WASH & MDG5: Linking poor water & sanitation to maternal & newborn health and to maternal mortality

Oona Campbell
on behalf of
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MARCH centre for MATERNAL REPRODUCTIVE & CHILD HEALTH

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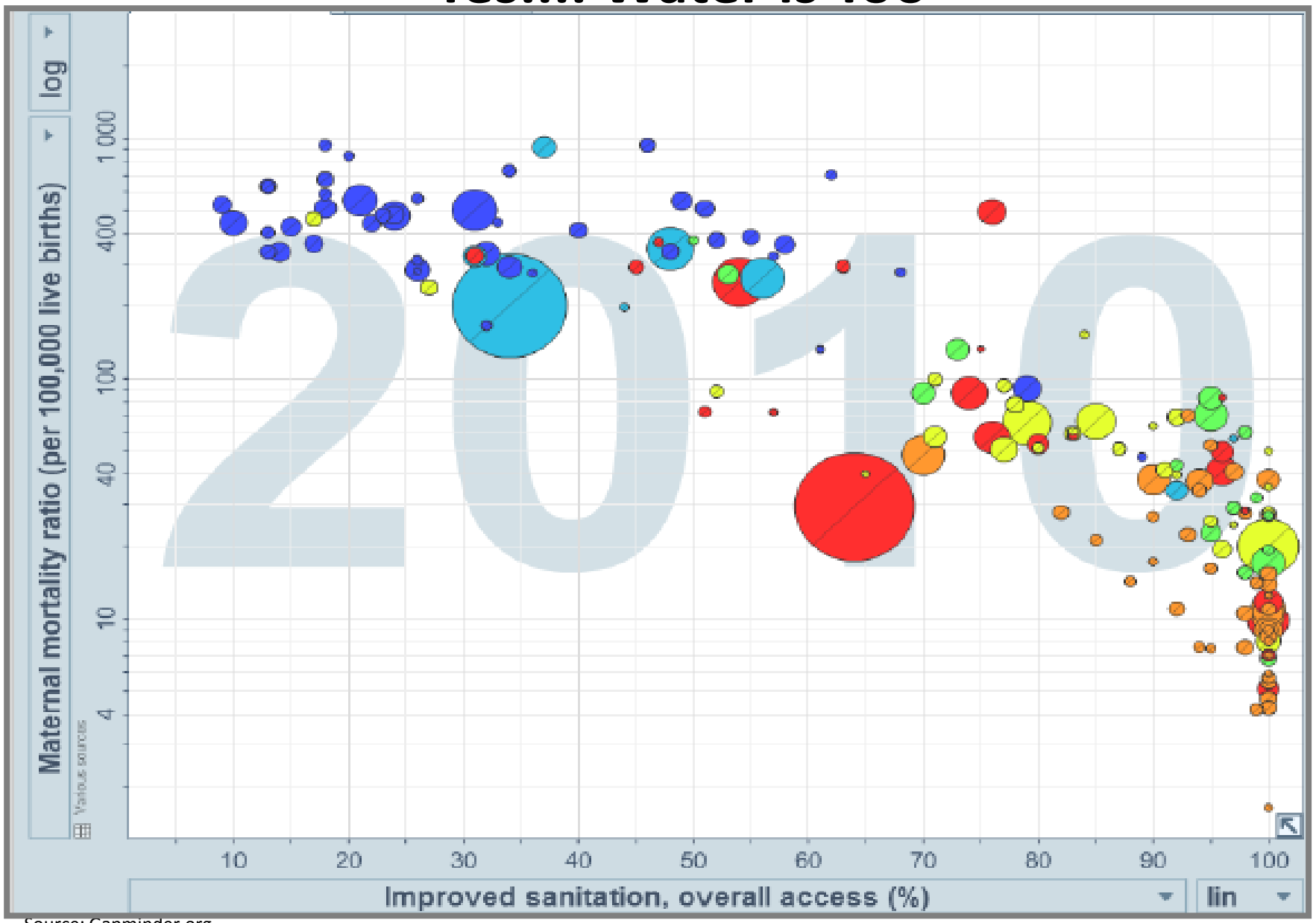
Is Sanitation correlated with Maternal Mortality?
Yes.... Water is Too



Source: Gapminder.org

Overview: Is WASH important for Maternal Health?

- **Conceptual framework**
- **Systematic review** of evidence on effect of water & sanitation on maternal mortality
- **Secondary data analyses** on effect of water and sanitation on maternal mortality

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Is WASH important for maternal and reproductive health?

Conceptual framework with three lenses:

1. WASH transmission (biological)
2. Life-course (long-term perspective)
3. Gender (biological, social and behavioural)

1. In the water

2. Behaviour & location

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A. In the water: Inorganic contaminants

Industrial Contaminants

- Metals (lead, manganese, mercury, potassium, thallium)
- Cyanide, selenium, sulphate
- Nitrates/nitrites
- Pesticides & herbicides
- Pharmaceuticals & personal care products (endocrine disruptors)

Naturally Occurring

- Arsenic
- Fluoride
- Salinity
- Hardness (Ca & Mg)

Deliberate additives

- Chlorine & by-products
- Fluoride

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B-D. In the water: Infectious agents

Water-borne

- Salmonella, Listeria, E Coli
- Hepatitis E
- Hookworm, other helminths, Toxoplasmosis

Water-based

- Schistosomiasis
- Tapeworm
- Guinea worm

Water Systems

- Legionellosis

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E-F. Behavioural aspects: infectious

Water-related insect vector borne

- Mosquito (Malaria, Dengue)
- Black flies (onchocerchiasis)
- Tse-tse flies (sleeping sickness)

Water-washed

- Wound infections (tetanus)
- Enteric infections
- Puerperal sepsis
- Respiratory infections (influenza)
- Skin, eye, ear infections
- Lice & flea-borne
- Rodent transmitted

Isolated water & sanitation facilities

Real or perceived availability or risk

Physical burden

Costs

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G-I. Behavioural aspects: non-infectious

Water-related insect vector borne

Water-washed

Isolated water & sanitation facilities

- Pests (insects, snakes)
- Drowning
- Perverts (harassment/rape)

Real or perceived availability or risk

- Fear, isolation & mental distress
- Reduction in drinking or eating
- Alcohol substitution
- Avoiding Education or Health facilities

Physical burden

- Water load (prolapse, spinal effects, calories)
- Handling faeces (infection)

Costs

- Time (opportunity costs, school dropout)
- Financial (buy/treat water, illness)

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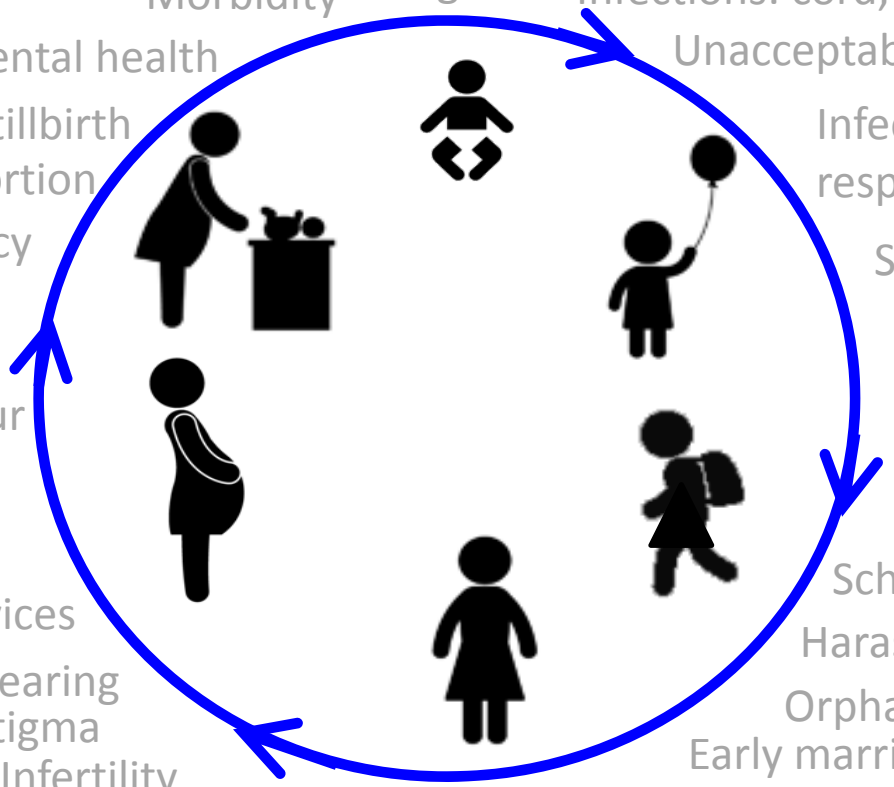
Life course perspective on potential impacts



Low birth weight
Morbidity
Infections: cord, skin & eye
Unacceptable child health services
Poor mental health
Stillbirth
Infections: enteric, parasitic, respiratory
Spontaneous abortion
Repeated pregnancy
Stunting
Maternal Death
C-section
Anaemia, rheumatic disease
Obstructed labour
Cognitive impairment
Cardiac disease
UTI
Anaemia
UTI
Unacceptable schools
Unacceptable ANC, delivery & PNC services
School absenteeism/dropout
Harassment, rape
Early childbearing
Orphans
Stigma
Early marriage
Infertility
Opportunity costs
Unacceptable FP services
Pelvic inflammatory disease
Spinal compression
Short adult
Prolapse
Caloric expenditure

