
Moran's I (p-value)	0.341	0.252	0.258	0.255	0.409
Socio-Economic and Health Controls	Yes	Yes	Yes	Yes	Yes
Other Health Aid Control	N/A	Yes	Yes	Yes	Yes
TA Fixed Effects	Yes	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Average marginal effects reported with standard errors in parentheses. Standard errors clustered on traditional authorities. N/A refers to not applicable. TA refers to traditional authorities. The health aid variable reflects the aid sector listed in the column heading.

Table I.2. Sensitivity Analysis, Survey Weights: Health Care Quality as Outcome

	Dependent Variable: Individual Reporting Above Average Health Care Quality				
	All Health Aid	Medical Services Aid	Basic Health Care Aid	Basic Health Infrastructure Aid	Parasitic Disease Control Aid
No Interaction Term					
Health Aid × Year	−0.016 (0.018)	0.082 (0.051)	−0.049*** (0.014)	0.155*** (0.046)	0.112** (0.054)
Observations	68,719	68,719	68,719	68,719	68,719
Moran's I (p-value)	0.68	0.473	0.9	0.372	0.738
Socio-Economic and Health Controls	Yes	Yes	Yes	Yes	Yes
Other Health Aid Control	N/A	Yes	Yes	Yes	Yes
TA Fixed Effects	Yes	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes
Health Aid Impact Interacted with Wealth					
Health Aid × Year	−0.002 (0.021)	0.026 (0.041)	−0.055*** (0.017)	0.214*** (0.064)	0.254*** (0.084)
Health Aid × Year × Wealth	−0.006 (0.005)	0.014* (0.008)	0.003 (0.006)	−0.011 (0.008)	−0.028*** (0.01)
Observations	68,719	68,719	68,719	68,719	68,719
Moran's I (p-value)	0.731	0.373	0.933	0.423	0.846
Socio-Economic and Health Controls	Yes	Yes	Yes	Yes	Yes
Other Health Aid Control	N/A	Yes	Yes	Yes	Yes
TA Fixed Effects	Yes	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes
Health Aid Impact Interacted with Number of Health Facilities					
Health Aid × Year	−0.041 (0.031)	0.256 (0.185)	−0.083*** (0.023)	0.292*** (0.107)	0.125** (0.06)
Health Aid × Year × Health Facilities	0.516 (0.521)	−0.78 (0.582)	0.919** (0.468)	−0.76* (0.451)	−0.122 (0.362)
Observations	68,719	68,719	68,719	68,719	68,719
Moran's I (p-value)	0.624	0.554	0.866	0.418	0.717
Socio-Economic and Health Controls	Yes	Yes	Yes	Yes	Yes
Other Health Aid Control	N/A	Yes	Yes	Yes	Yes
TA Fixed Effects	Yes	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes
Health Aid Impact Interacted with Urban					
Health Aid ×	−0.016 (0.019)	0.159*** (0.061)	−0.051*** (0.014)	0.214*** (0.059)	0.175** (0.085)
Health Aid × Year × Urban	−0.00035 (0.021)	−0.052*** (0.009)	0.022 (0.029)	−0.046*** (0.011)	−0.044*** (0.014)
Observations	68,719	68,719	68,719	68,719	68,719
Moran's I (p-value)	0.703	0.362	0.915	0.525	0.835
Socio-Economic and Health Controls	Yes	Yes	Yes	Yes	Yes
Other Health Aid Control	N/A	Yes	Yes	Yes	Yes
TA Fixed Effects	Yes	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Average marginal effects reported with standard errors in parentheses. Standard errors clustered on traditional authorities. N/A refers to not applicable. TA refers to traditional authorities. The health aid variable reflects the aid sector listed in the column heading.

