

**Understanding the Drivers of Child Mortality  
during and after Illness in Africa and Asia**  
*October 19, 2022*

# Speakers



**Ezekiel Mupere**

Head of the Department of Paediatrics  
and Child Health  
Makerere University, Kampala, Uganda



**Jay Berkley**

Professor of Paediatric Infectious Diseases  
University of Oxford & KEMRI/Wellcome  
Trust Research Programme, Kenya

# Panelists



**Ameena Goga**  
Pediatrician  
Child Health and Development Units  
Research Team  
WHO



**Shaffiq Essajee**  
Senior Advisor in HIV  
UNICEF



**Pavani Ram**  
Chief of Child Health and  
Immunization  
USAID

# Moderators



**Peter Waiswa**

Associate Professor  
Makerere University School of Public Health  
Global Health Division  
Karolinska Institutet



**Judd Walson**

Professor  
Global Health, Medicine (Infectious  
Disease), Pediatrics and Epidemiology  
University of Washington





## Childhood Acute Illness & Nutrition Network



# What is the problem?



Many children with acute illness in LMICs remain at high risk of death...  
... despite global reductions in child mortality

Anthropometry/clinical features predictive but don't indicate mechanisms and treatment

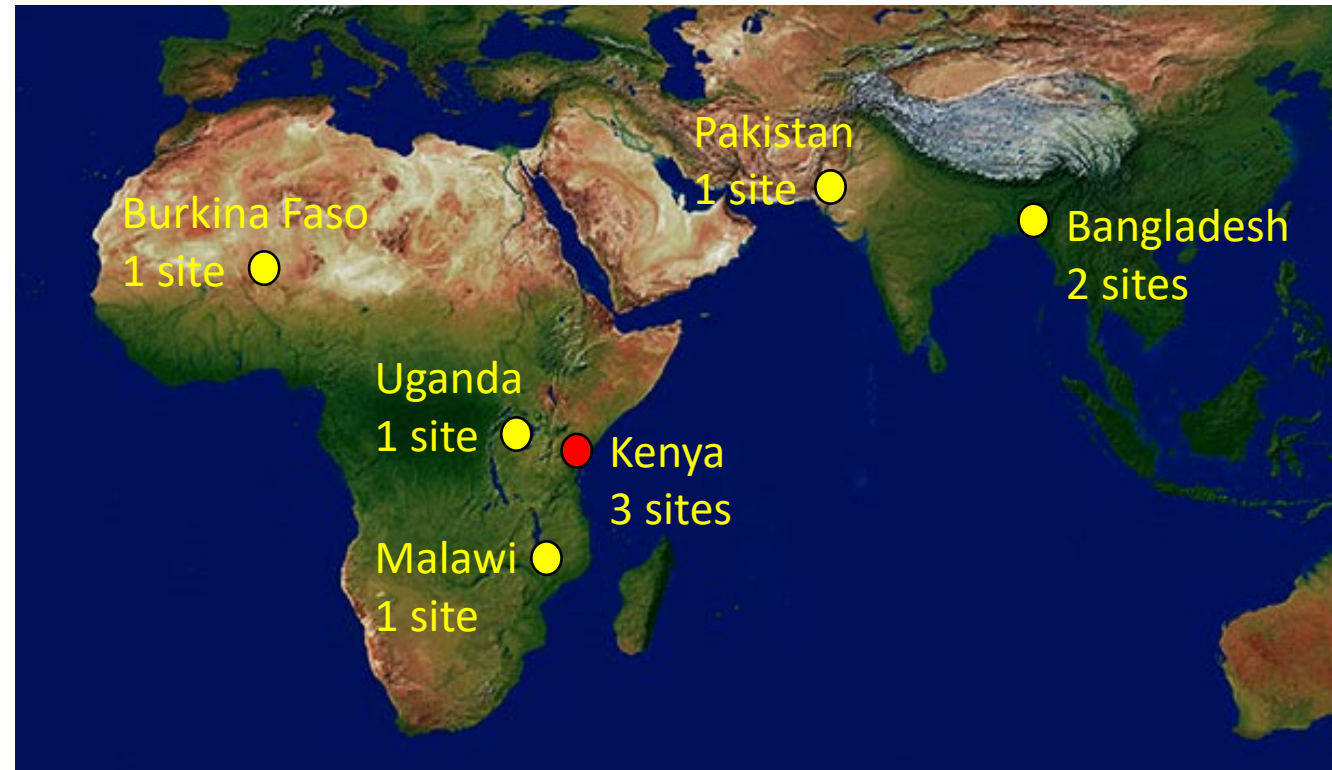
Emerging recognition of post-discharge mortality

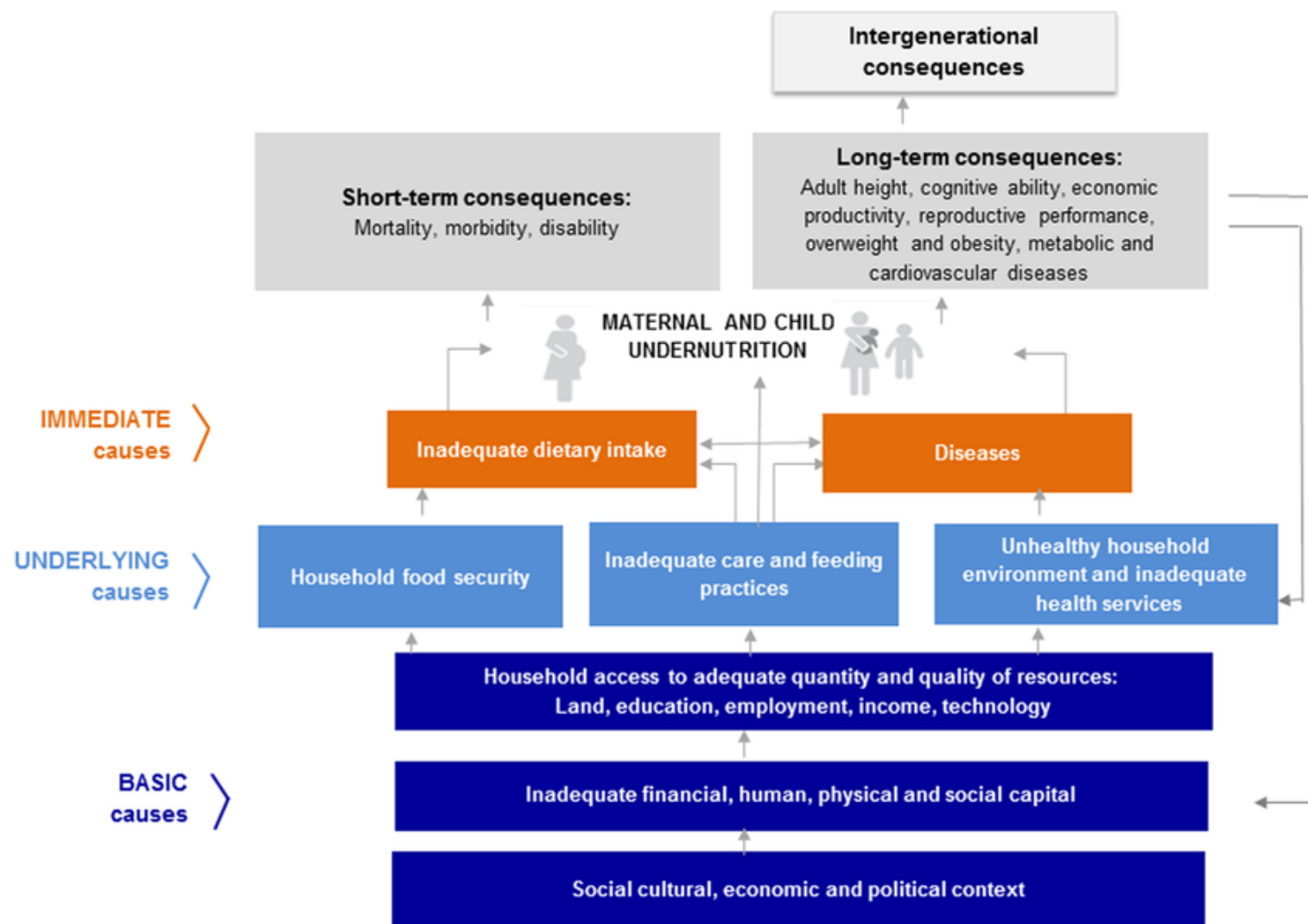




# The CHAIN Network

- Pathways leading to death
  - Clinical/nutrition/demographic
  - Social science
  - Systems biology
- Despite using guidelines
  - ...as far as possible
- Actionable interventions









