# Child survival and annual crop yield reductions in rural Burkina Faso: critical windows of vulnerability around early life development

Kristine Belesova, Antonio Gasparrini, Paul Wilkinson, Ali Sié, Rainer Sauerborn
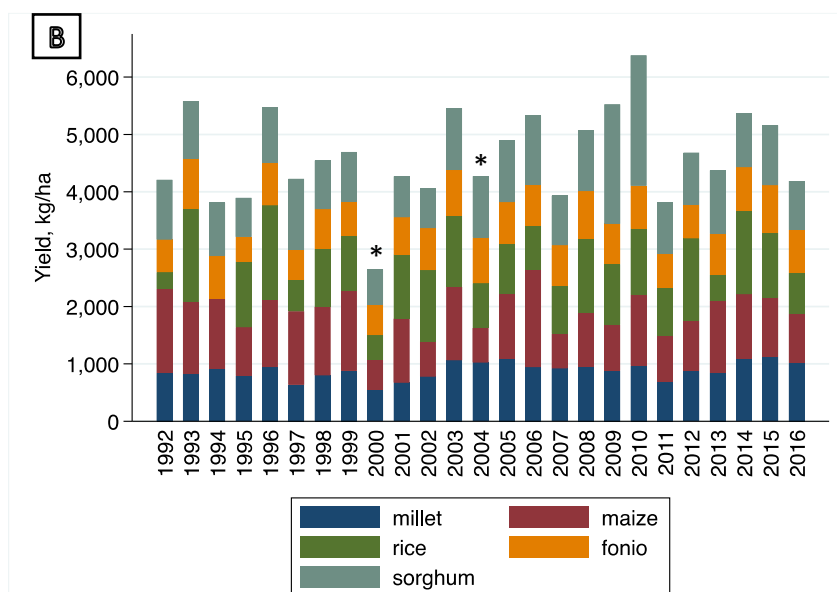
**Table of contents**

## Supplementary Information

**Web Table 2. Correlation coefficients of all the examined FCPI exposure metrics by timing of exposure.**

|  | Before conception | Gestational | 0–6 months | 6 months–2 years | 2–5 years | Year of birth | 0–2 years | First 1,000 days | Lifetime average |
|---|---|---|---|---|---|---|---|---|---|
| Before conception | 1.00 | | | | | | | | |
| Gestational | 0.44 | 1.00 | | | | | | | |
| 0–6 months | 0.28 | 0.69 | 1.00 | | | | | | |
| 6 months–2 years | 0.10 | 0.22 | 0.38 | 1.00 | | | | | |
| 2–5 years | 0.06 | -0.02 | 0.18 | 0.80 | 1.00 | | | | |
| Year of birth | 0.31 | 0.85 | 0.87 | 0.27 | -0.01 | 1.00 | | | |
| 0–2 years | 0.09 | 0.40 | 0.55 | 0.75 | 0.30 | 0.54 | 1.00 | | |
| First 1,000 days | 0.24 | 0.69 | 0.69 | 0.68 | 0.23 | 0.74 | 0.94 | 1.00 | |
| Lifetime average | 0.12 | 0.28 | 0.47 | 0.98 | 0.74 | 0.37 | 0.83 | 0.76 | 1.00 |



**Web Figure 2. Time series of the Food Crop Productivity Index (FCPI) (A) and annual yield of each individual crop comprising the FCPI (B) in the Kossi Province, Burkina Faso, 1992–2016.**
*HDSS population was expanded in the years 2000 and 2004*

**Web Table 2. Results of the sensitivity analyses replicating the Cox regression analyses when the dataset is restricted to the 46 villages that were part of the Nouna HDSS since 1994: child survival to 5 years of age in relation to individual food crop yield exposure indices in Nouna HDSS, Burkina Faso, 1994–2016**