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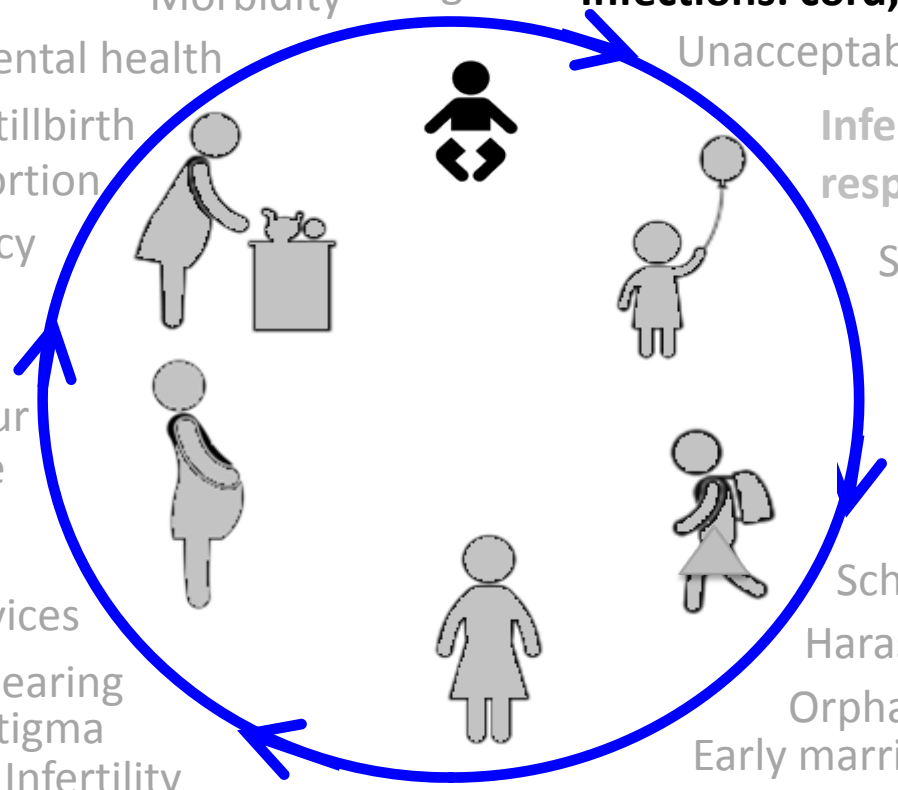
Infections



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Repeated pregnancy

Spontaneous abortion

Stillbirth

Poor mental health

Morbidity

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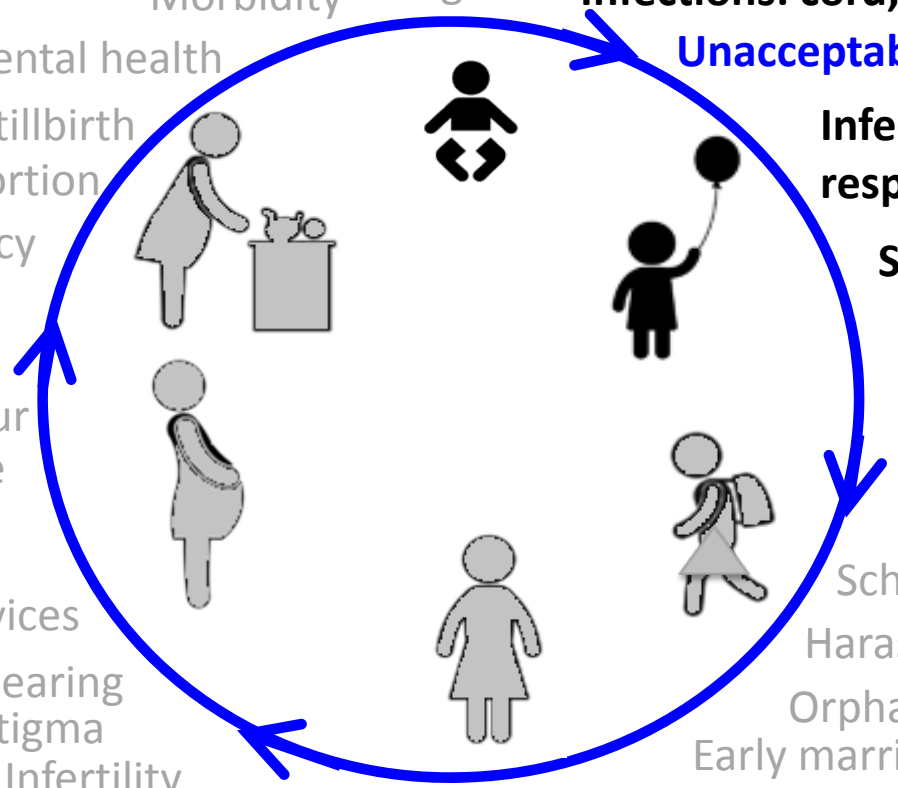
Infections → Stunting



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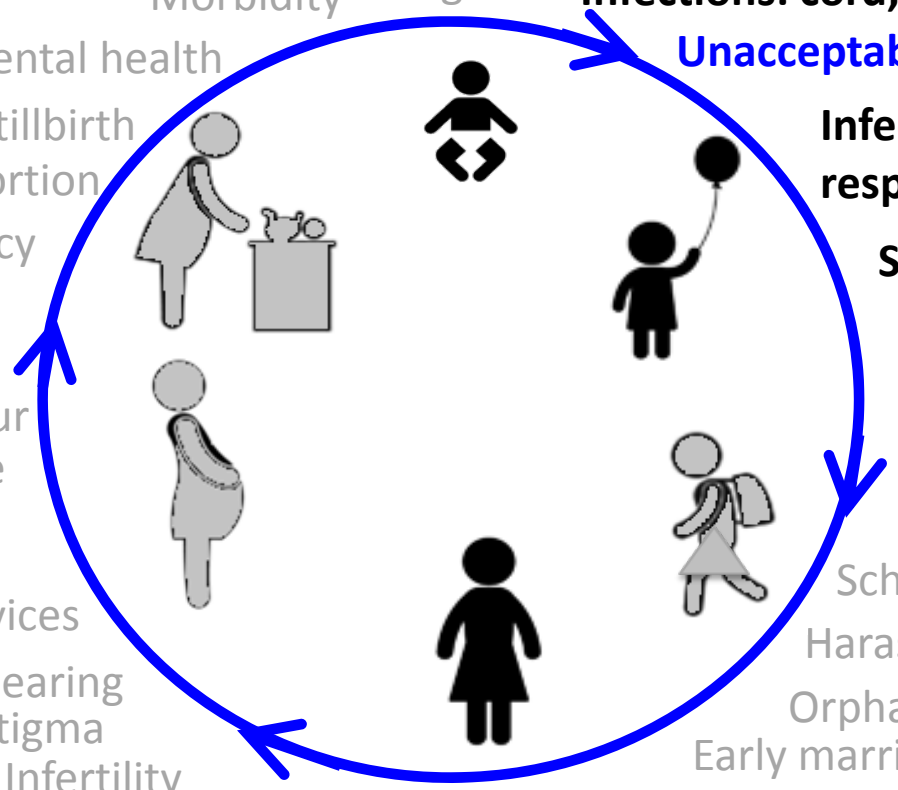
Infections → Stunting



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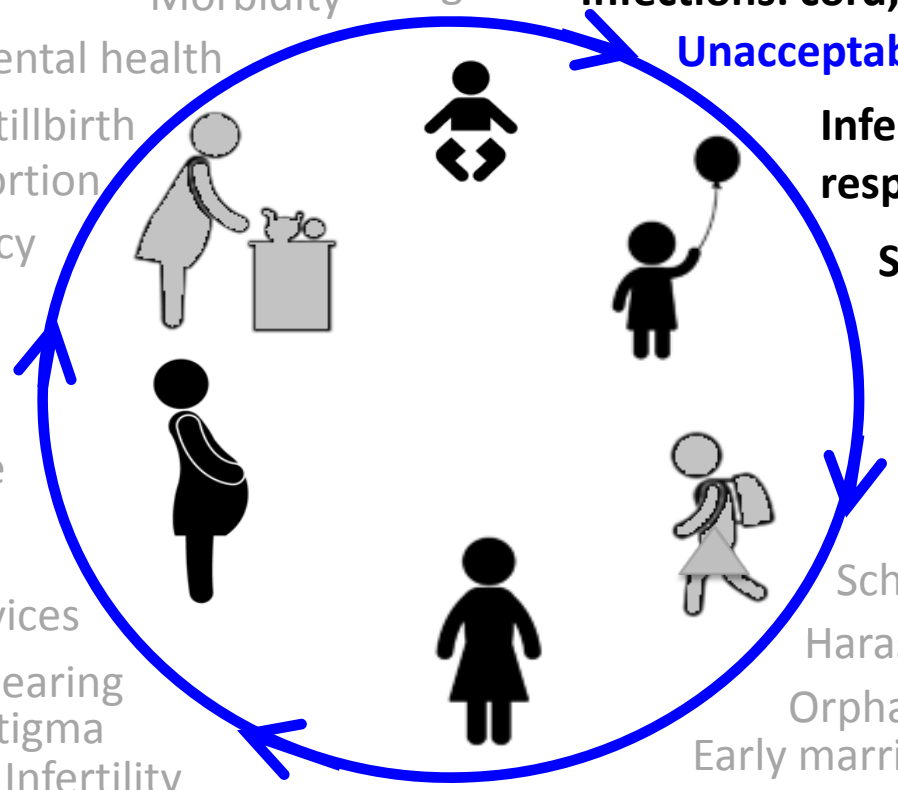
Infections → Stunting → Obstructed Labour



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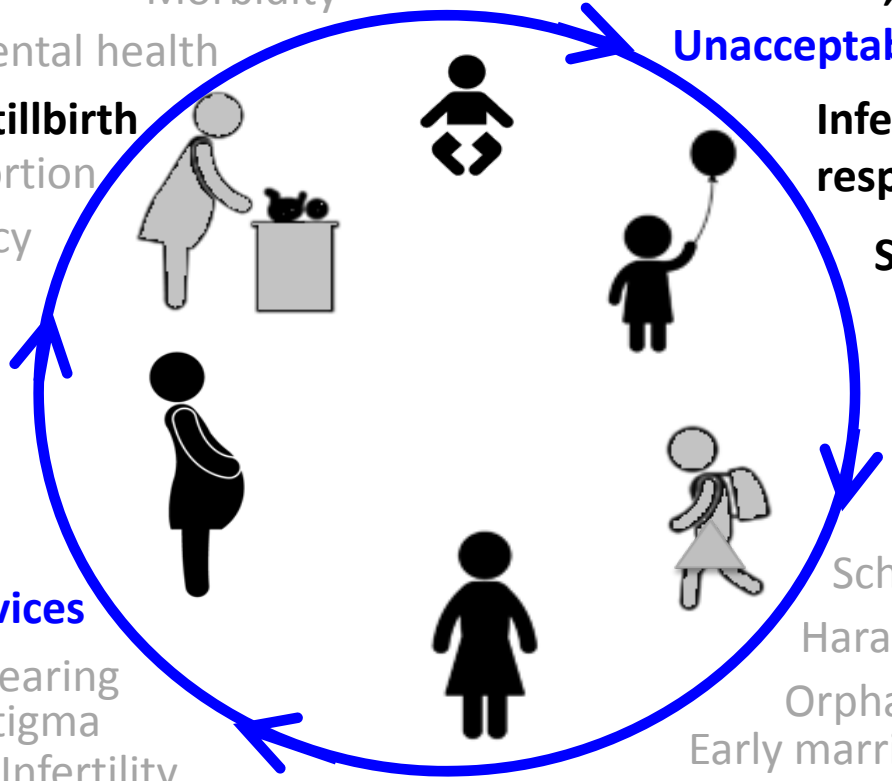
Infections → Stunting → Obstructed Labour → C-section or Maternal Death or Stillbirth



We found 67 potential biological/chemical linkages and 10 potential behavioural linkages

77 Systematic reviews needed!

Secondary analyses & new data collection needed too!

