

# **Breastfeeding and Policy strategies to protect critical infrastructures in fragile states**

Audrey Yeo

# Game Plan

- Part I: Breastfeeding in Brief
- Part II: Practices in lower income and fragile states
- Part III: Optimisation and Game Theory
- 3 minute Quiz, 4 questions

#strategyandgames #economics #publichealth

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Warning: Pictures may cause disturbance

**Breastfeeding** and **Policy strategies** to protect **critical infrastructures** in fragile states

# Breastfeeding for the wealth of a fragile nation



Breastfeeding is a child's right

Governments have a responsibility to "ensure that all segments of society, including parents and children, are informed, have access to education and are supported in the use of basic knowledge of child health and nutrition, the advantages of breastfeeding, hygiene and environmental sanitation and the prevention of accidents"

The United Nations Convention on Right of a Child

## Maternal, newborn, child and adolescent health

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### Breastfeeding

Over the past decades, evidence for the health advantages of breastfeeding and recommendations for practice have continued to increase. WHO can now say with full confidence that breastfeeding reduces child mortality and has health benefits that extend into adulthood. On a population basis, exclusive breastfeeding for the first six months of life is the recommended way of feeding infants, followed by continued breastfeeding with



### Recommended Practices

- Initiation of Breastfeeding within 1 hour of life
- Exclusive Breastfeeding for up to 6 months
- Continued for up to 2 years with nutritious and adequate complements

UNICEF, WHO

Section on Breastfeeding

### Breastfeeding and the Use of Human Milk

**ABSTRACT.** Considerable advances have occurred in recent years in the scientific knowledge of the benefits of breastfeeding, the mechanisms underlying these benefits, and in the clinical management of breastfeeding. This policy statement on breastfeeding replaces the 1997 policy statement of the American Academy of Pediatrics and reflects this newer knowledge and the supporting publications. The benefits of breastfeeding for the infant, the mother, and the community are summarized, and recommendations to guide the pediatrician and other health care professionals in assisting mothers in the initiation and maintenance of breastfeeding for healthy term infants and high-risk infants are presented. The policy statement delineates various ways in which pediatricians can promote, protect, and support breastfeeding.

tions are consistent with the goals and objectives of *Healthy People 2010*,<sup>4</sup> the Department of Health and Human Services' *HHS Blueprint for Action on Breastfeeding*,<sup>5</sup> and the United States Breastfeeding Committee's *Breastfeeding in the United States: A National Agenda*.<sup>6</sup>

This statement provides the foundation for issues related to breastfeeding and lactation management for other AAP publications including the *New Mother's Guide to Breastfeeding*<sup>7</sup> and chapters dealing with breastfeeding in the AAP/American College of Obstetricians and Gynecologists *Guidelines for Perinatal Care*,<sup>8</sup> the *Pediatric Nutrition Handbook*,<sup>9</sup> the *Red Book*,<sup>10</sup> and the *Handbook of Pediatric Environmental Health*.<sup>11</sup>



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### La-feeding:

Established. Consider

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Nutrition IQ and income

### Breast really is best

More evidence that breast-feeding babies changes their lives for the better



Mar 18th 2015



FOUR extra points of IQ, an extra year's education and a significantly enhanced income at the age of 30. Those are the benefits of having been breast-fed, according to a study just published in *Lancet Global Health*.

# Fragile states

Def: states who experience shocks, perpetuating famine, disease and poverty. Also states of weak legitimacy and capacity (World Bank)

## Context

- Armed conflict produce largest proportion of victims
- 1990 war-related family affected 20 million in south and north-eastern Africa (Sapir, 1990)
- A great majority are children and women (cited in Sapir, 1990)
- Economic, political, legal, social and health disruption (food as instrument of war)

**Table 2**

Selected disasters with large numbers of unaccompanied children

**Tableau 2**

Sélection de catastrophes dans lesquelles ont été dénombrés de nombreux enfants non accompagnés

Year Année	Disaster event Événement catastrophique	Estimated number of unaccompanied children Estimation du nombre d'enfants non accompagnés
1915	Armenian massacre – Massacre en Arménie	132 000
1919	Russian famine and revolution – Famine en Russie et révolution	800 000
1936	Spanish Civil War – Guerre civile espagnole	90 000
1939	World War II – Deuxième Guerre mondiale	13 000 000
1948	Greek Civil War – Guerre civile en Grèce	37 500
1950	Korean War – Guerre de Corée	100 000
1954	Tibetan refugees – Réfugiés tibétains	2 000
1954	Viet Nam War – Guerre du Viet Nam	880 000
1956	Hungarian Revolt – Soulèvement en Hongrie	6 000
1960	Cuban Revolution – Révolution cubaine	17 000
1970	Nigerian Civil War – Guerre civile au Nigéria	100 000
1970	Bangladesh cyclone and tidal wave – Cyclone et raz de marée au Bangladesh	7 000
1970	Bangladesh War of Independence – Guerre d'indépendance du Bangladesh	400 000
1972	Famine in Ethiopia – Famine en Ethiopie	2 000
1975	Viet Nam refugee exodus – Exode des réfugiés du Viet Nam	22 000
1975	Laotian refugees – Réfugiés laotiens	2 000
1979	Cambodian crises – Crises cambodgiennes	11 000

