# Supplement to Causes and consequences of child growth failure in low resource settings

*Andrew Mertens et al.*

*2019-12-19*

# Contents

# Chapter 1

# Overview

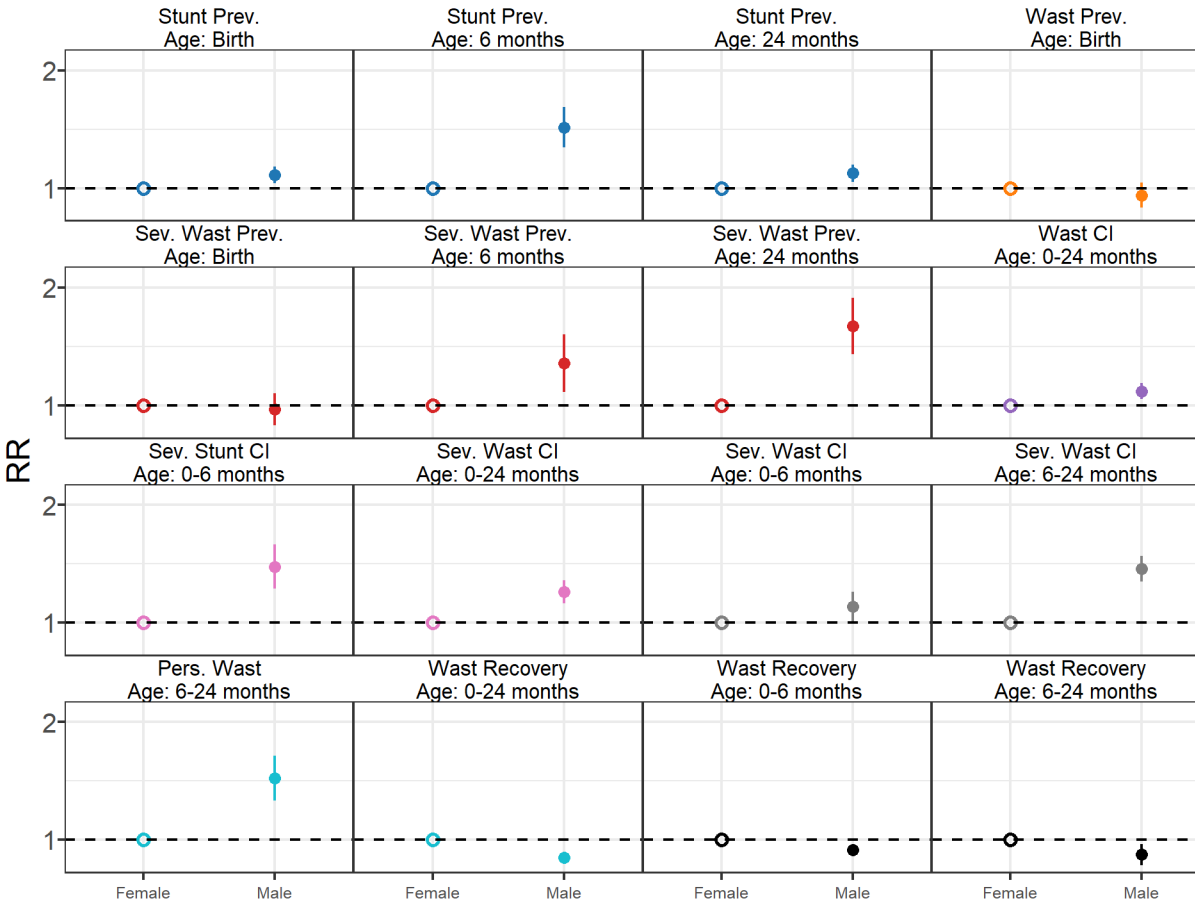
**Recommended citation:** Mertens A N, et al. 2020.Causes and consequences of child growth failure in low resource settings. *Journal Name.* doi.

This site contains supplementary information to the *Causes and consequences of child growth failure in low resource settings.*

# Chapter 2

# Relative risk plots

### 2.0.1 Relative risks between levels of all exposures for prevalence and cumulative incidence of wasting and stunting outcomes



# Chapter 3

# Growth velocity

** [TEMP] Will fill in with PAR plots of growth velocity **

# Chapter 4

# Sensitivity analysis using fixed effects

The primary analyses presented in this manuscript pooled across individual studies using random effects. Inferences about estimates from fixed effects models are restricted to only the included studies.[^1] The random effects approach was more conservative in the presence of study heterogeneity, as evidenced by larger confidence intervals around each point estimates. Overall, the inference from results produced by each method was similar.

## 4.1 Primary manuscript figures recreated with estimates pooled using fixed effects

More estimates are significant when pooling using fixed effects due to the generally smaller confidence intervals.