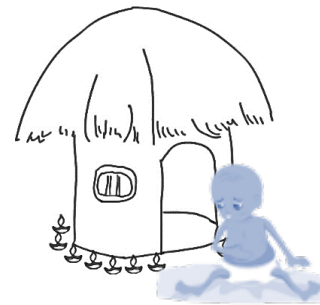
# CHAIN Cohort

Acutely-ill children aged 2-23 months → 3 strata by anthropometry

NW

MW

SWK



Home visit

Death → Verbal autopsy

**Admission**

Daily observation

**Discharge**

Disch.  
+ 45

Disch.  
+ 90

Disch.  
+ 180



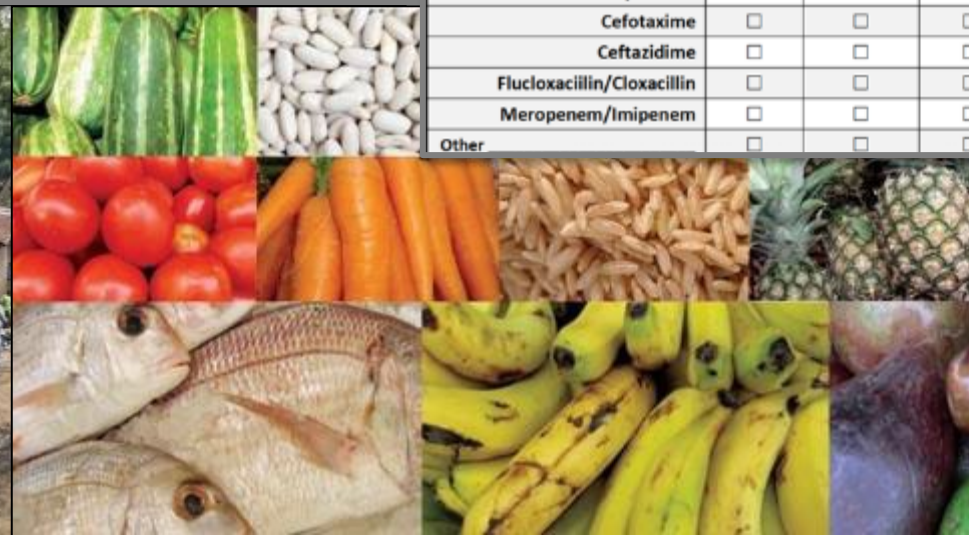
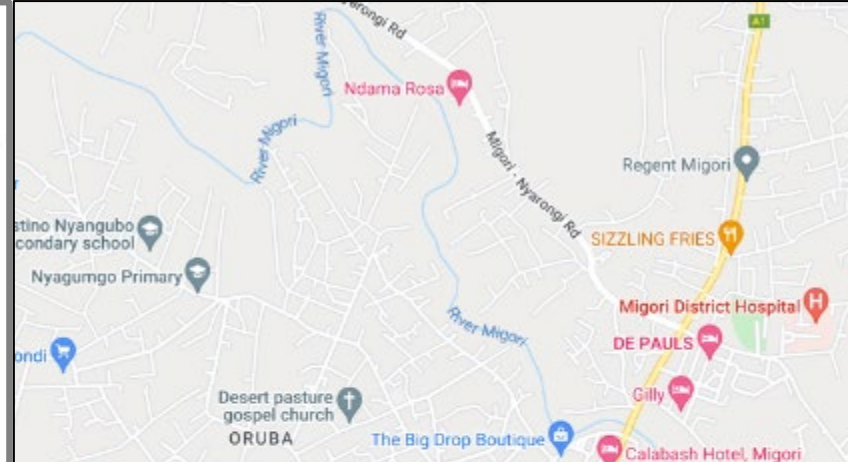
<b>Circulation:</b>	<input type="checkbox"/> >3s	<input type="checkbox"/>
Cap Refill (select one)	<input type="checkbox"/> Shoulder	<input type="checkbox"/> Elbow
Cold Peripheries (select one)	<input type="checkbox"/> Alert	<input type="checkbox"/> Voice
Disability:	<input type="checkbox"/> Normal	<input type="checkbox"/> Bulge
Conscious level (select one)	<input type="checkbox"/> Normal	<input type="checkbox"/> Hypertensive
Fontanelle (select one)	<input type="checkbox"/> Normal	<input type="checkbox"/> Dehydrated
Tone (select one)	<input type="checkbox"/> Normal	<input type="checkbox"/> Irritable
Posture (select one)	<input type="checkbox"/> Normal	
Activity (select one)		
Dehydration:	<input type="checkbox"/> Y <input type="checkbox"/> N	Skin turgor
Sunken eyes?		
Drinking/Breastfeeding (Select one)	<input type="checkbox"/> Normal	<input type="checkbox"/> Poor
Jaundice (Select one)	<input type="checkbox"/> Not jaundiced	<input type="checkbox"/>
	<input type="checkbox"/> Normal	<input type="checkbox"/>

Oxygen saturation now	___ %
Respiratory rate now	___ /m
Heart rate now	___ /m
AVPU now (circle)	A V P U
Temperature now	___ °C
In PICU/ HDU now	Y N
In a surgical or specialist unit now	Y N
Currently has an IV cannula?	Y N
Currently IV antibiotic 1 <sup>st</sup> /2 <sup>nd</sup> /3 <sup>rd</sup> line?	1 2 3
Currently anti-TB treatment?	Y N

Clinical Observations now									
Oxygen saturation now	___%	___%	___%	___%	___%	___%	___%	___%	___%
Respiratory rate now	___/min	___/min	___/min	___/min	___/min	___/min	___/min	___/min	___/min
Heart rate now	___/min	___/min	___/min	___/min	___/min	___/min	___/min	___/min	___/min
AVPU now (circle)	A	V	P	U	A	IV ANTIN			
Temperature now	___ °C	___							
In PICU/ HDU now	Y	N							
In a surgical or specialist unit now	Y	N							
Currently has an IV cannula?	Y	N							
Currently IV antibiotic 1 <sup>st</sup> /2 <sup>nd</sup> /3 <sup>rd</sup> line?	1	2	3	N	1				
Currently anti-TB treatment?	Y	N							
					<div> <div>Penicillin</div> <div><input type="checkbox"/></div> <div><input type="checkbox"/></div> <div><input type="checkbox"/></div> <div><input type="checkbox"/></div> <div><input type="checkbox"/></div> </div>				
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					<div> <div>Chloramphenicol</div> <div><input type="checkbox"/></div> <div><input type="checkbox"/></div> <div><input type="checkbox"/></div> <div><input type="checkbox"/></div> <div><input type="checkbox"/></div> </div>				

					IV ANTIMICROBIALS IN LAST 24H			
Penicillin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gentamicin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ceftriaxone	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ampicillin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Amikacin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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(e.g. augmentin) Co-Amoxiclav	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<div>PHQ9</div> <div> <div>1. Little interest or pleasure in doing things</div> <div>2. Feeling down, depressed, or hopeless</div> <div>3. Trouble falling or staying asleep, or sleeping too</div> </div>			
Chloramphenicol	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
Cefotaxime	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
Ceftazidime	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
Flucloxacillin/Cloxacillin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
Meropenem/Imipenem	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
Other	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				