Source: Sapir, 1990

# Breastfeeding in brief

- Physiology
  - Hormones
  - Attachment
- Benefits
  - Infant morbidity
    - avoiding future cost of resource allocation for child and parent
  - Psychological benefits to mother
  - IQ

# Benefits of Breastfeeding (reducing the risks of)

## To the child

- diarrhoea
- pneumonia
- ear infection
- haemophilus influenza
- meningitis

- urinary tract infection

- type II diabetes

- ulcerative colitis

- Crohns disease

- childhood cancers

## To the mother

- delay return to fertility > space out births > more time to care for household and other children
- cervical cancer
- pre-menopausal breast cancer
- ovarian cancer
- bonding with child

# The cost of not breastfeeding : South East Asia studies (Walter et. al. 2016)

**Population:** Cambodia, Indonesia, Laos, Myanmar, Thailand, Timor Leste, Viet Nam

90% rate of exclusive breastfeeding for 6 months

Context: Fast economic growth, women's labour market are amongst the highest in the world. Increased baby-food industry, also varying range of baby-friendly facilities.

**Intervention:** Cost- Benefit, Cost-Effectiveness in seven countries modelled on national breastfeeding promotion strategy in Viet Nam

**Comparison:** Health cost savings, reduced mortality, reduced time lived with disability or impaired health, benefit cost ratio (economic returns from each dollar invested)

**Outcome:** Costs and Benefits to 1. reduced cognition, 2. health system treatment costs for selected illnesses in children under the age of 2 (diarrhoea and pneumonia), indirect costs, IQ increments (2.6 points with a 0.17 SDs) controlled

**Time horizon:** 12-14 weeks

- Cognitive Losses
- Child Mortality
- Maternal Mortality
- Health Systems Costs
- Indirect Costs
- Cost of Formula

# Associations between GDP and early childhood undernutrition (Vollmer et al, 2014)

**Population:** 36 countries of low to middle income in Asia, Sub Saharan Africa

**Intervention:** Z scores gathered from stunting, underweight, wasted scores as according to WHO

**Comparison:** Z scores vs GDP growth (with and without adjustment for age, sex, wealth, mother's age at birth, education, relationship status, household wealth quintile, urban or rural residence)

**Outcome:** Nil to quantitatively weak association with reduction in early childhood stunting, underweight and wasting, findings are robust for covariate adjustments etc.

**Time horizon:** 1990-2011

- Growth in incomes could be inequality distributed
- Rising income does not mean investments are optimally allocated
- Trickle down effects are not helpful to health outcomes in children
- Direct investments on nutrition required to see nutritional benefits
- Limitations of this study: Oversampling of wealthy countries. African countries do not have capacity nor political stability to undertake a survey of the scale (larger error margins for poor countries) and limited external validity
- Maybe we cannot measure short-term outcomes of GDP

# Current practices in developing nations

- Nepal : Sepsis management program
  - Small Gestational Age and Low Birth Weight
  - Lactation support
- Jordan : Syrian refugee camps
  - Safe place for mothers to breastfeed
  - Culturally aligned service

## Current practices in developing nations

- Australia
- UK

## The context of breastfeeding in fragile states:

- food insecurity
- poor sanitation
- overcrowding
- limited health services / health skill
- HIV, Stress

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**Governments** have a responsibility to “ensure that all segments of society, including parents and children, are informed, have access to education and are supported in the use of **basic knowledge of child health and nutrition**, the advantages of breastfeeding, hygiene and environmental sanitation and the **prevention of accidents”**

The United Nations Convention on Right of a Child

## Policy opportunities

- The health and mental health of women and children are particularly vulnerable
- Local health systems including NGOs are limited “badly prepared, mental diseases in children are left to degenerate until death p.46”
- Analysis of disaster impact and relief effectiveness hampered by lack of constant and accurate data, or standard management of info
- Good policies may also be abandoned from not only poor political stability, or willingness but the long and short-term goals are not well distinguished leading to unrealistic expectations
- Ad hoc policy, sure it happens, could be better

