

# Estimating the Global Burden of Foodborne Diseases

To foster  
global health security

To promote  
economic growth and development

To strengthen  
evidence-based policy-making

Estimer la charge mondiale  
des maladies d'origine alimentaire

Pour promouvoir  
la sécurité sanitaire internationale

Pour encourager  
la croissance économique et le développement

Pour renforcer  
l'élaboration des politiques sur la base d'éléments factuels



# Estimating the Burden of Foodborne Diseases in the Caribbean

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How safe  
is our food?



# What is a 'Burden of Illness' study?

- The burden of foodborne diseases can be defined as the incidence, prevalence of morbidity, disability and mortality associated with acute and chronic manifestations of FBD (*WHO 2006*)
- A burden of Illness study estimates the true burden of a syndrome (e.g. *gastroenteritis*) or pathogen e.g. *Salmonella*) in a community
  - What is the true **burden of diarrhea illness** in the community?
  - What is the true **burden of a specific pathogen e.g. *Salmonella*** in the community?

**Why the need to estimate  
the global  
burden of foodborne diseases?**

# Why do we need BOI studies

- FBD :important global cause of illness and death
- WHO: prevention and control of FBD: a priority (2002).
- **Large variation in capacities to detect, investigate and mitigate FBD –absence of reliable data on burden of FBD**
- **True burden and real health impact of FBD is not known/well understood, hence not prioritised**
- **Precise information on BOI is needed to allocate resources for *appropriate and most effective* FBD control efforts, and developing relevant public health policies**
- The WHO through the Global Burden Disease initiative, developed a rigorous approach for BOI estimation
- The underlying concept of this study rests on **defining the reporting pyramid for each country**

Programmes and projects

Food Safety

Zoonoses

Microbiological risks

Chemical risks

Biotechnology (GM foods)

Food standards (Codex Alimentarius)

Foodborne disease

Food production to consumption

Capacity building

Consumer education

## Initiative to estimate the Global Burden of Foodborne Diseases

### Foodborne Diseases – a Growing Risk

Foodborne diseases encompass a wide spectrum of illnesses and are a growing public health problem worldwide. They are the result of ingesting contaminated foodstuffs, and range from diseases caused by a multitude of microorganisms to those caused by chemical hazards. Recent global developments are increasingly challenging international health security. These developments include the growing industrialization and trade of food production, the rapid urbanization associated with a more frequent food preparation/consumption outside the home and the emergence of new or antibiotic-resistant pathogens.

The most common clinical presentation of foodborne diseases takes the form of gastrointestinal symptoms but such diseases can also lead to chronic, life-threatening symptoms including neurological, gynecological or immunological disorders as well as multiorgan failure, cancer and death.

The global burden of foodborne diseases and its impact on development and trade is currently unknown. Reliable epidemiological data are, however, urgently needed to enable policy-makers as well as other stakeholders to:

- appropriately allocate resources to foodborne disease, prevention and control efforts;
- monitor and evaluate food safety measures;
- develop new food safety standards;
- assess the cost-effectiveness of interventions; and
- quantify the burden in monetary costs.

As a response to the current data gap, the WHO Department of Food Safety, Zoonoses and Foodborne Diseases (FOS) launched a new Initiative to Estimate the Global Burden of Foodborne Disease in collaboration with multiple partners.

#### In this section:

1. Foodborne Diseases – a Growing Risk
2. [The Unknown Burden](#)
3. [WHO's Initiative](#)
4. [Foodborne Disease Burden Epidemiology Reference Group](#)
5. [Country Studies](#)
6. [Partnerships](#)
7. [Communication Strategy](#)
8. [Time frame, costs and outputs of the Initiative](#)
9. [Meetings](#)
10. [Media centre](#)



Initiative to estimate the Global Burden of Foodborne Diseases: [1](#), [2](#), [3](#), [4](#), [5](#), [6](#), [7](#), [8](#), [9](#), [10](#) | [Next page](#)



# Objectives of the Initiative to Estimate the Global Burden of Foodborne Diseases

## Objective 1

To provide estimates on the global burden of foodborne diseases according to age, sex and regions for a defined list of causative agents of microbial, parasitic, and chemical origin.