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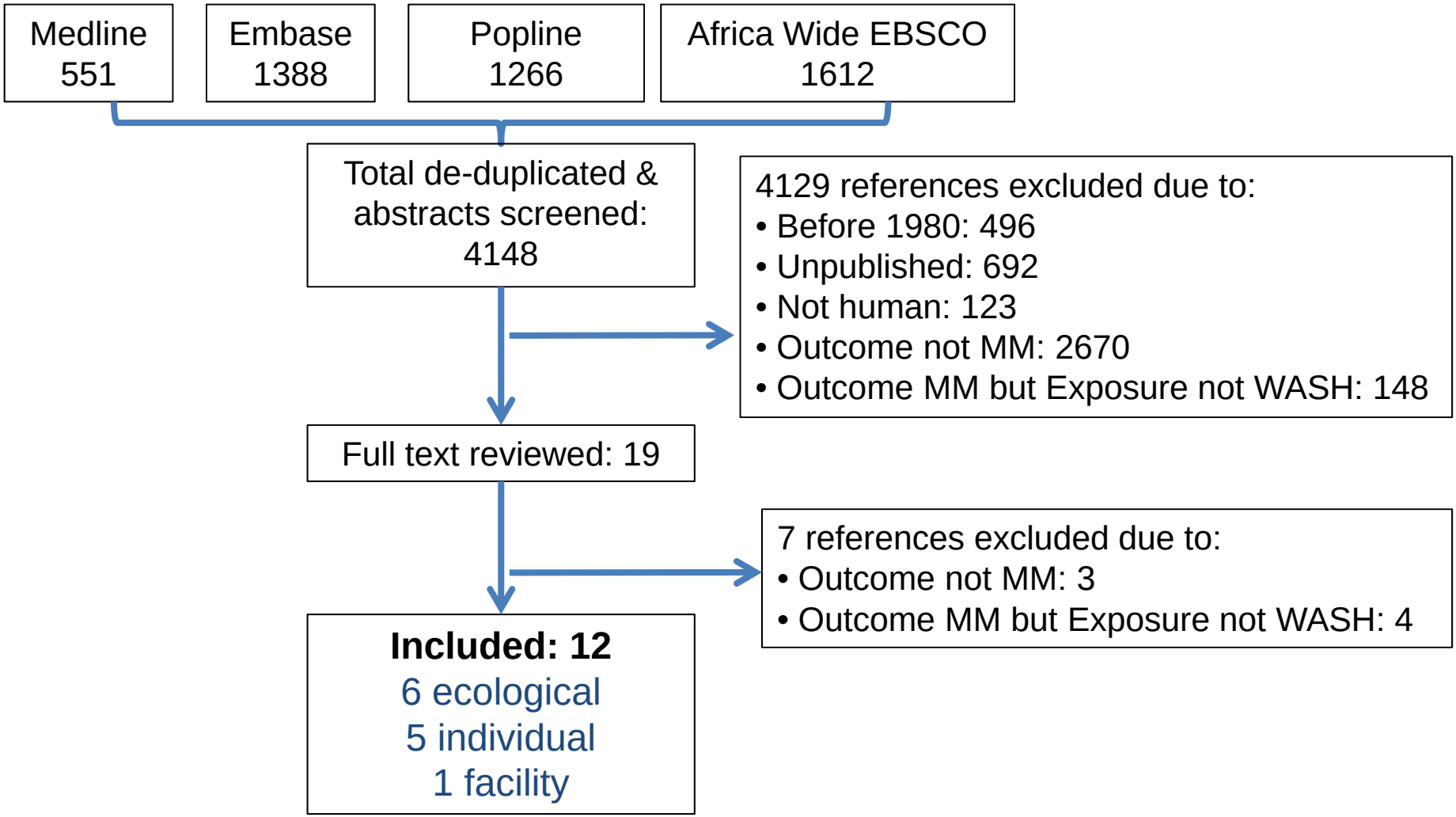
One of them: systematic literature review on maternal mortality

Medline, Embase, Global Health, Web of Science

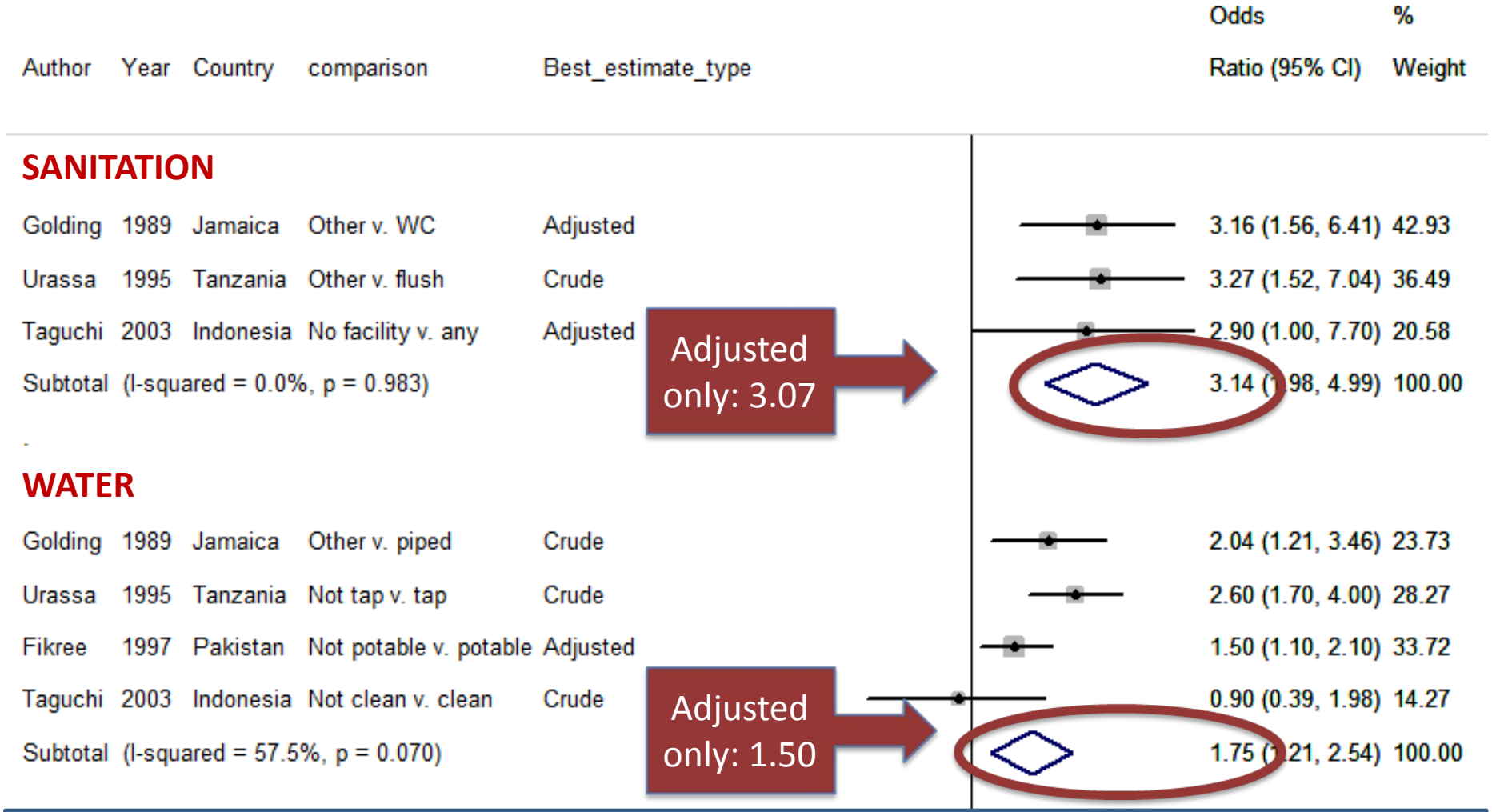


WASH & Maternal Mortality: ecological studies

Author, Year	Study sample/ year of data	Water	Sanitation	Confounders
Paul, 1993	36 African countries 1980-1987	% with access to safe water	NA	7
Hertz et al, 1994	55 countries no timeframe	% without safe water	% without excreta disposal facilities	6
Herrera et al, 2001	210 countries (final model 89) 1998	% with access to adequate amount of safe water (20 liters/day)	% with adequate extreta disposal	crude
Alvarez et al, 2009	45 sub-Saharan African countries 1997-2006	% with access to protected sources of water	% with access to sanitation	crude
Muldoon et al, 2011	136 countries MMR -2008; other- 2001-2008	% with sustainable access to water	% with sustainable access to sanitation	3
Cheng et al, 2012	193 countries MMR -2010; other 2008-2010	% with access to improved water source	% with access to improved sanitation	4

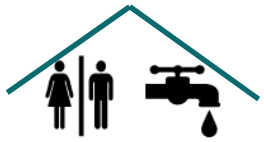
No effect Borderline Significant

Water & Sanitation and Individual Level Maternal Mortality Studies: Meta-analysis



We also see independent associations for analyses we have done in Afghanistan, Bangladesh and Pakistan

Our own secondary data analysis: Afghanistan



Main outcome: pregnancy-related mortality vs survived delivery and postpartum

Main exposures: household water sources & toilet facilities at the time of interview

- Joint Water Supply and Sanitation Monitoring Program classification *(JMP, 2011)*
- Binary (improved vs. unimproved) & ordered categorical (high, medium & low) to test dose-response

