Food Fortification Initiative
Enhancing Grains for Healthier Lives

Advancing Preconception Care: Moving from Evidence to Implementation

UNICEF photo from Burundi

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22 September 2015

7th International Conference
on the Prevention of Birth Defects
and Disabilities in the Developing World

Acknowledgements

- Alina Flores
- Cindy Moore
- Godfrey Oakley
- Diana Valencia
- Anna Verster
- Sarah Zimmerman

http://3.bp.blogspot.com/_bRNnsKPyfuA/S-Qbq1Hhzgl/AAAAAAAACNE/IleMVJwmRKk/s1600/flowers2.jpg

Main Messages

1. Neural tube defect risk can be reduced if women have optimum folate status before and in early pregnancy

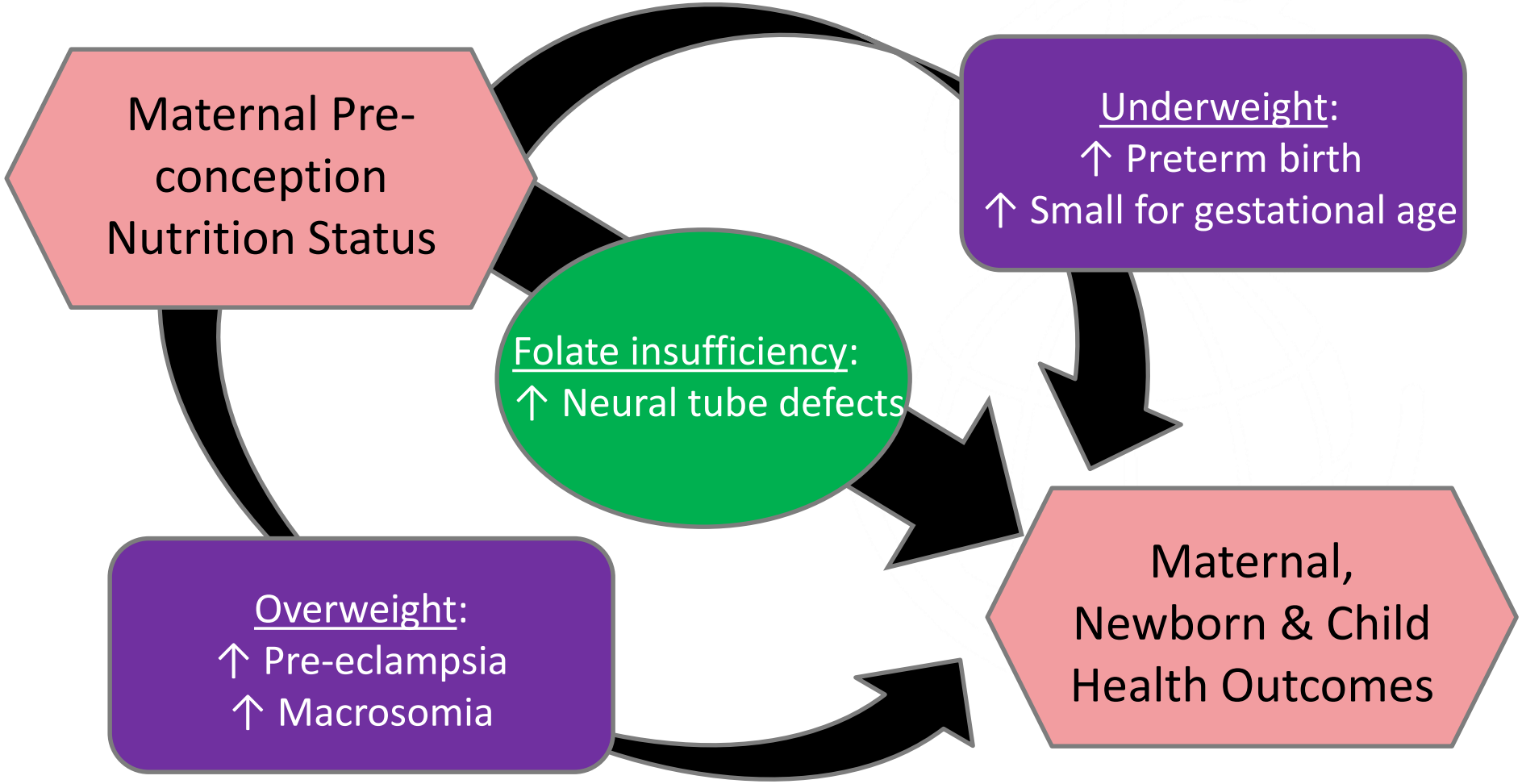
2. We can only meet global infant mortality targets by reducing birth defects

3. With all folic acid interventions, we should aim to reach a birth prevalence of ~6 neural tube defects/10,000

4. Food fortification is the best public health approach to deliver folic acid to women in the peri-conceptional period

5. You should act to ensure food fortification with folic acid is implemented & monitored in your country

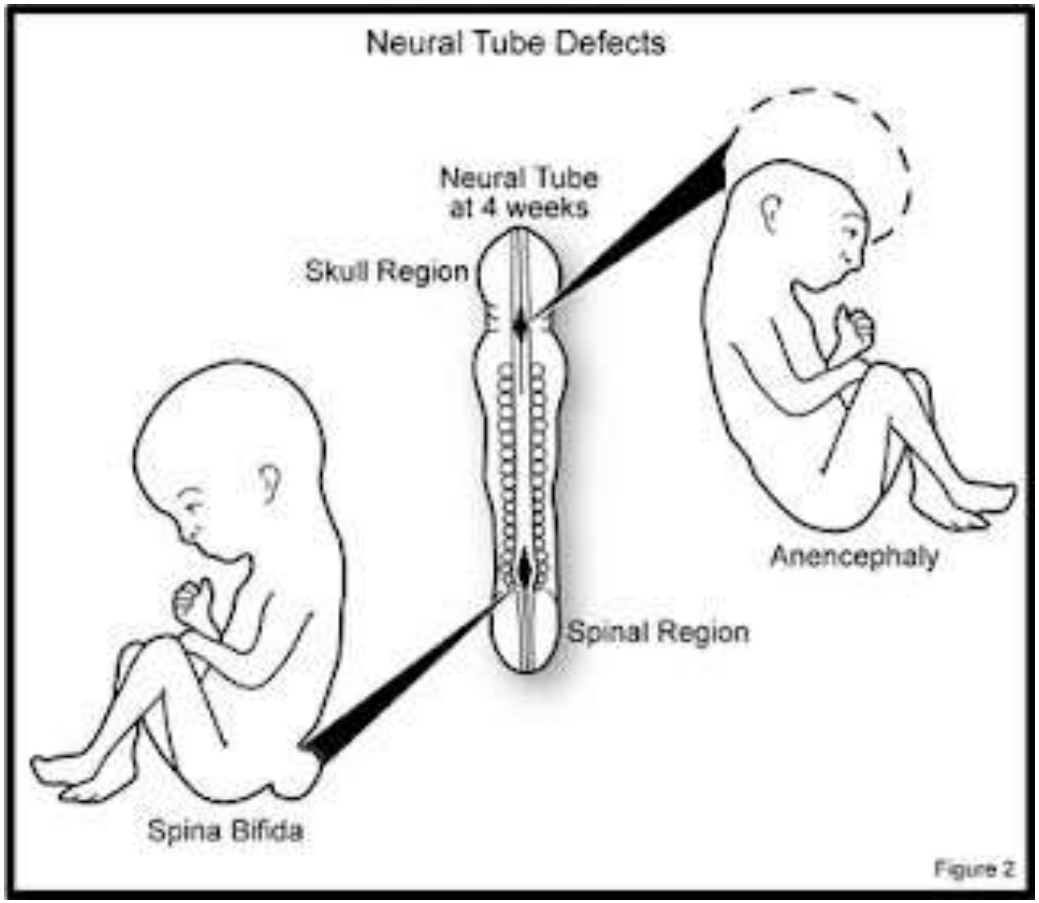
Role of Nutrition in Preconception Health



Dean 2014

Neural Tube Defects (NTDs)

