Lives Saved Tool Technical Note
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Technical Note on estimating rate of poor birth outcomes in risk groups

In LiST there are currently 11 interventions (some only available when shifting to developer mode) that improves poor birth outcomes (see the table below).

There are three slightly different methods used depending on the intervention. One type of intervention is one that is for all pregnant women and the efficacy is described in terms of reducing the overall rate of a SGA or preterm birth. These interventions do not have an affected fraction of as the efficacy applies to all women. For example, if current coverage of MMN is zero and is raised to 100% coverage we then would apply that 8% reduction in risk of preterm birth to all women, using the national estimate of the PTB rate. So, if the preterm birth rate was 8% with zero coverage we assume the overall preterm birth rate would drop to 7.36%. In the table below you can see there are 2 interventions of this type. For these intervention efficacy estimates are based on treating pregnant women with no risk assumptions.

The remaining 9 interventions that have an impact on birth outcomes all have an affected fraction. What this means is that only a percentage of pregnant women have this risk and the efficacy is related to the reduction in poor birth outcomes only for these women. For all of these interventions in order to estimate the reduction in poor birth outcomes we need to compute the risk of these women have a poor birth outcome. Drawing from the example above, if the national estimate of preterm births is 8% of all births, we need to estimate the preterm birth rate for women with the risk factor. To do this we have to use the relative risk as well of prevalence of the risk factor among pregnant women to calculate the preterm birth rate for this group assuming no coverage of the intervention. See the detailed formulas at the end of this document. Once this is calculated the impact of scaling up these interventions is the same. This approach applies to the remaining 9 interventions.

The nine interventions with affected fractions are treated slightly differently depending on the source of the relative risk for poor birth outcomes. The estimate of the relative risks were drawn from two recent papers that estimates the country-specific population attributable fraction due to approximately 25 risk factors for SGA and preterm birth.

Some of the risk factors (those marked with [b] in the table) have relative risks based on meta-analyses of randomized control trials. For these risk factors we use the relative risks reported in the papers. Other risks factors (those marked in the table with [c]) only or primarily had data on risk from observational studies. In the meta-analyses for these risk factors adjusted relative risks were used. However, few studies adjusted for a large set of possible confounding factors in estimating risk. For these risk factors we lower the excess relative risk by 20%. For example if the adjusted relative risk for a risk factor was 3.0 we reduced it to 2.6. The table present the values used in the current version of LiST.

References

Garung S, Tong HH, Bryce E, Katz J, Lee CC, Black RE, Walker N. A systematic review on estimating population attributable fraction for risk factors for small-for-gestational-age births in 81 low- and middle-income countries. Journal of Global Health 2022; **12**-04024.

Bryce E, Garung S, Tong HH, Katz J, Lee CC, Black RE, Walker N. Population attributable fractions for risk factors for spontaneous preterm births in 81 low- and middle-income countries: A systematic analysis. Journal of Global Health 2022; **12**-04013.

Table: Interventions in *LiST* that have an impact on birth outcomes and their assumption

Intervention	Efficacy	Affected Fraction	Outcome	Relative Risk	Population receiving service
Multiple micronutrient supplementation	.07	N/A	SGA birth	1.0[a]	All Pregnant women
Multiple micronutrient supplementation	.05	N/A	Preterm birth	1.0[a]	All Pregnant women
Omega 3 fatty acid supplements[D]	.10	N/A	Preterm birth	1.0 [a]	All pregnant women
Prevention of malaria in pregnancy	.26	Percent of pregnant women living in an endemic area with falciparum having their 1st or 2nd birth	Preterm birth	1.45 [c]	All pregnant women in malarious (falciparum) areas
Calcium supplementation	.19	Percent calcium deficient	Preterm birth	1.23 [b]	All pregnant women
Folic acid fortification	.12	Percent folate insufficient	Preterm birth	1.1 [c]	All pregnant women
Zinc supplementation during pregnancy [D]	.13	Percent zinc deficient	Preterm birth	1.12 [C]	All pregnant women
Syphilis detection and treatment	.51	Percent with active syphilis	Preterm birth	2.8[C]	All pregnant women tested, treatment for positive
Detection and treatment of asymptomatic bacteriuria[D]	.43	Percent with asymptomatic bacteriuria	Preterm birth	1.77 [C]	All pregnant women tested, treatment for positive
Low-dose aspirin	.11	Percent of women having their first birth plus women with hypertension plus women with previous pre-eclampsia.	Preterm birth	1.1 [C]	Percent of women having their first birth plus women with hypertension plus women with previous pre-eclampsia
Progesterone	.08	Percent of non-first births times rate of previous preterm births	Preterm birth	2.28 [C]	Percent of non-first births times rate of previous preterm births

Stop smoking education[D]	.07	Percent who smoke	Preterm birth	1.22 [C]	Pregnant women who smoke
Balanced Energy Supplementation	.29	Food insecure pregnant women	SGA birth	1.41 [c]	Food insecure pregnant women

[D] Interventions marked with [D] are only available as optional interventions in developer mode in LiST.
[a] These interventions do not use relative risk to recalculate PTB/SGA rates; [b]These interventions are using the relative risks that were derived from RCTs and need no adjustment; [c] These interventions operate on risks whose relative risks for birth outcomes were based on non-RCT studies.

Detailed formula for calculating birth outcomes for women at risk

We have PTB/SGA rate by country that is the preterm/SGA birth risk when all risk factors are present in numbers consistent with the affected fractions

If this is the case we can calculate a PTB for women who have the risk factor and those that do not.

$PTB_0 = PTBwo * (1 – AF) + PTBw * AF$
$PTBw = aRR * PTBwo$
Where PTB_0 is the baseline PTB rate among all pregnant women. PTBwo is the PTB rate among pregnant women without the risk factor. PTBw is the PTB rate among pregnant women with the risk factor.

With rearrangement and substitution we get:
$PTBwo = PTB_0/(AF*aRR + 1 – AF)$
$PTBw = aRR * PTB_0/(AF*aRR + 1 – AF)$

And women who are treated would have
$PTBtr = Eff*aRR*PTB_0/(AF*aRR + 1 – AF)$
Where PTBtr in the PTB rate among pregnant women with risk factor and received intervention

Then we can calculate the PTB for any level of coverage like this:

$PTB_t = (1 – AF) * PTBwo + AF * (1 – COV) * PTBw + AF * COV * PTBtr$
wher PTBt is the endline PTB rate among all pregnant women.

And then the percent reduction would be this:

$(PTB_0 – PTB_t) / PTB_0$

The same calculations were applied to estimate SGA rates for women who have the risk factor and those who do not.