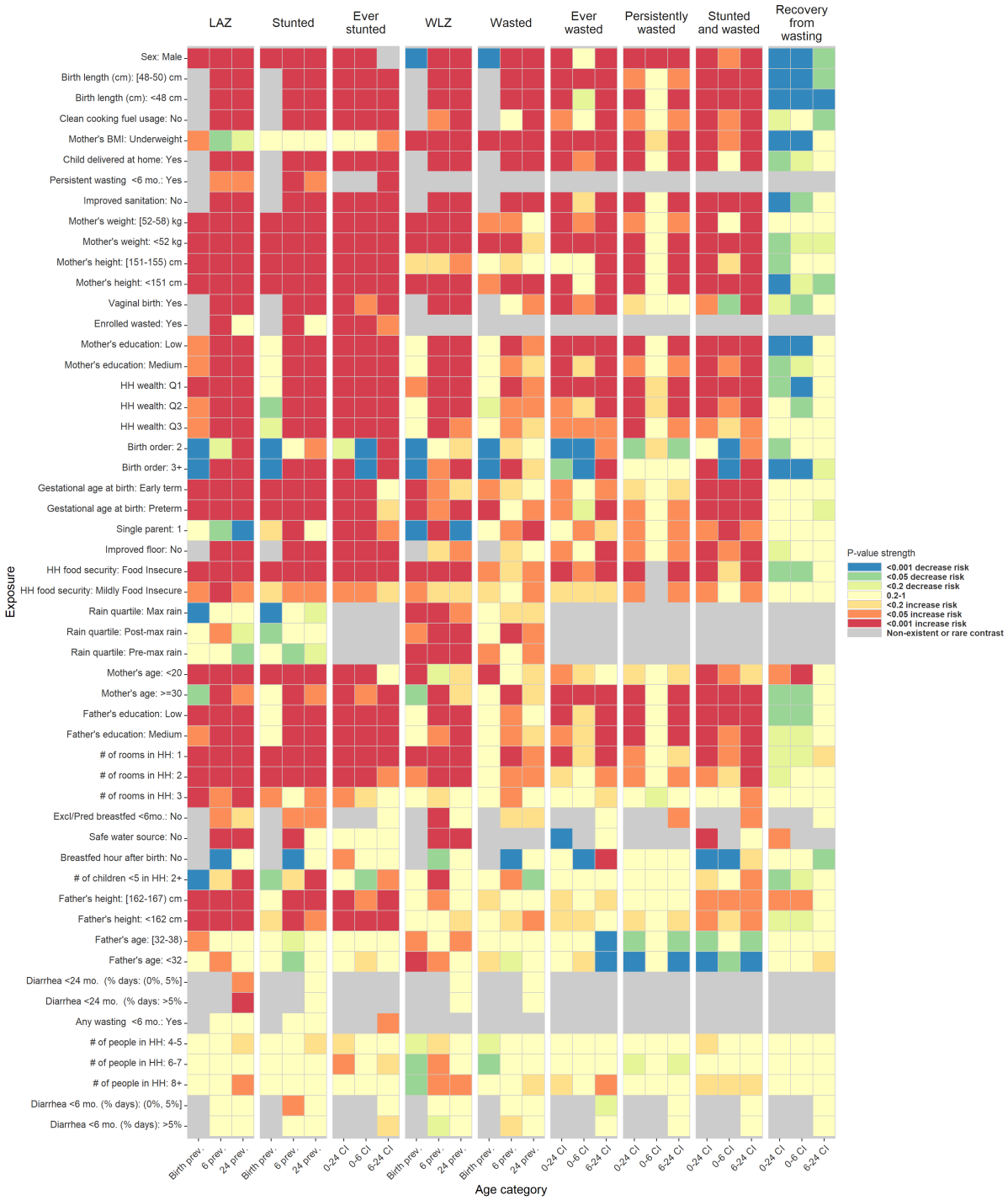
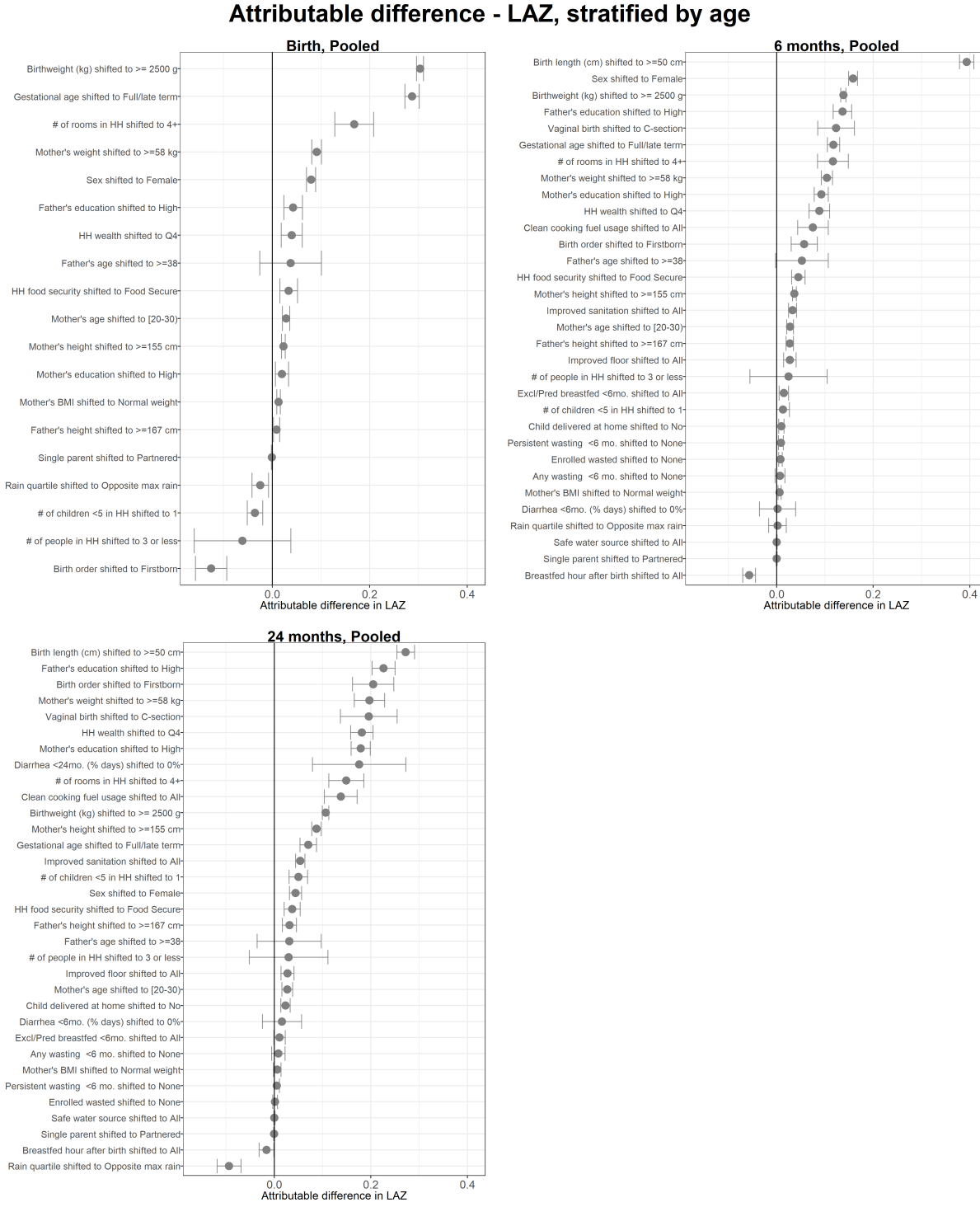
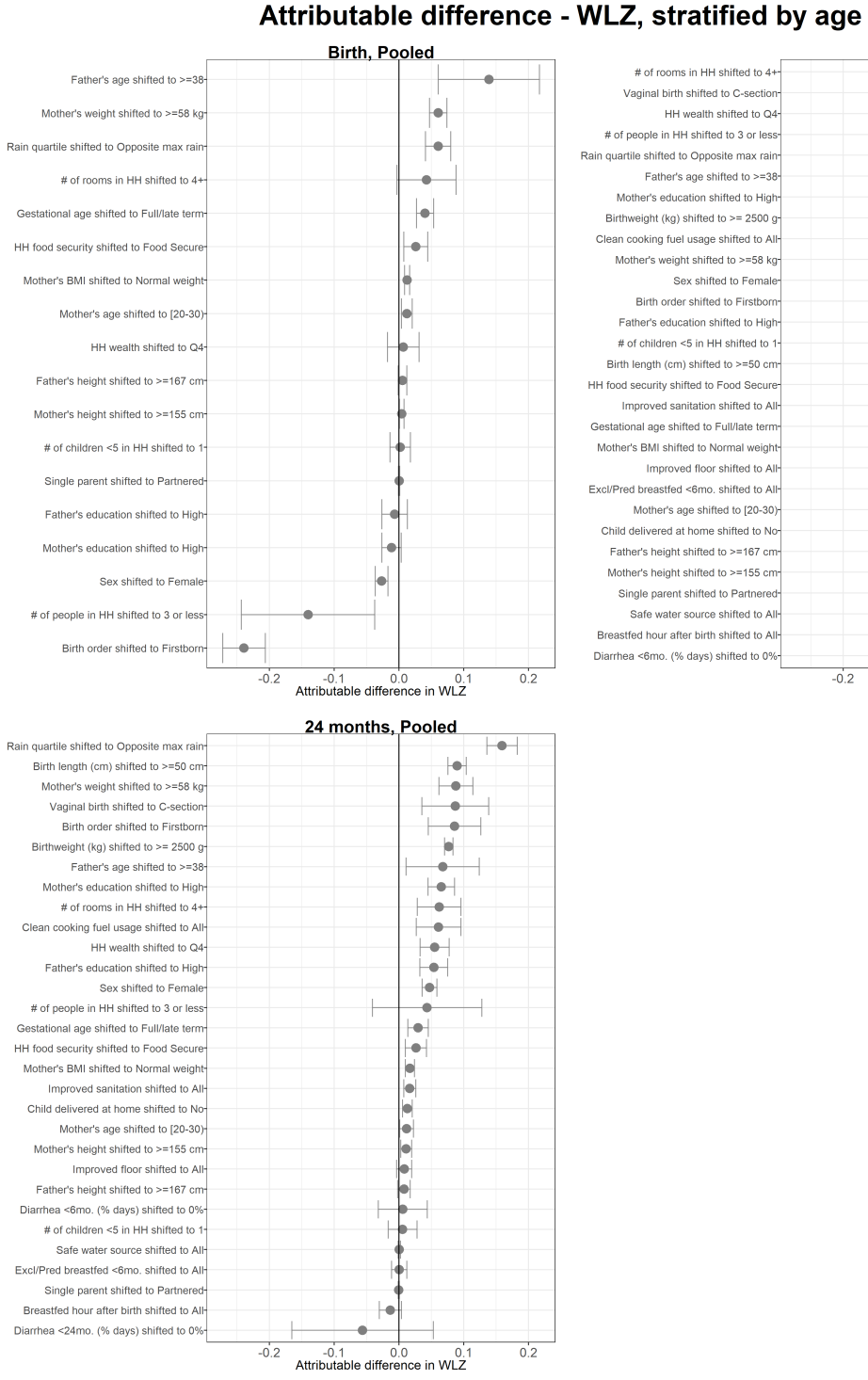