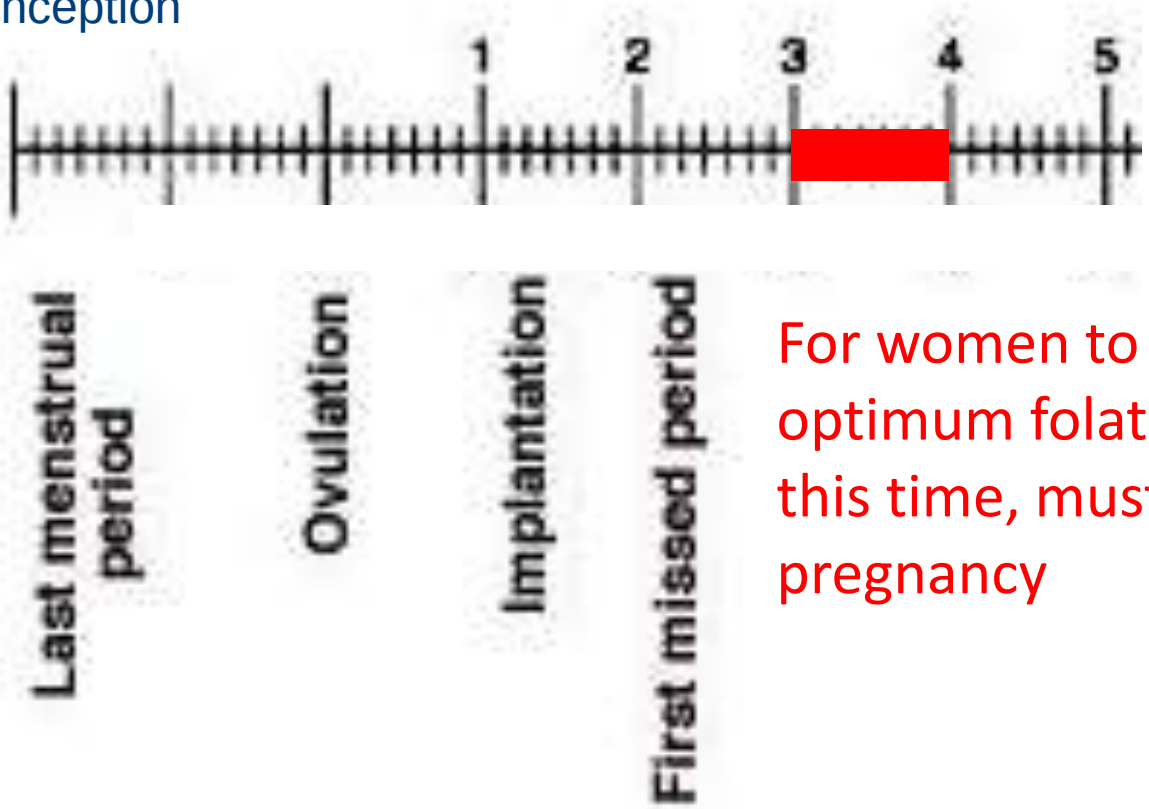
Birth defect affecting the brain and spinal cord



http://www.thescienceofpregnancy.id.au

Neural Tube Closes ~4 Weeks after Conception

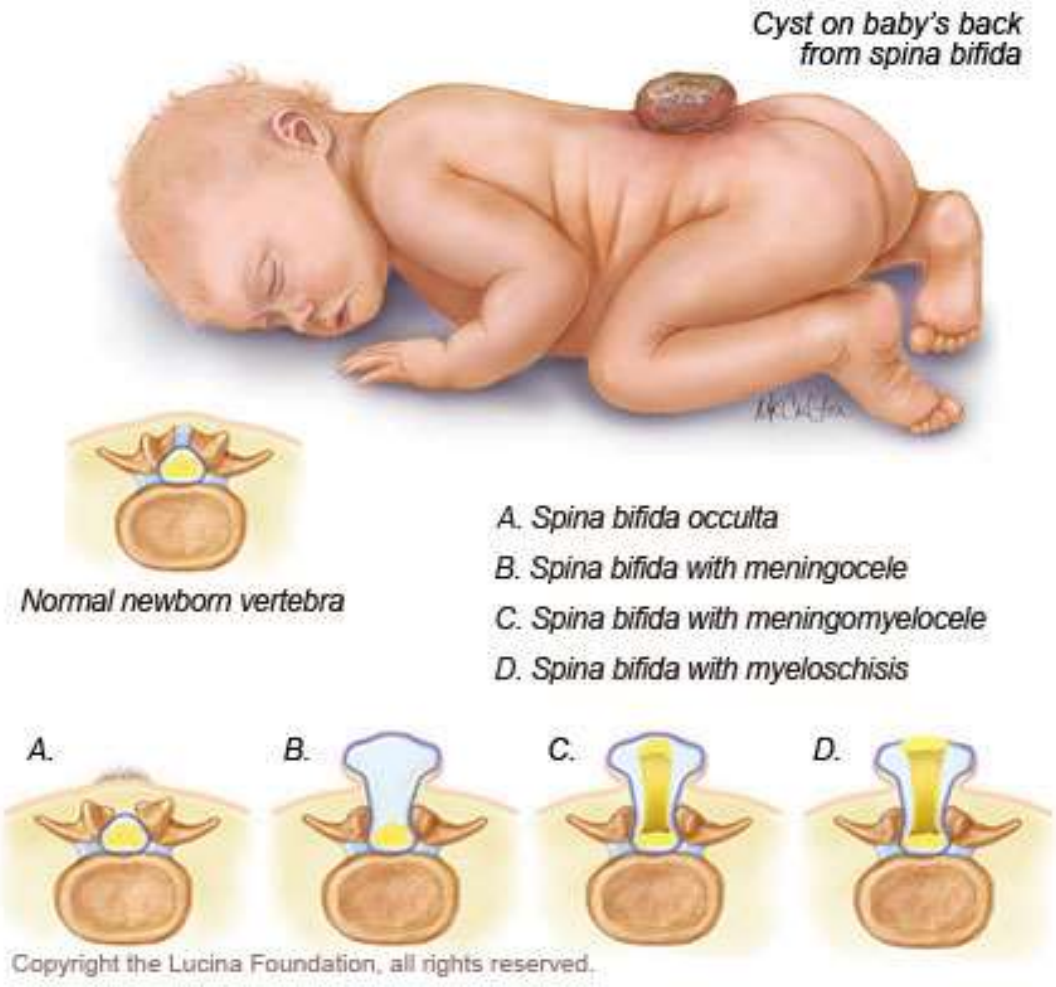
Weeks post-conception



For women to have optimum folate status by this time, must act before pregnancy

Byer 1999

Spina Bifida



NIH 2013

Anencephaly

WHO/CDC/ICBDSR 2014

~320,000 Pregnancies Affected with Neural Tube Defects Annually

http://thebumpwa.org.au/wp-content/uploads/2014/04/10-women-holding-hands.jpg

Global neural tube defects birth prevalence: 24/10,000

March of Dimes 2006

Opportunities to Reduce Neural Tube Defects

Neural Tube Defects are Preventable with Folic Acid

TABLE IV—PREVALENCE OF NEURAL TUBE DEFECTS (NTD) ACCORDING TO RANDOMISATION GROUP: MAIN ANALYSIS BASED ON ALL WOMEN RANDOMISED WHO HAD AN INFORMATIVE PREGNANCY CLASSIFIED ACCORDING TO RANDOMISATION GROUP (INTENTION-TO-TREAT ANALYSIS)

Randomisation group			All women			Women not already pregnant at randomisation*		
	Folic acid	Other vitamins	NTD/all		Relative risk: folic acid *vs* non-folic acid (95% CI)	NTD/all		Relative risk: folic acid *vs* non-folic acid (95% CI)
A	+	−	2/298	6/593 (1·0%)	0·28 (0·12–0·71)	2/258	5/514 (1·0%)	0·28 (0·11–0·75)
B	+	+	4/295			3/256		
C	−	−	13/300	21/602 (3·5%)		11/260	18/517 (3·5%)	
D	−	+	8/302			7/257		

*First day of last menstrual period was 14 days or more after date of randomisation

72% of neural tube defects were prevented through the administration of folic acid to women

MRC 1991

WHO Recommendations

Standards
for Maternal and
Neonatal Care

Prevention of neural tube defects

INTEGRATED MANAGEMENT OF PREGNANCY AND CHILDBIRTH **(IMPAC)**

1.5

The standard

All women, from the moment they begin trying to conceive until 12 weeks of gestation, should take a folic acid supplement. Women who have had a fetus diagnosed as affected by a neural tube defect (NTD) or have given birth to a baby with NTD should receive information on the risk of recurrence, be advised on the protective effect of periconceptional[1] folate supplementation and be offered high-dose supplementation.

Aim

To prevent NTDs and other congenital malformations in the fetus.