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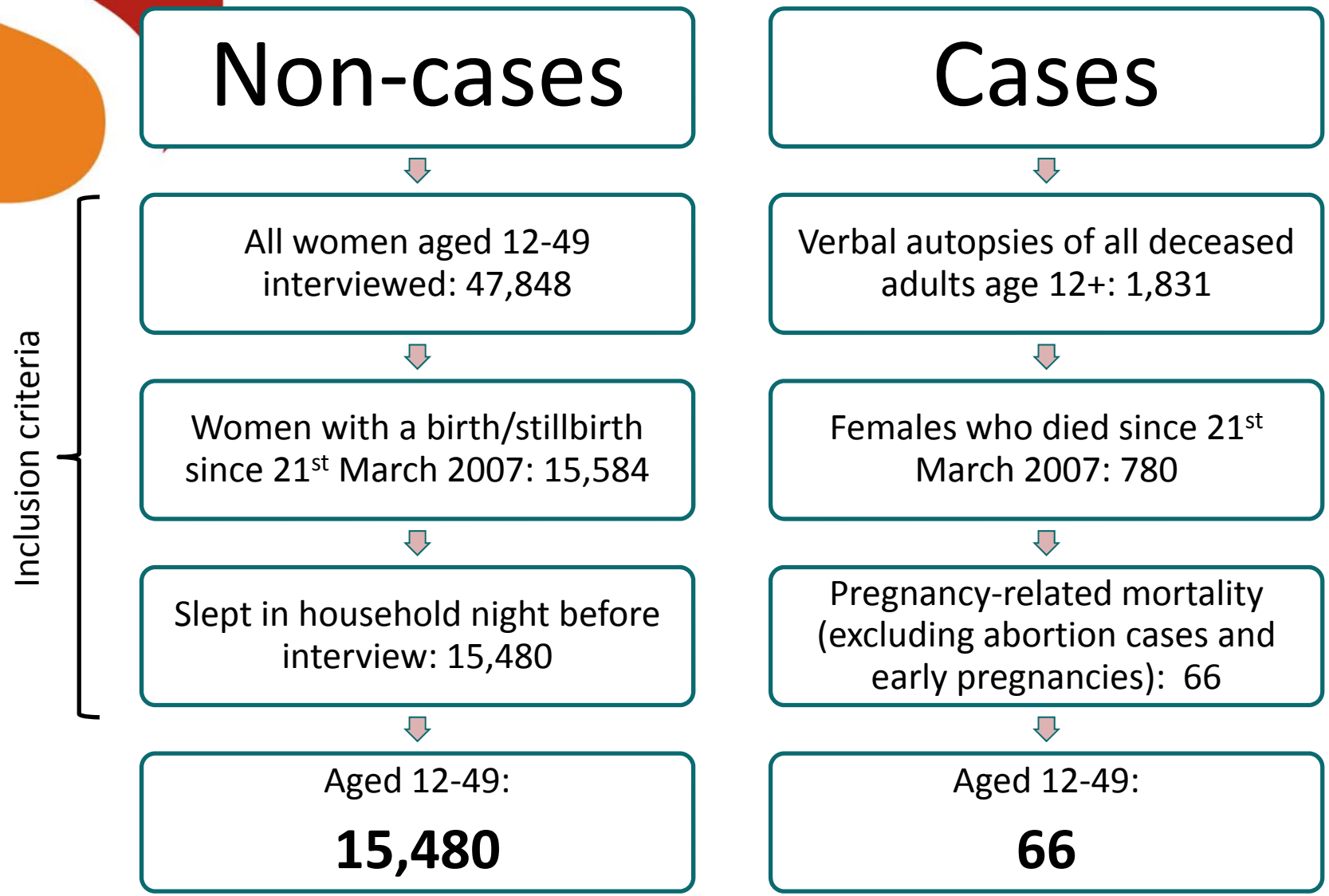

Comparable in all relevant aspects except dead/alive status

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Confounders adjusted for:
(potential alternative explanations)

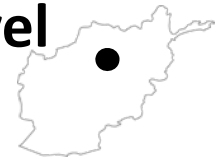
Individual level

- age
- current marital status
- education
- ethnicity of the household
- parity

Household level

- socio-economic position
- crowding

Cluster level



- place of delivery
- infrastructure quintile

Temporal & spatial characteristics

- woman's place of residence
- region
- year & season of delivery (non-cases) or death (cases)

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What do we see?
Overall association

Water Source: Adjusted OR=1.91 (95% CI 1.11-3.30); p-value=0.020

Toilet facilities: Adjusted OR=2.25 (95% CI 0.71–7.19); p-value=0.169

Adjusted for age, ethnicity, education, socio-economic position, crowding, place of delivery, infrastructure quintile, residence, season, year and region

No important changes when **sensitivity analyses** were run imputing missing parity values

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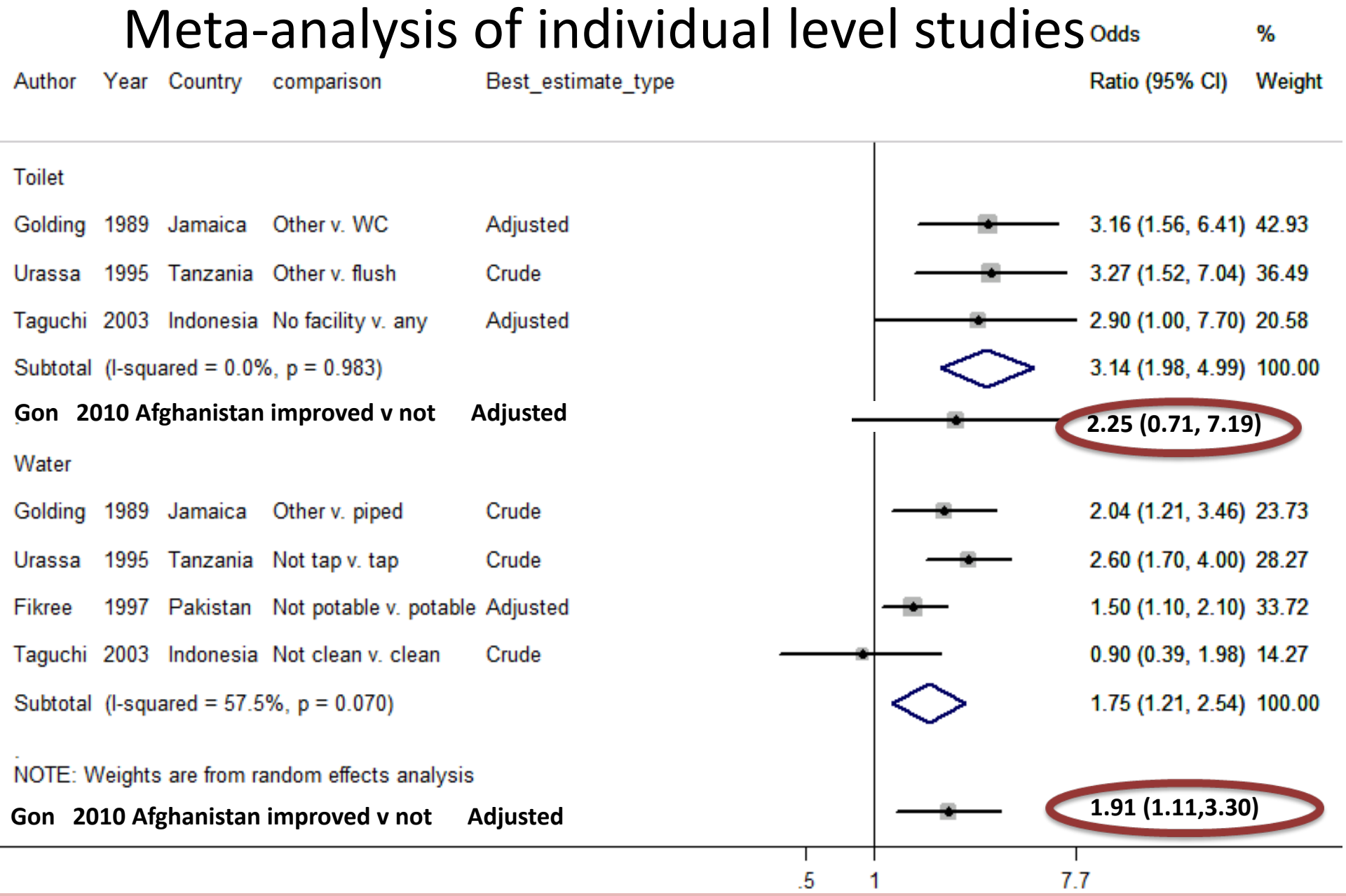
Meta-analysis of individual level studies



Adjusted for age, ethnicity, education, socio-economic position, crowding, place of delivery, infrastructure quintile, residence, season, year & region