LAZ
Stunted
Ever stunted
WLZ
Wasted
Ever wasted
Persistently wasted
Stunted and wasted
Recovery from wasting
Exposure
Sex: Male
Birth length (cm): [48-50) cm
Birth length (cm): <48 cm
Clean cooking fuel usage: No
Mother's BMI: Underweight
Child delivered at home: Yes
Persistent wasting <6 mo.: Yes
Improved sanitation: No
Mother's weight: [52-58) kg
Mother's weight: <52 kg
Mother's height: [151-155) cm
Mother's height: <151 cm
Vaginal birth: Yes
Enrolled wasted: Yes
Mother's education: Low
Mother's education: Medium
HH wealth: Q1
HH wealth: Q2
HH wealth: Q3
Birth order: 2
Birth order: 3+
Gestational age at birth: Early term
Gestational age at birth: Preterm
Single parent: 1
Improved floor: No
HH food security: Food Insecure
HH food security: Mildly Food Insecure
Rain quartile: Max rain
Rain quartile: Post-max rain
Rain quartile: Pre-max rain
Mother's age: <20
Mother's age: >=30
Father's education: Low
Father's education: Medium
# of rooms in HH: 1
# of rooms in HH: 2
# of rooms in HH: 3
Excl/Pred breastfed <6mo.: No
Safe water source: No
Breastfed hour after birth: No
# of children <5 in HH: 2+
Father's height: [162-167) cm
Father's height: <162 cm
Father's age: [32-38)
Father's age: <32
Diarrhea <24 mo. (% days: (0%, 5%]
Diarrhea <24 mo. (% days: >5%
Any wasting <6 mo.: Yes
# of people in HH: 4-5
# of people in HH: 6-7
# of people in HH: 8+
Diarrhea <6 mo. (% days): (0%, 5%]
Diarrhea <6 mo. (% days): >5%
Birth prev.
6 prev.
24 prev.
0-24 CI
0-6 CI
6-24 CI
Age category
P-value strength
<0.001 decrease risk
<0.05 decrease risk
<0.2 decrease risk
0.2-1
<0.2 increase risk
<0.05 increase risk
<0.001 increase risk
Non-existent or rare contrast