WHO 2007

WHO Recommendations

- Women trying to conceive need **400 µg folic acid daily,** starting two months before the planned pregnancy.
- Pregnant women need to continue taking **400 µg folic acid daily** until they are 12 weeks pregnant.

http://1.bp.blogspot.com/-LO5gumeAZh8/TbPdBJh3M8I/AAAAAAAAACE/9bio7Te6TWA/s1600/heart..jpg

µg, micrograms

WHO 2007

WHO Recommendations

- Pregnant women who have previously had a baby with a NTD, have diabetes, or who are under anticonvulsant treatment need **5 mg folic acid daily** plus increased food folate intake.

http://www.aquila-style.com/wp-content/uploads/2014/07/shutterstock_21.545cc160715.original-e1406446683307.jpg

NTD, neural tube defect

WHO 2007

3 GOOD HEALTH AND WELL-BEING

Ensure healthy lives and promote well-being for all at all ages

TARGETS

3.1
By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births

3.2
By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births

3.3
By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases

3.4
By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being

3.5
Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol

3.6
By 2020, halve the number of global deaths and injuries from road traffic accidents

3.7

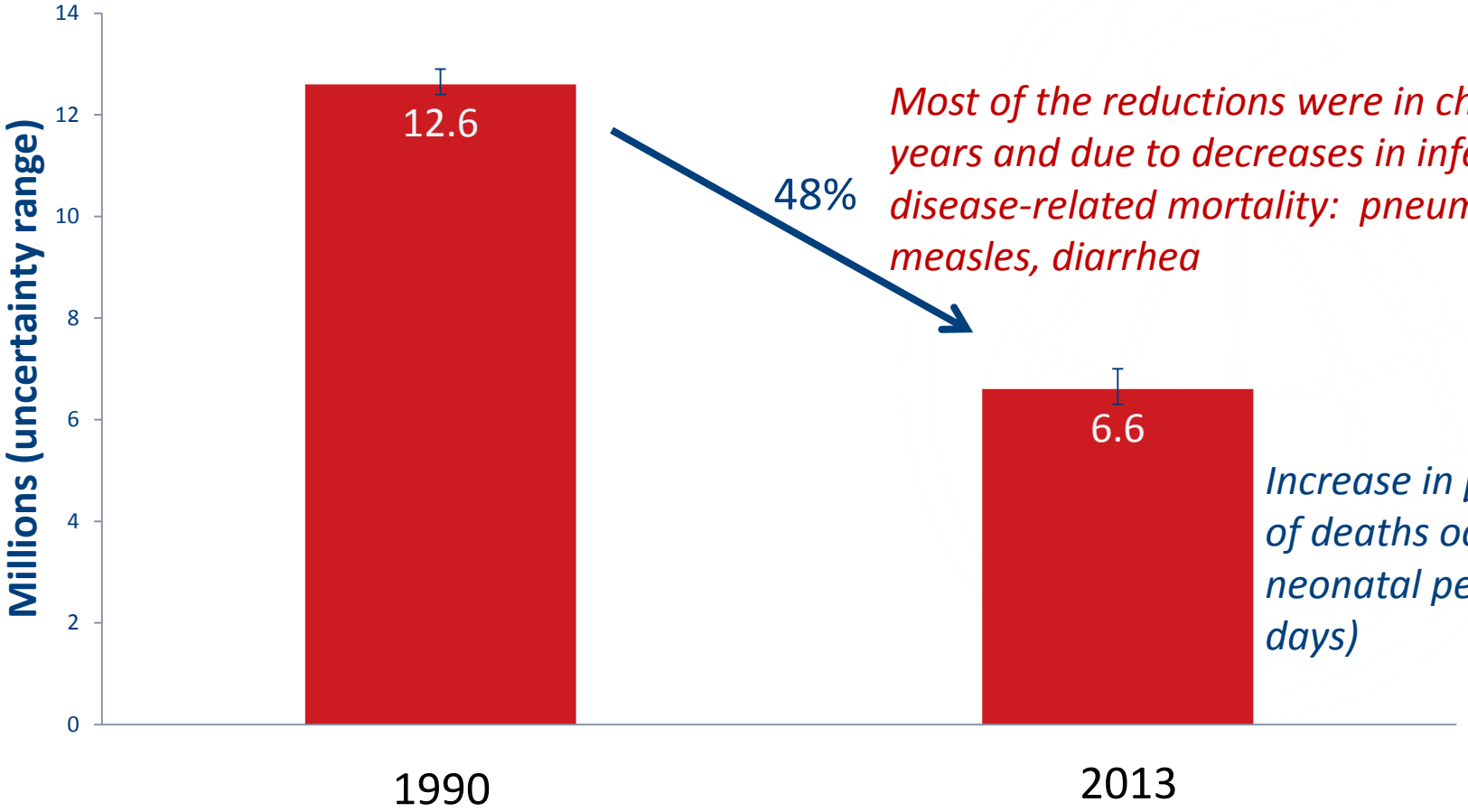
RELEVANT TOPICS


Health and population


National Sustainable Development Strategies (NSDS)

https://sustainabledevelopment.un.org/topics

Globally: Annual Deaths Decreased in Children <5 Years

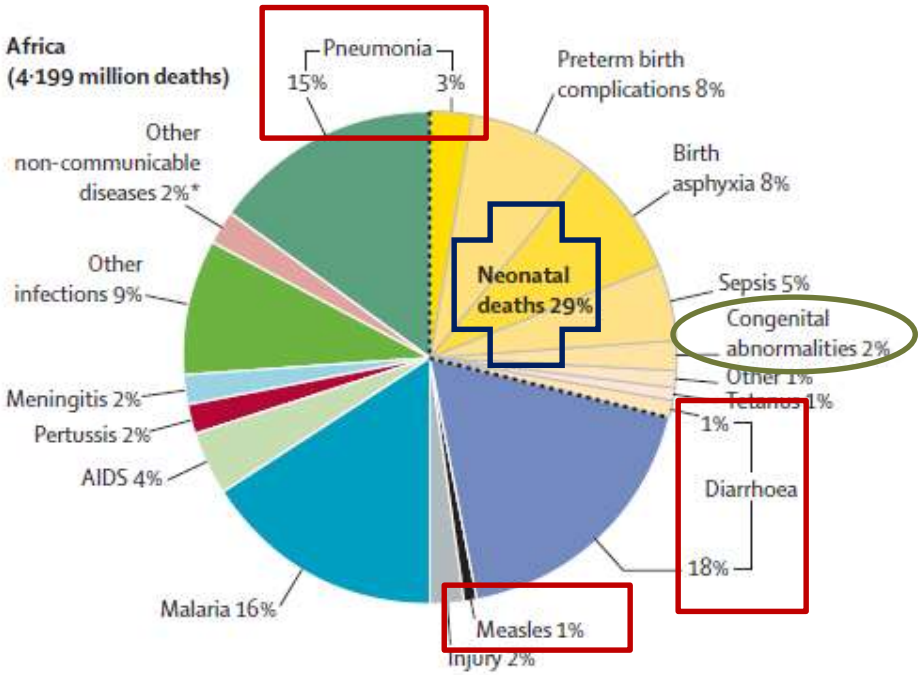


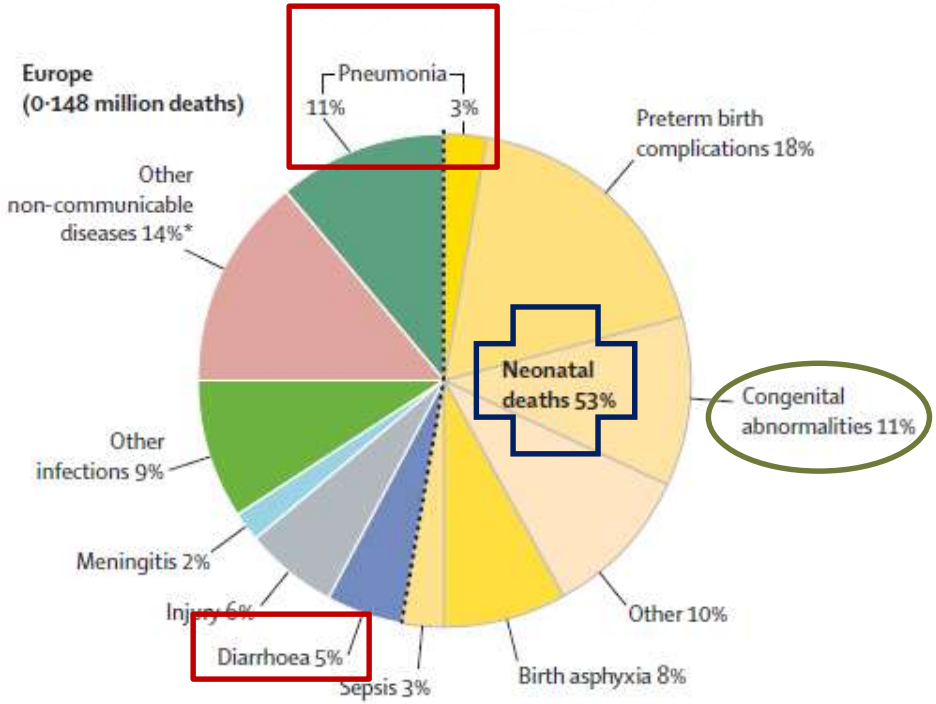
Most of the reductions were in children 1-4 years and due to decreases in infectious disease-related mortality: pneumonia, measles, diarrhea