## Objective 2

To strengthen the capacity of countries in conducting burden of foodborne disease assessments and to increase the number of countries who have undertaken a burden of foodborne disease study.

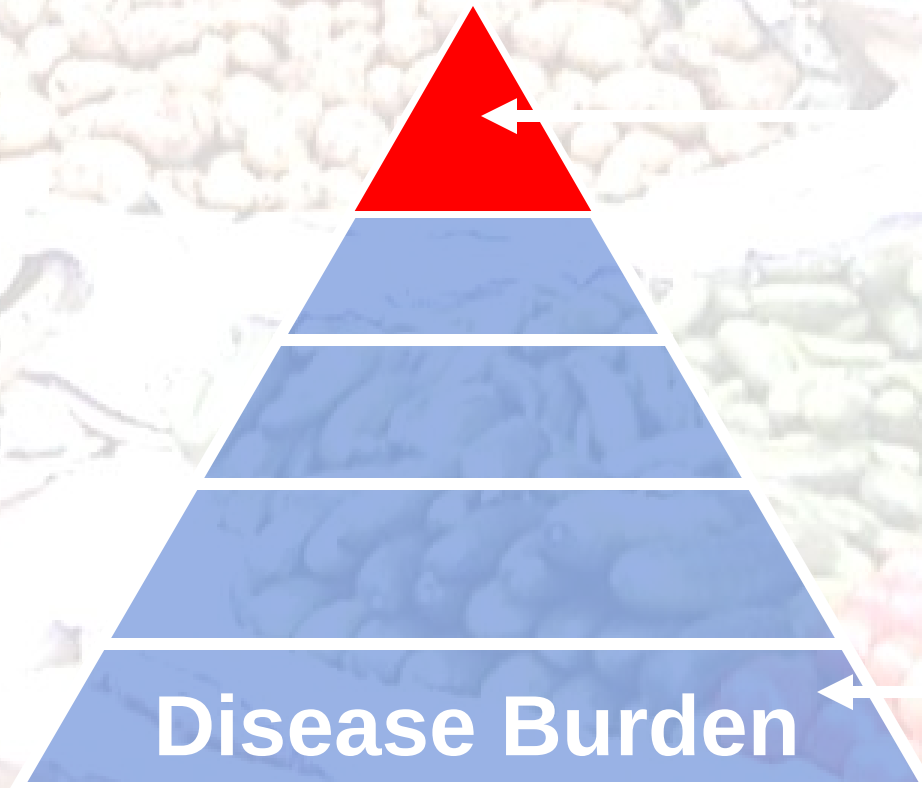
## Objective 3

To increase awareness and commitment among Member States for the implementation of food safety standards.

## Objective 4

To encourage countries to use burden of foodborne disease estimates (e.g. for cost-effective analyses of prevention, intervention and control measures).

# Surveillance of Foodborne Disease



**What we do  
know...**  
**(reported cases)**

**What we need to  
know!**



# Known Studies of Burden of Foodborne Illness





## Benefits of conducting a 'BOI' study

- Obtain estimates of the burden of enteric pathogens and acute gastroenteritis of foodborne origin in the community
- Obtain estimates of the burden caused by specific enteric pathogens commonly transmitted by food in the community
- Gain a better understanding of how your surveillance system and laboratories are working
- Promote cooperation and collaboration among various government sectors
- Advocate for gaining money and affect policy change
- Build capacity and promote intersectoral collaboration
- Determine more appropriate intervention measures for FBD, guide policy



# Caribbean Burden of Illness Study 2007-present

# *Why Caribbean needs a BOI study*

- The epidemiology of food and waterborne illnesses at the community level are poorly understood in the Caribbean.
- Little information on disease burden is available: limiting appropriate prevention measures & allocation of resources
- Large number of marginalized populations with poor access to health are often at high risk to food, waterborne and zoonotic infections – causing considerable morbidity, and largely undetected by routine surveillance systems
- Communicable disease surveillance in the region has primarily been based on syndromic surveillance and there is limited aetiology (based laboratory- confirmed cases) *since stools are not routinely collected for lab testing.*