J. Entropy Balancing Methodology and Results

We use entropy balancing as an alternative method to examine causal impacts of health aid. Entropy balancing is a multivariate reweighting method that generates covariate balance between treatments and controls.¹ We use this approach as it directly adjusts covariate means to balance and avoids iterative approaches to developing propensity scores, matching, and checking covariate balance. Entropy balancing requires establishing common units across the baseline and endline. As the household surveys are not panels, we use traditional authorities as the unit of analysis. Consequently, the outcome variables are the percentage of people in each traditional authority that reported having malaria-like symptoms, and the average health care rating. Due to skewness in these variables, we use them in log form. We balance on baseline levels of the outcome variables and other baseline variables that likely also influence health outcomes and infrastructure. Specifically, these include average levels of malaria prevalence, perceptions of wealth, mosquito net ownership, health care quality perception, the number of health facilities, urban, education level of the household head, temperature, precipitation, and average number of people with inadequate floor materials, walls, toilets and drinking water sources. In difference-in-difference models, household condition variables (type of floor, wall, toilet, and drinking water source) are included as factor variables; however to create an average of these variables we create dummy variables indicating whether the characteristic is inadequate. Following from usage with USAID demographic and health surveys, we define inadequate as natural or rustic materials.² Consequently, we define inadequate floors as sand or smoothed mud; inadequate walls as compacted earth, grass/palm leaves, mud, or wood; inadequate toilet as latrine without roof, traditional latrine with roof, or none; and inadequate water source as communal open, unprotected well, lake/ reservoir, personal open unprotected well, or river/spring.

In sector-specific models, we balance on the log of per capita aid disbursements from other health aid sectors (adding 0.1 to per capita aid before logging to retain values of zero). The entropy balancing algorithm successfully balances covariates at the 5% level (see table C.1 for covariates means across treatment and control groups before and after entropy balancing).

We examine the average treatment effect on the treated, estimated as:

$$\tau_{ATT} = E[Y(1)|D = 1] - E[Y(0)|D = 1]$$

where Y is the treatment, health aid, and D refers to treatment areas. Using weights developed from entropy balancing, we generate the covariate-balanced counterfactual mean as follows:

$$E[Y(0)|\hat{D} = 1] = \frac{\sum_{\{i|D=0\}} Y_i w_i}{\sum_{\{i|D=0\}} w_i}$$

where w are the weights.

Entropy balancing results show all aid sectors significantly associated with reducing malaria prevalence at the 5% level (see table C.1). Health aid, generally, is associated with a 16% reduction in malaria prevalence. The coefficients on basic infrastructure aid and parasitic control aid have the largest coefficients in magnitude; basic infrastructure aid is associated with reducing malaria by 13% and parasitic control aid is associated with reducing malaria by 21%.

Entropy balancing results show that health aid, generally, is associated with increasing individuals' perceptions of health care quality by about 5.0% (see table C.3). Similar to difference-in-difference results, entropy balancing results only show basic health infrastructure and parasitic control aid to be significantly associated with enhancing health infrastructure. Basic health infrastructure and parasitic control aid are associated with a 4.8% and 9.9% increase in individuals's perceptions of health care quality respectively ($p < 0.10$).

1. Hainmueller J. Entropy balancing for causal effects: A multivariate reweighting method to produce balanced samples in observational studies. *Political Analysis*. 2012;20(1):25–46. doi: 10.1093/pan/mpr025.

2. Rutstein S., and Staveteig S. Making the Demographic and Health Surveys Wealth Index Comparable: DHS Methodological Reports 9. ICF International; 2014 [cited 2016 Sept 27]. Available from: <https://dhsprogram.com/pubs/pdf/MR9/MR9.pdf>

Table J.1. Covariate Means Across Treatment and Control Groups Before and After Entropy Balancing