Increase in <u>proportion</u> of deaths occurring in neonatal period (1-28 days)

Bhutta 2013, Black 2010

When Mortality from Infections is Lower, Burden from Birth Defects* is Higher





Infection deaths due to pneumonia (15% + 3%) + measles (1%) + diarrhea (18% + 1%) = **38%**

Infection deaths due to pneumonia (11% + 3%) + measles (0%) + diarrhea (5%) = **19%**

* Birth defects & congenital anomalies are used synonymously

Black 2010, Bhutta 2013, WHO 2015

Public Health Strategies to Reduce the Risk of Neural Tube Defects

Provide Vitamin B9

www.breakingmuscle.com

FOOD FOLATE

FOLIC ACID

Sources of Food Folate

https://recipemashups.files.wordpress.com/2008/12/asparagus.jpg

http://yang-sheng.com/wp-content/uploads/2012/07/beans.jpg

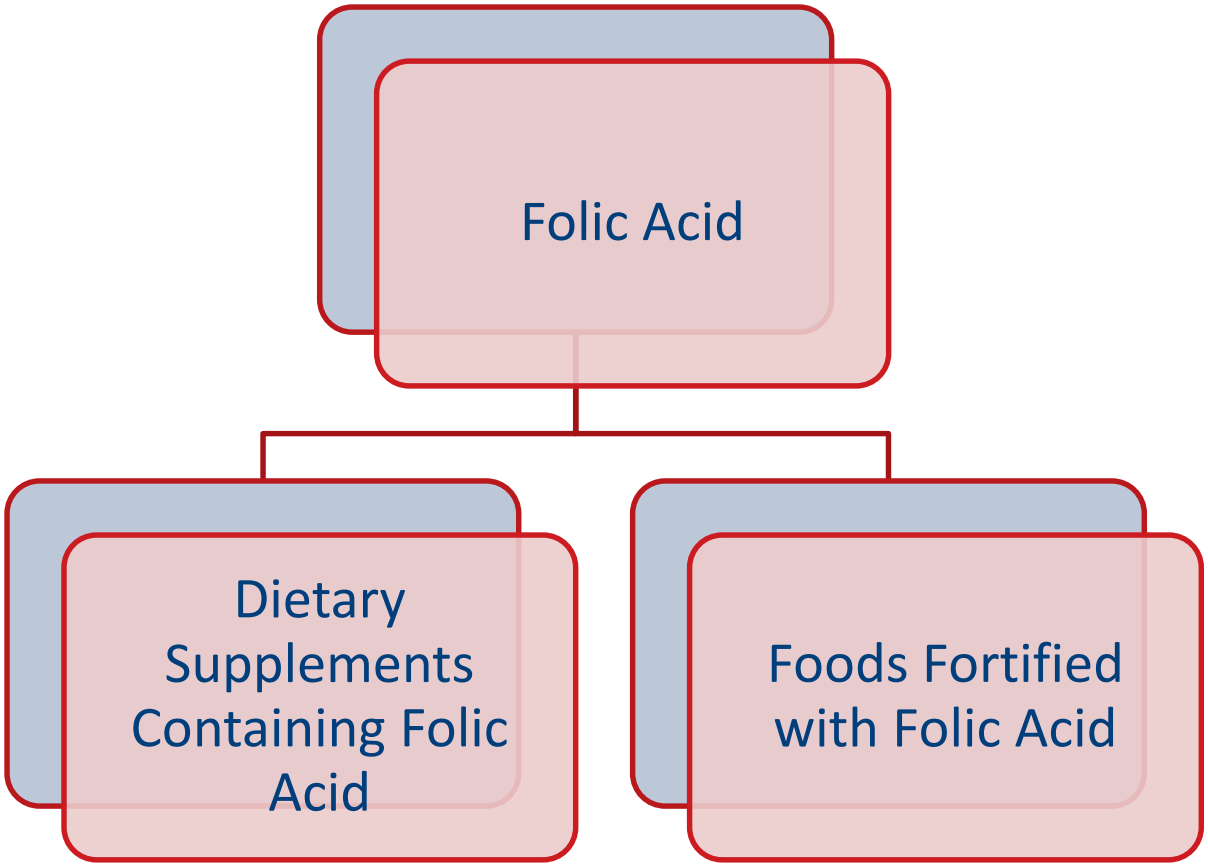
https://jayhealth.files.wordpress.com/2012/02/spinach.jpg

http://popsgrassfedbeef.org/images/bigstock_Beef_Liver_With_Dill_C

WHO recommendations to prevent neural tube defects: folic acid (primarily)

Suitor 2000, WHO 2007

Sources of Folic Acid



Suitor 2000

Dietary Supplements Containing Folic Acid

Women planning a pregnancy were given daily

- folic acid and other nutrients (in the vitamin group), or
- other nutrients (in the trace-element group)

http://www.cdc.gov/ncbddd/folicacid/images/recommend.jpg

Table 3. Congenital Malformations, According to Study Group.

Malformation	Vitamin Group	Trace-Element Group	
	number		
Neural-tube defect	0	6	*P = 0.29*

Folic acid supplements given daily to women reduce the first occurrence of a neural tube defect

Czeizel 1992

Folic Acid Supplement Use is Low

- Assessed in 49 studies from 22 countries
- Peri-conceptional use ranged from 0.5% (Italy) - 52% (Netherlands)

http://www.compasscare.info/wp-content/uploads/2011/10/woman-taking-abortion-pill.jpg

In practice, folic acid supplement use is low

Ray 2004

Many Pregnancies are Unplanned

"Almost half of all pregnancies worldwide, estimated to be over 100 million annually, are unintended or mistimed."

https://toneblackdoctor.files.wordpress.com/2014/06/sad-couple-over-pregnancy.jpg?w=725&h=483

If women are not planning pregnancy, they may not take supplements in peri-conceptional period

Thurman 2011

Folic Acid Supplementation AND Fortification

- Compared NTD levels before and after recommendations were issued for folic acid supplementation (~1992)
- 13 birth defects registries; 9 European countries + Israel
- “The issuing of recommendations on folic acid [supplementation] was followed by no detectable improvement in the trends of incidence of neural tube defects.”

All women capable of becoming pregnant should be encouraged to take folic acid supplements
AND…