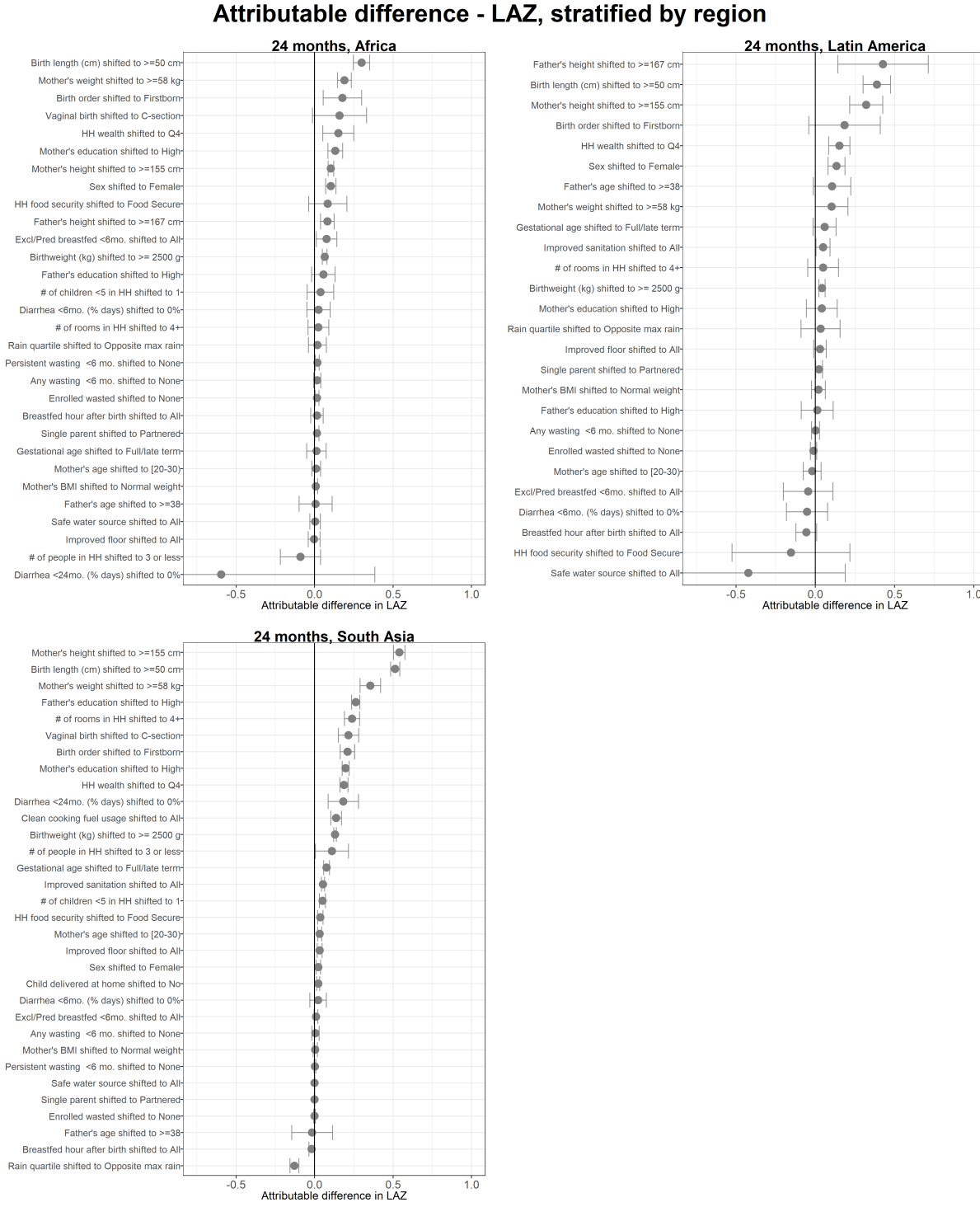
**Figure 1a. Heatmap of significance and direction across exposure-outcome combinations of associations estimated using fixed effects.**


Attributable difference - LAZ, stratified by age
Birth, Pooled
Birthweight (kg) shifted to >= 2500 g
Gestational age shifted to Full/late term
# of rooms in HH shifted to 4+
Mother's weight shifted to >=58 kg
Sex shifted to Female
Father's education shifted to High
HH wealth shifted to Q4
Father's age shifted to >=38
HH food security shifted to Food Secure
Mother's age shifted to [20-30)
Mother's height shifted to >=155 cm
Mother's education shifted to High
Mother's BMI shifted to Normal weight
Father's height shifted to >=167 cm
Single parent shifted to Partnered
Rain quartile shifted to Opposite max rain
# of children <5 in HH shifted to 1
# of people in HH shifted to 3 or less
Birth order shifted to Firstborn
0.0
0.2
0.4
Attributable difference in LAZ
6 months, Pooled
Birth length (cm) shifted to >=50 cm
Sex shifted to Female
Birthweight (kg) shifted to >= 2500 g
Father's education shifted to High
Vaginal birth shifted to C-section
Gestational age shifted to Full/late term
# of rooms in HH shifted to 4+
Mother's weight shifted to >=58 kg
Mother's education shifted to High
HH wealth shifted to Q4
Clean cooking fuel usage shifted to All
Birth order shifted to Firstborn
Father's age shifted to >=38
HH food security shifted to Food Secure
Mother's height shifted to >=155 cm
Improved sanitation shifted to All
Mother's age shifted to [20-30)
Father's height shifted to >=167 cm
Improved floor shifted to All
# of people in HH shifted to 3 or less
Excl/Pred breastfed <6mo. shifted to All
# of children <5 in HH shifted to 1
Child delivered at home shifted to No
Persistent wasting <6 mo. shifted to None
Enrolled wasted shifted to None
Any wasting <6 mo. shifted to None
Mother's BMI shifted to Normal weight
Diarrhea <6mo. (% days) shifted to 0%
Rain quartile shifted to Opposite max rain
Safe water source shifted to All
Single parent shifted to Partnered
Breastfed hour after birth shifted to All
0.0
0.2
0.4
Attributable difference in LAZ
24 months, Pooled
Birth length (cm) shifted to >=50 cm
Father's education shifted to High
Birth order shifted to Firstborn
Mother's weight shifted to >=58 kg
Vaginal birth shifted to C-section
HH wealth shifted to Q4
Mother's education shifted to High
Diarrhea <24mo. (% days) shifted to 0%
# of rooms in HH shifted to 4+
Clean cooking fuel usage shifted to All
Birthweight (kg) shifted to >= 2500 g
Mother's height shifted to >=155 cm
Gestational age shifted to Full/late term
Improved sanitation shifted to All
# of children <5 in HH shifted to 1
Sex shifted to Female
HH food security shifted to Food Secure
Father's height shifted to >=167 cm
Father's age shifted to >=38
# of people in HH shifted to 3 or less
Improved floor shifted to All
Mother's age shifted to [20-30)
Child delivered at home shifted to No
Diarrhea <6mo. (% days) shifted to 0%
Excl/Pred breastfed <6mo. shifted to All
Any wasting <6 mo. shifted to None
Mother's BMI shifted to Normal weight
Persistent wasting <6 mo. shifted to None
Enrolled wasted shifted to None
Safe water source shifted to All
Single parent shifted to Partnered
Breastfed hour after birth shifted to All
Rain quartile shifted to Opposite max rain
0.0
0.2
0.4
Attributable difference in LAZ