# Policy format

<b>Criteria</b>	<b>Policy measures</b>
Criticality: How essential is the asset?	IQ, Earnings, GDP and HDI
Vulnerability: How susceptible is the asset to surveillance or attack?	Probability of direct or indirect attack (physical or cyber)
Reconstructability: How hard will it be to recover and restore normal operations ?	DALY, QALY, GDP and HDI
Threat: How probable is an attack on this asset?	GDP and HDI

Source : Adapted from Brown & Carlyle, 2009

# Minimizing costs, maximising outcome: A strategic policy

“The whole is greater than the sum of its parts”

*Aristotle*

Critical infrastructures are vulnerable in the fragile states. The National strategy for Homeland Security identifies thirteen infrastructure sections critical to the United States, which are defined as physical systems that connect components of an economy, and represents a huge investment in any nation's wealth (in Brown & Carlyle, 2005). Minor disruptions, random or deliberate can severely degrade a system's performance due to spillover effects on its codependent systems (Brown & Carlyle, 2005). Any infrastructure can be vulnerable in a fragile state and a thorough assessment, can make policy more informed in the allocation of scarce resources.

# Optimising cost function

$$\text{mix max } c_1y_1 + c_2y_2 + c_3y_3 + c_4y_4$$

$$s.t. \mathbf{A}\mathbf{y}_1 + \mathbf{I}_1\mathbf{y}_2 + \mathbf{I}_3\mathbf{y}_3 + \mathbf{I}_4\mathbf{y}_4 = \mathbf{b}$$

$$c_{1-4}$$

$$\mathbf{y} \in Y, \mathbf{A}, \mathbf{I} \in A$$

(Y=system's constraints)

**y** represents the limits: gains or losses in IQ, future earning, GDP, QALY, DALY, HDI increments, or number of patients or skilled staff.

**c** represents the cost per unit

**A** or **I** are derived from public and private insight, measures the probability of input **y**

**b** represents a vector of supply and demand

90% of efficiency frontier

# Defender-Attacker Model

		<b>Defender</b>	
		<b>Kill</b>	<b>Miss</b>
<b>Attacker</b>	<b>Kill</b>	<b>2,2</b>	<b>6,0</b>
	<b>Miss</b>	<b>0,6</b>	<b>4,4</b>

Source: Harrington et al, 2009

# GAMES

	T = 1	T= 2	T = 3	T = 4
<b>Attacker</b>	kill = 2	kill = 2	kill = 2	kill = 2
<u>Attacker</u>	kill = 0	kill = 2	kill = 2	kill = 2

Figure A: Pay-off for consistently Killing

	T = 1	T= 2	T = 3	T = 4
<b>Attacker</b>	miss = 4	miss = 4	miss = 4	miss = 4
Defender	miss = 4	miss = 4	miss = 4	miss = 4

Figure B: Pay-off for consistent Peace

Source: Harrington et al, 2009

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## GAMES II

	T = 1	T= 2	T = 3	T = 4
Attacker	miss = 4	miss = 4	miss = 4	miss = 4
Defender	miss = 4	miss = 4	miss = 4	miss = 4

Figure B: Pay-off for consistent Peace

	T = 1	T= 2	T = 3	T = 4
Attacker	kill = 6	kill = 2	kill = 2	kill = 2
Defender	miss = 0	kill = 2	kill = 2	kill = 2

Figure D: Pay-off for deviating: Grim strategy for Kill

Source: Harrington et al, 2009

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# Getting the desired cooperation

James Breakwell  @XplodingUnicorn

[kids playing cards]

Me: What game are you playing?

6-year-old: War.

Me: Who's winning?

6: Nobody wins.

Whoa.

4:21 PM - 25 Mar 2017

1,886 8,206

Deviating reduces pay offs as we compare Table 4 and 5:

$$\frac{2}{1-\delta} > \delta \frac{2}{1-\delta}$$

Even with Grim Trigger strategy, repeated games in “miss” has a higher pay offs than kill (Table 5 and 6)

$$\frac{4}{1-\delta} > 6 + \delta \frac{2}{1-\delta}$$

*[formula 1]*

Following Solving for  $\delta$  from *formula 1*:

$$(1 - \delta) \times \frac{4}{1-\delta} \geq (1 - \delta) \times \delta \left[ 6 + \delta \left( \frac{2}{1-\delta} \right) \right]$$
$$4 \geq (1 - \delta)6 + \delta 2 \Rightarrow 4\delta \geq 2 \Rightarrow \delta \geq \frac{1}{2}$$

We obtain the coefficient  $\delta$  for cooperation as 0.5.

Source: Harrington et al, 2009

## Limitations

- Counterfactuals, lack of data et cetera
- Could input be a constraint ?

## Strengths

- Accountability
- Transparency
- Priority-setting
- Sustainability: Changing the game over time through small actions

Two roads diverged in a yellow wood,  
And sorry I could not travel both



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