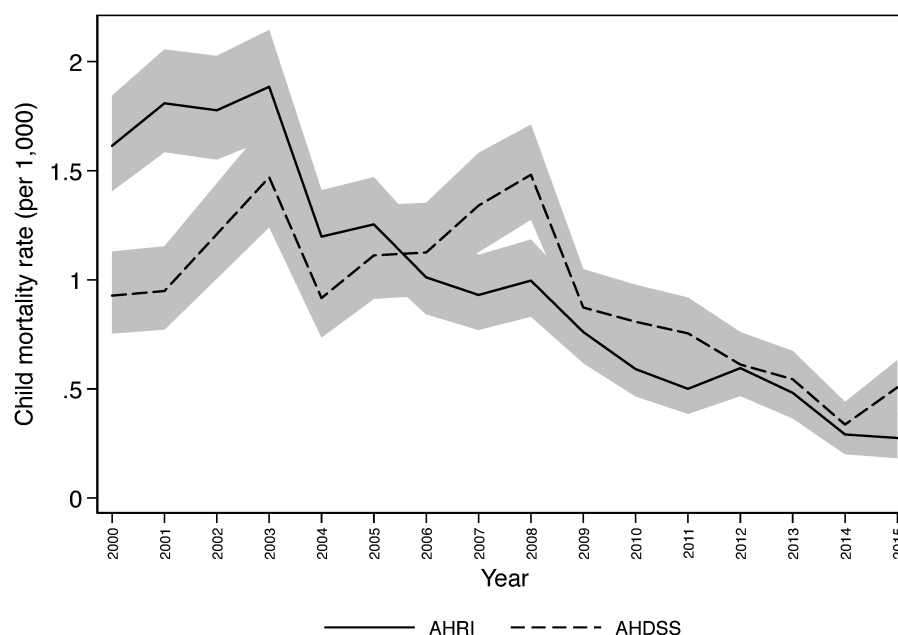
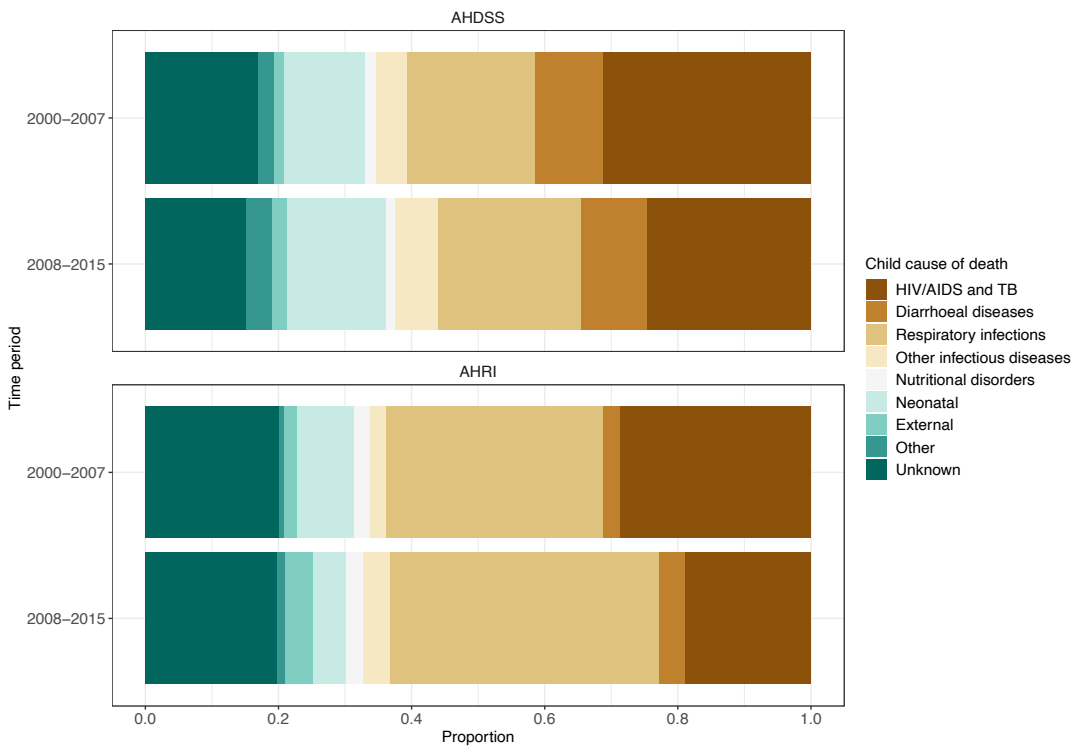


**Supplemental Figure 1.** Child mortality rates by year, Agincourt Health and Demographic Surveillance System (AHDSS) and Africa Health Research Institute (AHRI), South Africa 2000-2015.



