

# **Incidence of typhoid and paratyphoid fevers among adolescents and adults in Yangon, Myanmar**

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To Whare Whare o Otago

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Good afternoon everyone. Thank you for giving me opportunity to present at this conference . I am Win Thandar, Doctoral student from University of Otago, also faculty member from department of microbiology university of medicine 1, Yangon, Myanmar  
Today I am going to present a study on incidences of typhoid and paratyphoid fevers among adolescents and adults in Yangon, Myanmar.  
This is the first study that estimates incidence of enteric fever in Myanmar

## Background: enteric fever

- **Typhoid and paratyphoid fevers**
- **Globally, typhoid cause 11.8 millions illness, 128200 deaths in 2016** (GBD, 2016)
- **In Myanmar, small outbreaks of typhoid reported since 1989**
- **Few prevalence studies of Typhoid fever in Myanmar that published**

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As you all know, Enteric fever comprises typhoid fever and paratyphoid fever. Globally, In 2016, typhoid cause 11.8 millions illness, 128200 deaths. In Myanmar, small outbreak of typhoid have been reported since 1989.

### **Background: Source of transmission**

- **Yangon water supply (aging and low quality treatment)**
  - **Sewerage and drainage system – low service coverage and aging of collection system**
  - **Street vended foods may important vehicles (Lack of clean water sources and food safety knowledge weakness)**
- (Lin et al, 2014)

To the best of our knowledge, major source and modes of transmission of enteric fever in Yangon is unknown. But we believed that waterborne transmission plays important based on the data from others major cities of Asia.

According to YCDC (Yangon city development committee) report, water supply and sewerage systems in Yangon are aging and it have been operating more than 100 years. The ratio of chlorinated water volume over supplied water volume is only 25%. Service coverage in the existing sewerage system is merely less than 10%. There habitual flood occurs in most area of Yangon which worse the water population of the region.

Street vended food may play important role in diseases transmission. A study reported that most of street foods vendors in Yangon have poor knowledge of food safety and not assess to clean water sources.

We believed that all these situation may play important role in typhoid disease transmission.

## **Background: enteric fever**

- Consideration for **typhoid conjugate vaccine** implementation
- Need for improved **data on typhoid fever epidemiology**
- **No published data from Yangon region, Myanmar**

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For vaccine adoption and strategies in our country, improved and updated data on typhoid fever epidemiology is needed. However, to our knowledge, there is no data on incidence of typhoid and paratyphoid fevers in Yangon region, Myanmar.

