

Supplementary Files

Supplementary Table 1. Malawi variance inflation factor (VIF) & 1/VIF

Variable	VIF	1/VIF
Parity	3.35	0.299
Age group	2.98	0.336
Wealth status	1.87	0.535
Residence	1.50	0.665
Television watching	1.46	0.683
Education level	1.45	0.690
Mobile phone ownership	1.30	0.771
Region	1.22	0.821
Radio listening	1.22	0.822
Ethnicity	1.20	0.833
Marital status	1.18	0.848
Contraceptive use	1.15	0.867
Newspaper or magazine reading	1.10	0.907
HIV status	1.08	0.923
Religion	1.07	0.937
Working status	1.06	0.942
Health insurance coverage	1.06	0.946
Recent health facility visits	1.03	0.967
STI status	1.00	0.995
Smoking status	1.00	0.997
Mean VIF	1.41	

Supplementary Table 2. Zambia variance inflation factor (VIF) & 1/VIF

Variable	VIF	1/VIF
Wealth status	3.61	0.277
Parity	2.96	0.338
Age group	2.61	0.383
Residence	2.15	0.465
Television watching	1.81	0.552
Education level	1.56	0.640
Mobile phone ownership	1.36	0.736
Marital status	1.31	0.762
Health insurance coverage	1.28	0.783
Working status	1.18	0.851
Region	1.13	0.882
Contraceptive use	1.13	0.886
Radio listening	1.12	0.892
Newspaper or magazine reading	1.10	0.911
HIV status	1.08	0.928
Recent health facility visits	1.03	0.969
Smoking status	1.01	0.993
Religion	1.00	0.995
STI status	1.00	0.996
Mean VIF	1.55	

Supplementary Table 3. Malawi Multi-level Analysis Results

Variable	Model 0 (Null)	Model 1 (Individual)	Model 2 (Community)	Model 3 (Full)
Fixed Effects	OR (95% CI)	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)
Age groups				
15-24	—	Ref	—	Ref
25-29	—	1.38 (1.22, 1.56) ***	—	1.37 (1.21, 1.55) ***
30-39	—	2.01 (1.75, 2.31) ***	—	2.00 (1.74, 2.30) ***
40-49	—	2.71 (2.31, 3.19) ***	—	2.70 (2.30, 3.18) ***
Education level				
No formal	—	Ref	—	Ref
Primary	—	1.47 (1.26, 1.71) ***	—	1.46 (1.26, 1.70) ***
Secondary & higher	—	1.53 (1.29, 1.82) ***	—	1.46 (1.23, 1.74) ***
Working status				
Not working	—	Ref	—	Ref
Informal work	—	1.11 (1.02, 1.21) *	—	1.12 (1.03, 1.22) *
Formal work	—	1.09 (0.97, 1.24)	—	1.10 (0.97, 1.24)
Other	—	1.12 (0.97, 1.29)	—	1.13 (0.98, 1.29)
Wealth status				
Poorest	—	Ref	—	Ref
Poorer	—	1.04 (0.92, 1.18)	—	1.02 (0.90, 1.16)
Middle	—	1.08 (0.95, 1.23)	—	1.03 (0.91, 1.18)
Richer	—	1.24 (1.10, 1.41) **	—	1.15 (1.00, 1.31) *
Richest	—	1.42 (1.22, 1.64) ***	—	1.18 (1.01, 1.39) *
Marital status				
Not in union	—	Ref	—	Ref
In union	—	1.03 (0.95, 1.12)	—	1.05 (0.97, 1.15)
Parity				
Nulliparous	—	Ref	—	Ref
1 birth	—	2.14 (1.82, 2.52) ***	—	2.15 (1.83, 2.53) ***
2 births	—	2.43 (2.04, 2.90) ***	—	2.43 (2.04, 2.90) ***
3 births	—	2.89 (2.37, 3.52) ***	—	2.89 (2.37, 3.52) ***
4+ births	—	2.67 (2.17, 3.28) ***	—	2.71 (2.20, 3.34) ***
Ethnicity				
Chewa	—	Ref	—	Ref
Tumbuka	—	1.01 (0.87, 1.18)	—	1.05 (0.88, 1.24)
Lomwe	—	1.76 (1.56, 1.99) ***	—	1.19 (1.04, 1.37) *
Yao	—	1.17 (0.99, 1.38)	—	0.84 (0.70, 1.00) *
Ngoni	—	1.31 (1.14, 1.50) ***	—	1.08 (0.94, 1.23)
Other Malawi ethnicities	—	1.20 (1.06, 1.37) **	—	1.00 (0.87, 1.15)
Other country ethnicities	—	0.73 (0.38, 1.42)	—	0.66 (0.34, 1.29)
Religion				
Catholic	—	Ref	—	Ref
Protestant	—	1.03 (0.92, 1.15)	—	1.03 (0.92, 1.15)
Other christian	—	1.02 (0.91, 1.15)	—	1.03 (0.92, 1.16)
Muslim	—	1.06 (0.89, 1.27)	—	1.05 (0.88, 1.25)
No & other religion	—	0.75 (0.45, 1.23)	—	0.76 (0.46, 1.25)
HIV status				
Positive	—	Ref	—	Ref
Negative	—	0.19 (0.17, 0.22) ***	—	0.20 (0.18, 0.23) ***
Other	—	0.19 (0.10, 0.35) ***	—	0.19 (0.10, 0.37) ***
STI in last 12 months				
No	—	Ref	—	Ref
Yes	—	1.16 (1.01, 1.34) *	—	1.17 (1.01, 1.35) *
Health insurance				
Not covered	—	Ref	—	Ref
Covered	—	2.09 (1.54, 2.85) ***	—	2.00 (1.47, 2.72) ***