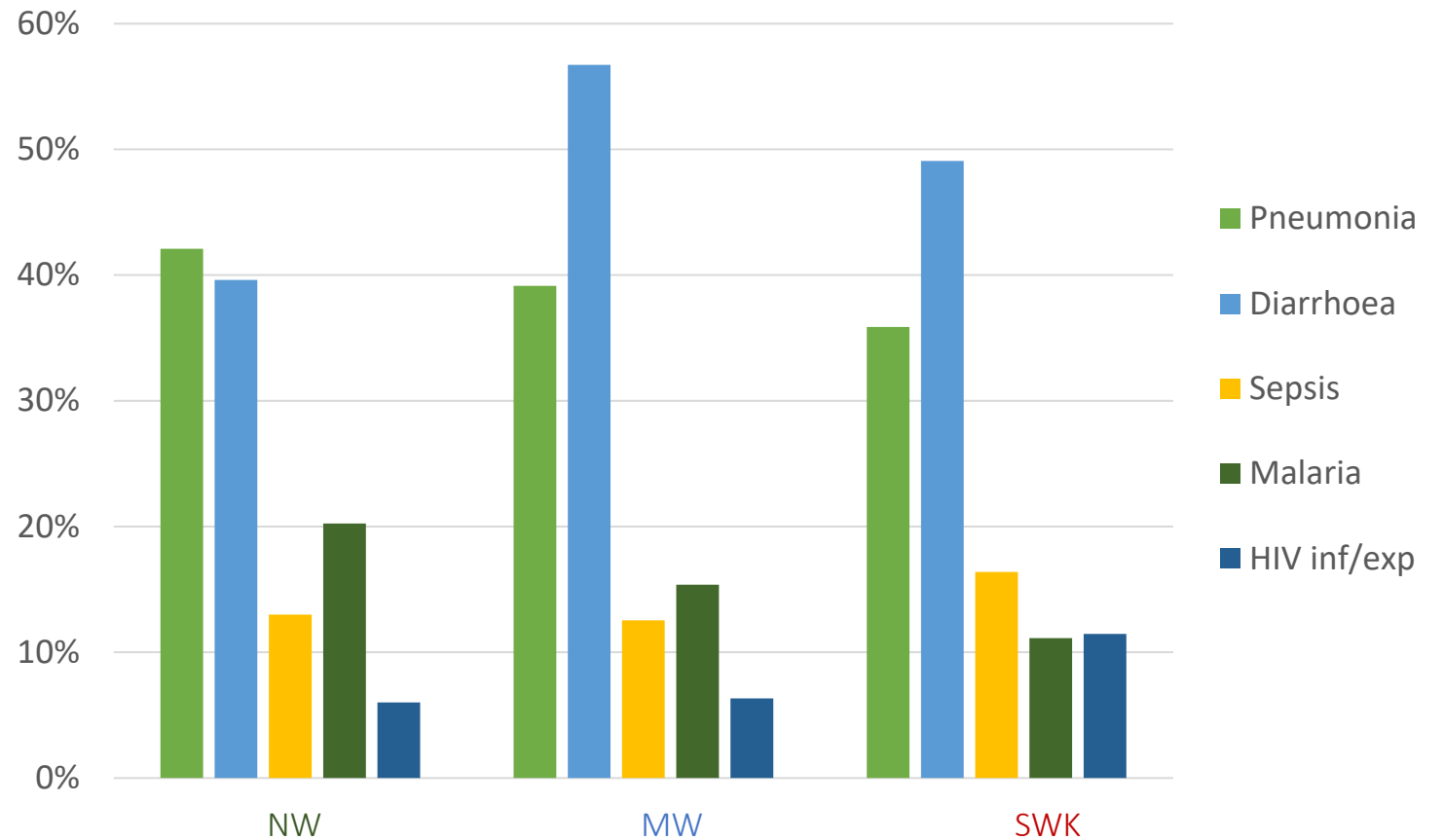
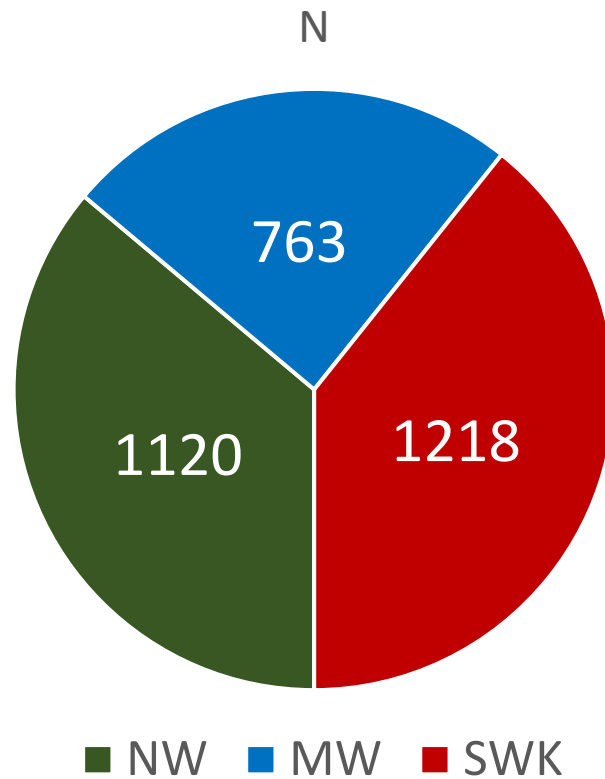
PHQ9		Not at all	Several days	More than half the days	Nearly every day
1.	Little interest or pleasure in doing things	0	1	2	3
2.	Feeling down, depressed, or hopeless	0	1	2	3
3.	Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4.	Feeling tired or having little energy	0	1	2	3
5.	Poor appetite or overeating	0	1	2	3
6.	Feeling bad about yourself — or that you are a failure or have let yourself or your family down	0	1	2	3
7.	Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8.	Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9.	Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3





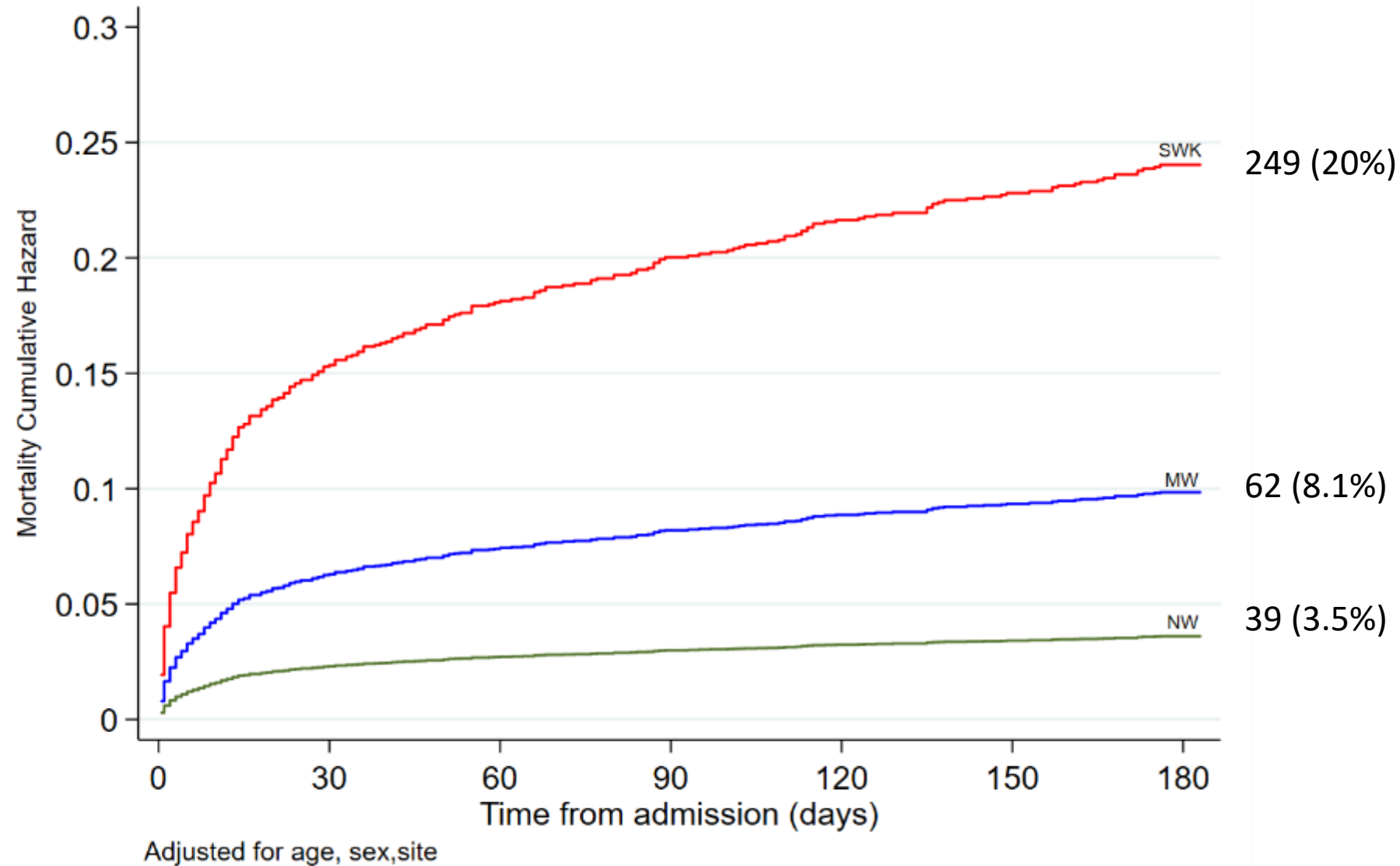
# 3,101 children enrolled at admission to hospital