**Supplemental Figure 2.** Distribution of child causes of death over time, Agincourt Health and Demographic Surveillance System (AHDSS) and Africa Health Research Institute (AHRI), South Africa 2000-2007 and 2008-2015. Child causes of death classified by InterVA-5 based on VA.



**Supplemental Table 1.** Multilevel relative risk regression of child death on household structure and controls, Agincourt Health and Demographic Surveillance System (AHDSS) and Africa Health Research Institute (AHRI), South Africa 2000-2015 (n=3,637,638 child months).

	RRR	95% CI	p-value
Site			
AHRI	1	-	
AHDSS	0.757	[0.647, 0.887]	0.001
Time period			
2000 to 2007	1	-	
2008 to 2015	0.415	[0.346, 0.498]	<0.001
Site X time period			
AHDSS X 2008 to 2015	1.454	[1.251, 1.689]	<0.001
Sex of child			
Female	1	-	
Male	1.124	[1.049, 1.204]	0.001
Child age (months)			
<1	1	-	
1 to 6	0.38	[0.342, 0.423]	<0.001
7 to 23	0.177	[0.159, 0.196]	<0.001
24 to 59	0.035	[0.031, 0.039]	<0.001
Multiple birth			
Singleton	1	-	
Multiple birth	1.818	[1.557, 2.124]	<0.001
Mother's age at birth (years)			
15-19	0.864	[0.780, 0.956]	0.005
20-24	1	-	
25-29	1.264	[1.148, 1.392]	<0.001
30-34	1.089	[0.969, 1.225]	0.152
35+	1.237	[1.091, 1.403]	0.001
Number ages 0-5			
0	1	-	
1	1.098	[1.011, 1.192]	0.027
2+	1.251	[1.138, 1.376]	<0.001
Number ages 5-19			
0	1	-	
1 to 2	0.98	[0.849, 1.132]	0.787
3 to 4	0.928	[0.800, 1.076]	0.321
5+	1.044	[0.894, 1.219]	0.588
Number ages 20+			
0 to 2	1	-	
3 to 4	0.975	[0.879, 1.081]	0.631
5+	0.938	[0.841, 1.046]	0.249

Household structure			
Nuclear	1	-	
Vertical only	1.644	[1.325, 2.041]	<0.001
Horizontal/vertical	1.635	[1.408, 1.898]	<0.001
No parents, kin present	2.906	[2.169, 3.895]	<0.001
Mother only	1.554	[1.313, 1.839]	<0.001
Other	1.809	[1.411, 2.319]	<0.001
Site X household structure			
AHDSS X Vertical only	1.181	[0.892, 1.563]	0.245
AHDSS X Horizontal/vertical	1.07	[0.877, 1.305]	0.506
AHDSS X No parents, kin present	0.938	[0.595, 1.479]	0.784
AHDSS X Mother only	1.373	[1.112, 1.696]	0.003
AHDSS X Other	1.932	[1.339, 2.787]	<0.001
Time period X household structure			
2008 to 2015 X Vertical only	0.842	[0.632, 1.122]	0.241
2008 to 2015 X Horizontal/vertical	0.905	[0.742, 1.104]	0.324
2008 to 2015 X No parents, kin present	0.818	[0.506, 1.323]	0.413
2008 to 2015 X Mother only	1.2	[0.973, 1.479]	0.089
2008 to 2015 X Other	1.07	[0.725, 1.578]	0.734
	Parameter		
$\sigma_{mother}^2$	3.152	[2.574, 3.859]	

**Supplemental Table 2.** Multilevel relative risk regression of child death on kin presence and controls, Agincourt Health and Demographic Surveillance System (AHDSS) and Africa Health Research Institute (AHRI), South Africa 2000-2015 (n=3,637,638 child months).