Recent health facility visits				
No	–	Ref	–	Ref
Yes	–	1.29 (1.18, 1.40) ***	–	1.28 (1.18, 1.39) ***
Contraceptive use				
None	–	Ref	–	Ref
Traditional	–	1.07 (0.84, 1.36)	–	1.07 (0.84, 1.36)
Modern	–	1.13 (1.04, 1.22) **	–	1.14 (1.05, 1.23) **
Smoking status				
Non-smoker	–	Ref	–	Ref
Smoker	–	0.48 (0.30, 0.77) **	–	0.47 (0.29, 0.75) **
Radio listening				
Not at all	–	Ref	–	Ref
Less than once a week	–	1.03 (0.93, 1.14)	–	1.04 (0.94, 1.16)
At least once a week	–	1.00 (0.91, 1.10)	–	1.01 (0.92, 1.11)
Television watching				
Not at all	–	Ref	–	Ref
Less than once a week	–	1.21 (1.05, 1.38) **	–	1.18 (1.03, 1.35) *
At least once a week	–	1.13 (0.99, 1.28)	–	1.09 (0.96, 1.24)
Newspaper reading				
Not at all	–	Ref	–	Ref
Less than once a week	–	1.16 (1.02, 1.31) *	–	1.17 (1.03, 1.33) *
At least once a week	–	1.07 (0.92, 1.25)	–	1.08 (0.93, 1.27)
Mobile phone ownership				
No	–	Ref	–	Ref
Yes	–	1.06 (0.98, 1.15)	–	1.08 (0.99, 1.17)
Residence				
Urban	–	–	Ref	Ref
Rural	–	–	0.83 (0.70, 0.98) *	0.81 (0.68, 0.97) *
Region				
Central	–	–	Ref	Ref
Northern	–	–	0.93 (0.82, 1.07)	0.93 (0.78, 1.09)
Southern	–	–	1.91 (1.73, 2.11) ***	1.92 (1.69, 2.18) ***
Cluster poverty level				
Low	–	–	Ref	Ref
Moderate	–	–	1.03 (0.87, 1.22)	1.10 (0.92, 1.32)
High	–	–	0.89 (0.74, 1.09)	0.98 (0.79, 1.22)
Proportion of uneducated				
Low	–	–	Ref	Ref
Moderate	–	–	0.83 (0.72, 0.96) **	0.84 (0.72, 0.98) *
High	–	–	0.65 (0.55, 0.76) ***	0.68 (0.57, 0.81) ***
Random Effects				
Cluster variance (SE)	0.319 (0.029)	0.235 (0.027)	0.144 (0.019)	0.156 (0.022)
Model Fit				
ICC	8.85%	6.66%	4.19%	4.53%
Log Likelihood	-11017.124	-9821.196	-10866.765	-9726.82
AIC	22038.25	19730.39	21751.53	19555.64
BIC	22053.84	20073.46	21821.7	19953.29
Ref = Reference category				
Bold: Statistically significant; * p-value ≤ 0.05, **p-value < 0.01, ***p-value < 0.001				