median age 11 (IQR 6-16) months





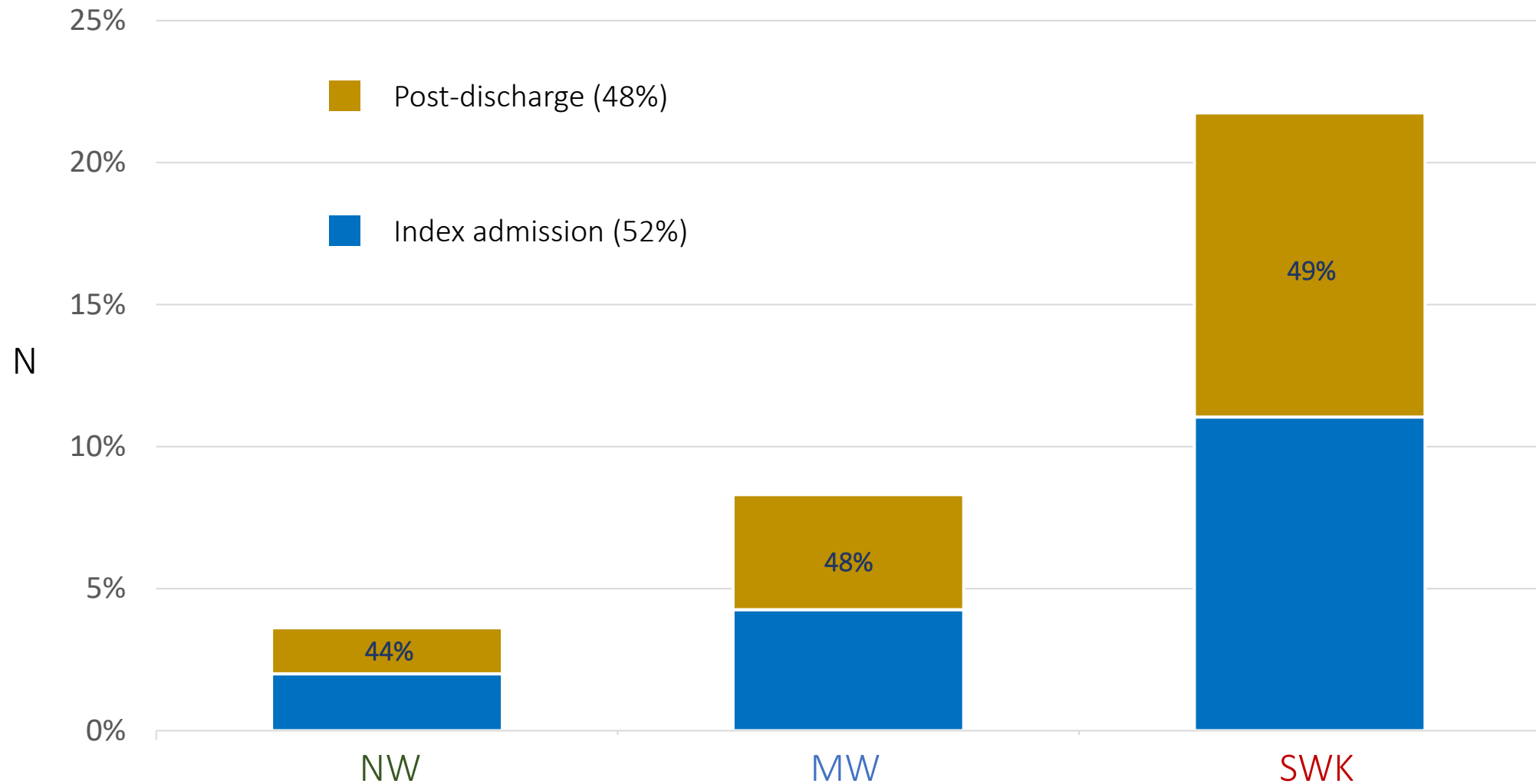
# Overall mortality



Lost to follow up: 116 (3.7%)