| FCPI exposure | No. of children | Model 1[a] | | Model 2[b] | | Model 3[c] | |
|---|---|---|---|---|---|---|---|
| | | HR | 95% CI | HR | 95% CI | HR | 95% CI |
| Before conception | 38,970 | 1.34 | 1.23, 1.45 | 0.93 | 0.98, 1.17 | 1.04 | 0.96, 1.14 |
| First 1,000 days | 38,970 | 1.41 | 1.30, 1.53 | 1.15 | 1.04, 1.27 | 1.15 | 1.04, 1.27 |
| Gestational | 38,970 | 1.26 | 1.17, 1.36 | 1.07 | 0.98,1.16 | 1.06 | 0.97, 1.16 |
| 0─2 years | 38,970 | 1.38 | 1.27, 1.49 | 1.15 | 1.05, 1.26 | 1.15 | 1.04, 1.26 |
| 0─6 months | 38,970 | 1.26 | 1.16,1.36 | 1.07 | 0.98, 1.17 | 1.06 | 0.97, 1.16 |
| 6 months─2 years | 38,970 | 1.30 | 1.21, 1.40 | 1.11 | 1.02, 1.21 | 1.11 | 1.02, 1.21 |
| 2─5 years | 29,138[d] | 1.22 | 1.05, 1.42 | 0.84 | 0.70,1.01 | 0.84 | 0.70, 1.01 |
| Lifetime average | 38,970 | 1.30 | 1.21, 1.40 | 1.11 | 1.02, 1.21 | 1.11 | 1.02, 1.21 |
| Year of birth | 38,970 | 1.26 | 1.17, 1.35 | 1.10 | 1.01, 1.19 | 1.09 | 1.01, 1.19 |

Abbreviations: CI, confidence interval; HR, hazard ratio; FCPI, food crop productivity index.

[a] Model 1 with random effects (shared frailty by village), unadjusted for other variables.

[b] Model 2 additionally to Model 1 adjustments, adjusted for the presence of undernutrition treatment programme (indicator of step change in 2007), time trend.

[c] Model 3 additionally to Model 2 adjustments, adjusted for season of birth, sex, ethnicity, religion, mother's and father's ability to read, household's wealth index, presence of any members in the household involved in a non-agricultural occupation, level of village infrastructural development, and semi-rural *vs* rural residence.

[d] To enable fitting the FCPI exposure over 2─5 years of age, the analyses dataset had to be restricted to the observations of these children who survived to and remained present in Nouna HDSS at 2 years of age.

**Web Table 3. Results of Cox regression analysis: child survival to 5 years of age in relation to multiple simultaneously fitted exposure indices in Nouna HDSS, Burkina Faso, 1994–2016**