Supplementary Table 4. Zambia Multi-level Analysis Results

Variable	Model 0 (Null)	Model 1 (Individual)	Model 2 (Community)	Model 3 (Full)
Fixed Effects	OR (95% CI)	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)
Age groups				
15-24	—	Ref	—	Ref
25-29	—	1.56 (1.34, 1.83) ***	—	1.57 (1.34, 1.84) ***
30-39	—	2.33 (1.96, 2.77) ***	—	2.31 (1.95, 2.74) ***
40-49	—	2.77 (2.27, 3.38) ***	—	2.74 (2.24, 3.34) ***
Education level				
No formal	—	Ref	—	Ref
Primary	—	1.12 (0.92, 1.37)	—	1.10 (0.90, 1.34)
Secondary & higher	—	1.21 (0.98, 1.51)	—	1.17 (0.94, 1.45)
Working status				
Not working	—	Ref	—	Ref
Informal work	—	1.07 (0.96, 1.19)	—	1.08 (0.97, 1.20)
Formal work	—	1.16 (0.96, 1.41)	—	1.19 (0.98, 1.44)
Wealth status				
Poorest	—	Ref	—	Ref
Poorer	—	1.07 (0.91, 1.26)	—	1.03 (0.87, 1.22)
Middle	—	1.30 (1.10, 1.54) **	—	1.07 (0.89, 1.29)
Richer	—	1.46 (1.20, 1.78) ***	—	1.02 (0.80, 1.29)
Richest	—	1.55 (1.23, 1.97) ***	—	1.02 (0.77, 1.37)
Marital status				
Not in union	—	Ref	—	Ref
In union	—	0.95 (0.85, 1.06)	—	0.98 (0.88, 1.10)
Parity				
Nulliparous	—	Ref	—	Ref
1 birth	—	2.08 (1.73, 2.51) ***	—	2.08 (1.72, 2.50) ***
2 births	—	2.38 (1.94, 2.93) ***	—	2.35 (1.91, 2.90) ***
3 births	—	2.48 (1.98, 3.12) ***	—	2.45 (1.95, 3.07) ***
4+ births	—	2.10 (1.66, 2.66) ***	—	2.12 (1.68, 2.68) ***
Religion				
Christian	—	Ref	—	Ref
Muslim	—	0.33 (0.13, 0.86) *	—	0.32 (0.12, 0.84) *
Other	—	1.46 (0.65, 3.25)	—	1.48 (0.66, 3.32)
HIV status				
Positive	—	Ref	—	Ref
Negative	—	0.09 (0.08, 0.11) ***	—	0.10 (0.08, 0.12) ***
Other	—	0.11 (0.06, 0.20) ***	—	0.12 (0.07, 0.22) ***
STI in last 12 months				
No	—	Ref	—	Ref
Yes	—	1.08 (0.85, 1.35)	—	1.07 (0.85, 1.35)
Health insurance				
Not covered	—	Ref	—	Ref
Covered	—	1.51 (1.26, 1.80) ***	—	1.52 (1.28, 1.81) ***
Recent health facility visits				
No	—	Ref	—	Ref
Yes	—	1.19 (1.06, 1.34) **	—	1.17 (1.04, 1.32) *
Contraceptive use				
None	—	Ref	—	Ref
Traditional	—	0.84 (0.64, 1.09)	—	0.83 (0.64, 1.08)
Modern	—	1.17 (1.06, 1.29) **	—	1.17 (1.05, 1.29) **
Smoking status				
Non-smoker	—	Ref	—	Ref
Smoker	—	1.30 (0.86, 1.96)	—	1.25 (0.83, 1.88)