	RRR	95% CI	p-value
Site			
AHRI	1	-	
AHDSS	0.874	[0.794, 0.961]	0.006
Time period			
2000 to 2007	1	-	
2008 to 2015	0.456	[0.399, 0.520]	<0.001
Site X time period			
AHDSS X 2008 to 2015	1.437	[1.241, 1.664]	<0.001
Sex of child			
Female	1	-	
Male	1.125	[1.050, 1.205]	0.001
Child age (months)			
<1	1	-	
1 to 6	0.379	[0.341, 0.422]	<0.001
7 to 23	0.176	[0.159, 0.195]	<0.001
24 to 59	0.035	[0.031, 0.039]	<0.001
Multiple birth			
Singleton	1	-	
Multiple birth	1.804	[1.545, 2.106]	<0.001
Mother's age at birth (years)			
15-19	0.866	[0.780, 0.961]	0.007
20-24	1	-	
25-29	1.277	[1.155, 1.413]	<0.001
30-34	1.127	[0.995, 1.278]	0.06
35+	1.309	[1.143, 1.499]	<0.001
Number ages 0-5			
0	1	-	
1	1.096	[1.009, 1.190]	0.029
2+	1.249	[1.136, 1.373]	<0.001
Number ages 5-19			
0	1	-	
1 to 2	1.069	[0.917, 1.246]	0.395
3 to 4	1.014	[0.864, 1.189]	0.865
5+	1.147	[0.969, 1.357]	0.11
Number ages 20+			
0 to 2	1	-	
3 to 4	0.953	[0.861, 1.056]	0.359
5+	0.903	[0.811, 1.004]	0.06
Parental presence			

Both parents	1	-	
One parent	1.569	[1.363, 1.807]	<0.001
Neither parent	2.623	[2.058, 3.343]	<0.001
Related adult presence			
No	1	-	
Yes	2.954	[1.769, 4.931]	<0.001
Parental presence X related adult presence			
One parent X related adult present	0.316	[0.188, 0.530]	<0.001
Neither parent X related adult present	0.307	[0.171, 0.551]	<0.001
Related siblings			
No	1	-	
Yes	0.712	[0.606, 0.837]	<0.001
Parental presence X related siblings			
One parent X related siblings present	1.464	[1.233, 1.737]	<0.001
Neither parent X related siblings present	1.518	[1.070, 2.153]	0.019
Time period X related adult presence			
2008 to 2015 X related adult presence	0.806	[0.698, 0.932]	0.004
	Parameter		
$\sigma^2_{mother}$	1.128	[0.944, 1.349]	

**Supplemental Table 3.** Multilevel relative risk regression of child death on household structure and controls, Agincourt Health and Demographic Surveillance System (AHDSS) and Africa Health Research Institute (AHRI), South Africa 2000-2015 (n=3,637,638 child months). Estimation sample restricted to those with household SES information.

	RRR	95% CI	p-value
Site			
AHRI	1	-	
AHDSS	0.772	[0.625, 0.954]	0.017
Time period			
2000 to 2007	1	-	
2008 to 2015	0.391	[0.305, 0.501]	<0.001
Site X time period			
AHDSS X 2008 to 2015	1.395	[1.141, 1.705]	0.001
Sex of child			
Female	1	-	
Male	1.134	[1.037, 1.240]	0.006
Child age (months)			
<1	1	-	
1 to 6	0.355	[0.304, 0.415]	<0.001
7 to 23	0.176	[0.152, 0.205]	<0.001
24 to 59	0.036	[0.030, 0.042]	<0.001
Multiple birth			
Singleton	1	-	
Multiple birth	1.58	[1.281, 1.948]	<0.001
Mother's age at birth (years)			
15-19	0.897	[0.785, 1.024]	0.107
20-24	1	-	
25-29	1.364	[1.202, 1.548]	<0.001
30-34	1.175	[1.008, 1.368]	0.039
35+	1.391	[1.183, 1.634]	<0.001
Number ages 0-5			
0	1	-	
1	1.049	[0.943, 1.167]	0.375
2+	1.225	[1.082, 1.387]	0.001
Number ages 5-19			
0	1	-	
1 to 2	1.031	[0.855, 1.243]	0.746
3 to 4	0.949	[0.782, 1.152]	0.594
5+	1.034	[0.843, 1.268]	0.748
Number ages 20+			
0 to 2	1	-	
3 to 4	0.912	[0.798, 1.041]	0.174
5+	0.868	[0.753, 1.002]	0.053