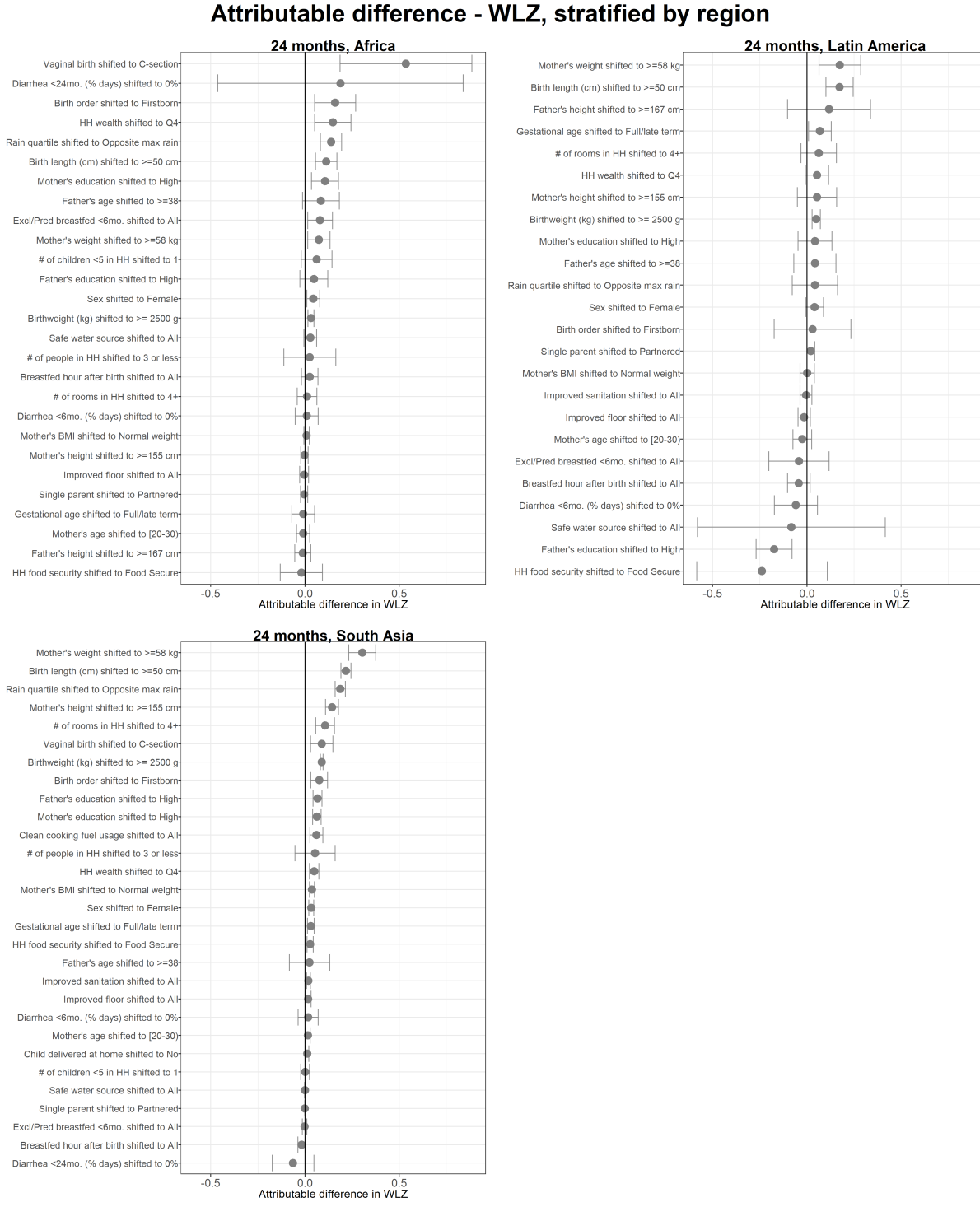
**Extended Data Figure 3 | Age-stratified population attributable differences in length-for-age Z-scores estimated using fixed effects.**


Attributable difference - WLZ, stratified by age
Birth, Pooled
Father's age shifted to >=38
Mother's weight shifted to >=58 kg
Rain quartile shifted to Opposite max rain
# of rooms in HH shifted to 4+
Gestational age shifted to Full/late term
HH food security shifted to Food Secure
Mother's BMI shifted to Normal weight
Mother's age shifted to [20-30)
HH wealth shifted to Q4
Father's height shifted to >=167 cm
Mother's height shifted to >=155 cm
# of children <5 in HH shifted to 1
Single parent shifted to Partnered
Father's education shifted to High
Mother's education shifted to High
Sex shifted to Female
# of people in HH shifted to 3 or less
Birth order shifted to Firstborn
-0.2 -0.1 0.0 0.1 0.2
Attributable difference in WLZ
6 months, Pooled
# of rooms in HH shifted to 4+
Vaginal birth shifted to C-section
HH wealth shifted to Q4
# of people in HH shifted to 3 or less
Rain quartile shifted to Opposite max rain
Father's age shifted to >=38
Mother's education shifted to High
Birthweight (kg) shifted to >= 2500 g
Clean cooking fuel usage shifted to All
Mother's weight shifted to >=58 kg
Sex shifted to Female
Birth order shifted to Firstborn
Father's education shifted to High
# of children <5 in HH shifted to 1
Birth length (cm) shifted to >=50 cm
HH food security shifted to Food Secure
Improved sanitation shifted to All
Gestational age shifted to Full/late term
Mother's BMI shifted to Normal weight
Improved floor shifted to All
Excl/Pred breastfed <6mo. shifted to All
Mother's age shifted to [20-30)
Child delivered at home shifted to No
Father's height shifted to >=167 cm
Mother's height shifted to >=155 cm
Single parent shifted to Partnered
Safe water source shifted to All
Breastfed hour after birth shifted to All
Diarrhea <6mo. (% days) shifted to 0%
-0.2 -0.1 0.0 0.1 0.2
Attributable difference in WLZ
24 months, Pooled
Rain quartile shifted to Opposite max rain
Birth length (cm) shifted to >=50 cm
Mother's weight shifted to >=58 kg
Vaginal birth shifted to C-section
Birth order shifted to Firstborn
Birthweight (kg) shifted to >= 2500 g
Father's age shifted to >=38
Mother's education shifted to High
# of rooms in HH shifted to 4+
Clean cooking fuel usage shifted to All
HH wealth shifted to Q4
Father's education shifted to High
Sex shifted to Female
# of people in HH shifted to 3 or less
Gestational age shifted to Full/late term
HH food security shifted to Food Secure
Mother's BMI shifted to Normal weight
Improved sanitation shifted to All
Child delivered at home shifted to No
Mother's age shifted to [20-30)
Mother's height shifted to >=155 cm
Improved floor shifted to All
Father's height shifted to >=167 cm
Diarrhea <6mo. (% days) shifted to 0%
# of children <5 in HH shifted to 1
Safe water source shifted to All
Excl/Pred breastfed <6mo. shifted to All
Single parent shifted to Partnered
Breastfed hour after birth shifted to All
Diarrhea <24mo. (% days) shifted to 0%
-0.2 -0.1 0.0 0.1 0.2
Attributable difference in WLZ

**Extended Data Figure 4 | Age-stratified population attributable differences in weight-for-length Z-scores estimated using fixed effects.**