Variable	Treatment Mean	Control Mean (Unweighted)	Control Mean (Weighted)	p-value: treatment and weighted control difference
All Health Aid				
Wealth Index	1.891	1.7881	1.891	0.999893
Own Mosquito Net	0.436	0.4248	0.436	0.999686
Health Care Quality	1.499	1.3909	1.499	0.999906
Number of Health Facilities	0.0521	0.0565	0.0521	0.999737
Urban	0.2056	0.0735	0.2056	0.999711
Education	2.1204	2.0327	2.1204	0.999741
Age	21.3591	21.7356	21.359	0.999656
Temperature	-0.2787	0.4385	-0.2787	0.999748
Precipitation	-0.1209	0.1902	-0.1208	0.999743
Malaria Prevalence	0.0712	0.0704	0.0712	0.999983
Inadequate Drinking Water Source	0.3188	0.2904	0.3188	0.99984
Inadequate Toilet	0.9247	0.9611	0.9247	0.999963
Inadequate Walls	0.3089	0.3361	0.3088	0.999497
Inadequate Floor	0.7347	0.8104	0.7347	0.999671
Medical Services Aid				
Wealth Index	1.8907	1.8453	1.8907	0.999782
Own Mosquito Net	0.5956	0.4081	0.5956	0.999923
Health Care Quality	1.4814	1.4535	1.4814	0.999677
Number of Health Facilities	0.0623	0.0526	0.0623	0.999284
Urban	0.2727	0.1373	0.2727	0.999231
Education	2.3399	2.0499	2.3398	0.999627
Age	21.4168	21.5181	21.4167	0.999625
Temperature	0.1532	-0.022	0.1532	0.999881
Precipitation	0.189	-0.0272	0.189	0.999996
Malaria Prevalence	0.0677	0.0714	0.0677	0.999457
Other Aid	0.9441	0.8697	0.9442	0.999638
Inadequate Drinking Water Source	0.1968	0.3237	0.1969	0.999583
Inadequate Toilet	0.8845	0.9466	0.8845	1
Inadequate Walls	0.1124	0.3492	0.1124	0.999499
Inadequate Floor	0.6156	0.7855	0.6156	0.998954
Basic Health Care Aid				
Wealth Index	1.8907	1.8453	1.8907	0.999782
Own Mosquito Net	0.5956	0.4081	0.5956	0.999923
Health Care Quality	1.4814	1.4535	1.4814	0.999677
Number of Health Facilities	0.0623	0.0526	0.0623	0.999284
Urban	0.2727	0.1373	0.2727	0.999231
Education	2.3399	2.0499	2.3398	0.999627
Age	21.4168	21.5181	21.4167	0.999625
Temperature	0.1532	-0.022	0.1532	0.999881
Precipitation	0.189	-0.0272	0.189	0.999996
Malaria Prevalence	0.0677	0.0714	0.0677	0.999457
Other Aid	0.9441	0.8697	0.9442	0.999638
Inadequate Drinking Water Source	0.1968	0.3237	0.1969	0.999583
Inadequate Toilet	0.8845	0.9466	0.8845	1
Inadequate Walls	0.1124	0.3492	0.1124	0.999499
Inadequate Floor	0.6156	0.7855	0.6156	0.998954
Basic Health Infrastructure Aid				
Wealth Index	2.0348	1.8017	2.0348	0.999998
Own Mosquito Net	0.5217	0.4075	0.5217	1
Health Care Quality	1.4958	1.4466	1.4958	1
Number of Health Facilities	0.0528	0.0541	0.0528	1
Urban	0.2703	0.1232	0.2703	0.999998
Education	2.3125	2.0257	2.3125	0.999999
Age	21.1914	21.5896	21.1914	0.999998
Temperature	-0.3277	0.0879	-0.3277	0.999999
Precipitation	-0.0531	0.0142	-0.0531	0.999999
Malaria Prevalence	0.0666	0.0721	0.0666	1
Other Aid	0.7219	0.6686	0.7219	1
Inadequate Drinking Water Source	0.2832	0.3143	0.2832	0.999998
Inadequate Toilet	0.8796	0.9547	0.8796	1
Inadequate Walls	0.2749	0.3314	0.2749	0.999999
Inadequate Floor	0.6434	0.7965	0.6434	0.999998