# *Why Caribbean needs a BOI study*

- Syndromes are often under-reported. Especially true for GE as many people will self-treat without seeking health care, (doctors do not routinely request stool samples for AGI )
- Limited understanding of which pathogens (etiologies) are responsible for the illnesses manifest in the 3 key syndromes (*acute GE, undifferentiated fever, fever and respiratory*)
- Even with the enhanced CD system, persons unable/unwilling to go to a health care provider will not be captured leading to a paucity of information about these individuals and the illnesses
- Ltd development of targeted disease reduction interventions.
- Conduct of BOI studies is therefore needed in the Caribbean

<b>Symptom</b>	<b># cases 2005</b>	<b># cases 2006</b>	<b># cases 2007</b>	<b># cases 2008</b>	<b>cases 2009</b>
<b>Gastroenteritis (GE) &lt;5</b> <i>(17-20 CMCS)</i>	25, 819	58,772	41, 536	57,834	49,564
<b>Gastroenteritis (GE) &gt;5</b> <i>(17-20 CMCS)</i>	34,658	57, 836	52,316	68,571	71159
<b>GE/FBD outbreaks</b>	21	21	22		
<b>FBD Etiologic agent (Laboratory-confirmed)</b>					
<b><i>Campylobacter</i></b> <i>(3-6CMCS)</i>	37	43	37	64	
<b><i>Escherichia coli</i></b> <b><i>(pathogenic)</i></b>	0	3	6	8	1
<b><i>Norovirus</i></b> <i>(3-4CMCS)</i>	3	7	19	12	11
<b><i>Listeria</i></b>	0	13	0	0	0
<b><i>Salmonella</i></b> <i>(13-15CMCS)</i>	838	533	528	428	678
<b><i>Shigella</i></b> <i>(7-11CMCS)</i>	183	156	103	74	173
<b>Typi and Paratyphi</b>	0	356	110	6	6
<b>Vibrio</b>	1	0	0	0	1
<b>Rotavirus</b>		154	72	117	54
<b>(Clinical diagnoses)</b>					
<b><i>Ciguatera</i> poisoning</b> <i>(4-6CMCS)</i>	453	387	263	349	91

# Background

- **2007- present**

- BOI studies : Part of PAHO's BWP (SO9) on food safety- for promoting & building capacity integrated FBD surveillance in countries (reason for starting)
- Part of CEHP program

- **2010 to the future**

- WHO 52<sup>nd</sup> resolution May 2010

“Advancing food safety initiatives”

- URGES Member States to establish or improve the evidence base for food safety through systematic efforts on disease-burden estimation and surveillance.....
- REQUESTS the Director-General: to monitor regularly and report to Member States on the global burden of foodborne and zoonotic diseases from the country, regional and international perspectives;



## Background

- **Countries (8):**
  - **St Lucia, Grenada, Jamaica, Trinidad, Guyana Dominica**
  - **Bermuda, Barbados**
  - **Based on size, capacity, tourism dependence**
  - Request and agreements from MoHs
  - representative of the CARICOM countries
- **Coordination: CAREC with PAHO, PHAC**
- **Each country: responsible for conduct of study**
  - Steered by CMO, national epidemiologist & lab director

# Objectives of Study

- Det community prevalence of gastroenteritis, fever and acute respiratory illness and undifferentiated fever
- Quantify the under-reporting of disease syndromes.
- Develop source attribution estimates for GE illnesses.
- Understand the etiology of key pathogens commonly transmitted by food in the Caribbean. *Salmonella, Shigella, Campylobacter, Staphylococcus, pathogenic E coli 0157:H7, Norovirus*
- Provide baseline information on exposure to key zoonoses
- Improve laboratory capacity to enable timely and sensitive diagnose of infectious diseases.
- Build capacity to analyze surveillance and research data.
- Strengthen national and regional surveillance systems.
- Promote the generation of public policies and interventions for foodborne infections

# Research Protocol



**What we do  
know...**  
**(reported cases)**

**What we need to  
know!**

# Sources of Information

1

How many cases are reported to surveillance?