Attributable difference - LAZ, stratified by region
24 months, Africa
Birth length (cm) shifted to >=50 cm
Mother's weight shifted to >=58 kg
Birth order shifted to Firstborn
Vaginal birth shifted to C-section
HH wealth shifted to Q4
Mother's education shifted to High
Mother's height shifted to >=155 cm
Sex shifted to Female
HH food security shifted to Food Secure
Father's height shifted to >=167 cm
Excl/Pred breastfed <6mo. shifted to All
Birthweight (kg) shifted to >= 2500 g
Father's education shifted to High
# of children <5 in HH shifted to 1
Diarrhea <6mo. (% days) shifted to 0%
# of rooms in HH shifted to 4+
Rain quartile shifted to Opposite max rain
Persistent wasting <6 mo. shifted to None
Any wasting <6 mo. shifted to None
Enrolled wasted shifted to None
Breastfed hour after birth shifted to All
Single parent shifted to Partnered
Gestational age shifted to Full/late term
Mother's age shifted to [20-30)
Mother's BMI shifted to Normal weight
Father's age shifted to >=38
Safe water source shifted to All
Improved floor shifted to All
# of people in HH shifted to 3 or less
Diarrhea <24mo. (% days) shifted to 0%
-0.5
0.0
0.5
1.0
Attributable difference in LAZ
24 months, Latin America
Father's height shifted to >=167 cm
Birth length (cm) shifted to >=50 cm
Mother's height shifted to >=155 cm
Birth order shifted to Firstborn
HH wealth shifted to Q4
Sex shifted to Female
Father's age shifted to >=38
Mother's weight shifted to >=58 kg
Gestational age shifted to Full/late term
Improved sanitation shifted to All
# of rooms in HH shifted to 4+
Birthweight (kg) shifted to >= 2500 g
Mother's education shifted to High
Rain quartile shifted to Opposite max rain
Improved floor shifted to All
Single parent shifted to Partnered
Mother's BMI shifted to Normal weight
Father's education shifted to High
Any wasting <6 mo. shifted to None
Enrolled wasted shifted to None
Mother's age shifted to [20-30)
Excl/Pred breastfed <6mo. shifted to All
Diarrhea <6mo. (% days) shifted to 0%
Breastfed hour after birth shifted to All
HH food security shifted to Food Secure
Safe water source shifted to All
-0.5
0.0
0.5
1.0
Attributable difference in LAZ
24 months, South Asia
Mother's height shifted to >=155 cm
Birth length (cm) shifted to >=50 cm
Mother's weight shifted to >=58 kg
Father's education shifted to High
# of rooms in HH shifted to 4+
Vaginal birth shifted to C-section
Birth order shifted to Firstborn
Mother's education shifted to High
HH wealth shifted to Q4
Diarrhea <24mo. (% days) shifted to 0%
Clean cooking fuel usage shifted to All
Birthweight (kg) shifted to >= 2500 g
# of people in HH shifted to 3 or less
Gestational age shifted to Full/late term
Improved sanitation shifted to All
# of children <5 in HH shifted to 1
HH food security shifted to Food Secure
Mother's age shifted to [20-30)
Improved floor shifted to All
Sex shifted to Female
Child delivered at home shifted to No
Diarrhea <6mo. (% days) shifted to 0%
Excl/Pred breastfed <6mo. shifted to All
Any wasting <6 mo. shifted to None
Mother's BMI shifted to Normal weight
Persistent wasting <6 mo. shifted to None
Safe water source shifted to All
Single parent shifted to Partnered
Enrolled wasted shifted to None
Father's age shifted to >=38
Breastfed hour after birth shifted to All
Rain quartile shifted to Opposite max rain
-0.5
0.0
0.5
1.0
Attributable difference in LAZ

**Extended Data Figure 7 | Region-stratified population attributable differences in length-for-age Z-scores estimated using fixed effects.**


Attributable difference - WLZ, stratified by region
24 months, Africa
Vaginal birth shifted to C-section
Diarrhea <24mo. (% days) shifted to 0%
Birth order shifted to Firstborn
HH wealth shifted to Q4
Rain quartile shifted to Opposite max rain
Birth length (cm) shifted to >=50 cm
Mother's education shifted to High
Father's age shifted to >=38
Excl/Pred breastfed <6mo. shifted to All
Mother's weight shifted to >=58 kg
# of children <5 in HH shifted to 1
Father's education shifted to High
Sex shifted to Female
Birthweight (kg) shifted to >= 2500 g
Safe water source shifted to All
# of people in HH shifted to 3 or less
Breastfed hour after birth shifted to All
# of rooms in HH shifted to 4+
Diarrhea <6mo. (% days) shifted to 0%
Mother's BMI shifted to Normal weight
Mother's height shifted to >=155 cm
Improved floor shifted to All
Single parent shifted to Partnered
Gestational age shifted to Full/late term
Mother's age shifted to [20-30)
Father's height shifted to >=167 cm
HH food security shifted to Food Secure
-0.5
0.0
0.5
Attributable difference in WLZ
24 months, Latin America
Mother's weight shifted to >=58 kg
Birth length (cm) shifted to >=50 cm
Father's height shifted to >=167 cm
Gestational age shifted to Full/late term
# of rooms in HH shifted to 4+
HH wealth shifted to Q4
Mother's height shifted to >=155 cm
Birthweight (kg) shifted to >= 2500 g
Mother's education shifted to High
Father's age shifted to >=38
Rain quartile shifted to Opposite max rain
Sex shifted to Female
Birth order shifted to Firstborn
Single parent shifted to Partnered
Mother's BMI shifted to Normal weight
Improved sanitation shifted to All
Improved floor shifted to All
Mother's age shifted to [20-30)
Excl/Pred breastfed <6mo. shifted to All
Breastfed hour after birth shifted to All
Diarrhea <6mo. (% days) shifted to 0%
Safe water source shifted to All
Father's education shifted to High
HH food security shifted to Food Secure
-0.5
0.0
0.5
Attributable difference in WLZ
24 months, South Asia
Mother's weight shifted to >=58 kg
Birth length (cm) shifted to >=50 cm
Rain quartile shifted to Opposite max rain
Mother's height shifted to >=155 cm
# of rooms in HH shifted to 4+
Vaginal birth shifted to C-section
Birthweight (kg) shifted to >= 2500 g
Birth order shifted to Firstborn
Father's education shifted to High
Mother's education shifted to High
Clean cooking fuel usage shifted to All
# of people in HH shifted to 3 or less
HH wealth shifted to Q4
Mother's BMI shifted to Normal weight
Sex shifted to Female
Gestational age shifted to Full/late term
HH food security shifted to Food Secure
Father's age shifted to >=38
Improved sanitation shifted to All
Improved floor shifted to All
Diarrhea <6mo. (% days) shifted to 0%
Mother's age shifted to [20-30)
Child delivered at home shifted to No
# of children <5 in HH shifted to 1
Safe water source shifted to All
Single parent shifted to Partnered
Excl/Pred breastfed <6mo. shifted to All
Breastfed hour after birth shifted to All
Diarrhea <24mo. (% days) shifted to 0%
-0.5
0.0
0.5
Attributable difference in WLZ