NTD, neural tube defect

Botto 2005

Food Fortification with Folic Acid

Fortification: the addition of nutrients to foods during processing

Wheat flour

www.importexportplatform.com

Maize flour

www.the-gluten-free-chef.com

Rice

www.onepointdestination.com

Salt

thekingscrumbs.wordpress.com

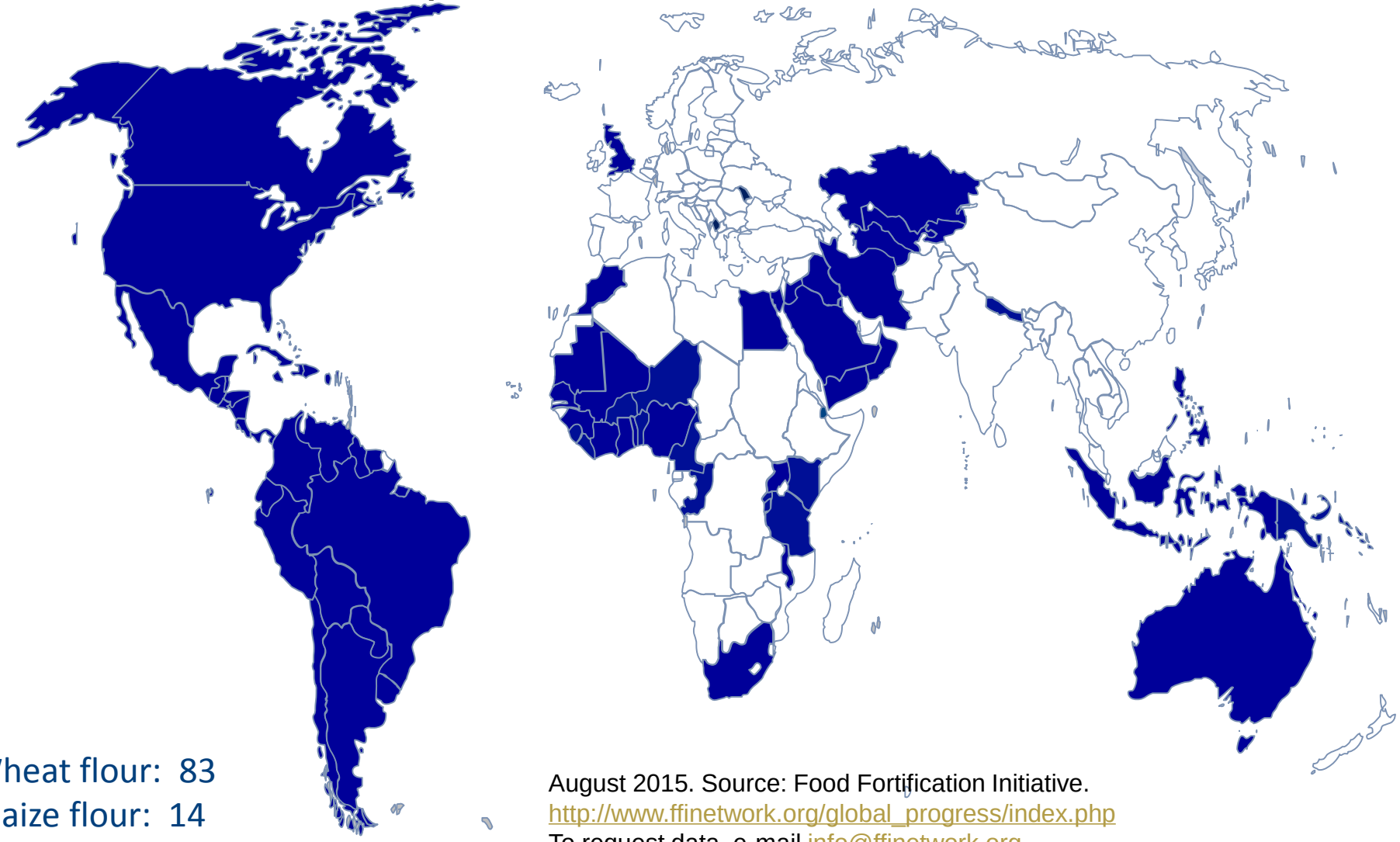
Without behavior change, women continue to eat foods, now fortified with folic acid.
Extra folic acid will improve women's folate status.
Women with unplanned pregnancies will have optimal folate status to prevent NTDs.

NTDs, neural tube defects

WHO/FAO 2006

Countries with Grain Fortification Mandates

84 countries require fortification of wheat flour, maize flour, and/or rice



Wheat flour: 83
Maize flour: 14
Rice: 6

August 2015. Source: Food Fortification Initiative.
http://www.ffinetwork.org/global_progress/index.php
To request data, e-mail info@ffinetwork.org

Global Experience of Grain Fortification with Folic Acid

- Mandate fortification with folic acid
  - Wheat flour: 79 of 84 countries
  - Maize flour: 12 of 14 countries
  - Rice: 4 of 6 countries
- Folic acid levels required
  - Wheat flour: 0.5-3.3 mg/kg
  - Maize flour: 0.5-2.5 mg/kg
  - Rice: 1-3.08 mg/kg

http://3.imimg.com/data3/PG/AS/MY-7179372/fortified-atta-500x500.jpg

mg/kg = parts per million (ppm)

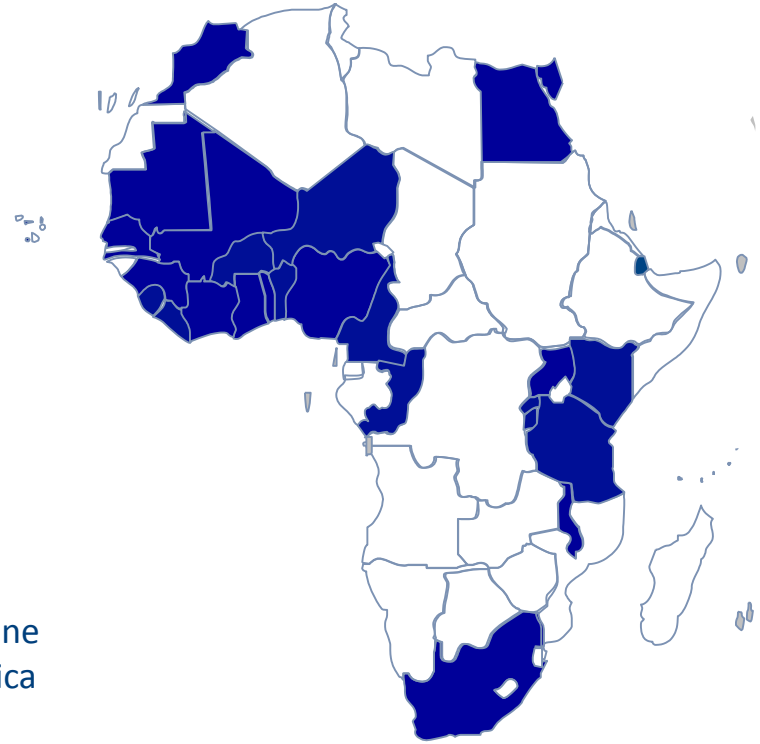
FFI 2015

Grain Fortification in Africa

African Countries with Grain Fortification Mandates

Wheat flour (n=26)

- Benin
- Burkina Faso
- Burundi
- Cameroon
- Cape Verde
- Congo
- Cote d'Ivoire
- Djibouti
- Egypt
- Ghana
- Guinea
- Kenya
- Liberia
- Malawi
- Mali
- Mauritania
- Morocco
- Niger
- Nigeria
- Rwanda
- Senegal
- Sierra Leone
- South Africa
- Tanzania
- Togo
- Uganda



Maize flour (n=8)

- Burundi
- Kenya
- Malawi
- Nigeria
- Rwanda
- South Africa
- Tanzania
- Uganda

Rice (n=0)

FFI 2015

African Experience of Grain Fortification with Folic Acid

- Mandate fortification with folic acid
  - Wheat flour: 24 of 26 countries (*Exceptions: Congo, Nigeria*)
  - Maize flour: 7 of 8 countries (*Exception: Nigeria*)

Congo

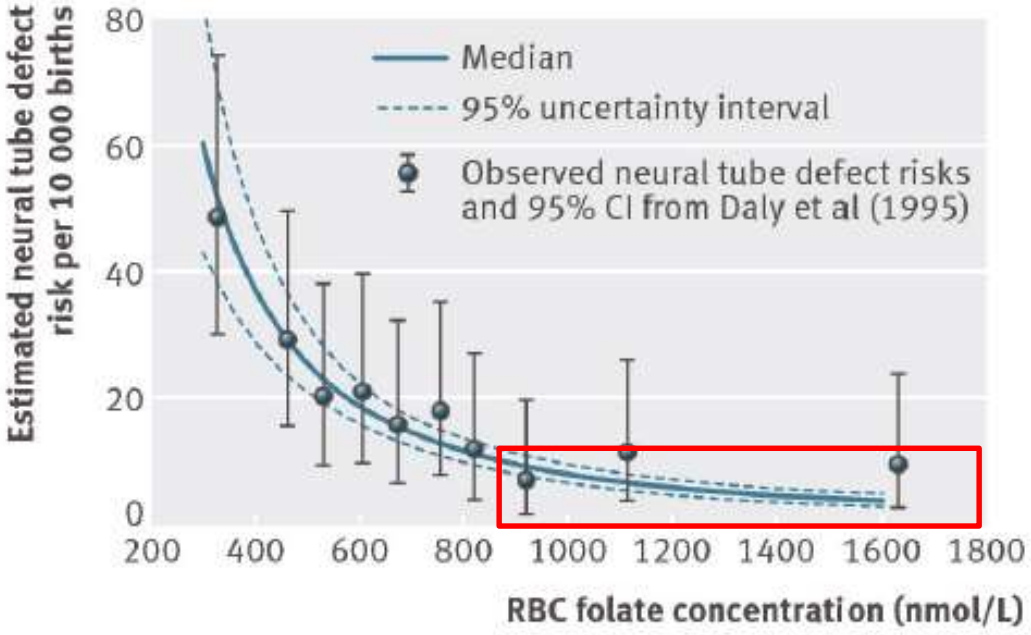
Nigeria

FFI 2015; maps from es.Wikipedia.org

Evidence for grain fortification with folic acid reducing neural tube defects

6/10,000: Lowest Birth Prevalence of NTDs with Folic Acid

Optimal population red blood cell (RBC) folate concentration to prevent neural tube defects (NTDs)