Surveillance system

How often are laboratory-confirmed cases reported?

Laboratory survey

How sensitive are the laboratory tests?

Laboratory survey

How often do laboratories test for a pathogen?

Laboratory survey

How often are specimens submitted?

Population survey

3

How often do ill persons seek medical care?

Population survey

# Methodology

## To estimate the burden of FBD: 2 Components

- **A population-based component**
  - Population survey based on self reported cases
  - 2 surveys during high and low GI periods
- **A laboratory-based component**
  - Enhanced lab testing for 1 year
  - Review of lab results before and after
- **Information and Policy-based component**

# 1: Population Component

- Population survey based on self-reported cases of AGI
- Administered as a retrospective population based survey
- Use a standardized questionnaire, administered by trained interviewers from randomly selected enumeration districts in each parish

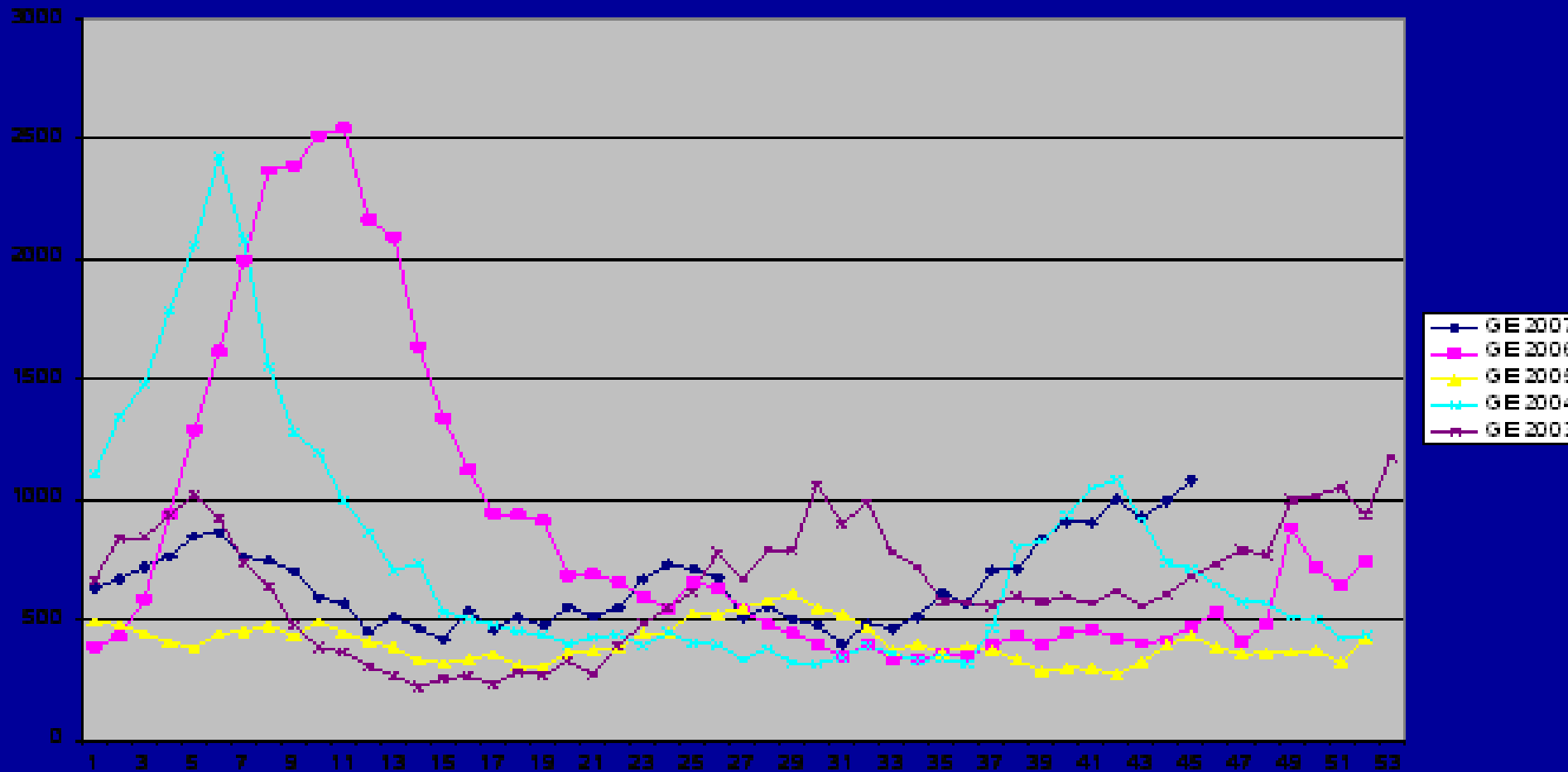
## Survey

- Information on acute GE, undifferentiated fever, fever and respiratory symptoms experienced over the past 30 day
- symptoms, socio-demographics, frequency of health care seeking behaviours, frequency of appropriate laboratory specimen submissions, use of antibiotics and other medications, and perceived cause of illness



# Population Survey (based on GI trends)

- **Ist survey: February 21-March 7, 2009** (2 weeks) to capture the high AGI season (*typically during the winter months (December-February)*)
- **second phase during 14-27 June 2009** (2 weeks)) to capture the low season. (2 weeks)) to capture the low season usually during May – July-.



## 2: Population survey

### Outcomes

- estimate of the no of persons in population experiencing these syndromes and proportion of those who sought medical care.
- determine proportion of those seeking care for diarrhea provided a stool for diagnosis, under-reporting factors
- Info to estimate the social and economic cost of AGI