Table F.1. (Continued)

Variable	Treatment Mean	Control Mean (Unweighted)	Control Mean (Weighted)	p-value: treatment and weighted control difference
Parasitic Control Aid				
Wealth Index	2.1903	1.8097	2.1645	0.769285
Own Mosquito Net	0.4196	0.4331	0.4205	0.980785
Health Care Quality	1.5673	1.4436	1.5587	0.876398
Number of Health Facilities	0.0566	0.0535	0.0564	0.985579
Urban	0.3684	0.1282	0.3519	0.821416
Education	2.3173	2.0582	2.2997	0.766107
Age	20.6179	21.6135	20.6841	0.87212
Temperature	-1.0514	0.1281	-0.9716	0.246558
Precipitation	-0.3113	0.0379	-0.2881	0.819162
Malaria Prevalence	0.062	0.072	0.0626	0.90667
Other Aid	0.814	0.7319	0.8069	0.975271
Inadequate Drinking Water Source	0.3547	0.302	0.3511	0.936346
Inadequate Toilet	0.8433	0.9505	0.8507	0.869094
Inadequate Walls	0.4587	0.3025	0.4486	0.86729
Inadequate Floor	0.6463	0.7785	0.6554	0.864937

Temperature and precipitation variables are standardized, and other aid is log per capita.

Table J.2. Impact of Health Aid on Malaria / Fever Prevalence

	Dependent Variable: log(Malaria Prevalence)				
	All Health Aid	Medical Services Aid	Basic Health Care Aid	Basic Health Infrastructure Aid	Parasitic Disease Control Aid
Health Aid	-0.165*** (0.038)	-0.128*** (0.036)	-0.094** (0.037)	-0.139*** (0.030)	-0.210*** (0.057)
Observations	175	175	175	175	175
Adjusted R ²	0.368	0.423	0.248	0.350	0.671

Note: *p<0.1; **p<0.05; ***p<0.01. Coefficients reported with robust standard errors in parentheses. The health aid variable reflects the aid sector listed in the column heading. Regressions control for variables balanced on.

Table J.3. Impact of Health Aid on Health Care Quality

	Dependent Variable: log(Average Health Care Quality)				
	All Health Aid	Medical Services Aid	Basic Health Care Aid	Basic Health Infrastructure Aid	Parasitic Disease Control Aid
Health Aid	0.050** (0.021)	0.008 (0.024)	0.003 (0.021)	0.048** (0.022)	0.099*** (0.028)
Observations	175	175	175	175	175
Adjusted R ²	0.191	0.201	0.249	0.161	0.572

Note: *p<0.1; **p<0.05; ***p<0.01. Coefficients reported with robust standard errors in parentheses. The health aid variable reflects the aid sector listed in the column heading. Regressions control for variables balanced on.

K. Translating Treatment Effects into Malaria Reduction

This appendix describes our approach to estimating a policy-relevant interpretation of the impact effects found in this paper; specifically, we estimate the number of people that did not get malaria-like symptoms as a result of aid (cases prevented), the number of days people were able to conduct their normal activities as a result of an individual not being sick (productive days gained), and the cost to donors per case prevented and productive day gained. Cases prevented and productive days gained are estimated using equations 1–3:

$$Cases\ Prevented_{Diff\ in\ Diff} = Total\ Population\ in\ Treated\ Areas \times \tau_{ATT} \quad (1)$$

$$Cases\ Prevented_{Entropy} = Number\ with\ Malaria\ in\ Treated\ Areas \times \tau_{ATT} \quad (2)$$

$$Productive\ Days\ Gained = Cases\ Prevented \times (Days_{Sick} + Days_{Other}) \quad (3)$$

