# Polygyny and child health revisited

**Matthias Rieger[a,1] and Natascha Wagner[a]**

Until recently, the United Nations, development practitioners, and academics unanimously labeled polygyny a harmful cultural practice for child health. Lawson et al. (1) reassess the association between polygyny and child health using data from 56 Tanzanian villages. Their study suggests that children coresiding with their polygynous father tend to be better off in terms of weight-for-height, a measure of wasting, compared with children of monogamous fathers.

The study's claim that child health is positively or not correlated with polygyny is not fully supported by the data for four main reasons:

First, weight-for-height is a short-term indicator of child health that accounts for sickness spells and short-lived shocks (2). The finding that polygyny (among some ethnic groups) has a "positive" effect on wasting should be interpreted carefully. Opting for polygyny permanently affects the per capita distribution of household assets. When analyzing the impact of permanent demographic decisions on child health, measures of long-term accumulated health, such as height-for-age, are more suitable (3).

Second, across models Lawson et al. (1) tend to find a negative correlation with the cumulative, long-term indicator of child growth. Height-for-age is systematically and negatively correlated with polygyny both at the individual and the village levels. In most specifications the effect is imprecisely estimated, which may be attributed to the small sample size. The moderately sized, negative, yet insignificant estimate [$\beta = -0.07$, 95% confidence interval (CI) = −0.20; 0.06, $P > 0.1$] found in the main specification is in line with estimates based on large sample evidence. Pooling African demographic and health surveys and assessing them at the micro level using fixed- and mixed-effect models, Wagner and Rieger (4) detected a statistically equal, significantly negative effect ($\beta = -0.09$, 95% CI = −0.12; −0.06, $P < 0.01$).

Third, weight-for-height should be interpreted like a ratio in that the separate effects of height and weight on polygyny are conflated. Even if both child weight and height are negatively correlated with polygyny, which is suggested by existing studies (4), the "ratio"—as expressed in weight-for-height—can mechanically show a positive or insignificant effect.

Fourth, it is well known that children across Africa are born with relatively similar height and weight, yet the adverse effects of resource-poor settings, as well as maternal conditions for child growth, magnify with age (5). In other words, being born into a polygynous household is not the same as growing up in a polygynous household. The models should take into account such age heterogeneities resulting in growth faltering (as presented in Table 1, where we split the sample at the median child age, and Fig. 1, which presents a nonparametric plot of the age profiles by marital status).

We fully agree with Lawson et al. (1) that labeling polygyny a unequivocally harmful cultural practice neglects the historical and cultural relevance of polygyny. A more agnostic approach is needed in this literature. Additional evidence could be collected about cowives and inheritance conflicts and longitudinal nutritional and educational outcomes for children of polygynous families to gauge whether polygyny is really harmful for children in the long run.

**1** Lawson DW, et al. (2015) No evidence that polygynous marriage is a harmful cultural practice in northern Tanzania. *Proc Natl Acad Sci USA* 112(45):13827–13832.
**2** Fishman SM, et al. (2004) Childhood and maternal underweight. *Comparative Quantification of Health Risks: Global and Regional Burden of Disease Attributable to Selected Major Risk Factors*, eds Ezzati M, Lopez A, Rodgers A, Murray CJL (WHO, Geneva), pp 39–161.
**3** Duflo E (2000) Child health and household resources in South Africa: Evidence from the old age pension program. *Am Econ Rev* 90(2):393–398.
**4** Wagner N, Rieger M (2015) Polygyny and child growth: Evidence from twenty-six African countries. *Fem Econ* 21(2):105–130.
**5** Rieger M, Trommlerová SK (2016) Age-specific correlates of child growth. *Demography* 53(1):241–267.

[a]The International Institute of Social Studies, Erasmus University, Rotterdam 2518 AX, The Netherlands
Author contributions: M.R. and N.W. designed research, performed research, analyzed data, and wrote the paper.
The authors declare no conflict of interest.
[1]To whom correspondence should be addressed. Email: rieger@iss.nl.