proportion of gastrointestinal illness (AGI) attributed to food and the specific pathogens, (*Salmonella*, *Shigella*, *Campylobacter*, pathogenic *Staphylococcus aureus*, *Escherichia coli* 0157:H7, *Vibrio* and *Norovirus*) will then be estimated (in conjunction with other data, including outbreak and laboratory based surveillance data).

## 2: Laboratory Component

*Goal:* better understand and improve routine laboratory surveillance at country level & to determine the prevalence of specific aetiologies commonly transmitted by food

The **laboratory based component** includes

- Lab capacity strengthening initiative
  - Methods and media
- Baseline survey of the national laboratory
- One year enhanced testing
- Survey following one year testing

# Outcomes of Lab Study

- estimate the number of specimens received in the laboratories servicing the study sites
- proportion of cases lost to surveillance because of negative findings
- proportion of confirmed cases reported to the surveillance systems in the participating countries.
- Laboratory and population survey- used to estimate the true impact of specific pathogens wrt to diarrheic disease in the populations

# Sources of Information

1

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Surveillance system

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How sensitive are the laboratory tests?

Laboratory survey

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Population survey

**Example:** What is the true burden  
of *Salmonella* in the community?



# To estimate the burden of illness'

## Step 1: Collect and analyze data

- (I) Review of current surveillance system:
- (II) **Conduct a laboratory-based component**
  - *One year enhanced lab testing & survey*
- (iii) **Conduct a population-based survey**
  - *Two surveys based on AGI trends*

## Step 2: Calculate Multipliers

## Step 3: Calculate Burden of Illness

## Step 2: Calculate multipliers

- What is a multiplier?
  - A multiplier is the inverse of a proportion calculated to account for the underreporting between two steps in a surveillance pyramid
    - $10\% = 100/10 = \text{Multiplier of } 10$
    - $20\% = 100/20 = \text{Multiplier of } 5$
    - $15\% = 100/15 = \text{Multiplier of } 6.7$

## Step 2: Calculate Multipliers

How many cases are reported to surveillance?