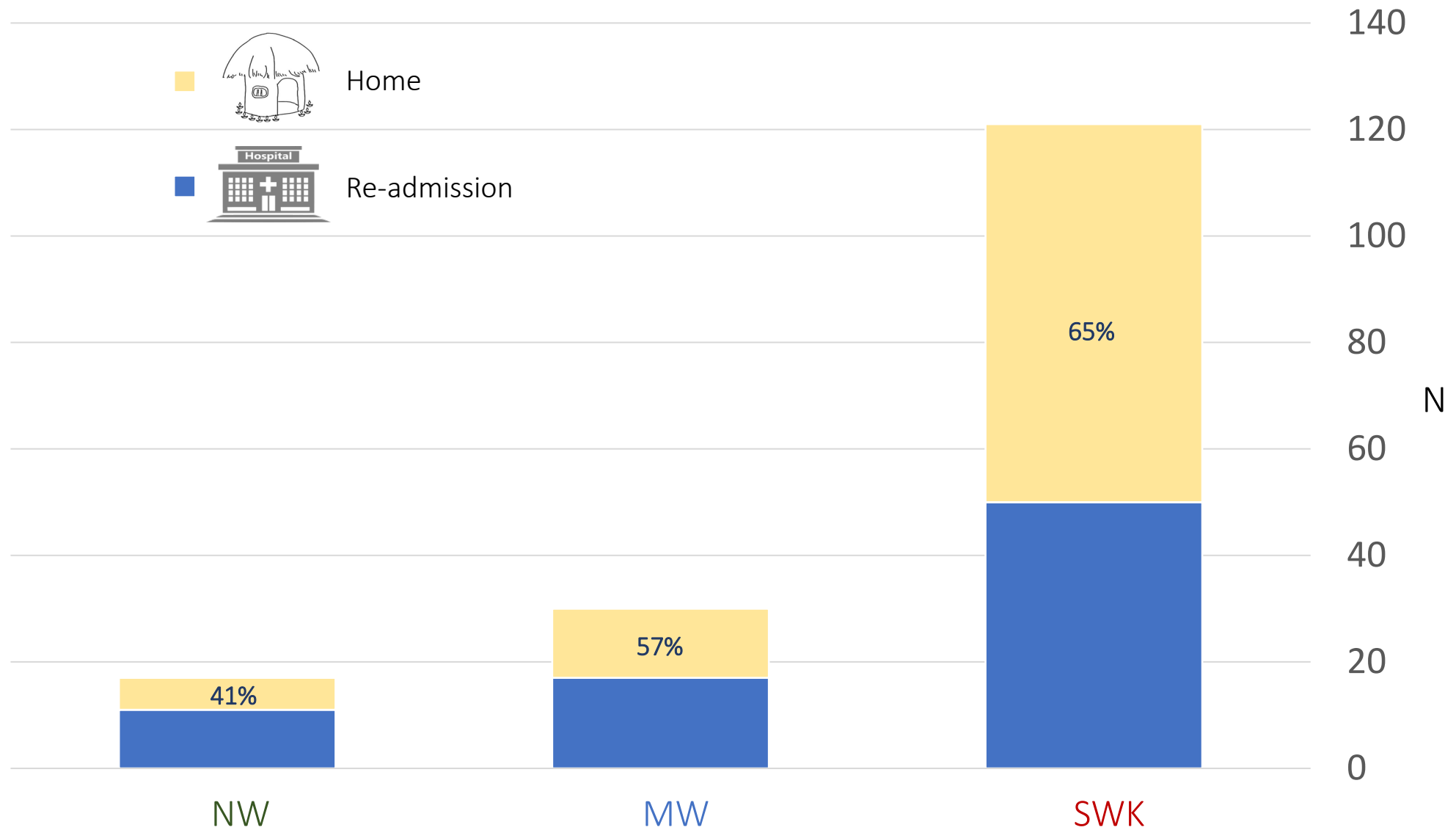


# Inpatient & post-discharge mortality

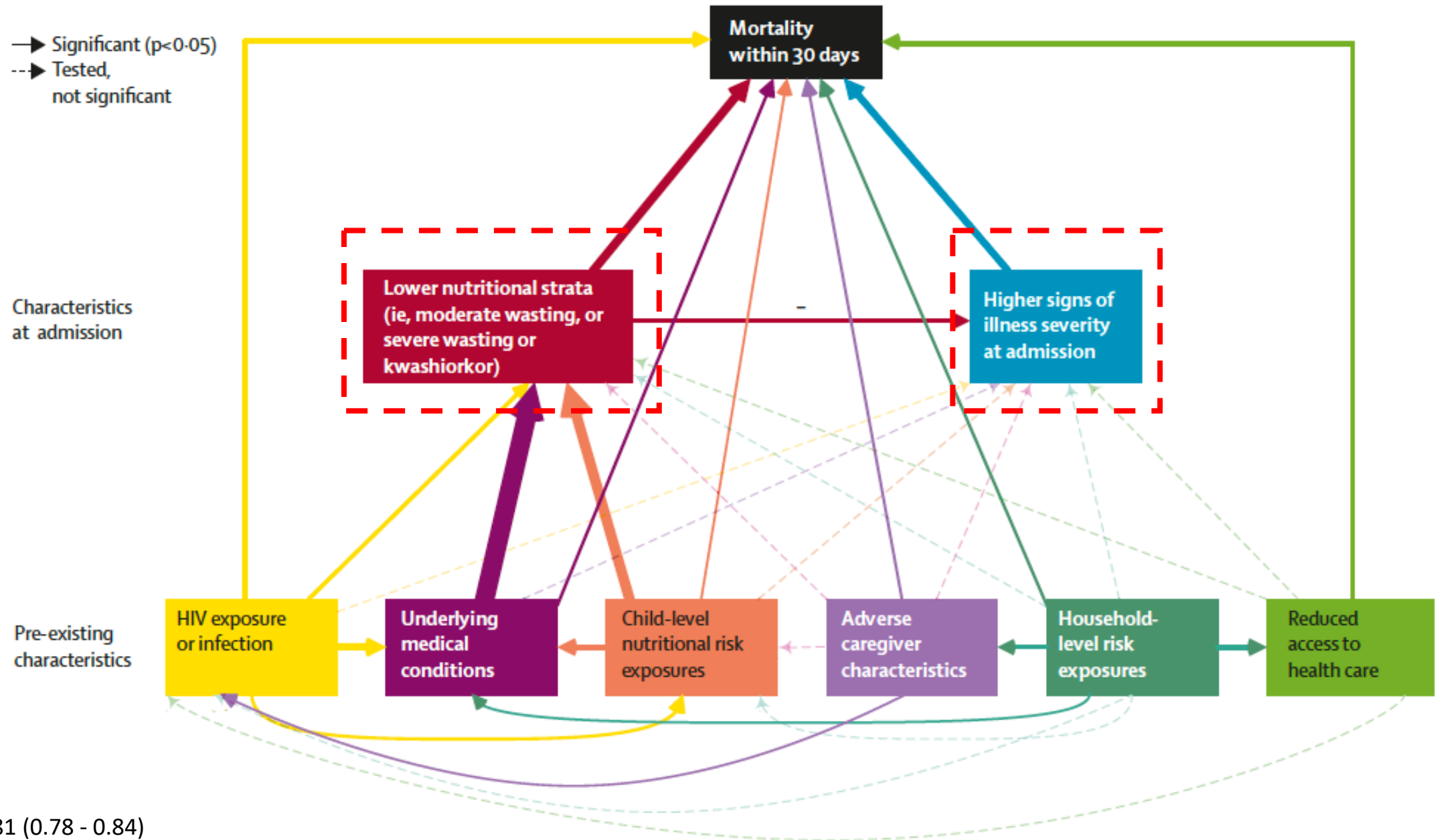


No heterogeneity between strata  $P=0.85$

# Place of post-discharge death



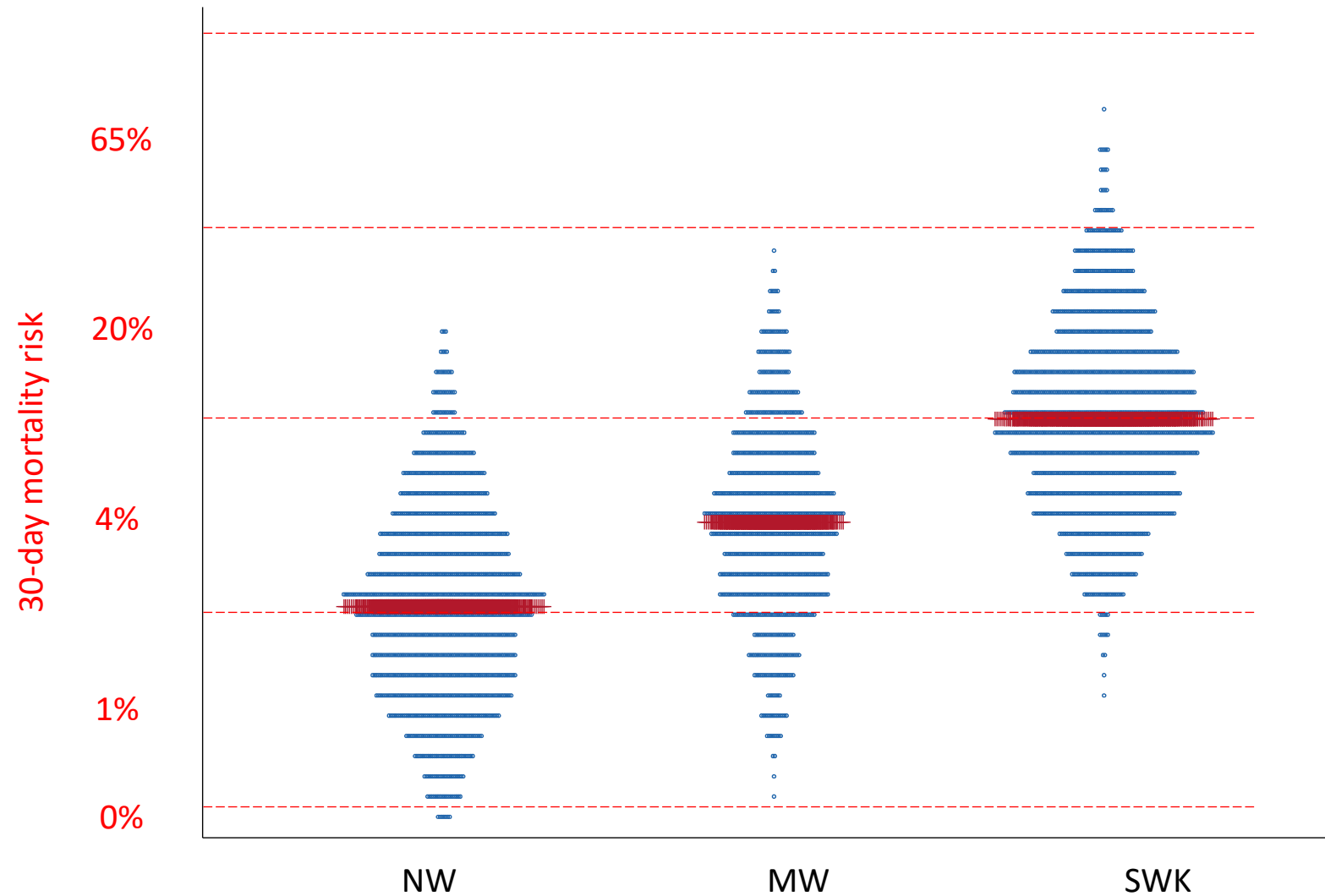
# SEM: 30-day mortality



Bootstrapped AUC: 0.81 (0.78 - 0.84)



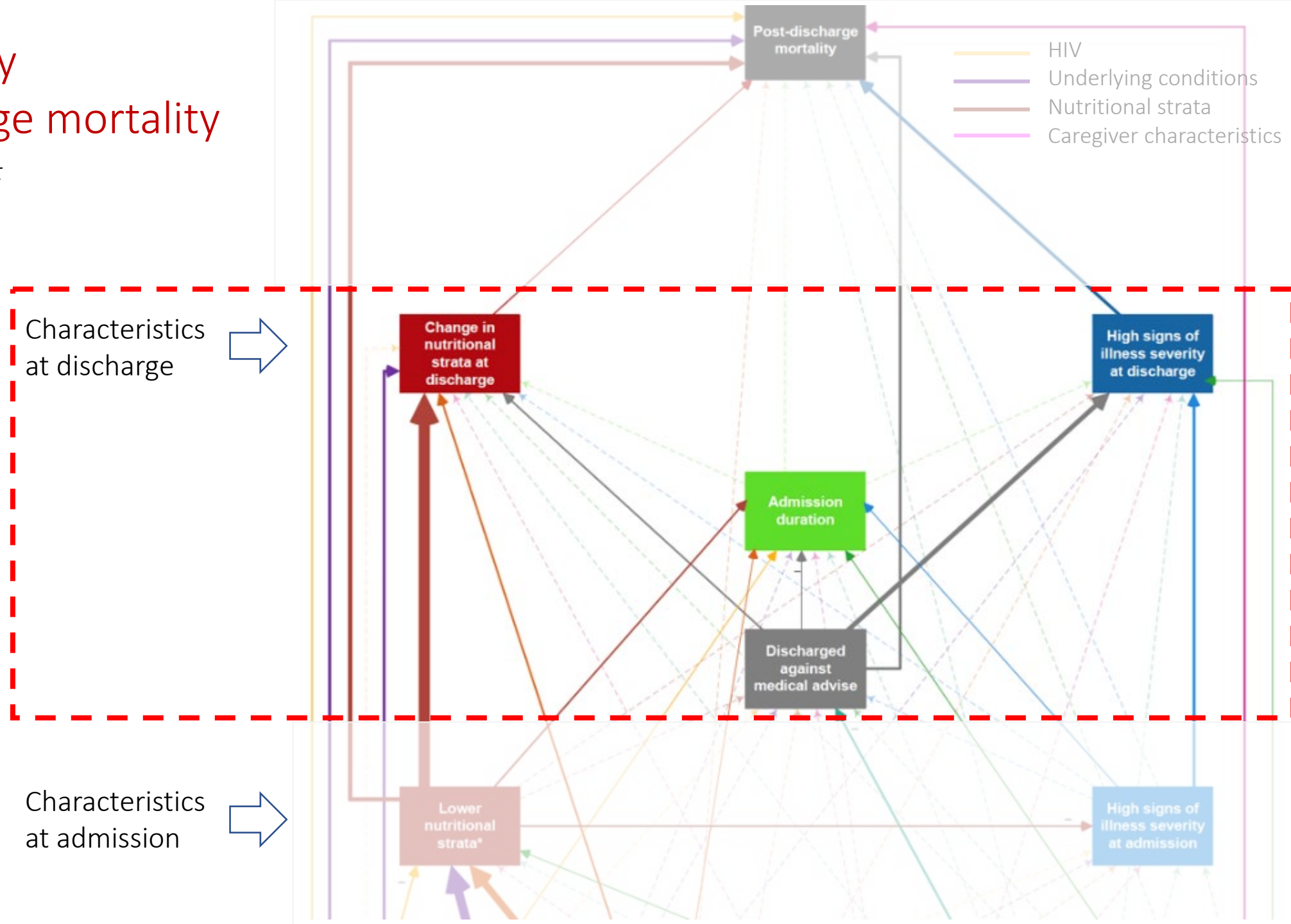
# 30-day mortality scores by anthropometric strata