where $Days_{Sick}$ refers to the average number of days a person who fell ill had to stop their normal activities and $Days_{Other}$ refers to the average number of days other people had to stop their normal activities to assist the ill individual; estimates come from Malawi’s 2010/11 Integrated Household Survey. τ_{ATT} refers to the average treatment effect on the treated. In the first equation (for difference-in-difference models), τ_{ATT} represents a percentage point change, while in the second equation (for entropy balancing models) τ_{ATT} represents a percent change and thus is multiplied against the estimated number of individuals with malaria-like symptoms. Estimates will be conservative as any beneficial impact of aid will have benefits beyond the snapshot in time used in this analysis. Despite conservative estimates, translating treatment effects into cases prevented and productive days gained provides a common metric to compare treatment effects between difference-in-differences and entropy balancing models.

Population and number with malaria in treated areas are estimated using equations 4 and 5:

$$Total\ Population\ in\ Treated\ Areas = Total\ Population \times \% \text{ in Treated Areas} \quad (4)$$

$$Number\ with\ Malaria\ in\ Treated\ Areas = Total\ Population \times \% \text{ in Treated Areas} \times \% \text{ with Malaria in Treated Areas} \quad (5)$$

To reflect uncertainty in these estimates, we use average values and values at the 95% confidence intervals for: (1) treatment effect estimates, (2) percent of the population in treated areas, (3) % of the population in treated areas with malaria, and (4) days individuals and other individuals had to stop productive activities due to an individual falling ill. The total population in 2010 was 15.05 million. The average number of days an individual who fell ill had to stop their normal activities due to malaria was 3.007 (95% CI: 3.272, 3.333), and the average number of days other people had to stop their normal activities to assist the ill individual was 2.269 (95% CI: 2.919, 2.974), where estimates come from the Malawi 2010/11 IHS data. We also estimate the amount of aid dollars per reduction in case of malaria and per gain in productive day. The below tables show parameter values and results.

Table K.1. Statistics on Treated Areas

Aid Type	Proportion of Population in Treated Areas	Percent with Malaria in Treated Areas
All	0.5578 [0.5532, 0.5624]	0.0615 [0.0585, 0.0645]
Medical Services	0.0896 [0.0870, 0.0923]	0.0601 [0.0527, 0.0674]
Basic Health Care	0.4284 [0.4239, 0.4330]	0.0644 [0.0609, 0.0678]
Basic Infrastructure	0.1851 [0.1816, 0.1887]	0.0532 [0.0484, 0.0580]
Parasitic Control	0.1088 [0.1059, 0.1116]	0.0466 [0.0407, 0.0525]

Estimates reported with 95% confidence interval in brackets.

Table K.2. Malaria Prevalence Reduction

Aid Type	Diff-in-Diff Estimates	Entropy Balancing Estimates
All	67,387 [-47,786, 184,455]	85,532 [44,015, 131,510]
Medical Services	2,708 [-20,556, 27,373]	10,417 [3,947, 18,711]
Basic Health Care	6,470 [-106,517, 121,884]	39,172 [8,165, 74,146]
Basic Infrastructure	33,556 [-10,091, 78,897]	20,709 [10,599, 32,829]
Parasitic Control	36,149 [6,975, 66,851]	16,093 [6,350, 28,580]

Values report estimates of malaria cases averted due to aid in 2010 alone. Estimates reported with 95% confidence interval in brackets. Negative values refer to a decrease in cases prevented (ie, an increase in cases of malaria).