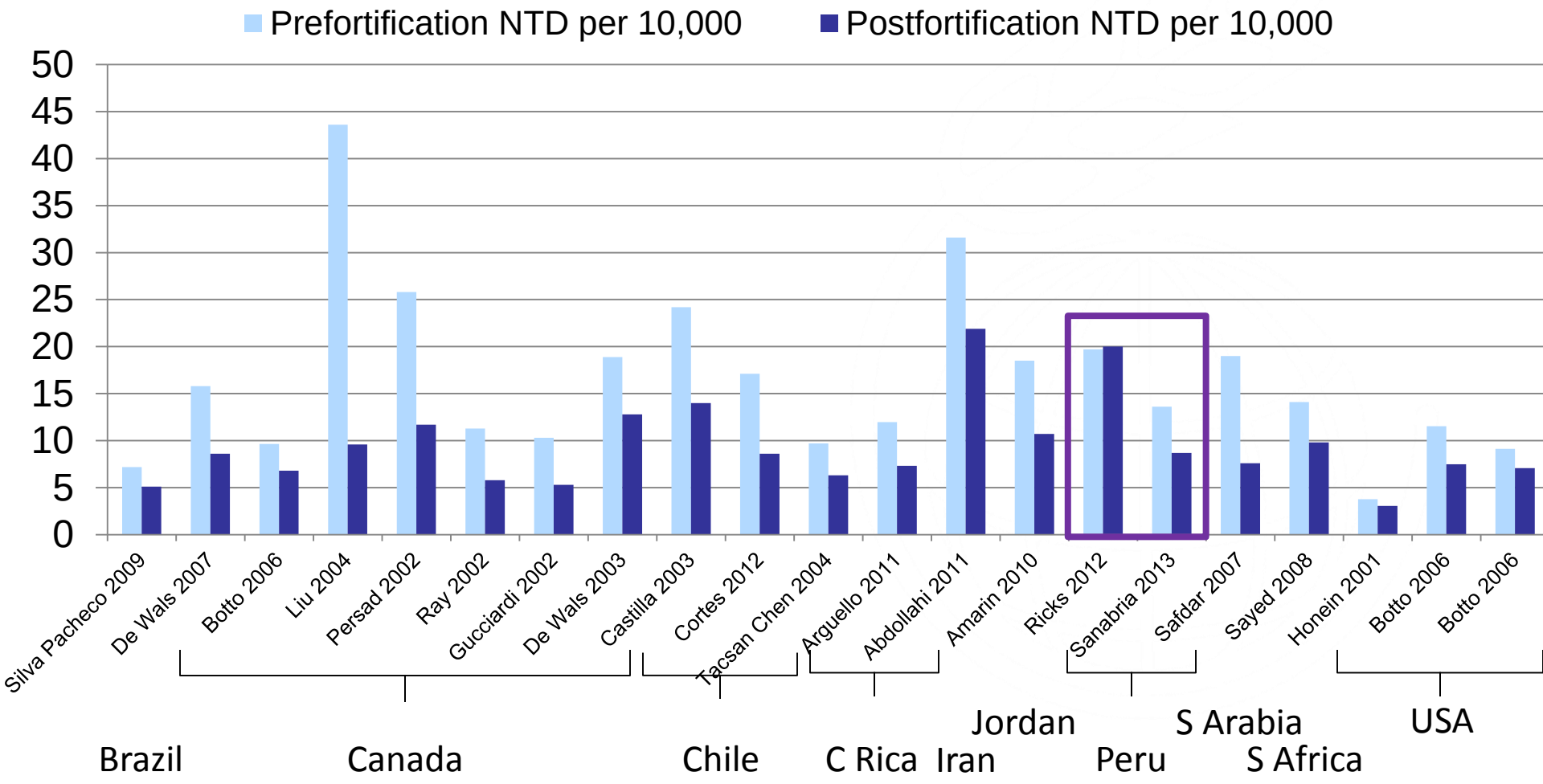
~6/10,000

Global NTD birth prevalence: 24/10,000

Goal: All countries' NTD birth prevalence to reach 6/10,000

Crider 2015, March of Dimes 2006

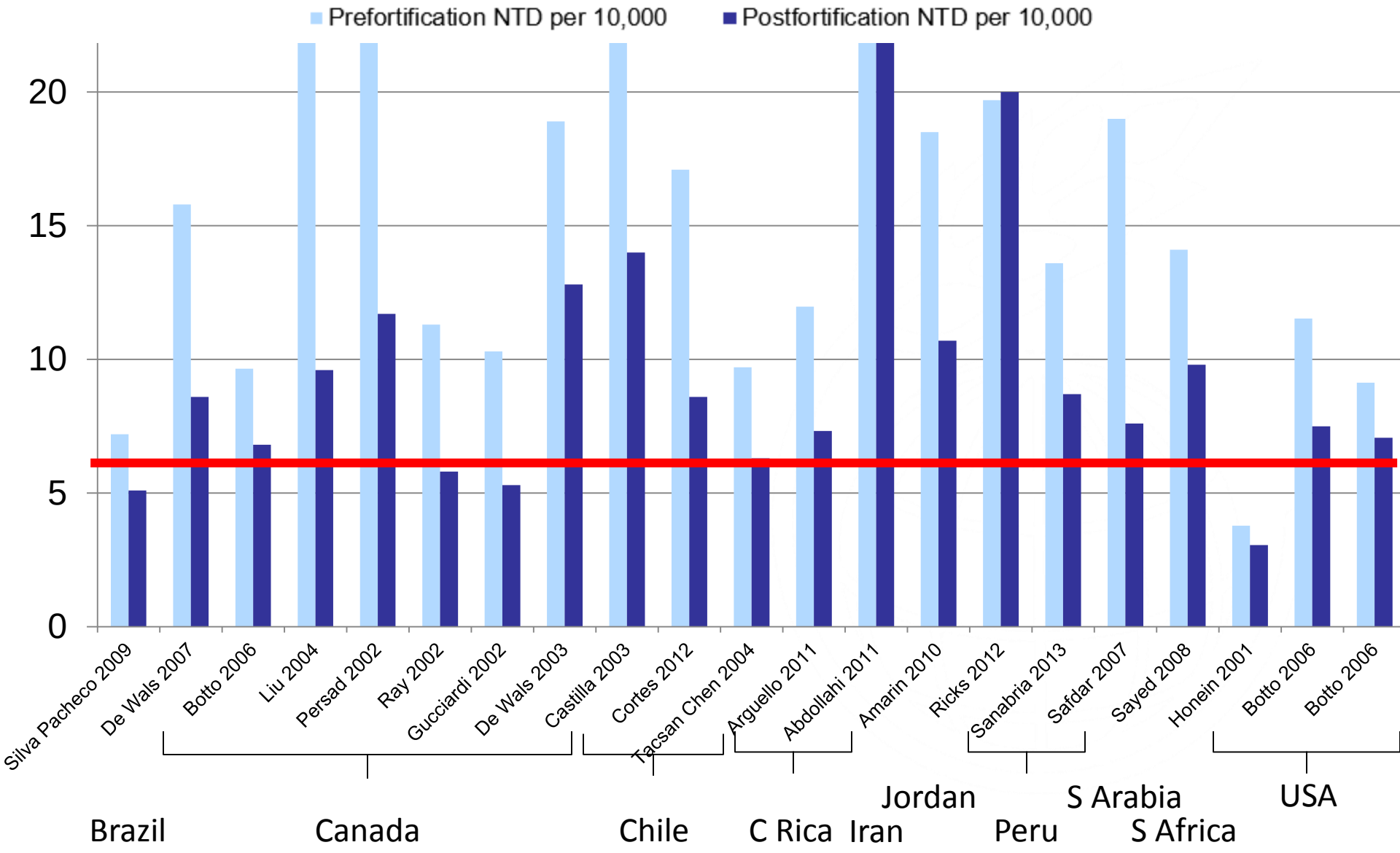
Reductions in Neural Tube Defects (NTDs) after Flour Fortification with Folic Acid was Initiated



Fortification of wheat flour ± maize flour; folic acid in flour ranged from 1.2-2.2 mg/kg