**Extended Data Figure 8 | Region-stratified population attributable differences in weight-for-length Z-scores estimated using fixed effects.**

# Chapter 5

# Unadjusted RF plots

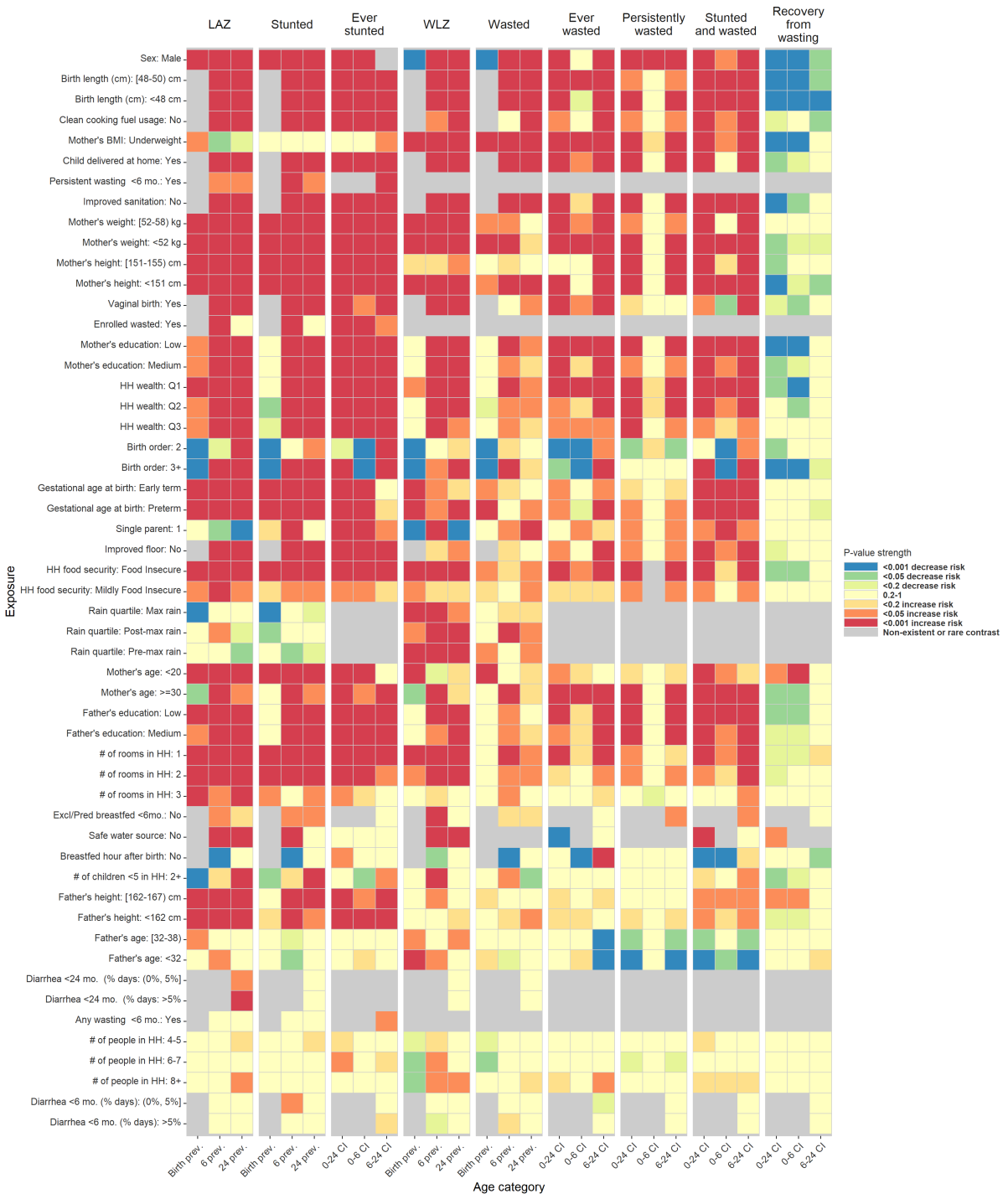
** [TEMP] Will fill in with all primary plots, unadjusted **