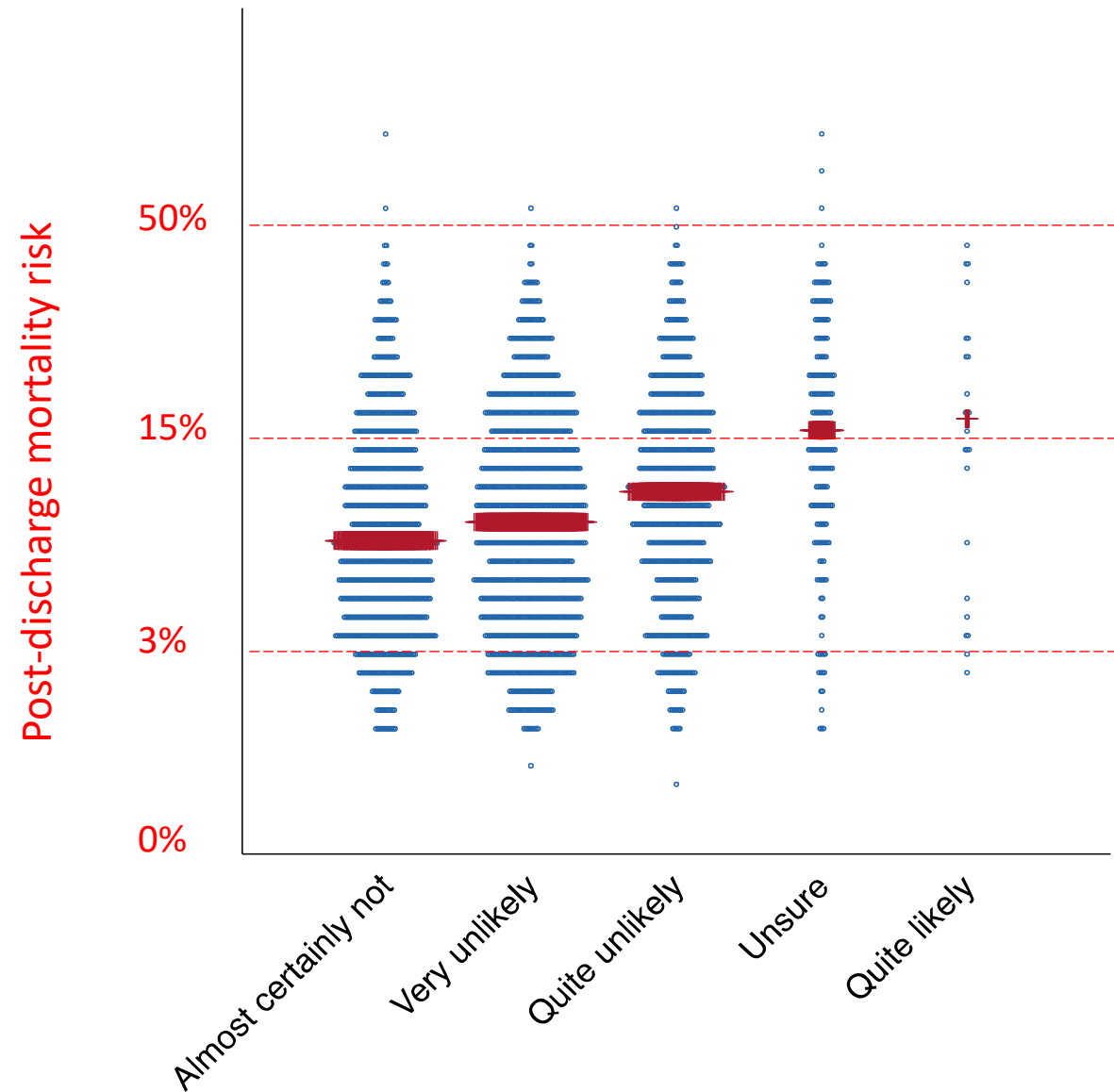
# SEM: 180-day post-discharge mortality

*site as a random effect*



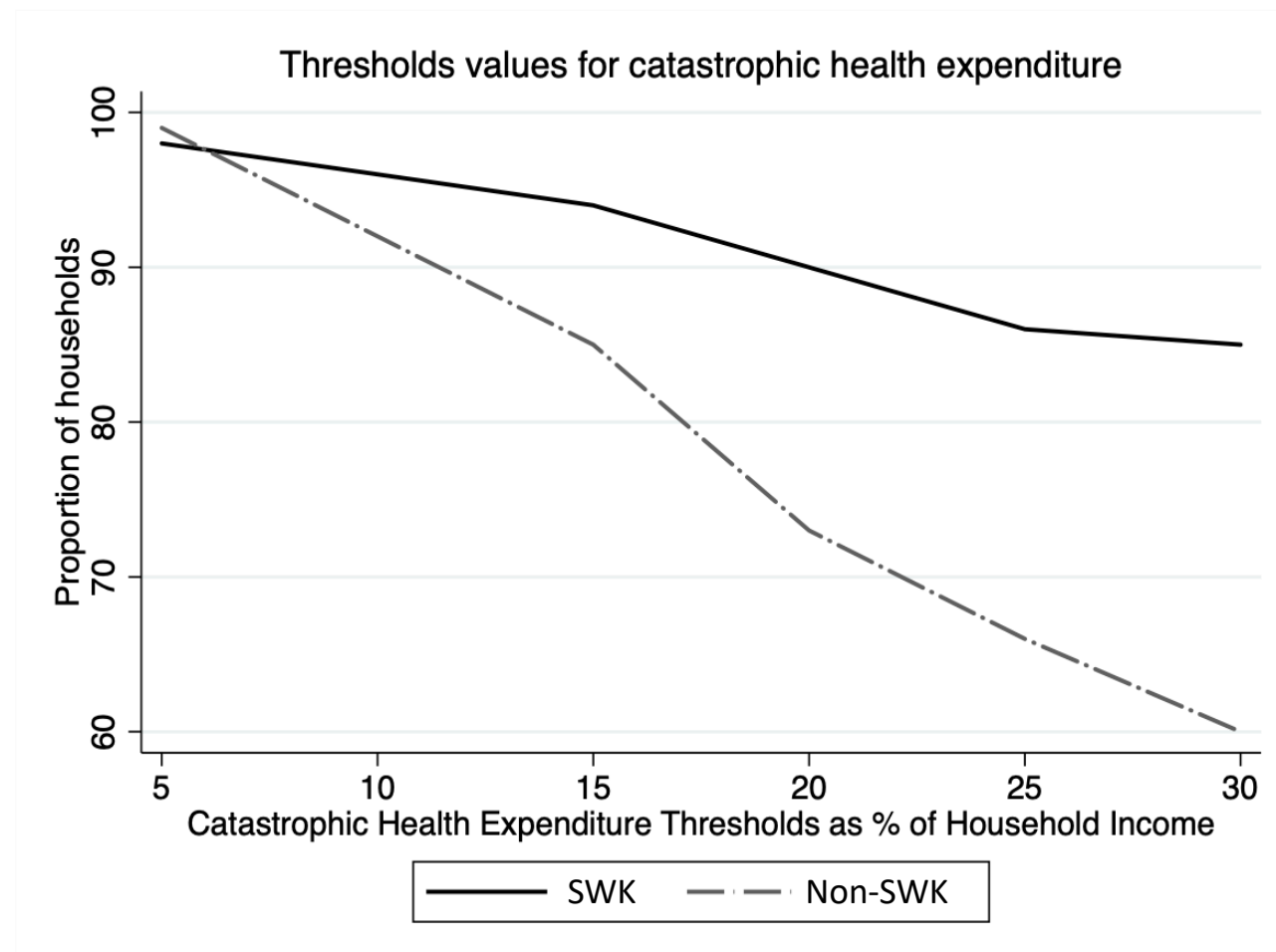
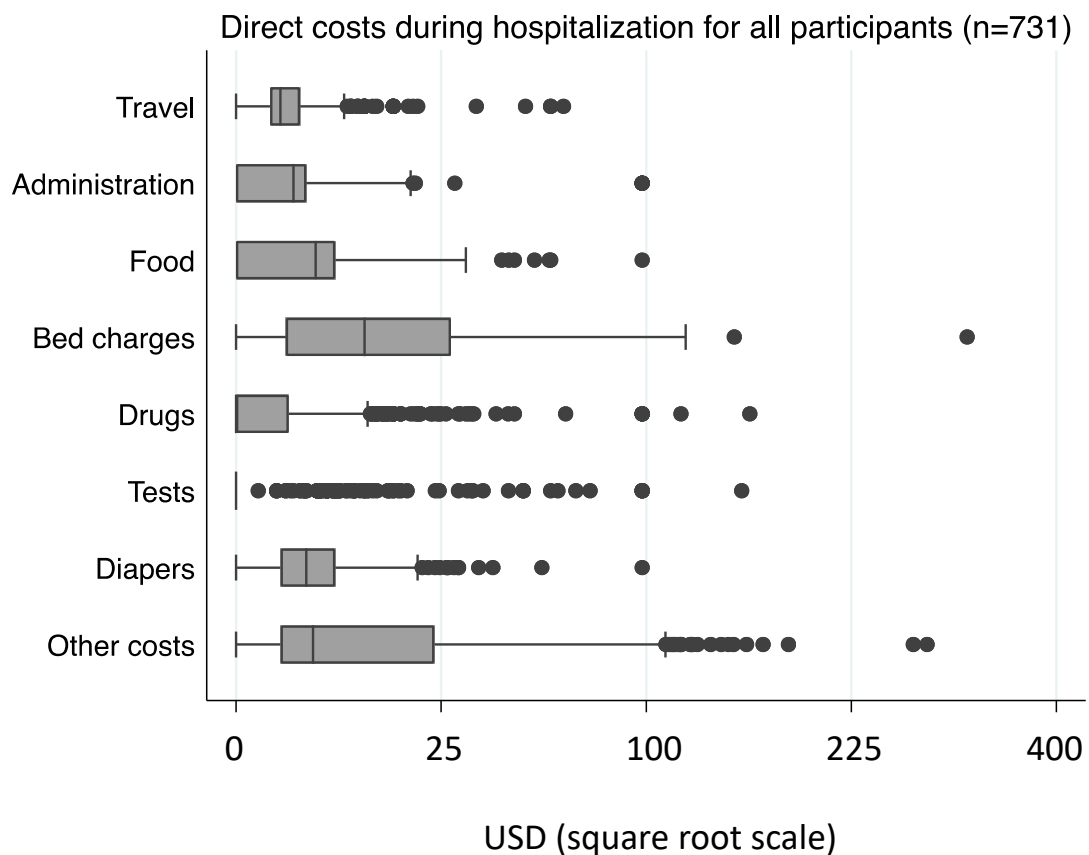