Policy context: Bangladesh

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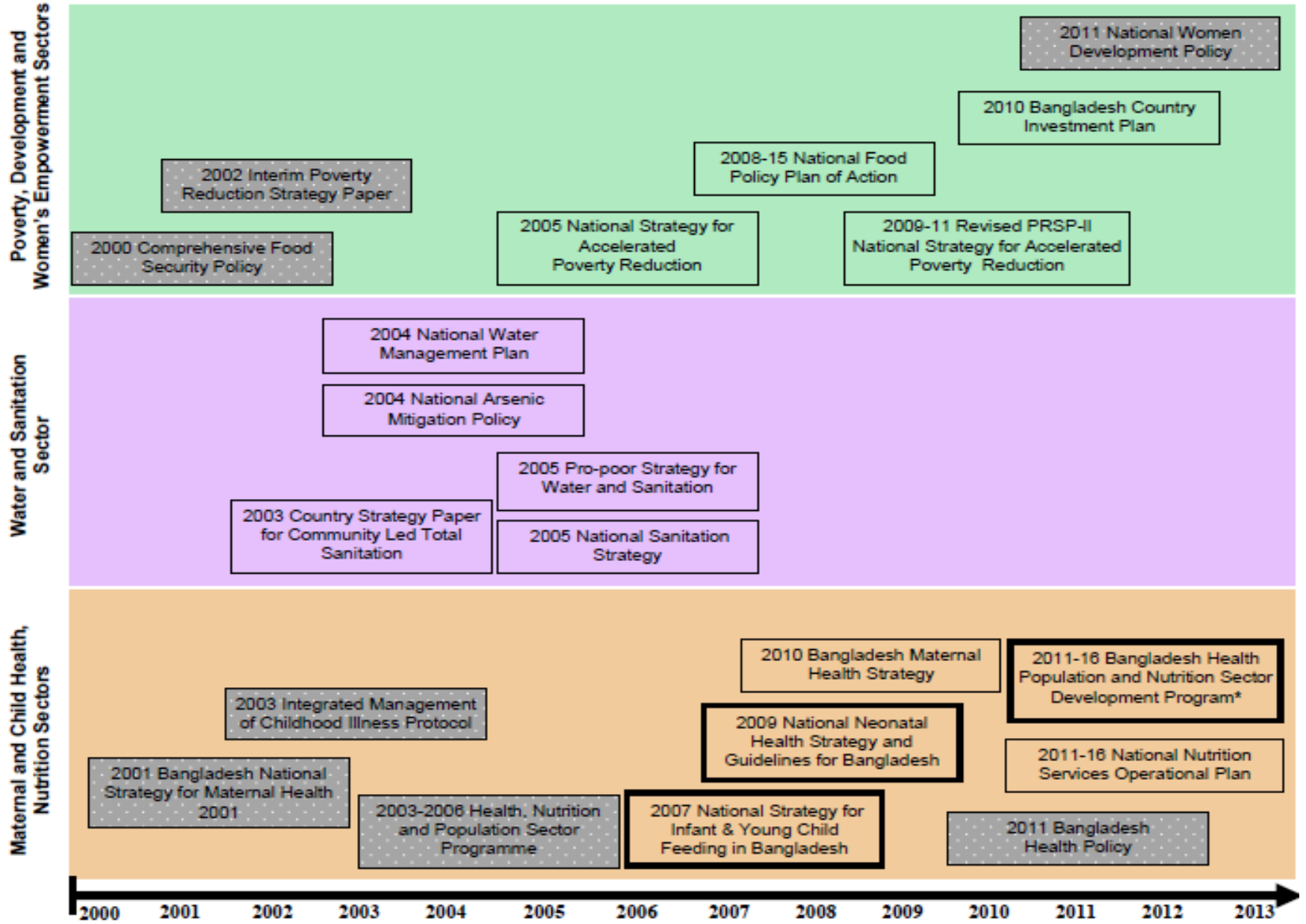
Poverty, Development and Women's Empowerment Sectors
2011 National Women Development Policy
2010 Bangladesh Country Investment Plan
2008-15 National Food Policy Plan of Action
2002 Interim Poverty Reduction Strategy Paper
2005 National Strategy for Accelerated Poverty Reduction
2009-11 Revised PRSP-II National Strategy for Accelerated Poverty Reduction
2000 Comprehensive Food Security Policy
Water and Sanitation Sector
2004 National Water Management Plan
2004 National Arsenic Mitigation Policy
2005 Pro-poor Strategy for Water and Sanitation
2003 Country Strategy Paper for Community Led Total Sanitation
2005 National Sanitation Strategy
Maternal and Child Health, Nutrition Sectors
2010 Bangladesh Maternal Health Strategy
2011-16 Bangladesh Health Population and Nutrition Sector Development Program*
2003 Integrated Management of Childhood Illness Protocol
2009 National Neonatal Health Strategy and Guidelines for Bangladesh
2011-16 National Nutrition Services Operational Plan
2001 Bangladesh National Strategy for Maternal Health 2001
2003-2006 Health, Nutrition and Population Sector Programme
2007 National Strategy for Infant & Young Child Feeding in Bangladesh
2011 Bangladesh Health Policy
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Thicker outline indicates cross-sectoral nature of policy document, including reference to both maternal/child health and water & sanitation sectors.
Grey shading indicates policy documents which were not accessed by the research team for full-text review.

Policy documents generally don't connect WASH & maternal health

WASH:

- Passing reference to improving MCH
- No advocacy for adequate WASH in health facilities (only bus stations, markets, schools & mosques)

HEALTH:

- 2007 *National Strategy for Infant & Young Child Feeding in Bangladesh*: drinking water for pregnant and lactating women
- 2009 *National Neonatal Health Strategy and Guidelines For Bangladesh*: soap and water for hand washing, water for mother and companion.
- 2011-2016 *Bangladesh Health Population and Nutrition Sector Development Program:* "facilities will be user and women friendly with adequate arrangements for female toilets, hand washing, water and sanitation."

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Our work so far

1. WASH and Maternal & Reproductive Health
   - Conceptual Framework paper published (open access)
2. Water & Sanitation and Maternal Mortality
   - Systematic Review published (open access)
   - Analyses of Afghanistan, Bangladesh & Pakistan completed
   - Afghanistan published (open access)
3. Policy case study for Bangladesh
   - Published (open access)
4. Water & Sanitation and Intrapartum Care
   - Signal functions paper published
   - Home and Facility births situation paper prepared
   - National assessment of Tanzania prepared; incorporated by E4A into national strategy

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What we know: Summary

- Plausible biological and social mechanisms link WASH with maternal health
- Poor water and poor sanitation environments are associated with higher maternal mortality
- Opportunities exist for improved synergy in policy domain
- High burden of poor water and sanitation in domestic and facility birth settings exists
- Existing evidence confirms that benefits of improvement may be substantial

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Burden of unsafe WASH in birth environment: Tanzania case study

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Kaosar Afsana, Giorgia Gon, Bruce Gordon, Moke Magoma, Joanna Esteves Mills

May 26, 2015

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Objectives

- Plausible biological and social mechanisms link WASH with maternal health
- Poor water and poor sanitation environments are associated with higher maternal mortality
- Opportunities exist for improved synergy in policy domain
- What is the burden of poor water and sanitation in domestic and facility childbirth settings?
- Highlight that benefits of improvement may be substantial

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Overview

1. Is WASH in childbirth settings a problem?
   - Domestic birth settings: 4 countries
   - Facility birth settings: Tanzania

2. Next steps toward WASH in facilities
   - Discussion – how do we prioritise WASH in healthcare facilities?

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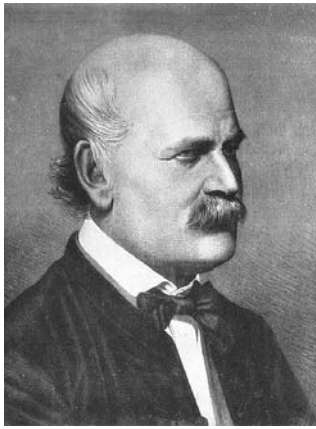
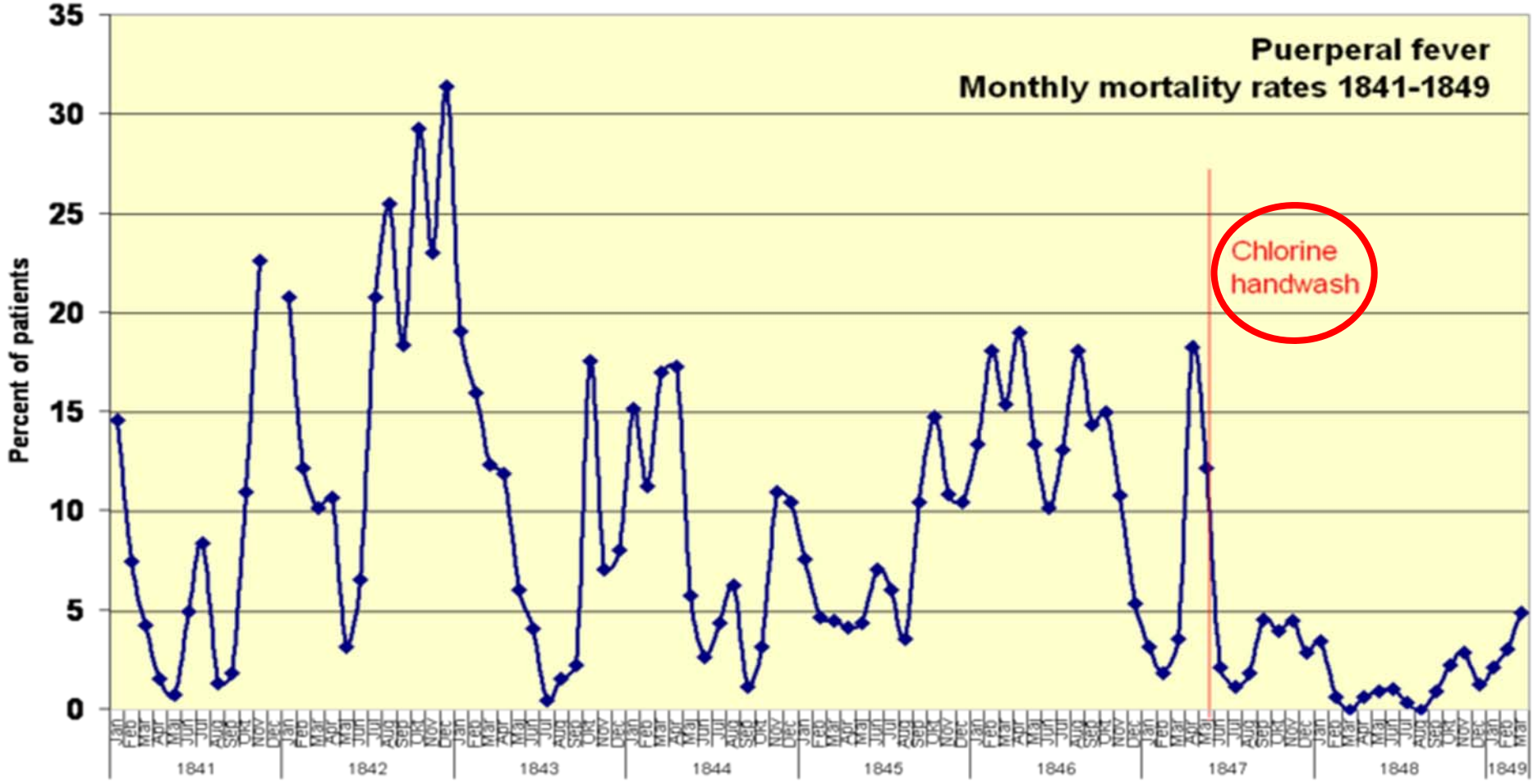
Historical case study