Household structure			
Nuclear	1	-	
Vertical only	1.851	[1.374, 2.495]	<0.001
Horizontal/vertical	1.733	[1.408, 2.131]	<0.001
No parents, kin present	3.356	[2.292, 4.914]	<0.001
Mother only	1.716	[1.357, 2.170]	<0.001
Other	1.892	[1.335, 2.680]	<0.001
Site X household structure			
AHDSS X Vertical only	1.099	[0.752, 1.604]	0.627
AHDSS X Horizontal/vertical	1.127	[0.863, 1.470]	0.38
AHDSS X No parents, kin present	1.072	[0.619, 1.857]	0.804
AHDSS X Mother only	1.309	[0.981, 1.746]	0.067
AHDSS X Other	2.069	[1.274, 3.360]	0.003
Time period X household structure			
2008 to 2015 X Vertical only	0.734	[0.502, 1.075]	0.112
2008 to 2015 X Horizontal/vertical	0.838	[0.648, 1.085]	0.181
2008 to 2015 X No parents, kin present	0.763	[0.416, 1.399]	0.382
2008 to 2015 X Mother only	1.278	[0.978, 1.669]	0.073
2008 to 2015 X Other	1.044	[0.624, 1.745]	0.87
Household SES			
Low	1	-	
Middle	0.949	[0.852, 1.058]	0.346
High	0.788	[0.702, 0.883]	<0.001
Household head gender			
Female	1	-	
Male	1.104	[0.999, 1.220]	0.052
Parameter			
$\sigma_{mother}^2$	3.152	[2.574, 3.859]	



**Supplemental Table 4.** Multilevel relative risk regression of child death on kin presence and controls, Agincourt Health and Demographic Surveillance System (AHDSS) and Africa Health Research Institute (AHRI), South Africa 2000-2015 (n=2,468,466 child months). Estimation sample restricted to those with household SES information.

	RRR	95% CI	p-value
Site			
AHRI	1	-	
AHDSS	0.903	[0.797, 1.022]	0.106
Time period			
2000 to 2007	1	-	
2008 to 2015	0.442	[0.367, 0.532]	<0.001
Site X time period			
AHDSS X 2008 to 2015	1.374	[1.129, 1.672]	0.002
Sex of child			
Female	1	-	
Male	1.136	[1.039, 1.242]	0.005
Child age (months)			
<1	1	-	
1 to 6	0.354	[0.303, 0.414]	<0.001
7 to 23	0.176	[0.152, 0.204]	<0.001
24 to 59	0.036	[0.030, 0.042]	<0.001
Multiple birth			
Singleton	1	-	
Multiple birth	1.571	[1.275, 1.936]	<0.001
Mother's age at birth (years)			
15-19	0.889	[0.775, 1.019]	0.091
20-24	1	-	
25-29	1.4	[1.227, 1.597]	<0.001
30-34	1.246	[1.059, 1.466]	0.008
35+	1.523	[1.280, 1.812]	<0.001
Number ages 0-5			
0	1	-	
1	1.046	[0.941, 1.163]	0.406
2+	1.219	[1.077, 1.380]	0.002
Number ages 5-19			
0	1	-	
1 to 2	1.19	[0.974, 1.454]	0.089
3 to 4	1.103	[0.894, 1.360]	0.36
5+	1.212	[0.971, 1.513]	0.089
Number ages 20+			
0 to 2	1	-	
3 to 4	0.89	[0.780, 1.015]	0.081
5+	0.827	[0.719, 0.951]	0.008

Parental presence			
Both parents	1	-	
One parent	1.609	[1.341, 1.930]	<0.001
Neither parent	2.865	[2.086, 3.933]	<0.001
Related adult presence			
No	1	-	
Yes	4.031	[2.137, 7.604]	<0.001
Parental presence X related adult presence			
One parent X related adult present	0.228	[0.120, 0.432]	<0.001
Neither parent X related adult present	0.229	[0.110, 0.474]	<0.001
Related siblings			
No	1	-	
Yes	0.6	[0.487, 0.739]	<0.001
Parental presence X related siblings			
One parent X related siblings present	1.695	[1.360, 2.113]	<0.001
Neither parent X related siblings present	1.84	[1.185, 2.856]	0.007
Time period X related adult presence			
2008 to 2015 X related adult presence	0.722	[0.599, 0.871]	0.001
Household SES			
Low	1	-	
Middle	0.946	[0.849, 1.054]	0.314
High	0.784	[0.699, 0.879]	<0.001
Household head gender			
Female	1	-	
Male	1.107	[1.004, 1.221]	0.042
	Parameter		
$\sigma^2_{mother}$	3.375	[2.494, 4.568]	