# Clinician Likert Scale at discharge



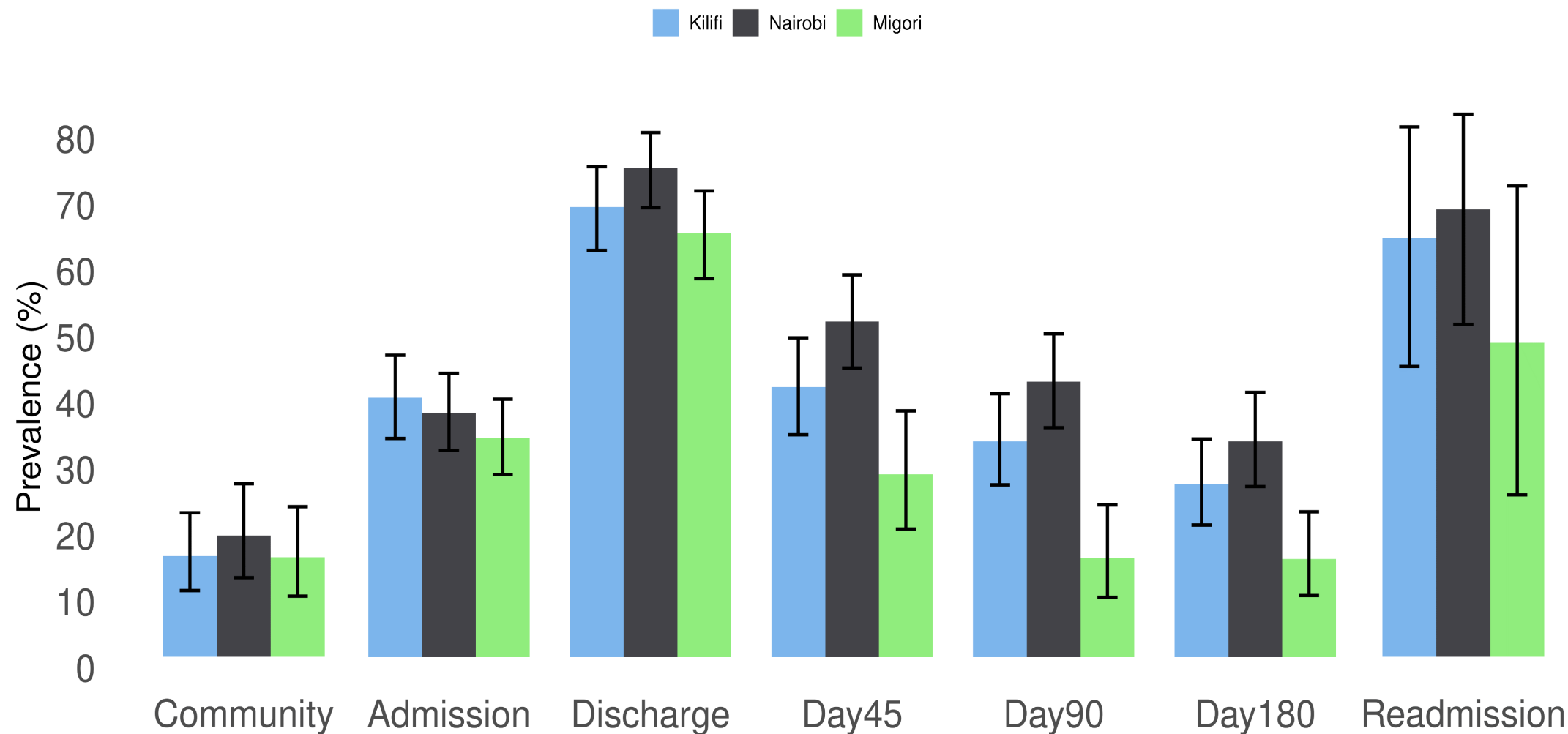


# Costs to families - Kenya/Uganda





## Antimicrobial resistance - Kenya sites

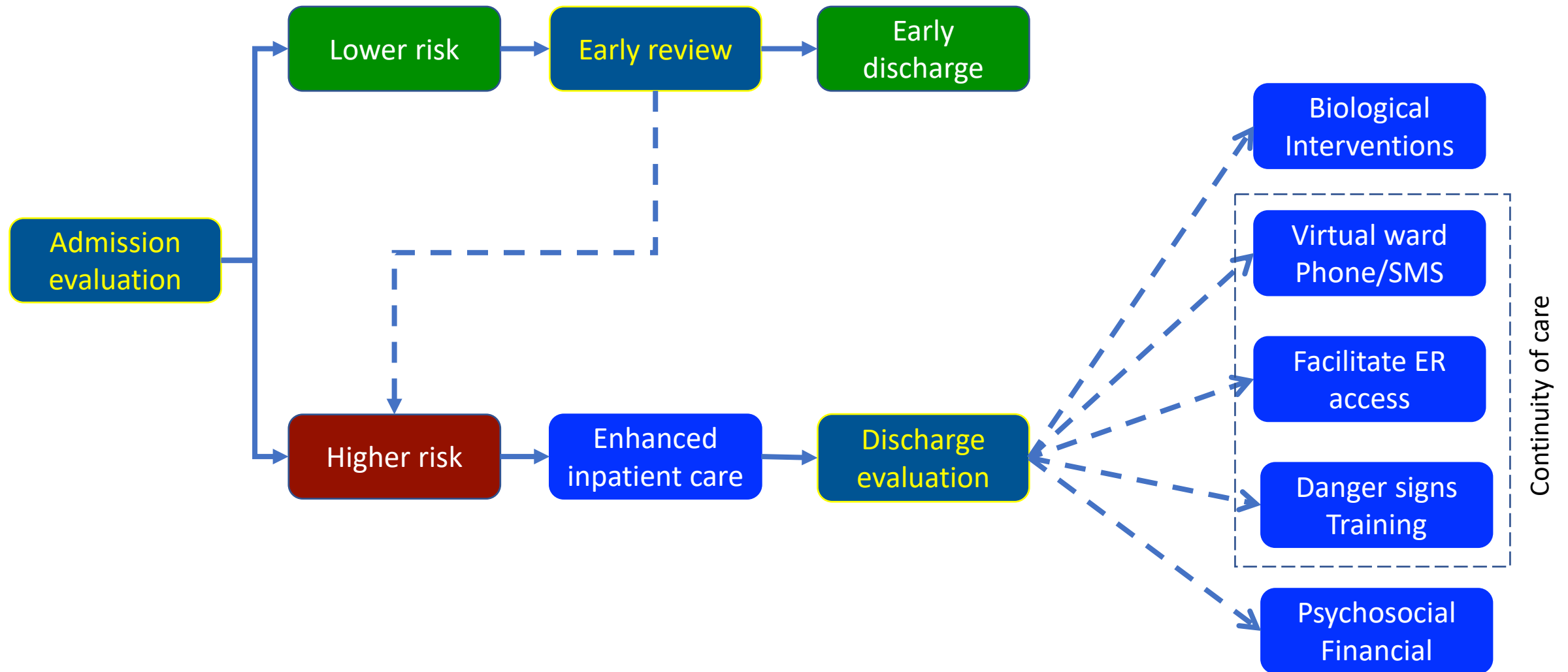






## Implications for care

- Anthropometry a crude risk marker capturing various domains
  - Maternal & social risks important
  - Clinician 'Gestalt' performs poorly
  - Many low risk - early recognition & discharge
  - Substantial post-discharge mortality
- Child centred care
  - Respect
  - Communication
  - Resource allocation
  - Continuity of care



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# CHAIN NETWORK

The Childhood Acute Illness & Nutrition Network

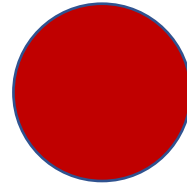
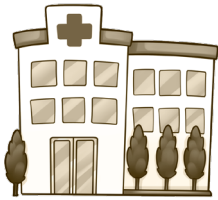
The CHAIN Network aims to optimize care for vulnerable children in low-resource settings to improve survival, growth and development.