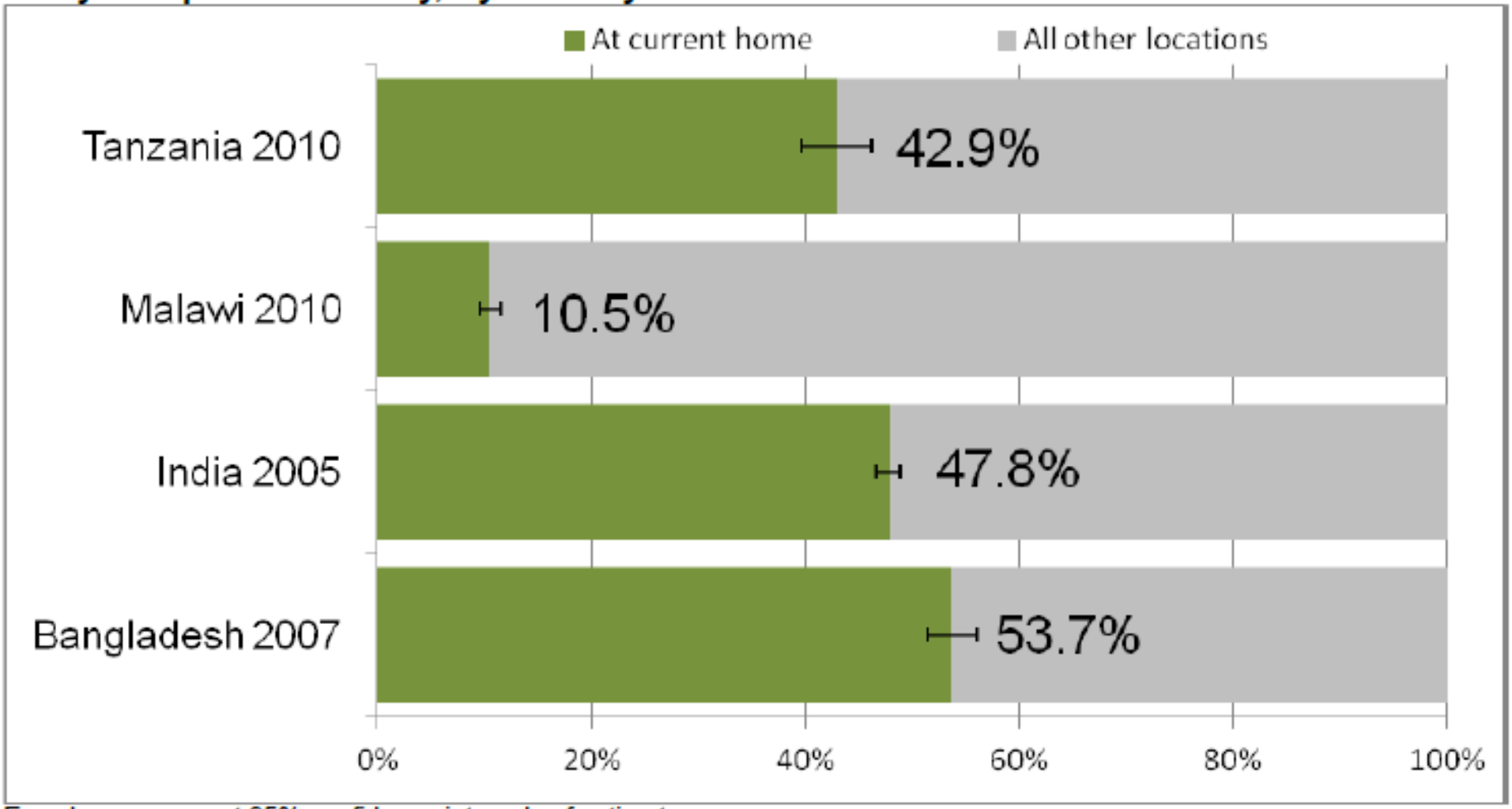


Poor hygiene in health facilities - Semmelweis 1847



Large proportions of births in homes

Figure 1. Proportion of births delivered in the current home among all live births in five years prior to survey, by country



Error bars represent 95% confidence intervals of estimates.

WASH Definition: domestic settings

UN (JMP) Joint Monitoring Programme definitions for 'improved':

1. 'WASH-safe' = improved water & sanitation
2. 'WASH-unsafe' = lacks either or both

Improved water source:
- Piped or protected well into dwelling, yard
- Public tap/standpipe or public well
- Neighbour's tap or borehole
- Rainwater or bottled water

Improved sanitation:
- Flush - to sewer, septic tank, pit latrine
- Pit latrine - ventilated improved pit (vip)
- Pit latrine - with slab
- Composting toilet

& is not shared

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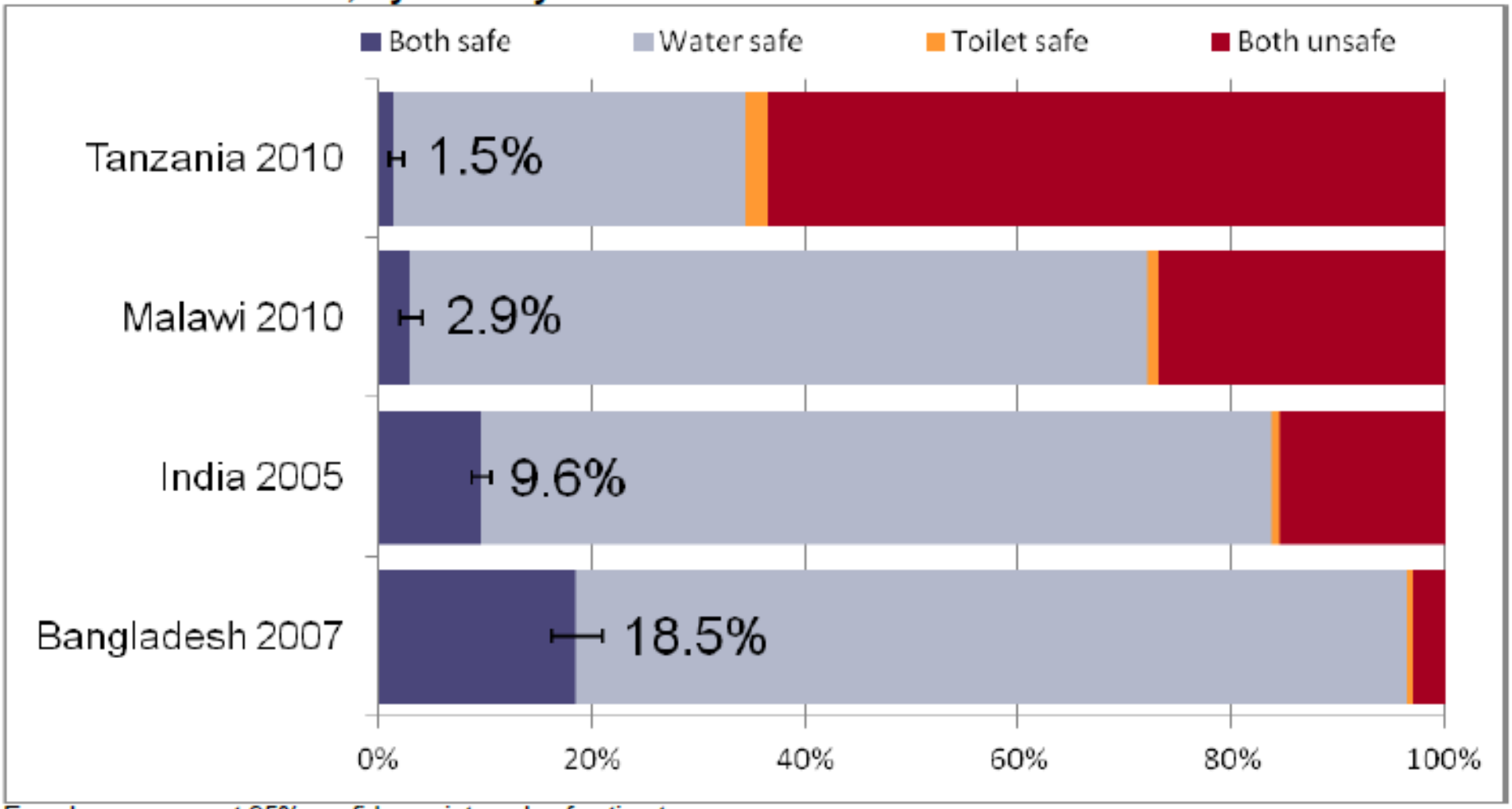
Poor WASH environment of domestic births

Figure 2. Proportion of births delivered at the current home by WATSAN environment of the current home, by country