**18,012**

How often are laboratory-confirmed cases reported?

**$100\% = 100/100 = 1.0$**

How sensitive are laboratory tests?

**$70\% = 100/70 = 1.4$**

How often do laboratories test for a pathogen?

**$100\% = 100/100 = 1.0$**

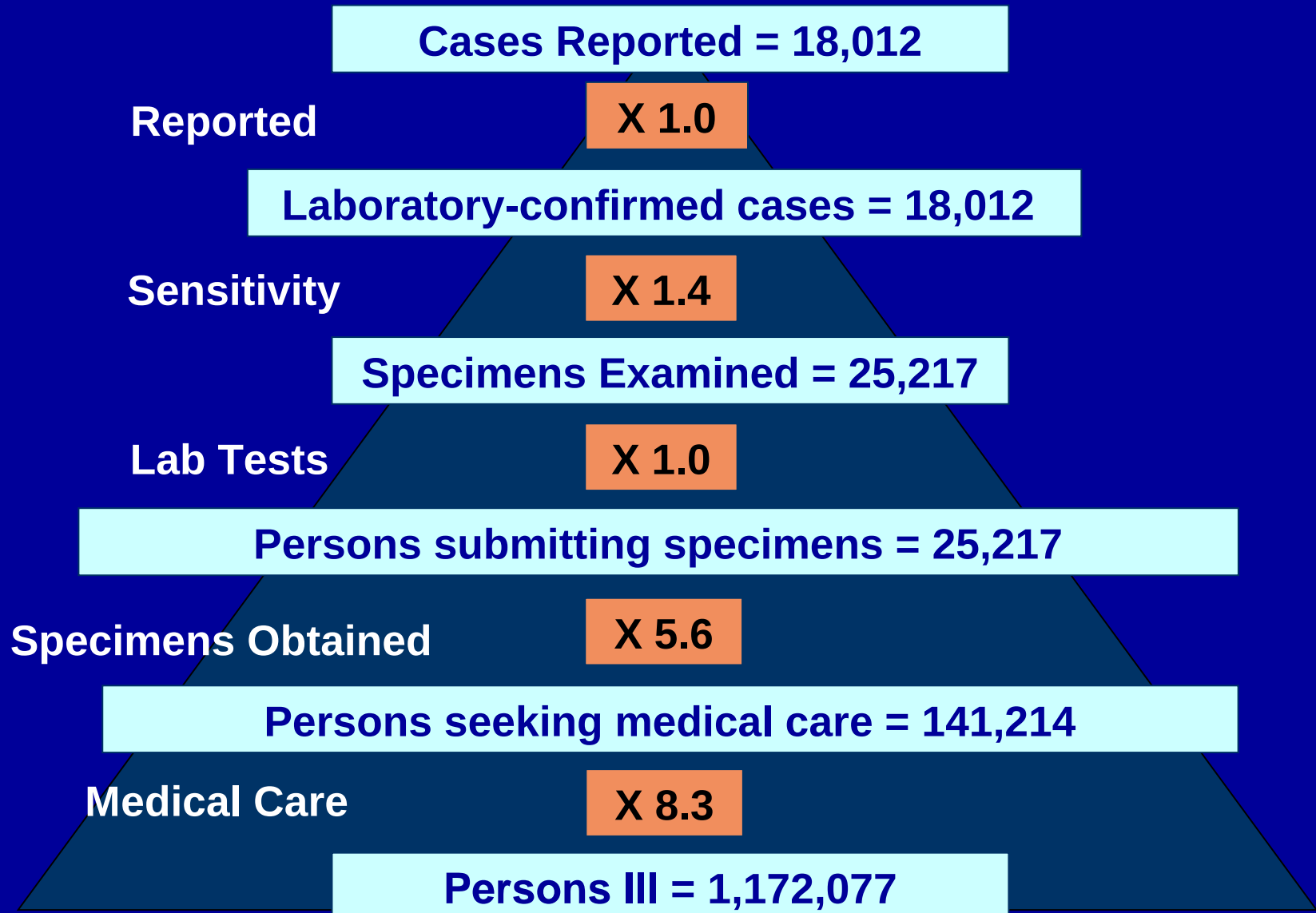
How often are specimens submitted?