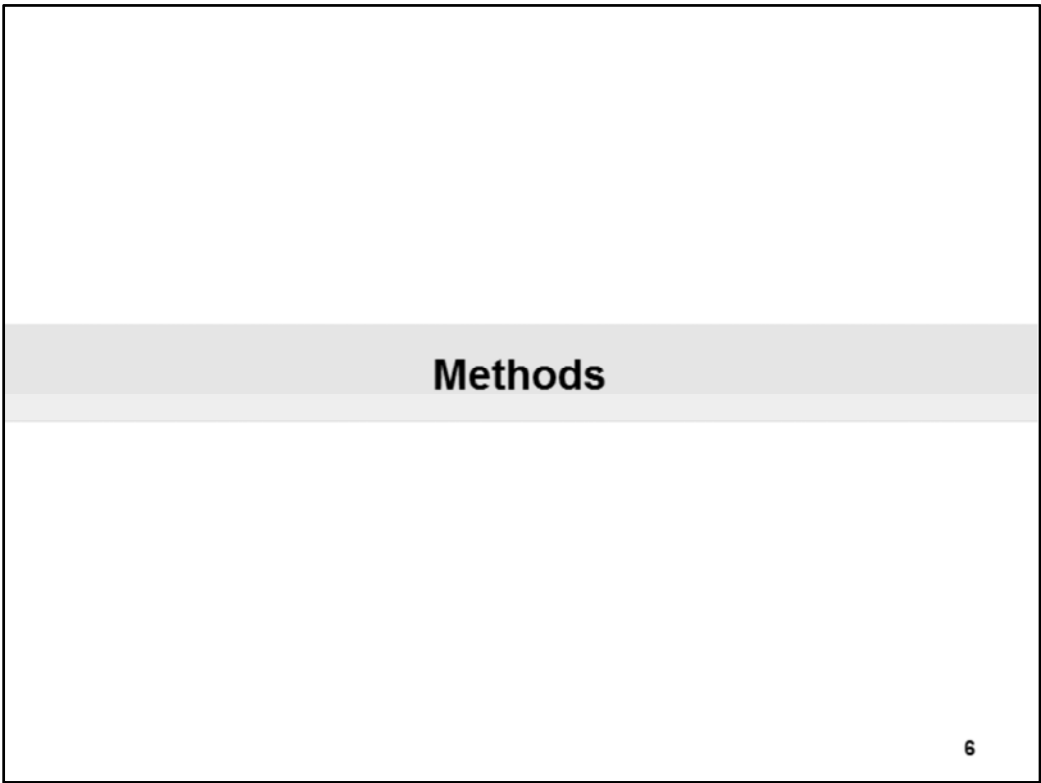
## Background: estimation of incidence

- **Active household surveillance** is difficult in limited resource areas
- **Combining sentinel hospital surveillance and healthcare utilization survey - an established method since 2008 for disease incidence estimation in low resources setting**

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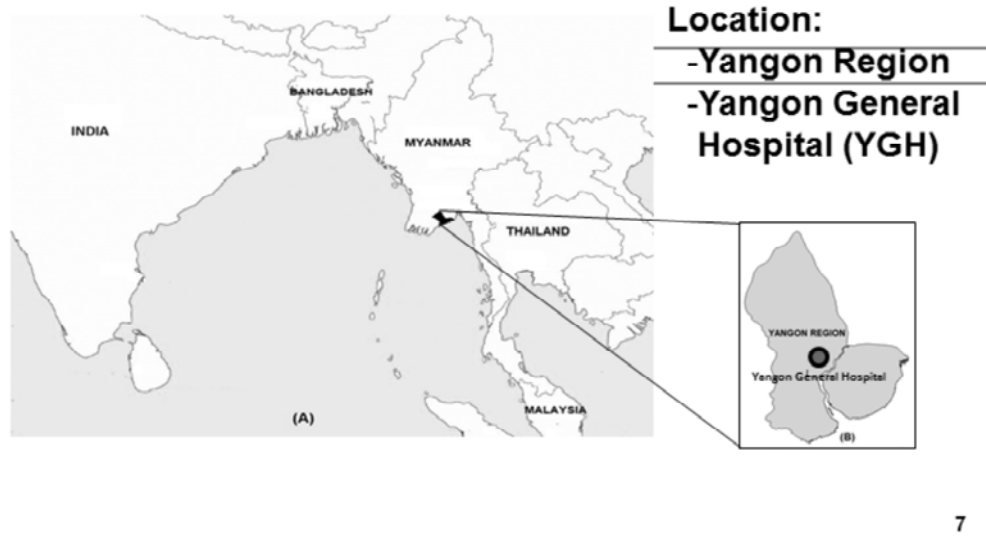
So, To estimate disease incidence in Myanmar, we use the establish methods which is combining sentinel site surveillance with healthcare utilization survey and because active household surveillance in the entire population is difficult in areas with limited resources like our country.

This method is establish method and use for estimation incidence of typhoid and other diseases since 2008.



Therefore, in order to estimate incidences of typhoid and paratyphoid fever in Myanmar, we choose study site to be .... (next slide)

## Map of South and South-East Asia showing Myanmar (panel A) and Yangon Region (panel B)



..... the Yangon Region because it is the most populous and most developed area in Myanmar and is also included in the catchment area of YGH. YGH is the tertiary referral hospital of the region.

For sentinel hospital surveillance, we used data from sentinel hospital surveillance study carried out at Yangon General Hospital during 2015-2016, and those from HCUS.

And incidences were estimated with the use of multipliers or multiplicative inverse of relevant proportions derived from these surveys.