Radio listening				
Not at all	–	Ref	–	Ref
Less than once a week	–	1.17 (0.98, 1.40)	–	1.16 (0.97, 1.39)
At least once a week	–	1.06 (0.93, 1.21)	–	1.07 (0.94, 1.22)
Almost every day	–	1.26 (1.10, 1.43) **	–	1.28 (1.12, 1.46) ***
Television watching				
Not at all	–	Ref	–	Ref
Less than once a week	–	1.06 (0.83, 1.37)	–	1.07 (0.83, 1.38)
At least once a week	–	1.03 (0.86, 1.24)	–	1.06 (0.88, 1.27)
Almost every day	–	1.02 (0.87, 1.18)	–	1.05 (0.90, 1.21)
Newspaper reading				
Not at all	–	Ref	–	Ref
Less than once a week	–	1.12 (0.92, 1.37)	–	1.08 (0.89, 1.32)
At least once a week	–	1.09 (0.90, 1.33)	–	1.07 (0.88, 1.30)
Almost every day	–	1.08 (0.79, 1.47)	–	1.06 (0.78, 1.44)
Mobile phone ownership				
No	–	Ref	–	Ref
Yes	–	1.31 (1.17, 1.47) ***	–	1.29 (1.15, 1.45) ***
Residence				
Urban	–	–	Ref	Ref
Rural	–	–	0.79 (0.65, 0.97) *	0.83 (0.66, 1.04)
Region				
Lusaka	–	–	Ref	Ref
Central	–	–	1.04 (0.83, 1.31)	0.98 (0.76, 1.28)
Copperbelt	–	–	0.96 (0.77, 1.19)	0.95 (0.74, 1.22)
Eastern	–	–	1.07 (0.84, 1.37)	1.19 (0.90, 1.58)
Luapula	–	–	1.03 (0.79, 1.33)	1.02 (0.76, 1.37)
Muchinga	–	–	1.08 (0.82, 1.41)	1.22 (0.90, 1.65)
Northern	–	–	1.15 (0.89, 1.50)	1.43 (1.06, 1.91) *
North Western	–	–	0.61 (0.47, 0.81) ***	0.69 (0.51, 0.94) *
Southern	–	–	1.31 (1.05, 1.64) *	1.38 (1.07, 1.79) *
Western	–	–	1.90 (1.47, 2.46) ***	1.97 (1.46, 2.66) ***
Cluster poverty level				
Low	–	–	Ref	Ref
Moderate	–	–	0.85 (0.69, 1.05)	0.86 (0.67, 1.10)
High	–	–	0.55 (0.42, 0.73) ***	0.62 (0.44, 0.86) **
Proportion of uneducated				
Low	–	–	Ref	Ref
Moderate	–	–	0.94 (0.80, 1.11)	1.03 (0.85, 1.25)
High	–	–	0.74 (0.59, 0.91) **	0.84 (0.65, 1.07)
Random Effects				
Cluster variance (SE)	0.385 (0.042)	0.287 (0.039)	0.169 (0.027)	0.225 (0.034)
Model Fit				
ICC	10.47%	8.03%	4.89%	6.41%
Log Likelihood	-7006.521	-5952.978	-6887.236	-5903.981
AIC	14017.04	11981.96	13806.47	11911.96
BIC	14031.76	12261.62	13924.22	12294.66
Ref = Reference category				
Bold: Statistically significant; * p-value ≤ 0.05, **p-value < 0.01, ***p-value < 0.001				

Supplementary Table 5. STROBE Statement

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page No.
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5
Bias	9	Describe any efforts to address potential sources of bias	N/A
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7-8
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	7-8
		(b) Describe any methods used to examine subgroups and interactions	8
		(c) Explain how missing data were addressed	5
		(d) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(e) Describe any sensitivity analyses	8
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	8
		(c) Consider use of a flow diagram	5-6
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8-12
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15*	Report numbers of outcome events or summary measures	N/A
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12-22
		(b) Report category boundaries when continuous variables were categorized	6-7
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	8-22
Discussion			

Key results	18	Summarise key results with reference to study objectives	22-23
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	25-26
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	22-25
Generalisability	21	Discuss the generalisability (external validity) of the study results	25
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	N/A