FFI 2012, updated 2015

Goal: All Countries' NTD Birth Prevalence to Reach 6/10,000



FFI 2012, updated 2015

38,417 Neural Tube Defects Prevented Annually

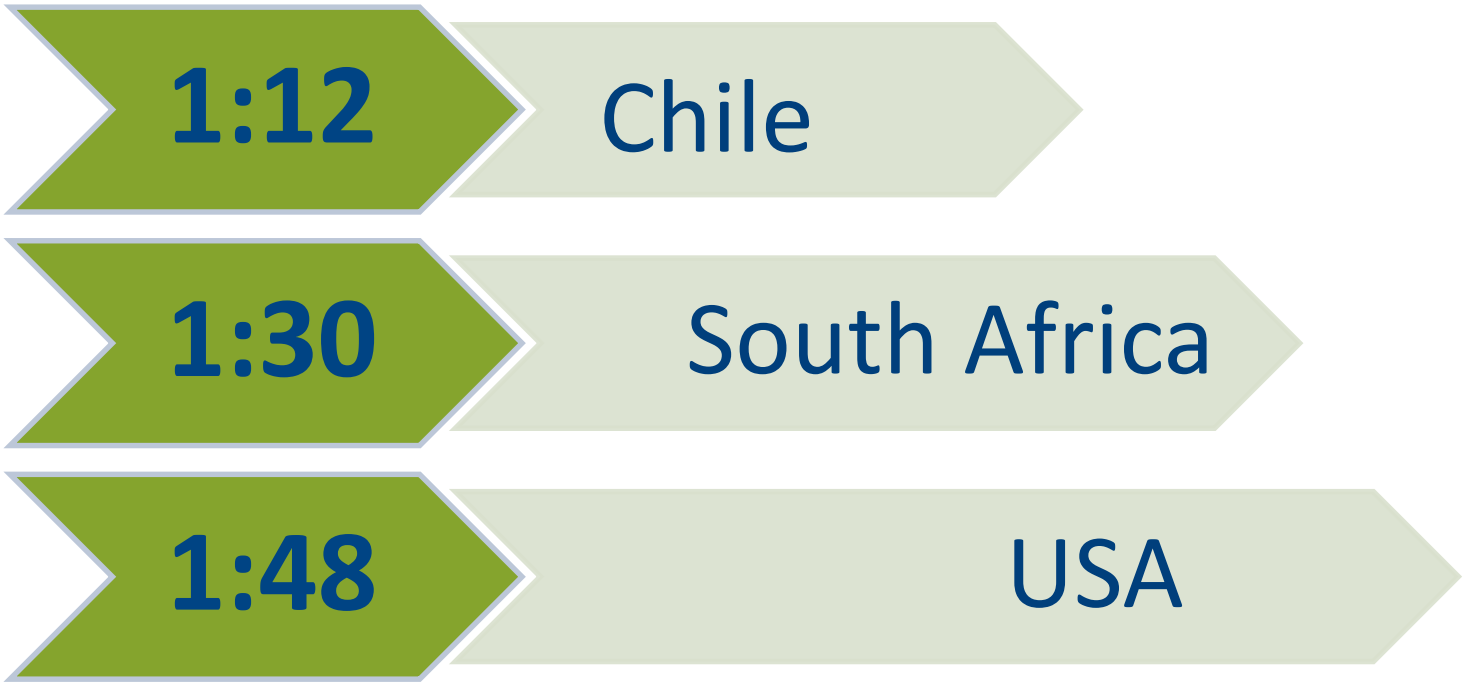
Dr. Vijaya Kancherla to present updated estimates in Symposia 9 (Thursday)

Globally an estimated ***38,417*** birth defects were prevented in 2012 – an average of ***105 a day*** – where flour was fortified with folic acid

istock

Youngblood 2013

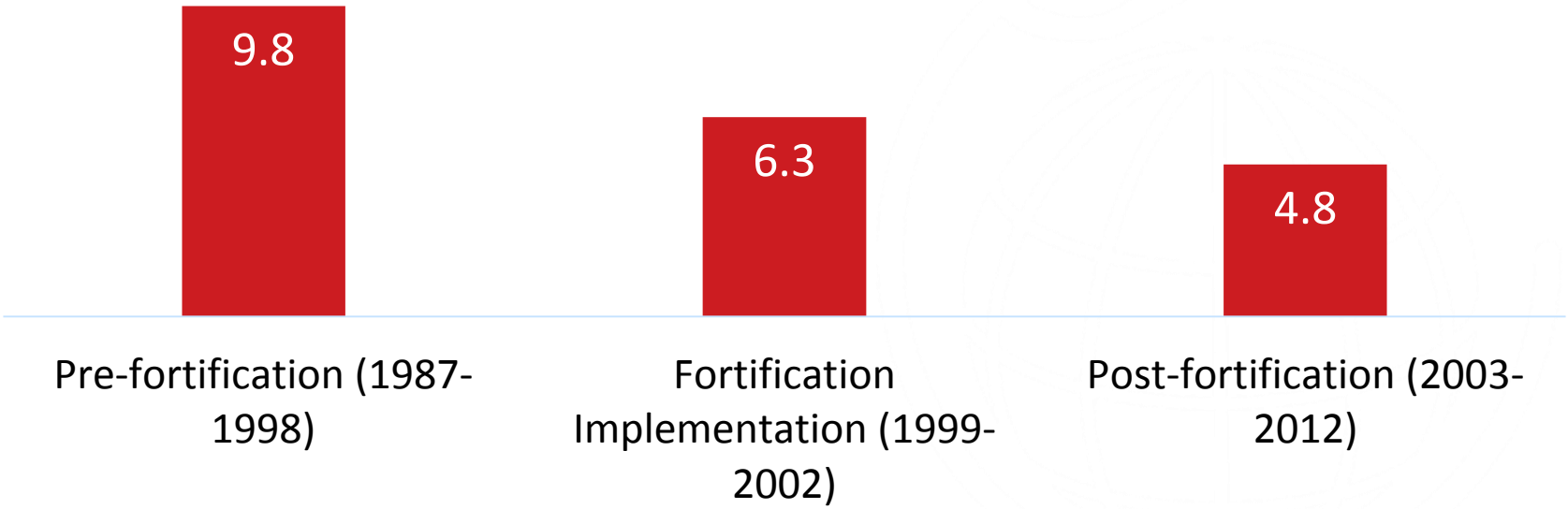
Favorable Cost:Benefit Ratio for Fortification Preventing Spina Bifida



Llanos 2007, Sayed 2008, Grosse 2005

Costa Rica Experience with Multiple Fortified Foods

Neural Tube Defects per 10,000 Live Births



Depending on the food patterns in a country, one or multiple foods may need to be fortified with folic acid to have maximum benefit

Foods fortified with folic acid: wheat flour, maize flour, dairy products, rice

Barboza 2014

Challenges in fortification with folic acid

Dr. Vijaya Kancherla to present updated estimates in Symposia 9 (Thursday)

Can have Greater Public Health Impact

~25% of FAP SBA is being prevented through flour fortification with folic acid

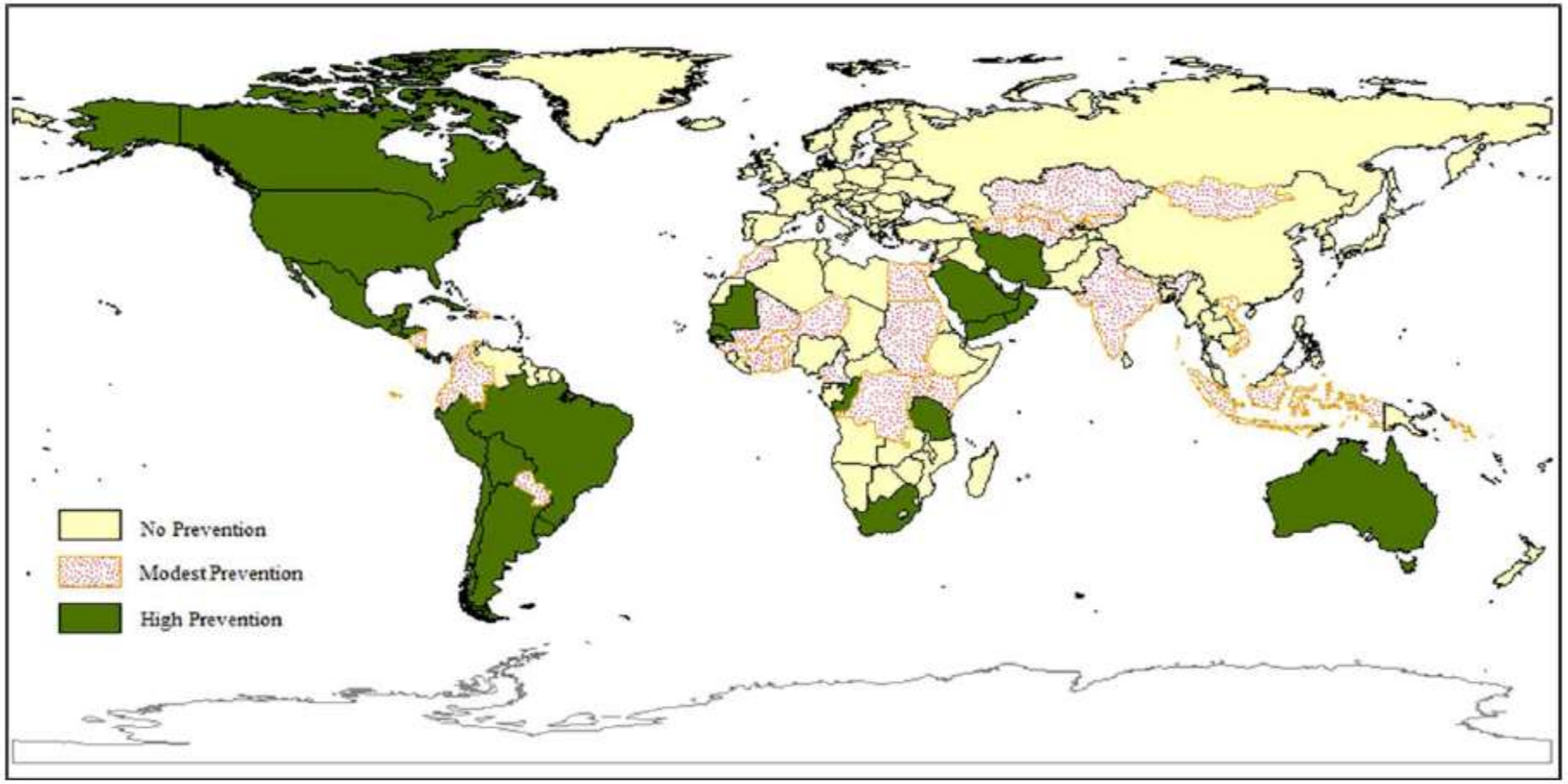


Figure 1. The status of global prevention of folic acid–preventable spina bifida and anencephaly (model II), 2012.