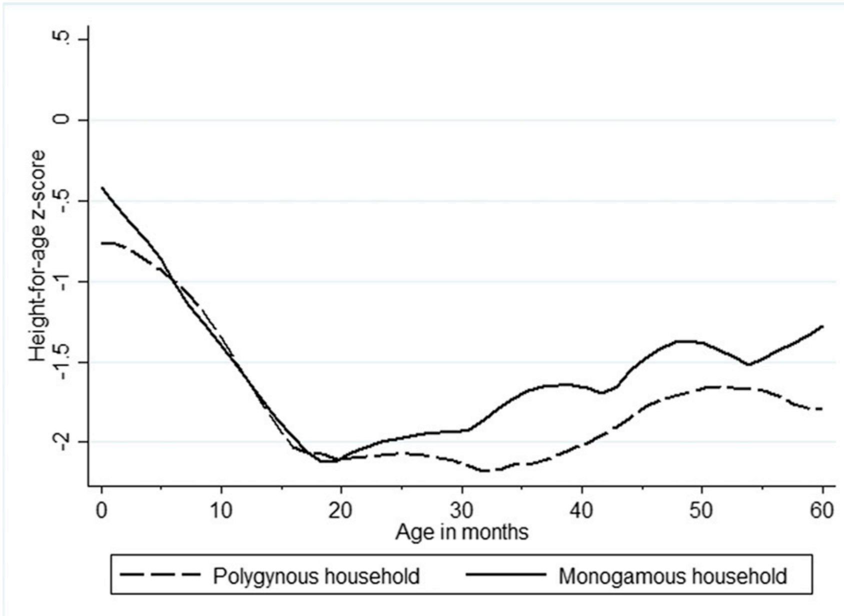


**Fig. 1.** **Age-profiles of height-for-age *z*-scores. Unconditional, flexible plots of *z*-scores across age groups for children living in polygamous and monogamous households. In both groups there is evidence of deteriorating *z*-scores as children grow older. These cross-sectional patterns are suggestive of growth faltering, in line with previous large-scale microstudies (5). Starting at the age of 20 mo, children residing in monogamous households show relative faster signs of recovery. These patterns are in line with lower *z*-scores among polygynous children in Table 1. Smoothed means by local polynomial regression using the lpoly command in STATA 13.**

**Table 1. Multilevel regression predicting height-for-age *z*-scores for the full sample and by age group**

| | Height-for-age z-score [β (95% CIs)] | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Sample | All children [compare with table S3 in Lawson et al. (1)] | Children ≥ 30 mo | Children < 30 mo | Children ≥ 30 mo | Children < 30 mo |
| Household type: Polygynous | −0.07 | −0.21** | 0.00 | −0.16* | 0.06 |
| (reference: monogamous) | (−0.20; 0.06) | (−0.38; −0.05) | (−0.19; 0.20) | (−0.33; 0.01) | (−0.14; 0.26) |
| Child age (mo) | −0.09*** | 0.07 | −0.18*** | 0.06 | −0.18*** |
| | (−0.10; −0.07) | (−0.03; 0.16) | (−0.22; −0.14) | (−0.03; 0.15) | (−0.21; −0.14) |
| Child age (mo2) | 0.00*** | 0.00 | 0.00*** | 0.00 | 0.00*** |
| | (0.00; 0.00) | (-0.00; 0.00) | (0.00; 0.01) | (-0.00; 0.00) | (0.00; 0.01) |
| Child sex (reference: boy) | 0.13** | 0.05 | 0.19** | 0.05 | 0.19** |
| | (0.02; 0.24) | (−0.09; 0.19) | (0.03; 0.36) | (−0.10; 0.19) | (0.02; 0.35) |
| Age of household head (y) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | (−0.00; 0.01) | (−0.00; 0.01) | (−0.00; 0.01) | (−0.00; 0.01) | (−0.00; 0.01) |
| Season: Hunger | −0.37*** | −0.36** | −0.36*** | −0.31** | −0.34*** |
| (reference: not hunger) | (−0.62; −0.12) | (−0.64; -0.08) | (−0.62; −0.11) | (−0.55; −0.07) | (−0.58; −0.10) |
| Polygyny prevalence | | | | 0.00 | 0.01 |
| | | | | (−0.01; 0.02) | (−0.01; 0.02) |
| Annual rainfall | | | | 0.01** | 0.01 |
| | | | | (0.00; 0.02) | (−0.00; 0.02) |
| Percent nonzero education | | | | 0.01*** | 0.01*** |
| | | | | (0.00; 0.02) | (0.00; 0.02) |
| Distance to capital | | | | 0.00 | −0.01* |
| | | | | (−0.01; 0.00) | (−0.01; 0.00) |
| Observations | 2,704 | 1,325 | 1,379 | 1,325 | 1,379 |

Column 1 replicates Lawson et al. (1). Columns 2 and 3 present estimates for children older and younger than 30 mo (split at the sample median of age to ensure balanced statistical power). Adverse effects of polygyny are concentrated among the older children. Qualitatively similar age patterns emerge when controlling for village-level covariates in columns 4 and 5, as well as village dummies (unreported). All models include random effects at the village level and an intercept. *$P < 0.1$, **$P < 0.05$, ***$P < 0.001$. Statistically significant estimates at $P > 0.1$ are in bold.