**$18\% = 100/18 = 5.6$**

How often do ill persons seek medical care?

**$12\% = 100/12 = 8.3$**

# Step 3: Calculate Burden of Illness



## Burden of Illness Calculator

### Salmonella

A how many cases of disease are reported?

2

B How often does the parish report to NND

100

1.000

B How often are laboratory confirmed cases reported to local health authority?

100

1.000

C How sensitive are the laboratory tests for pathogen?

75

1.333

D How often do laboratories test for pathogen?

88

1.136

E How often are specimens submitted?

100

1.000

E How often are requests for stool samples made ?

35

2.857

F How often do persons with a diarrheal illness seek care?

17.2

5.814

**Final Multiplier**

**25.169**

**Overall**

**50.34**

## Step 3: Calculate Burden of Illness

**Persons Ill = 1,172,077**



**There are approximately 1.2 million cases of *Salmonella* in the community**

## In country BOI Activities

- Provide technical assistance for overall coordination
- Finalization of protocols, questionnaire, timelines, budget, logistics, id of BOI coordinator
- Conduct lab training
- Develop Sampling frame with statistical unit
- Sensitization advocacy and Launch Meetings
- Survey Administration training workshops
- *Advocacy* for stool collection
- Monthly/Bimonthly Conference Calls/ Meetings

# Status of in country BOI studies

Time period	Country	Pop Survey Administration <sup>[1]</sup>		Laboratory testing (year)	Current Status and outstanding activities
		Survey (to capture high AGI season)	Survey (to capture low AGI season)		
2008-2009	St Lucia	April 2008 <i>Peak: week 12-15</i> <u><i>Survey: (Apr 28-May 3)</i></u>	Dec 2008 <i>Low: Weeks 44-50</i> <u><i>Survey: (Dec 8-13)</i></u>	April 2008-April 2009	? Completed, data to be analyzed ? Paper presented at CHRC 2009 ? Request for assistance to prepare country report
2008-2009	Grenada <sup>?</sup>	Feb/May 2009 <i>Peak: week 14-15</i> <u><i>Survey: Apr 12-18,</i></u>	Oct 2008 <i>Low: week 30-31</i> <u><i>Survey : Oct 12-18</i></u>	Oct 2008-Dec 2009	? Completed ? Paper presented at CHRC 2009 ? Country report received in May 2010 being reviewed by CAREC ? Abstract presented at ICEID 2010 ? Request by country for data to be disseminated in country ? Paper being written for journal
2008-2010	Trinidad and Tobago	Nov 2008 <i>Peak: week 46-47</i> <u><i>Survey Nov 9-15</i></u>	June 2009 <i>Low: week 25-26</i> <u><i>May 31-June</i></u>	Nov 2008-Dec 2009	? Completed ? Country report just received for review by CAREC ? Abstract to be presented at IUFOST 2010 ? Paper being written for CHRC 2010 ? Awaiting CAREC comments for data dissemination