| FCPI exposure timings | No. of children | Model 1[a] | | Model 2[b] | | Model 3[c] | |
|---|---|---|---|---|---|---|---|
| | | **HR** | **95% CI** | **HR** | **95% CI** | **HR** | **95% CI** |
| *Simultaneously fitted:* | | | | | | | |
| Gestational | 57,288 | 1.11 | 1.03, 1.20 | 1.02 | 0.94, 1.10 | 1.01 | 0.93, 1.10 |
| 0−2 years | | 1.33 | 1.23, 1.44 | 1.11 | 1.02, 1.22 | 1.12 | 1.02, 1.22 |
| *Simultaneously fitted:* | | | | | | | |
| Gestational | 57,288 | 1.19 | 1.08, 1.31 | 1.07 | 0.96, 1.18 | 1.06 | 0.96, 1.18 |
| 0−6 months | | 0.90 | 0.80, 1.02 | 0.93 | 0.82, 1.05 | 0.91 | 0.81, 1.04 |
| 6 months–2 years | | 1.33 | 1.22, 1.45 | 1.12 | 1.02, 1.24 | 1.14 | 1.04, 1.25 |
| *Simultaneously fitted:* | | | | | | | |
| Gestational | 57,288 | 1.13 | 1.05, 1.22 | 1.03 | 0.95, 1.11 | 1.02 | 0.94, 1.10 |
| Lifetime average | | 1.27 | 1.18, 1.36 | 1.09 | 1.00, 1.18 | 1.09 | 1.01, 1.18 |
| *Simultaneously fitted:* | | | | | | | |
| Before conception | 57,288 | 1.33 | 1.23, 1.44 | 1.09 | 1.01, 1.19 | 1.07 | 0.98, 1.16 |
| Gestational | | 0.97 | 0.89, 1.06 | 0.98 | 0.90, 1.07 | 0.98 | 0.90, 1.07 |
| 0−2 years | | 1.37 | 1.27, 1.49 | 1.14 | 1.04, 1.25 | 1.13 | 1.04, 1.24 |
| *Simultaneously fitted:* | | | | | | | |
| Before conception | 57,288 | 1.31 | 1.22, 1.41 | 1.08 | 1.00, 1.18 | 1.06 | 0.97, 1.15 |
| Gestational | | 1.05 | 0.94, 1.16 | 1.03 | 0.92, 1.14 | 1.04 | 0.93, 1.16 |
| 0−6 months | | 0.92 | 0.82, 1.04 | 0.93 | 0.82, 1.06 | 0.92 | 0.81, 1.04 |
| 6 months–2 years | | 1.34 | 1.23, 1.46 | 1.14 | 1.03, 1.25 | 1.15 | 1.04, 1.26 |
| *Simultaneously fitted:* | | | | | | | |
| Before conception | 57,288 | 1.15 | 1.06, 1.24 | 1.08 | 1.00, 1.18 | 1.06 | 0.97, 1.15 |
| Gestational | | 0.98 | 0.90, 1.07 | 0.99 | 0.91, 1.08 | 0.99 | 0.91, 1.08 |
| Lifetime average | | 1.06 | 0.98, 1.15 | 1.10 | 1.02, 1.19 | 1.10 | 1.02, 1.20 |
| *Simultaneously fitted:* | | | | | | | |
| Before conception | 57,288 | 1.28 | 1.19, 1.37 | 1.07 | 0.99, 1.15 | 1.04 | 0.97, 1.13 |
| First 1,000 days | | 1.36 | 1.26, 1.46 | 1.12 | 1.03, 1.22 | 1.12 | 1.03, 1.22 |
| *Simultaneously fitted:* | | | | | | | |
| First 1,000 days | 42,624 | 1.23 | 1.05, 1.43 | 0.80 | 0.66, 0.961 | 0.79 | 0.65, 0.96 |
| 2−5 years | | 1.16 | 1.01, 1.34 | 0.87 | 0.75, 1.02 | 0.88 | 0.75, 1.02 |
| *Simultaneously fitted:* | | | | | | | |
| Gestational | | 1.29 | 1.08, 1.54 | 1.05 | 0.87, 1.27 | 1.05 | 0.86, 1.27 |
| 0−6 months | 42,624 | 0.96 | 0.79, 1.16 | 0.92 | 0.75, 1.12 | 0.91 | 0.74, 1.11 |
| 6 months–2 years | | 1.13 | 0.85, 1.49 | 0.83 | 0.62, 1.12 | 0.84 | 0.62, 1.13 |
| 2−5 years | | 1.15 | 0.90, 1.45 | 0.99 | 0.77, 1.27 | 0.99 | 0.77, 1.27 |
| *Simultaneously fitted:* | | | | | | | |
| Before conception | | 1.45 | 1.25, 1.67 | 1.16 | 0.98, 1.37 | 1.14 | 0.96, 1.34 |
| Gestational | | 1.08 | 0.88, 1.31 | 0.99 | 0.81, 1.22 | 0.99 | 0.81, 1.22 |
| 0−6 months | 42,624 | 0.97 | 0.80, 1.18 | 0.92 | 0.76, 1.13 | 0.92 | 0.75, 1.12 |
| 6 months–2 years | | 1.23 | 0.93, 1.63 | 0.88 | 0.65, 1.20 | 0.88 | 0.65, 1.20 |
| 2−5 years | | 1.05 | 0.83, 1.34 | 0.97 | 0.75, 1.24 | 0.97 | 0.75, 1.24 |

Abbreviations: CI, confidence interval; HR, Hazard ratio; FCPI, food crop productivity index.
[a] Model 1 with random effects (shared frailty by village), unadjusted for other variables.
[b] Model 2 additionally to Model 1 adjustments, adjusted for the presence of undernutrition treatment programme (indicator of step change in 2007), time trend.
[c] Model 3 additionally to Model 2 adjustments, adjusted for season of birth, sex, ethnicity, religion, mother's and father's ability to read, household's wealth index, presence of any members in the household involved in a non-agricultural occupation, level of village infrastructural development, and semi-rural *vs* rural residence.