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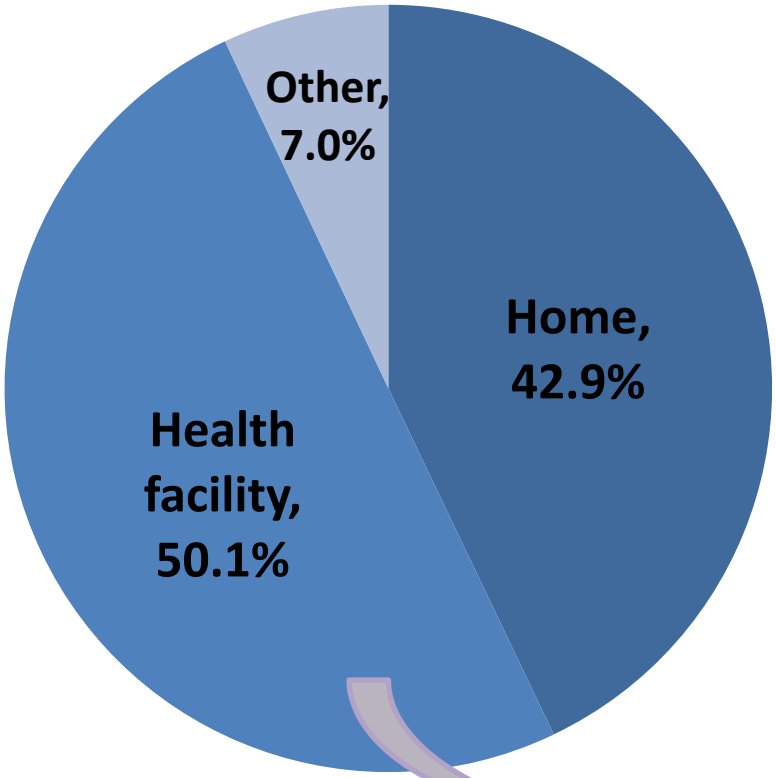
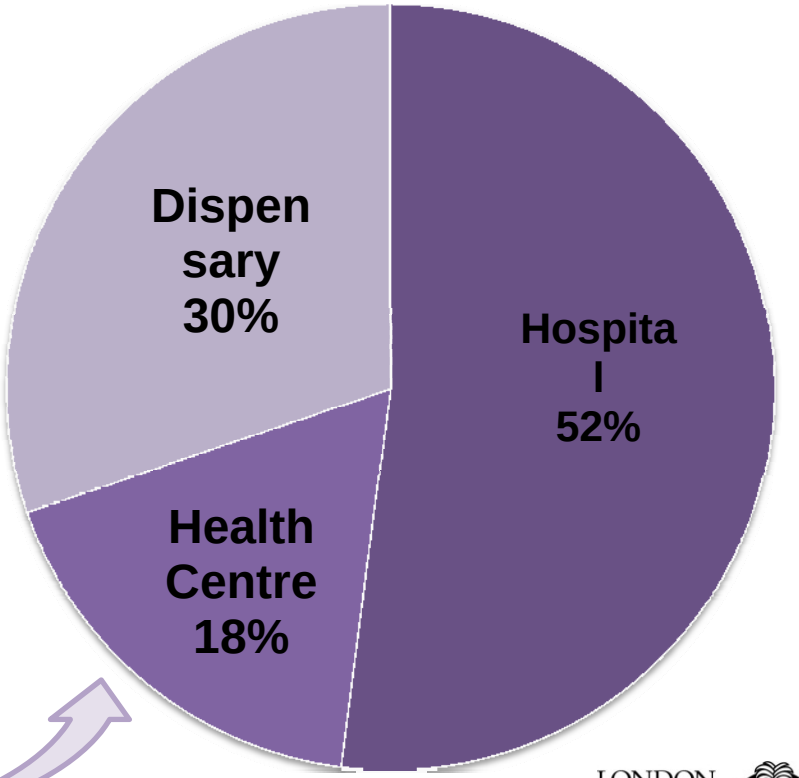
Tanzania case study:
Assess all births by WASH environment

Births by location



Facility births by facility type



n=8175, DHS 2010

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WASH Definition: facility settings

WASH-safe environment

Source of Data: Service Provision Assessment 2006

	FACILITY	DELIVERY ROOM
WATER	Piped from protected source, protected well or borehole **AND** Source on site (within 500m)	Facility water improved **AND** Delivery room running water: observed piped, bucket with tap **AND** Observed soap for hand-washing
	AND	**AND**
SANITATION	Functioning latrine for clients	Functioning latrine for clients

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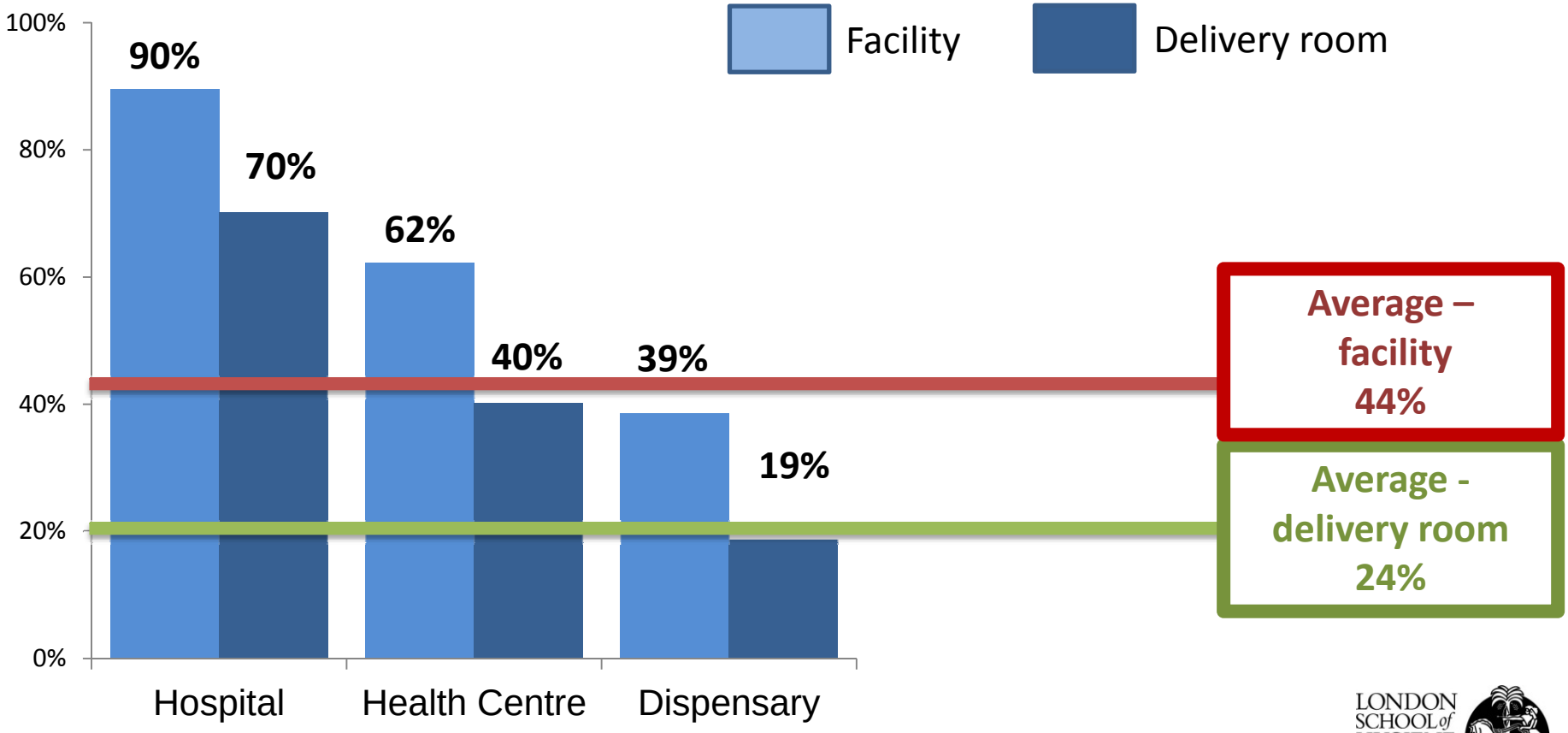
Facilities and their delivery rooms: % WASH-safe, Tanzania



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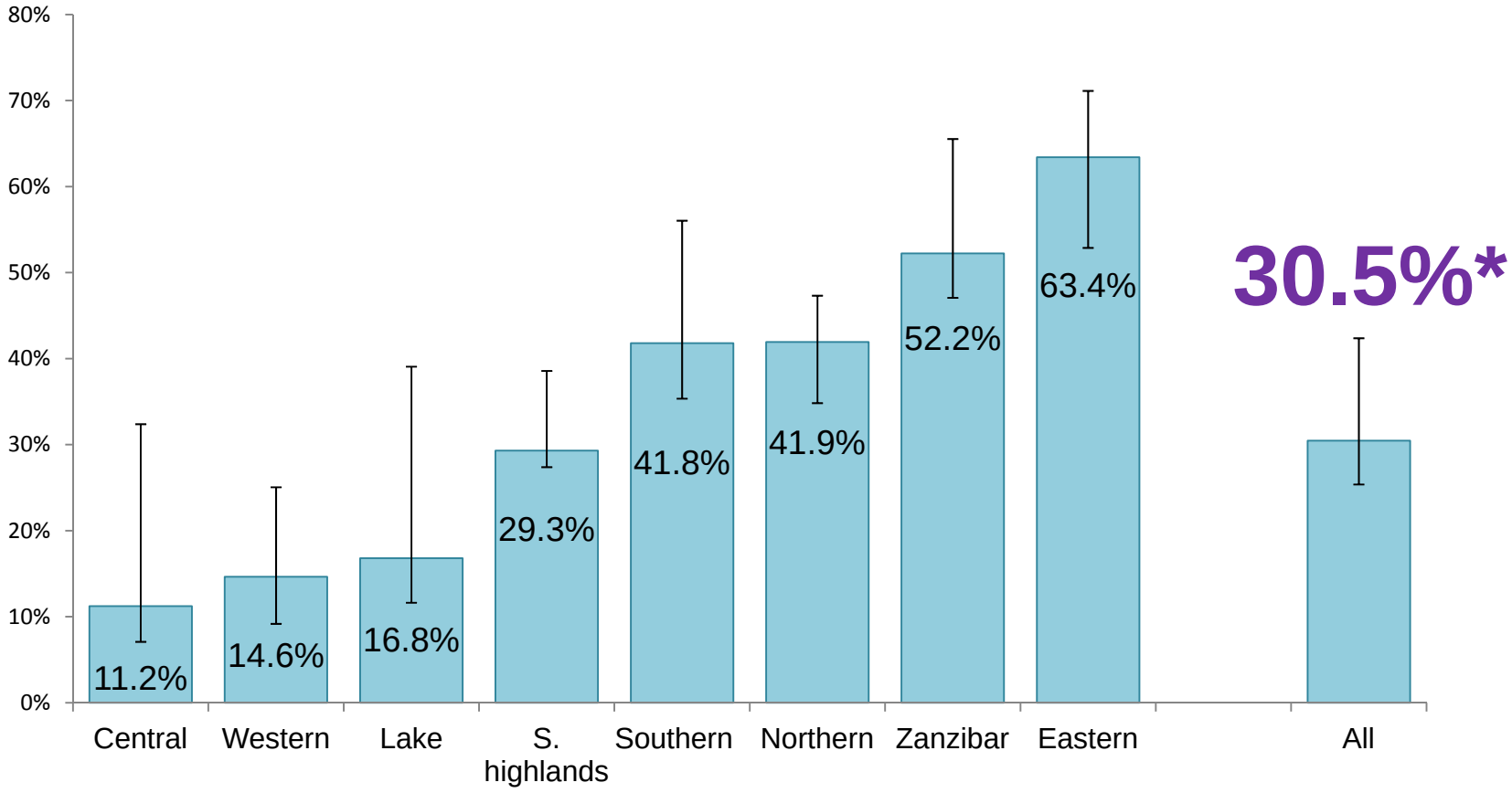
Tanzania: Less than 1/3 of ALL births in WASH-safe environment