## Sentinel surveillance study for enteric fever at Yangon General Hospital

- As part of a study of the etiology of febrile illness in Yangon, Myanmar
- **Study period:** 5 October 2015 – 4 October 2016
- **Study population:** adolescent and adult febrile patients  $\geq 12$  years old
- **Blood culture** was performed and incubated in a BacT /ALERT 3D machine and organisms were identified by Vitek 2 compact system
- ***Salmonella* serovars were identified by whole genome sequencing**

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- Sentinel hospital surveillance study was part of the study of etiology of febrile illness at the hospital, which detected bacteremic patients. Study period is from 5 October 2015 to 4 October 2016. YGH is only adults serving hospital which give healthcare to the patients who are 12 years and above. In the study, blood culture was performed and incubated in a BacT /ALERT 3D 60 and *Samonella* species were identified by Vitek 2 compact system. *Salmonella* serovars were confirmed by WGS.



## Healthcare utilization survey (HCUS), Yangon Region, 2018

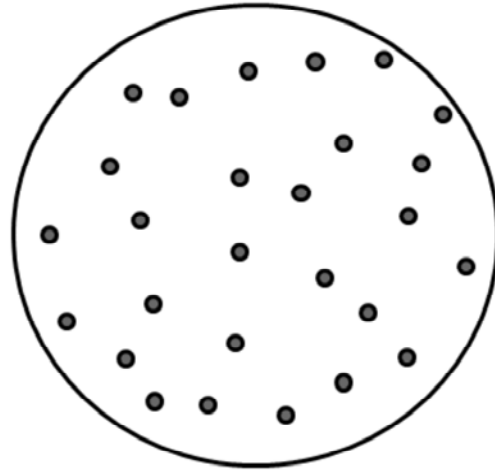
- **WHO Expanded Program of Immunization two stage cluster survey**

- **First Stage selection**

- 48 wards from total 689 wards of Yangon region

- **Second Stage selection**

- 336 households (1,598 household members) selected from 48 wards



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HCUS study design is WHO expanded program of immunization two-stage cluster survey design

The HCUS applied 2 stage-procedure.

In first stage ----- 48 wards were selected at random from total 689 wards of Yangon region based on 2014 census of Yangon region.

In second stage ----- 336 household with 1,598 household members were selected from those 48 wards by simple random sampling.

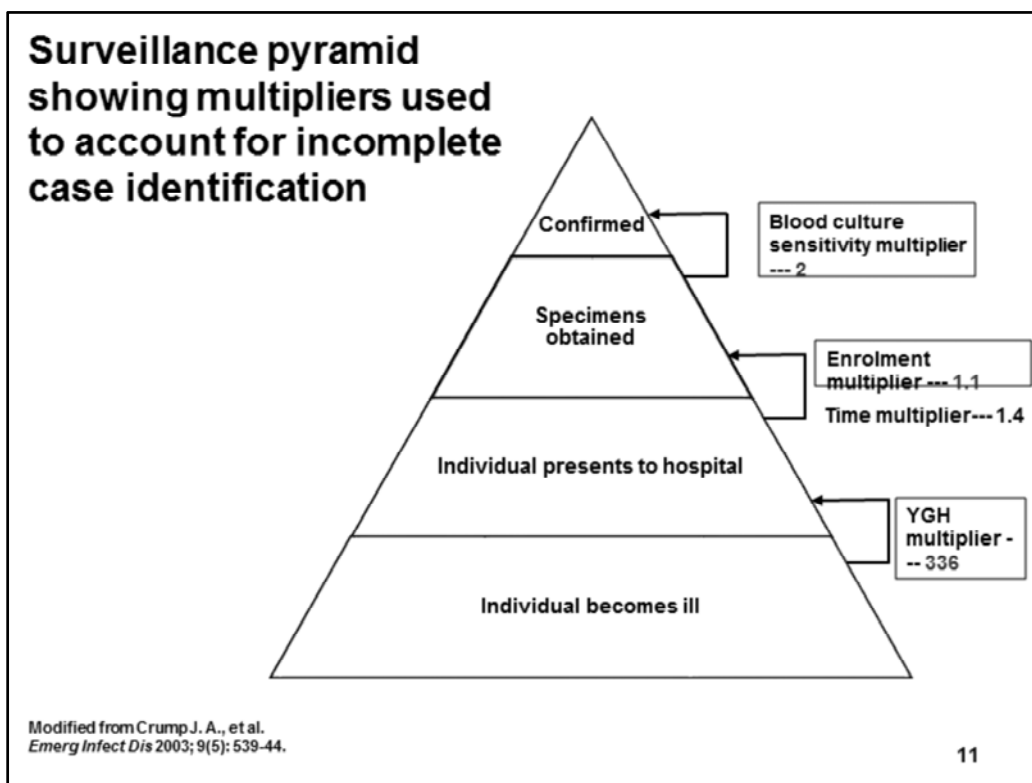
- **Key Questions from HCUS used for Incidence calculation**
  - **Usual healthcare seeking behaviour in the event of fever <3 days and  $\geq 3$  days duration**
  - **Actual healthcare seeking behaviour for fever**
  
