Cost-Effectiveness of Wheat Flour Fortification with Folic Acid for Reducing Neural Tube Defects in Yaoundé and Douala, Cameroon

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BACKGROUND

- 59% of women of reproductive age (WRA) in Cameroon had inadequate folate intake in 2009.[1]
- Folate deficiency increases the risk of neural tube defects (NTD), specifically spina bifida and anencephaly.
- The prevalence of NTD in Cameroon from 1997-2006 was four times that of the US, at 1.99/1000 cases per year. [2]
- Wheat flour fortification with micronutrients – including folic acid – was implemented in Cameroon in 2011, showing marked improvement in micronutrient status in WRA. [1]
- Food fortification programs are considered cost-effective; most cost-effectiveness estimates rely either on cost-per-individual reached or biological impact.

Figure 1: Cameroon's urban centers, Yaoundé and Douala

OBJECTIVE

Estimate the cost-effectiveness of folic acid wheat fortification in reducing the disease burden of NTDs in urban Cameroon.

METHODS

- Program costs and pre/post intervention NTD cases were estimated and projected over a 13-year period from 2009-2021.
- Program costs were gathered from program budgets, including initial 3-year start up costs and recurring maintenance costs.
- Pre-fortification NTD prevalence were obtained from 2008 study in Yaoundé
- Predicted reductions in NTD cases were estimated based on NTD burden and wheat flour intake.[3]
- DALY information obtained from Global Burden of Disease and NTD mortality rate in Sub-Saharan Africa.[4,5]

METHODS, Cont.

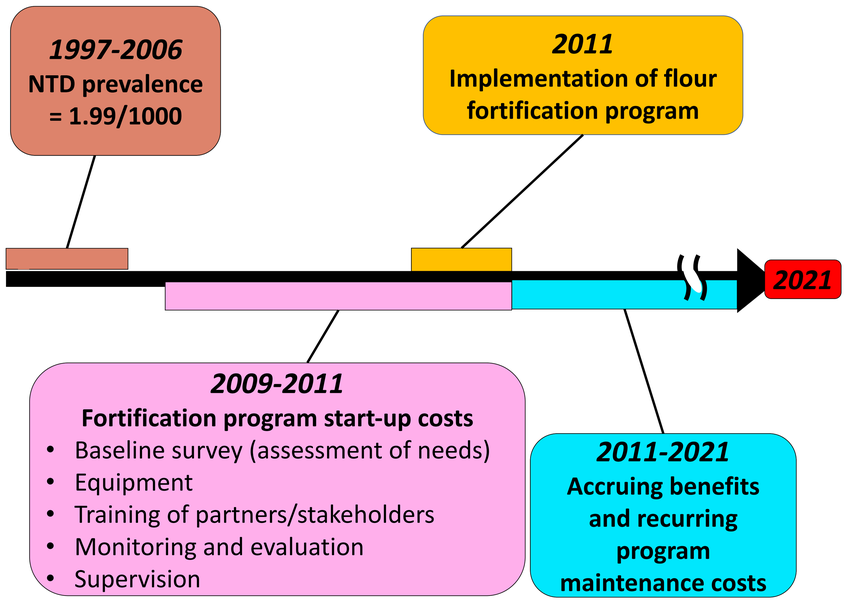

Figure 2: Cameroon food fortification program timeline

RESULTS

	USD
Start-up Costs (2009-2011)	$432,000
Maintenance Costs (2012-2021)	$2,007,000
Total Costs for 13 Years	$2,439,000

Table 1: Cost of wheat flour fortification in Yaoundé and Douala, Cameroon over 13 years.

RESULTS, Cont.

	Total Cases	Cost/Case (USD)	Total DALY	Cost/DALY (USD)
NTD	1,600	$1,530	49,310	$49.50

Table 2: Costs and impact of wheat flour fortification in Yaoundé and Douala, Cameroon over 13 years.

CONCLUSIONS

- Wheat flour fortification programs involving folic acid are effective in reducing NTDs.
- Program cost is significant, ~ $188,000/year for this 13-year program
- The cost to avert one case of NTD is relatively high, given low birth prevalence. However, the heavy burden associated with each case results in a low cost per DALY averted.
- The fortification program meets criteria for a *very cost-effective* intervention as defined by the WHO.[6]
  - Cost per DALY is substantially less than the GNI per capita of Cameroon ($3,640 in 2017)

DISCUSSION

- Our result is comparable to that of a study reporting $89/DALY of NTD averted, based on observed changes in a fortification program in Chile.[7]
- The cost of preventing NTD is likely to outweigh social and economic costs of treating these conditions.
- Local circumstances (reach of fortification vehicle, program maintenance, etc.) can greatly influence program efficiency.
- Sustained monitoring and support to the program are needed to ensure that these benefits are maintained.
- A post-fortification study of NTD prevalence in Cameroon must be done to validate the accuracy of these results.

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