*Range of uncertainty 25% - 42%

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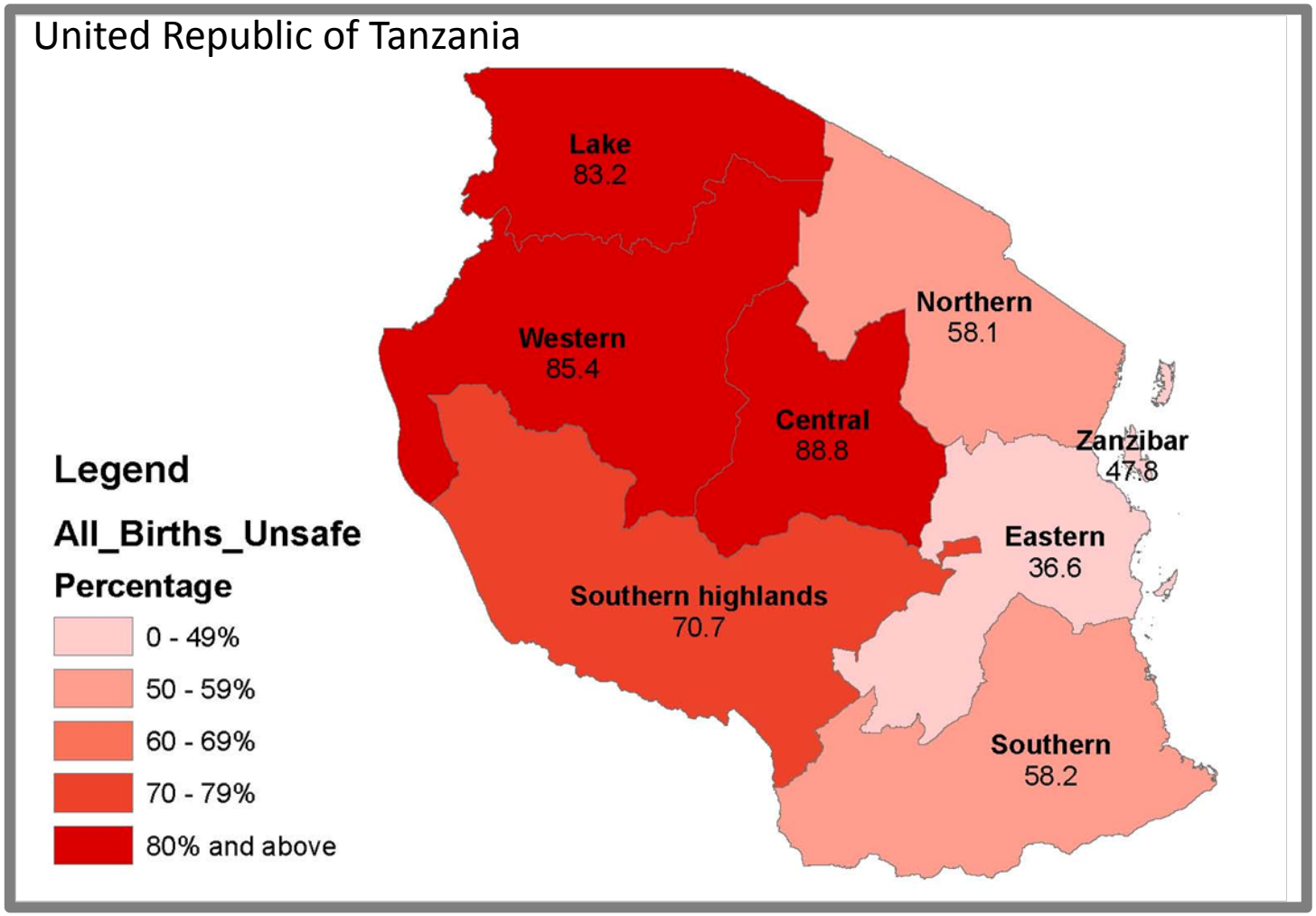
Geographic distribution:

% all births in WASH unsafe environments



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- High burden of poor water and sanitation in domestic and facility birth settings exists
- Benefits of improvement may be substantial

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Action Points

General:

- WASH & Maternal Health interface relates to many other big agenda issues
- Acts as an entry point & catalyst for joined-up thinking around quality of care, patient safety, women's empowerment, other non-health sector issues, etc. – many things currently being dealt with in silos

Policy:

- Ensure WASH and Health Policies synergize and specifically mention WASH in Health Facilities;
- Support WHO collaborative efforts to define adequate Facility WASH indicators and goals

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Action Points

Programmes:

- Support provision of facility-based Water and Sanitation

- WASH in facility based needs-assessments (SPA/SARA)
  - Definitions applied
  - Data available, updated, expanded (census/private)

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Action Points

Research:

- Support more research on links between WASH and maternal health

- Understand responsibilities and bottlenecks for sanitation in health facilities

- Increase understanding and channel action to improve hygiene on labour wards

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Thank you

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Acknowledgements

Supported by:

UKaid from the Department for International Development

This material has been funded by UK aid from the Department for International Development (DFID). However, the views expressed do not necessarily reflect the Department's official policies.

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Sanitation and Hygiene Applied Research for Equity

WASH as an Entry Point for Improving Maternity Services

Zanzibar Case Study

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Needs Assessment

Aim

To examine the **coverage** & **status** of WASH and IPC in maternity units across Zanzibar.

Goal

To **inform** MOH's wider improvement plans for WASH in maternity units across Zanzibar.

ZANZIBAR

- **3%** of the Tanzania's total population (**1.3 mil**)[1]
- **87%** popn = **Safe drinking water**
  - vs. 45% Tanzania mainland[2]
- **83.4% hsh = Basic sanitation fac.**
  - vs. 86.7% Tanzania mainland[2]
- **Facility delivery** = **49.2%**
  - vs. 50.2% mainland[3]

1. 2012 Population and Housing Census.
2. National Panel Survey 2012/13
3. 2010 Tanzania DHS

4 key partners supported the Zanzibar MoH to implement the WASH needs assessment

PHASE I
May – June, 2014

→

PHASE II
Aug – Sep, 2014

→

PHASE III
Nov, 2014

Facility questionnaire:

- All maternity units (n=37)
- Assess **Coverage** of WASH & IPC determinants.

In-Depth Assessment:

- 7 purposively sampled maternity units.
- Collect more in depth information on **Status** of WASH & IPC.
- Visual, photographs, microbiological swabs & water samples.

- IDIs with facility staff & clients.
- Key WASH & IPC challenges

Interpretation Workshop:

- Reflections on findings from phase I&II.
- Deciding on priority areas for improvement.
- Designing an improvement plan.

KEY FINDINGS

IMPROVED WATER SOURCE

- An **improved water source** was available in premises of all maternity units (n=37) i.e. tap water, protected well, borehole.

- However**, water interruption** main challenge
  - **86%** facilities reporting water **interruptions** at least once a month
  - **24% of PHC facilities** (n=29) > once a week
  - Interruptions **less often in bigger hospitals** (n=8)

WATER QUALITY

- **All 34 samples** of water taken from **hand washing stations** in 7 facilities (in-depth assessment) were **highly contaminated.**

Levels of bacteria, enterococcus and fecal coliform in hand-washing water (measured in colony forming units CFU/ML)

	0	1-10	11-100	101-300	300+	TOTAL
B.Count	0	0	13	17	4	34
E	11	10	13	0	0	34
F.C	26	8	0	0	0	34
TOTAL	37	18	26	17	4	102

- **All 9 water samples** from source of **drinking water** for clients **contaminated.**

Levels of bacteria, enterococcus and fecal coliform in drinking water (measured in CFU/ML)

	0	1-10	11-100	101-300	300+	TOTAL
B.Count	0	0	4	4	1	9
E	4	2	3	0	0	9
F.C	6	2	0	1	0	9
TOTAL	10	4	7	5	1	27

SOURCE OF DRINKING WATER FOR CLIENTS

- **Commonly** same source used for hand washing.

- Only 2 facilities visited had **special arrangement** of drinking water for clients.
  - Less contamin. = **26-45 CFU/ml**

HAND HYGIENE

- **Sufficient knowledge** on proper hand washing technique, even among cleaners.

- However, **limited supportive infrastructure** to put knowledge into practice.

- In **30% of PHCUs** there was **no functional hand washing stations** in the maternity area (n=29) .

- **Common source** of hand washing water in such maternity rooms.
  Principles of IPC ?

- **Soap availability good**
  - Only 2 facilities reported not having soap within the maternity unit.

IMPROVED SANITATION FACILITIES

- **All maternity units** had **at least one improved** type of a **toilet**.

- Major **challenges** however existed regarding;
  - Numbers,
  - Maintenance, including cleanliness

- **Insufficient** no. of toilets reported by **75%** of facilities (n=37).

- Only **12%** of toilets observed had a functioning **flushing system**.

At some visited maternity units, **cleanliness** of the **clients toilets** was **extremely poor**.

Three major challenges regarding proper maintenance of toilets (IDIs);

- **Shortage** of cleaners & WASH maintenance personnel.
  - Almost at all visited facilities
- **Cleaners** spent more time **doing clinical tasks.**
  - Including conducting deliveries (all PHCUs)
- **Poor women knowledge** on proper use of flushing toilets.
  - Frequently blocked toilets

Lack of Training in WASH

- NO training arrangement for newly hired cleaners.
  - Major IPC challenge due to cross contamination.

- Microbiology data revealed **highly contaminated surfaces.**
  - Swabs from patients lockers, door handles, tap handles etc. revealed high levels of **multiple organisms**, including **S. Aureus**.

Quality Improvement Workshop

3 days workshop

- Sharing Needs Assessment findings with the Minister of health.
- Discussions and reflections on the findings by MOH officials & research team.
- Identification of priority areas for action & developing action plans.

- Two action plans presented to the minister of health.
  i. Ensuring supportive infrastructures for hand hygiene.
  ii. Training package on proper WASH techniques for cleaners and other supporting staff.
- Implementation timelines Jan-Dec, 2015.

THANK YOU!