2009-2010	Jamaica	February 21-March 7, 2009	June 14-27, 09	March 2009-2010	? Completed ? Preliminary report sent to PAHO in May 2010 ? Request for assistance to prepare final country report and write paper
2009-2010	Dominica	Feb-March 2009 Peak: week 8-9 ( <i>Feb 22-Mar 09</i> )	Aug 2010	March 09-May 09	? Ongoing ? Ist phase of pop study completed ? Next phase : Aug 2010 ? Report due Dec 2010
2009-2010	Guyana	June-July 2009 <u>Survey Mid August 2009</u>	Nov-December <u>Survey: Mid Nov2009</u>	August 2009-August 2010	? Lab study Ongoing ? Population surveys completed , data being entered ? Need assistance in data analysis ? Report due Nov 2010
2010-2011	Barbados	Feb -April 2011 Peak: week 12-13 ( <i>Mar 29-Apr 4</i> )	July –Aug 2010 Low: wk 30-31 ( <i>Jul 26- Aug 08</i> )	Aug 2010-Aug 2011	? To be launched on August 9-13 <sup>th</sup> 2010 ? Final protocol and IRB approval in July 2010 ? LOA being finalized and preparation being made ? Ist population study to be conducted on Aug 14-20 2010
2010-2011	Bermuda	Oct 2010 Peak: week <u>Survey (Oct 2010)</u>	Feb 2010 low: week 4-5 ( <u>Jan 25-31</u> )	Oct 2010-Oct 2011	<ul style="list-style-type: none"> <li>Initial meeting in June 2010</li> <li>Protocol being prepared</li> <li>Proposed date for ist survey and launch : October 2 010</li> </ul>

**Table 1 : Key Summary data from BOI population and laboratory surveys**

AGE population and laboratory surveys data	Range * (from 6 countries)
Survey Respondent /cooperation rate	65.8%- 99.95%
Monthly Prevalence of AGE	4.03%- 10.7%
Incidence/ episodes of diarrheal per person year.	0.52 -1.4 episodes /year
Duration of Diarrhea	1-20 days
Mean duration of diarrhea	2.1-3.8 days
Loss of productive days due to illness	1-20 days
Mean Loss of productive days	1.5-4 days

AGE population and laboratory surveys data	Range * (from 6 countries)
Ill persons sought seek medical care	15.4%-36%
Hospitalizations	0-14%
Stool specimens requested <i>from ill person</i>	12.5 %- 23%
Stools specimens Submitted for testing	1%-43%
Laboratory tested for AGI stool specimen	25%-95%
Proportion of Laboratory positive AGE specimen	8.5%-47%
Laboratory confirmed AGE reported to surveillance unit	11.8%-76.4%
Treatment of AGE with ORS	4.3%- 65%
Treatment of AGE with antibiotics	2.0- 41%
Hand washing before and after toilet use	21%-58%
Using soap to wash hands.	28-68 %

# Critical success factors

1. **Advocacy /sensitization msgs for stool collection**
2. **To doctors, health care workers** for enhanced stool collection from cases with diarrhea

- **To public:** to bring /request/give stool samples

1. Timeliness of Stool collection & transport to lab

2. **Enhanced Laboratory testing**

- Media and supplies
- Proper info on forms (onset, symptoms, age)
- Standardized methods

- 3 **Survey administration**

- Follow protocol
- Avoid bias (convenient sample)
- Visit homes when entire household is present

# Capacity building

- Created/strengthened the capacity in the design of country protocols,
- Strengthened laboratory diagnosis and identification of FBD pathogens;
- BOI data analysis workshop Improved specimen collection and transport,
- Data analysis and assessment of the evidence
- Intersectoral collaboration,
- Strengthening the health surveillance system in the countries.

# Impact

- Promotion of Interdisciplinary team work, communication and data sharing between lab, epi, env health and vet
- Gaps in surveillance system identified
  - Improvement in FBD surveillance (timeliness of reporting, coordination, response)
- Increase in lab capacity and better lab data
  - More etiologies, more labs, more accurate data
  - Computerized data collection and analyses
- Data on burden of AGI and economic costs
  - Evidence of the importance of FBD
- Data on risk factors for infection
  - Improve food safety measures
- Definition of new research lines
  - Attribution to the source of origin
  - Burden of disease (Dalys calculation)

# Future actions

- Complete on-going studies
- Data dissemination
  - Country reports
  - Peer reviewed papers: regional and country data.
    - Workshop at Guelph (PHAC-U of Guelph)
    - Journal articles (Infection journal)
- Knowledge translation
  - Workshop for social network mapping
    - PVS tool
  - Follow-up the workshop as part of PAHO BWP in 2011 and in the BWP12-13 for the Caribbean led by CAREC.

*Thank you*