REPLY TO RIEGER AND WAGNER:

# Context matters when studying purportedly harmful cultural practices

David W. Lawson[a,1], Susan James[b], Esther Ngadaya[c], Bernard Ngowi[c], Sayoki G. M. Mfinanga[c], and Monique Borgerhoff Mulder[b,d]

Rieger and Wagner (1) present three lines of critique. First, Rieger and Wagner (1) argue that our (2) demonstration that polygyny predicts higher child weight-for-height *z*-scores (WHZ) in two out of three ethnic groups practicing polygyny should be disregarded because of inadequacies of this measure. We defend our use of WHZ because: (*i*) although no measure is perfect, many studies unequivocally confirm that WHZ is a useful indicator of acute malnutrition, highly predictive of child mortality (3); and (*ii*) regardless of construct validity, WHZ scores have guided the international development sector for decades, our primary audience in addressing claims that polygyny is universally harmful. We also emphasize that our interpretation that polygyny may, in certain contexts, serve female interests rests not only on differences in WHZ, but also on our demonstration that (male-headed) polygynous households are relatively food secure and wealthy compared with monogamous households.

Second, Rieger and Wagner (1) write that we demonstrate that child height-for-age *z*-scores (HAZ) are "systematically and negatively correlated with polygyny both at the individual and the village levels" (1), and that although our individual-level comparisons are statistically nonsignificant, this can be attributed to small sample size because their study of polygyny across 26 African nations revealed a statistically significant negative correlation at a similar magnitude (4). This critique fundamentally misses our central conclusion: context matters when studying purportedly harmful cultural practices. At the village level, the association between polygyny prevalence and child HAZ is accounted for by underlying contextual differences in ecological vulnerability (rainfall) and socioeconomic marginalization (education). At the individual level, our estimates are based on a specific area of Tanzania, and so cannot be meaningfully contrasted with Wagner and Rieger's (4) estimate based on Africa as a whole. Indeed, consistent with our analysis (2), Wagner and Rieger's cross-national study identifies considerable heterogeneity, with confidence intervals crossing zero for 15 of 26 countries and a positive (statistically nonsignificant) association between polygyny and HAZ in Tanzania (ref. 4, p 17). Africa is a diverse continent and polygyny a diverse institution, encompassing variable norms of residence, resource sharing, and spousal recruitment (5). A true understanding of polygyny can only be gained by acknowledging this diversity and designing analyses that take context into account (2).

Third, Rieger and Wagner (1) suggest our analyses (2) are flawed because we don't include interactions with child age. Reanalyzing our data selecting only children over 30 mo, Rieger and Wagner (1) report a negative association between polygyny and HAZ. However, our data are not suitable to test for age dependencies, which can only be confidently assessed via longitudinal analysis. Furthermore to achieve adequate sample size, Rieger and Wagner resort to (*i*) pooling data across ethnic groups, and so cannot rule out confounding with ethnicity, and (*ii*) crude comparisons neglecting wife rank (proxied by household head sex) that proved crucial in our original analysis. Notably, once adjusted for village differences, Rieger and Wagner's (1) effect estimate also falls short of standard levels of statistical significance (i.e., $P < 0.05$). We also observe a double standard: Wagner and Rieger's (4) own cross-national study of polygyny neglects age interactions. In studying "harmful cultural practices" it is vital that we apply equivalent standards of evidence independent of whether results meet or contradict conventional expectation.

[a]Department of Population Health, London School of Hygiene and Tropical Medicine, London WC1E 7HT, United Kingdom; [b]Savannas Forever Tanzania, Arusha, Tanzania; [c]National Institute for Medical Research, Muhimbili Medical Research Centre, Dar es Salaam, 11101, Tanzania; and [d]Department of Anthropology, University of California, Davis, CA 95616

Author contributions: D.W.L., S.J., E.N., B.N., S.G.M.M., and M.B.M. designed research; D.W.L. analyzed data; D.W.L. and M.B.M. wrote the paper; and S.J., E.N., B.N., and S.G.M.M. collected data.

The authors declare no conflict of interest.

[1]To whom correspondence should be addressed. Email: david.lawson@lshtm.ac.uk.

**1** Rieger M, Wagner N (2016) Polygyny and child health revisited. *Proc Natl Acad Sci USA*, 10.1073/pnas.1600882113.
**2** Lawson DW, et al. (2015) No evidence that polygynous marriage is a harmful cultural practice in northern Tanzania. *Proc Natl Acad Sci USA* 112(45):13827–13832.
**3** Olofin I, et al.; Nutrition Impact Model Study (anthropometry cohort pooling) (2013) Associations of suboptimal growth with all-cause and cause-specific mortality in children under five years: A pooled analysis of ten prospective studies. *PLoS One* 8(5):e64636.
**4** Wagner N, Rieger M (2014) Polygyny and child growth: Evidence from twenty-six African countries. *Fem Econ* 21(2):1–26.
**5** White DR (1988) Rethinking polygyny: Co-wives, codes, and cultural systems. *Curr Anthropol* 29(4):529–572.