# Chapter 6

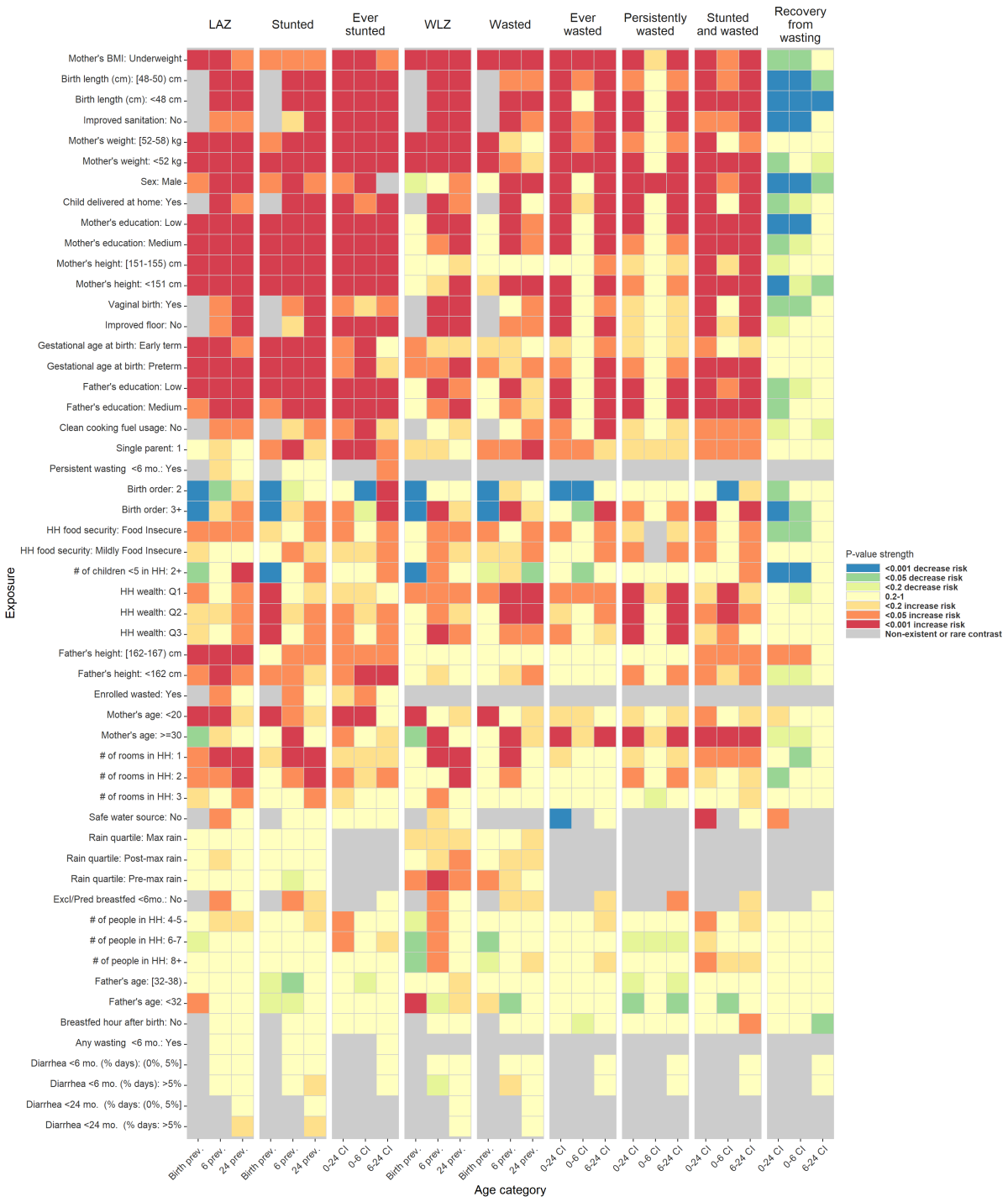
# Heatmaps

## 6.1 Heatmap of significance of estimates, region stratified

## 6.2 Heatmap of significance of estimates pooled using fixed effects



## 6.3 Heatmap of significance of estimate, unadjusted

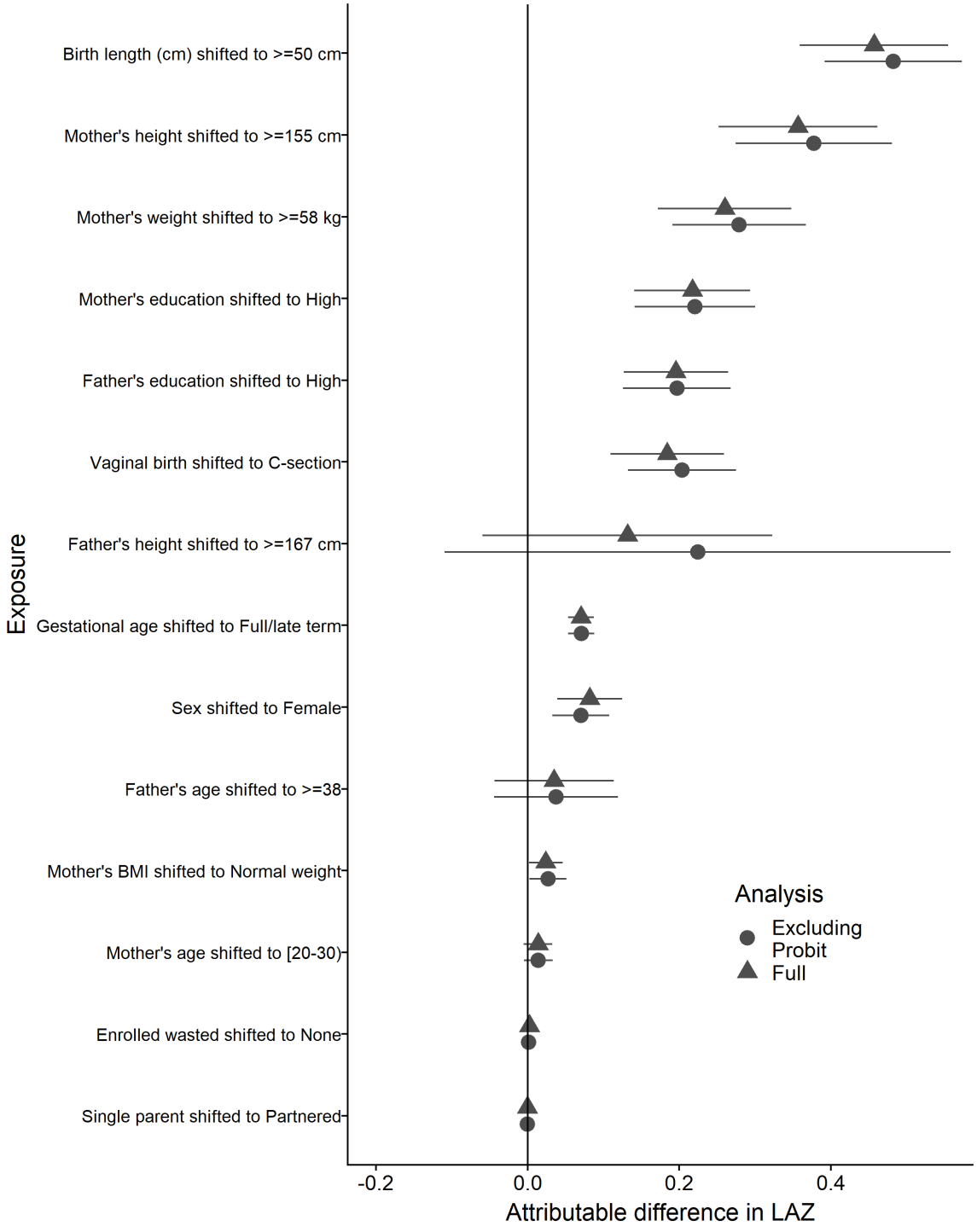


# Chapter 7

# Sensitivity to dropping PROBIT trial

## 7.1 Comparison of attributable differences estimated with and without the PROBIT trial

Because PROBIT was the only European study, we also conducted a sensitivity analysis as to the effect of removing PROBIT on attributable differences at 24 months (within the exposures measures during the PROBIT trial). Other than for the estimated associations between father's height and child Z-scores at 24 months (which was measured in few other studies), PROBIT is not highly influential.


Birth length (cm) shifted to >=50 cm
Mother's height shifted to >=155 cm
Mother's weight shifted to >=58 kg
Mother's education shifted to High
Father's education shifted to High
Vaginal birth shifted to C-section
Father's height shifted to >=167 cm
Gestational age shifted to Full/late term
Sex shifted to Female
Father's age shifted to >=38
Mother's BMI shifted to Normal weight
Mother's age shifted to [20-30)
Enrolled wasted shifted to None
Single parent shifted to Partnered
Exposure
Analysis
Excluding
Probit
Full
-0.2
0.0
0.2
0.4
Attributable difference in LAZ

# Chapter 8

# Forest plots of relative risk

** [TEMP] Will fill in with all primary forest plots - right now just printing one for space/speed of publishing **