- **Choices of healthcare facilities in case of fever:**
  - **YGH vs. Others**

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During HCUS, We asked questions to head of the household who is responsible for the decision making of health problem of the household member, on “healthcare seeking” ...

We asked questions..... separately about: (1) usual healthcare seeking behaviour in the event of fever <3 days and  $\geq 3$  days duration as well as with the second questions of (2) actual healthcare seeking behaviour of any individual household members experiencing fever in the past 3 months

Choices included YGH and others (such as public and private hospitals, health centres in Yangon, as well as drug shops, traditional healers, self-treatment, and nothing



This surveillance pyramid show types of multipliers derived from HCUS and sentinel hospital surveillance study:

At the top of pyramid, **sensitivity multiplier of 2** was applied to enteric fever confirmed cases to reflect sensitivity of single blood culture for diagnosis of typhoid and paratyphoid fever, estimated as 50% when compared to bone marrow aspirate culture

'**Time multiplier**' was calculated to account for enrolment occurring on weekdays of the week (ie. 5 of 7 days).

We included "**Enrolment multiplier**" was calculated to account for eligible patients who were not enrolled in the study for any reason.

'Based on responses from heads of households to healthcare utilization, "**YGH multiplier**" was calculated which represented the proportion of the people who use YGH in case of fever according to healthcare utilization survey.

## Results

## Multipliers based on responses to relevant questions in healthcare utilisation survey, Yangon Region, Myanmar, 2018

Age (years)	Households	YGH	YGH proportion	YGH multiplier
<b>Where household members would usually seek healthcare if they had fever of <math>\geq 3</math> days?</b>				
$\geq 12$	336	1	0.0030	<b>336</b>
12-19	148	1	0.0068	<b>148</b>
$\geq 20$	336	1	0.0030	<b>336</b>

Abbreviation: YGH=Yangon General Hospital

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This table shows the “YGH multipliers” calculated for the age of 12 years and above, 12-19 years, and 20 years and above. Among 336 households selected in all 3 age groups, only one head of the household chose YGH to seek for healthcare in the advent of fever of  $\geq 3$  days.

All 336 households have at least one member who was 12 year and above but for 12-19 year age group, only 148 household had at least one member who was between that age.

## Enteric Fever incidence estimates, Yangon Region, Myanmar 2015–2016

	Age (years)	YGH confirmed cases	Annual cases	Population	Case per 100,000 person year
<b>Enteric fever</b>	≥12	42	36,626	7,360,703	<b>498</b>
	≥12-19	13	4,815	1,131,867	<b>425</b>
	≥20	29	25,591	4,911,502	<b>521</b>
<b>Typhoid fever</b>	≥12	33	4,074	7,360,703	<b>391</b>
	≥12-19	11	19,414	1,131,867	<b>360</b>
	≥20	22	28,778	4,911,502	<b>395</b>
<b>Paratyphoid fever</b>	≥12	9	7,848	7,360,703	<b>107</b>
	≥12-19	2	741	1,131,867	<b>65</b>
	≥20	7	5,597	4,911,502	<b>114</b> <sup>14</sup>

Let me work you through enteric fever incidence estimated by our study, From sentinel surveillance study of CA BSI at YGH, 42 adolescent and adult patients were confirmed to have enteric fever with 33 cases of typhoid fever and 9 cases of paratyphoid fever

Applying multipliers, we estimated that, among 7.4 million Yangon population, the incidence of enteric fever among adolescent and adult populations in the Yangon Region as 498 per 100, 000 person year with typhoid and paratyphoid fever incidences as 391 and 107 per 100,000 person year respectively.