Table K.3. Productive Days Gained

Aid Type	Diff-in-Diff Estimates	Entropy Balancing Estimates
All	421,169 [-295,917, 1,163,458]	534,576 [272,562, 829,509]
Medical Services	16,925 [-127,292, 172,658]	65,106 [24,442, 118,024]
Basic Health Care	40,438 [-659,606, 768,792]	244,831 [50,562, 467,683]
Basic Infrastructure	209,726 [-62,493, 497,650]	129,436 [65,637, 207,073]
Parasitic Control	225,936 [43,195, 421,666]	100,585 [39,325, 180,275]

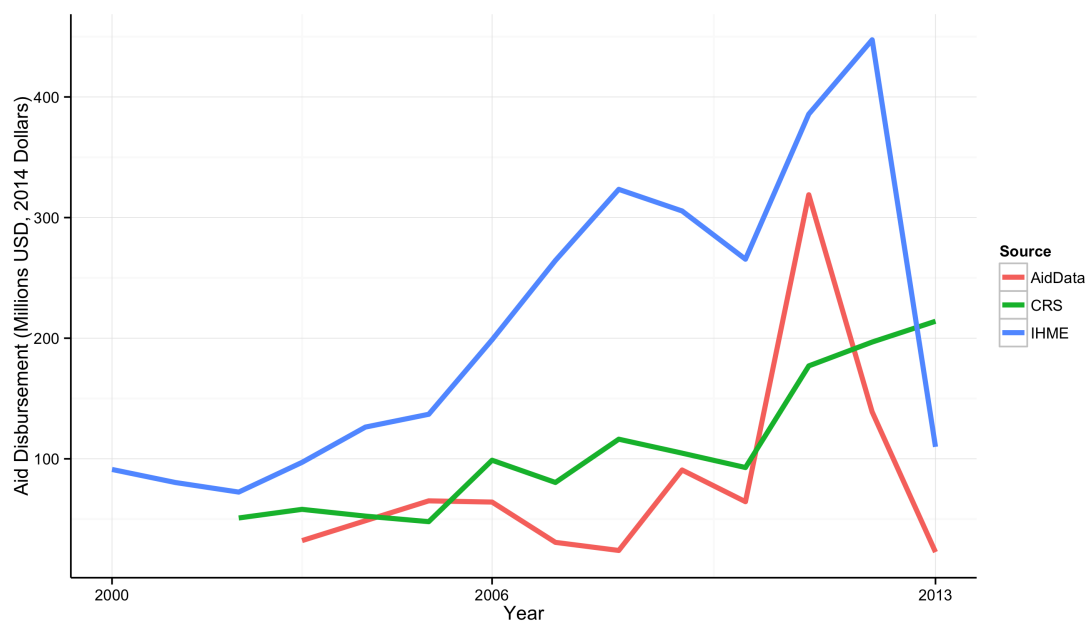
Values report estimates of productive days gained due to aid in 2010 alone. Estimates reported with 95% confidence interval in brackets.

L. Health Aid Disbursements to Malawi by Data Source

This appendix compares health aid disbursements to Malawi by different data sources. Specifically, it compares data from AidData's Malawi Aid Management Platform dataset used in this paper to two other commonly used datasets that provide national-level health aid flow information: the Organisation for Economic Co-operation and Development's (OECD) Creditor Reporting System (CRS) database¹ and the Institute for Health Metrics and Evaluation's (IHME) Development Assistance for Health Database.² In the AidData dataset, years are in terms of the project completion date. Data from IHME and the CRS are provided in constant 2014 USD, while values from AidData are reported in current USD. We convert aid values in AidData to constant 2014 USD.

Both the CRS and the AidData dataset underestimate aid flows compared to the IHME dataset. However, AidData and IHME follow roughly similar trends in flows, especially in later years. Aid flows are roughly comparable between AidData and the CRS.

Figure L.1. Health Aid Disbursements to Malawi by Data Source



1. Creditor Reporting System (CRS). OECD.Stat; 2016 [cited 2016 May 1]. Available from: <http://stats.oecd.org/viewhtml.aspx?datasetcode=CRS11&lang=en>

2. Development Assistance for Health Database 1990-2014. Global Health Data Exchange; 2016 [cited 2016 May 1]. Available from: <http://ghdx.healthdata.org/record/development-assistance-health-database-1990-2014>