FAP SBA, folic acid-preventable spina bifida and anencephaly (2 types of neural tube defects)

Youngblood 2013

Increasing Price of Folic Acid

www.phillyliving.com

Concerns with Folic Acid

Fortification with folic acid <u>does not</u>

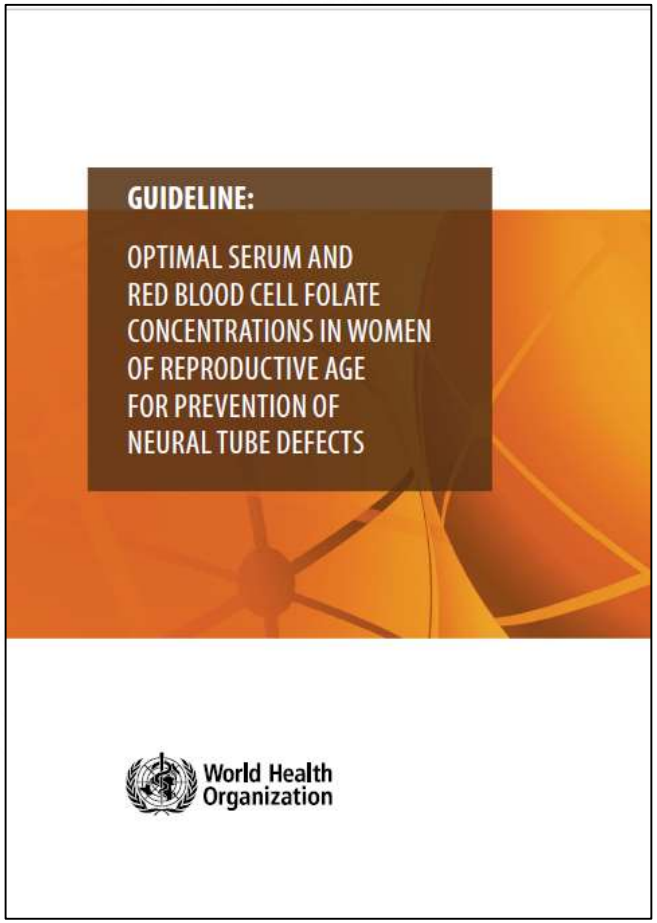
- Increase the incidence of cancer
- Mask vitamin B12 deficiency
- Cause dietary folic acid to exceed the Tolerable Upper Intake Level

http://cdn.madamenoire.com/wp-content/uploads/2013/08/woman-thinking2.jpg

Vollset 2012, Mills 2003, MPI 2012, Yang 2010, Yeung 2011

Limited Laboratory Capacity to Analyze RBC Folate

- WHO guidelines: RBC folate to estimate NTD risk
- ~3 laboratories with capacity to conduct RBC folate analyses using gold standard measure

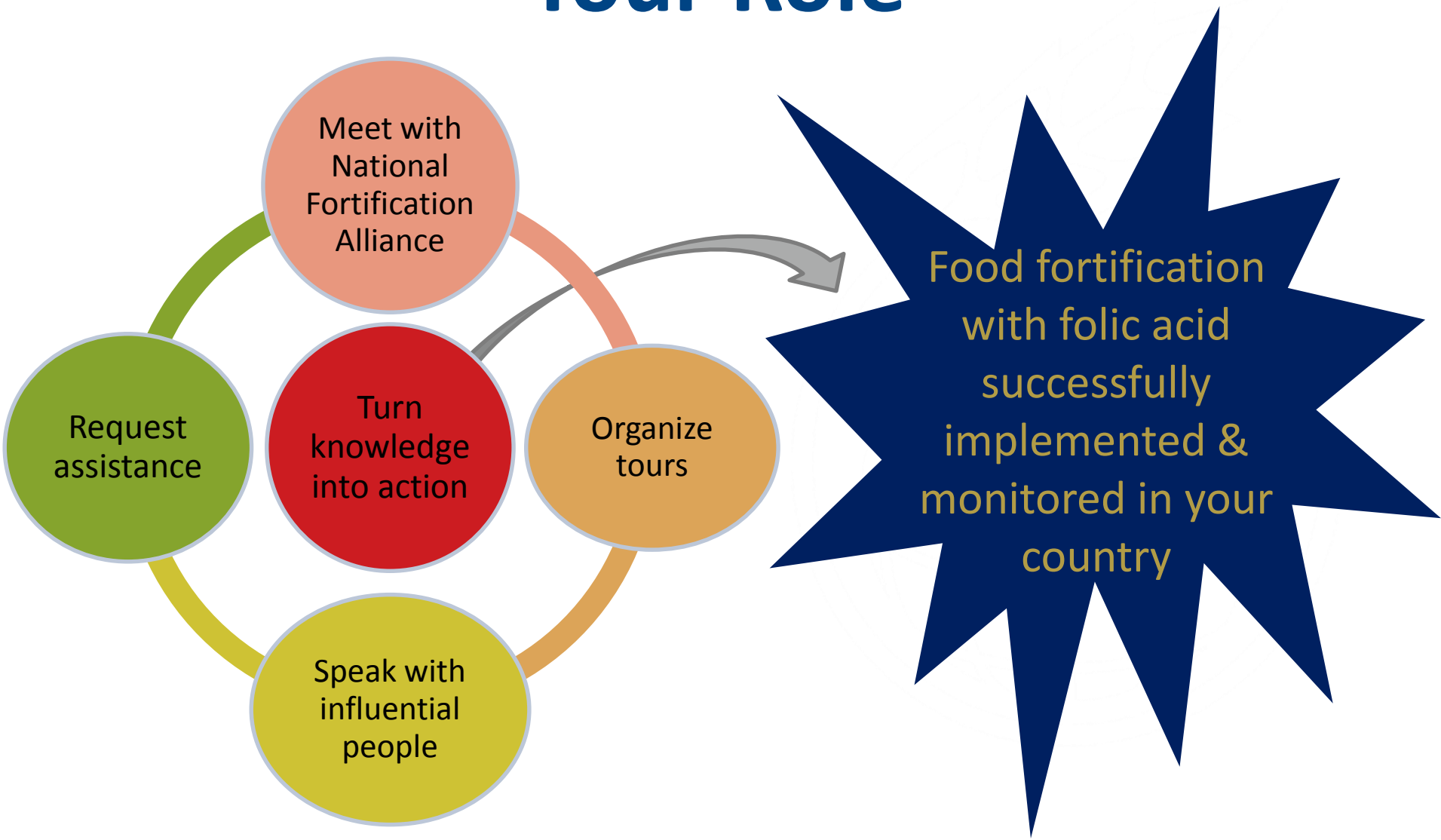


RBC, red blood cell; NTD, neural tube defect

WHO 2015

What You Can Do

Your Role


Meet with National Fortification Alliance
Request assistance
Turn knowledge into action
Organize tours
Speak with influential people
Food fortification with folic acid successfully implemented & monitored in your country

Conclusions (1)

1. Neural tube defect risk can be reduced if women have optimum folate status before and in early pregnancy
2. We can only meet global infant mortality targets by reducing birth defects
3. With folic acid interventions, we should aim to reach a birth prevalence of ~6 neural tube defects/10,000

Conclusions (2)

4. Food fortification is the best public health approach to deliver folic acid to women in the peri-conceptional period
5. You should act to ensure food fortification with folic acid is implemented & monitored in your country

For More Information

Smarter Futures	www.smarterfutures.net/
Food Fortification Initiative (FFI)	www.FFInetwork.org
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