### Sensitivity analysis of enteric fever incidence estimate, Yangon Region, 2015-1016

	Age, years	Households	YGH% (95% CI with binomial exact)		YGH multipliers (95% CI)		Case per 100,000 persons (95% CI)
<b>Enteric fever</b>	≥12	336	0.3	(<0.1, 1.6)	336	(62, 12,444)	<b>92 - 18,429</b>
	≥12-19	148	0.7	(<0.1, 3.0)	148	(33, 493)	<b>95 - 1417</b>
	≥20	336	0.3	(<0.1, 1.6)	336	(62, 12444)	<b>96 - 19297</b>
<b>Typhoid fever</b>	≥12	336	0.3	(<0.1, 1.6)	336	(62 12444)	<b>72 - 14,480</b>
	≥12-19	148	0.7	(<0.1, 3.0)	148	(33, 493)	<b>80 - 1,199</b>
	≥20	336	0.3	(<0.1, 1.6)	336	(62, 12444)	<b>73 - 14,639</b>
<b>Paratyphoid fever</b>	≥12	336	0.3	(<0.1, 1.6)	336	(62, 12444)	<b>20 - 39,49</b>
	≥12-19	148	0.7	(<0.1, 3.0)	148	(33, 493)	<b>15 - 218</b>
	≥20	336	0.3	(<0.1, 1.6)	336	(62, 12444)	<b>21 - 4,221</b>

We have done one way sensitivity analysis, repeating our estimates of incidence for varying proportions of populations that would visit YGH with febrile illness.

We found out that annual incidence of typhoid fever ranged from 72 to 14480 cases per 100, 000 population and paratyphoid varied from 20 to 3949 cases per 100,000 population

## Conclusion

- **Enteric fever incidence among adolescents and adults in Yangon, Myanmar, exceeds 100 per 100,000 persons per year.**

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According to our study, enteric fever incidence among adolescents and adults in Yangon, Myanmar, exceeds 100 per 100,000 person year, it is the widely accepted threshold for “high” enteric fever incidence.

Incidence of typhoid and paratyphoid is usually highest among infants and children we believed that typhoid and paratyphoid fever incidence may be considerably higher among in children and infants more that what we observe in adolescents and adults in Yangon region



## Limitations of the study

- **Restricted to adolescent and adult age groups  $\geq 12$  years**
- **Incidence is usually high among infants and young children in endemic region**
- **Only small proportion of community members using YGH for fever that increase the uncertainty of our incidence estimate**
- **Explored and expressed in 1 way sensitivity analysis**

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There are some limitations in our study. Unlike studies from other countries, findings from our study were restricted to adolescent and adult age groups since we enrolled patients who attended YGH, which is an adult-serving hospital.

Incidence is usually highest among infants and children, but we could not include that age group in our study.

According to our HCUS, only a small proportion of community members use YGH for fever, which increases the uncertainty of our incidence estimate. Some of these things were explored and expressed in a one-way sensitivity analysis.

## **Future directions**

- **Incidence estimate in infants and children**
- **Future sentinel surveillance in wider range of healthcare facilities since YGH is not common type of healthcare seeking site**
- **Epidemiologic research is also needed to inform non-vaccine control measures**
- **Introduction of typhoid conjugate vaccine**

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Further research to estimate the incidence of typhoid fever among infants and children in Yangon is needed to inform the best strategy for typhoid conjugate vaccine use.

Future sentinel surveillance in wider range of healthcare facilities is recommended since YGH is not a common type of healthcare seeking site according to our healthcare utilization survey.

For control of enteric fever, more epidemiologic research is also needed to inform non-vaccine measures. Improved water and sanitation and infrastructure development are important.

In addition, introduction of typhoid conjugate vaccine to infants and young children should be considered in our country.

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