[www.chainnetwork.org](http://www.chainnetwork.org)

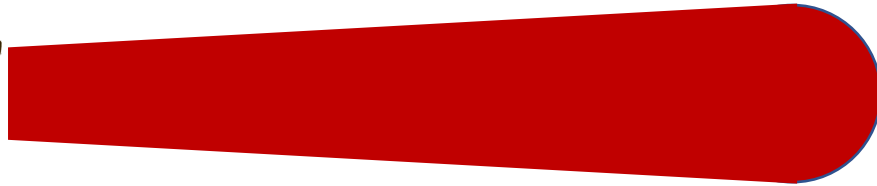
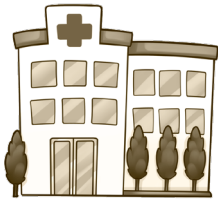
Additional slides



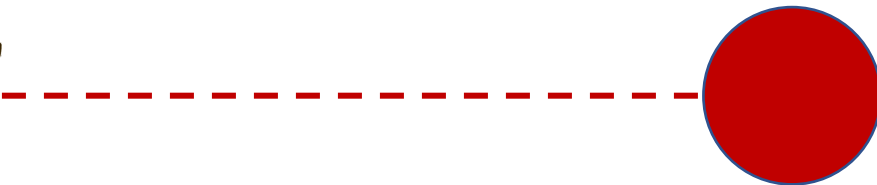
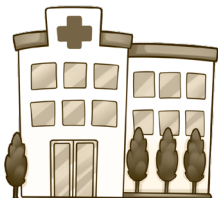
# Types of life-threatening events post-discharge



Separate episode  
(usually same risk factors)



Inadequate treatment

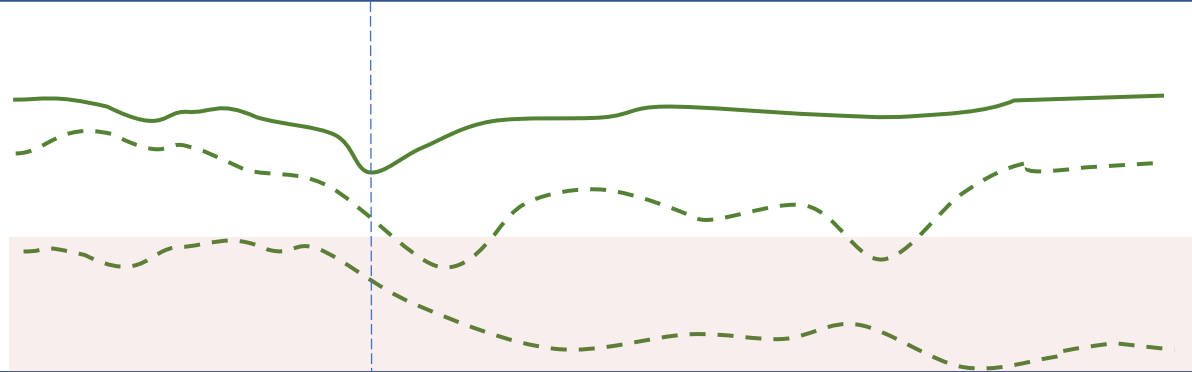


Healthcare acquired,  
community presentation

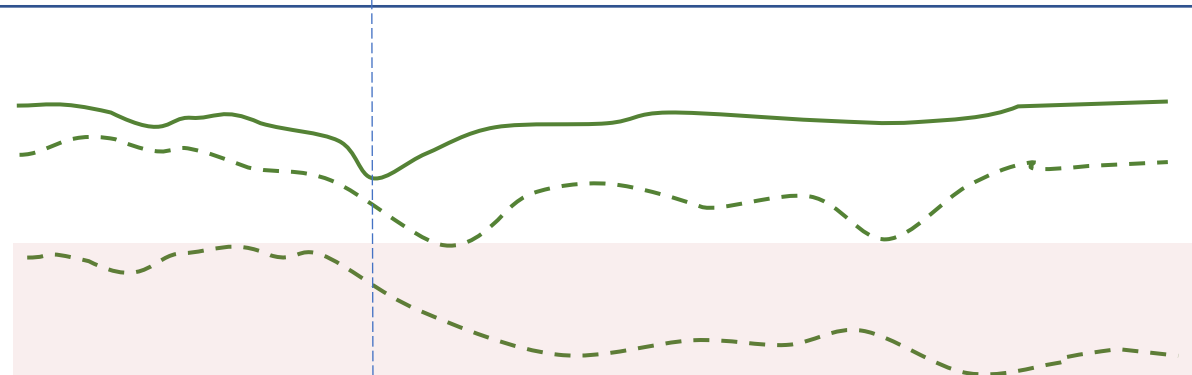
Birth

Age 1 year

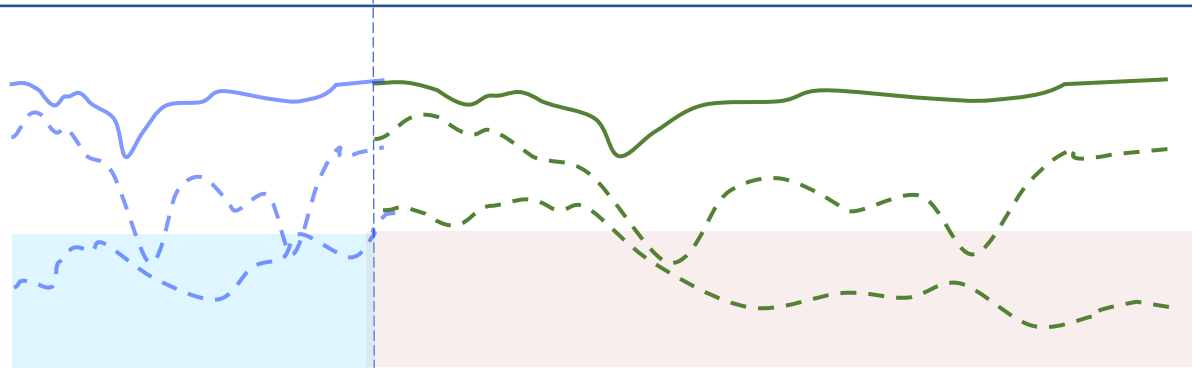
Household



Mother/carer(s)



Infant



# Optimizing Post-Discharge Care in Acutely Ill Children in Uganda



The Childhood Acute Illness & Nutrition (CHAIN) Network

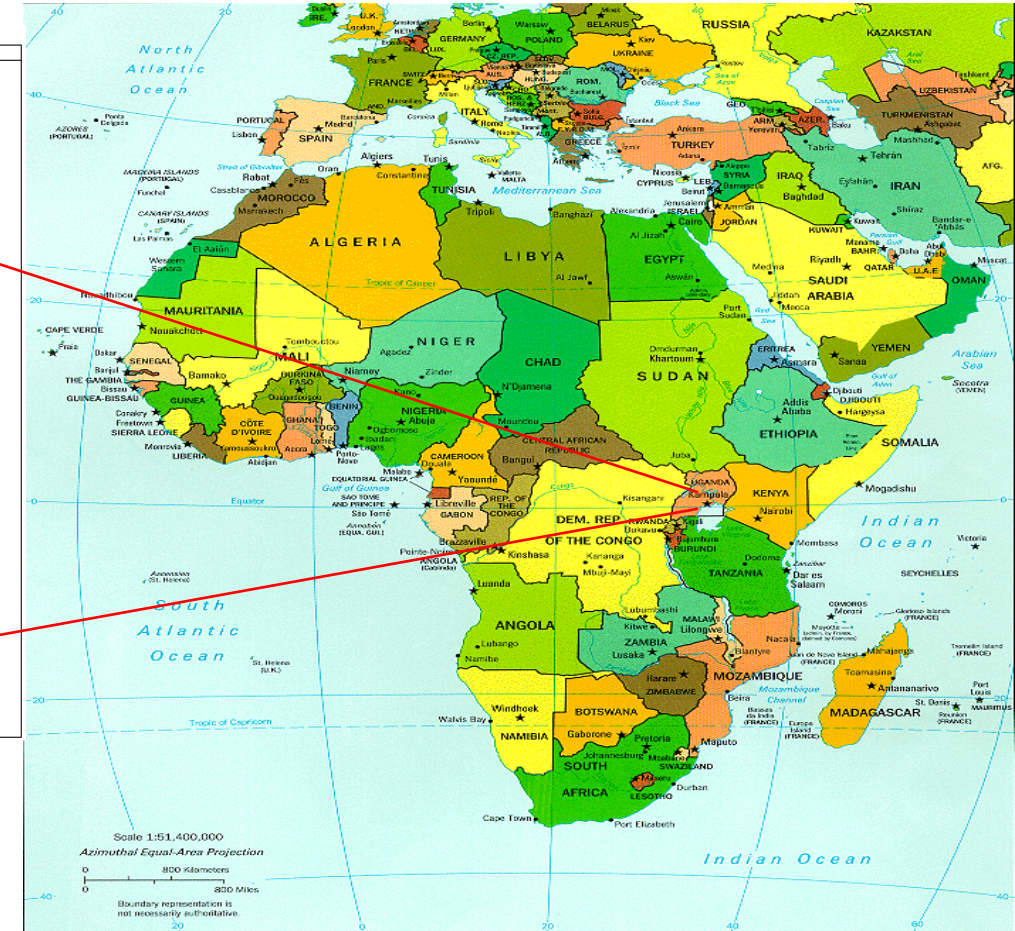
Ezekiel Mupere MBChB, MMed, MS., PhD

Site PI and Chair, Paediatrics and Child Department Makerere University

19<sup>th</sup> October 2022

# Background

- Uganda population over 42 million
  - Children <5 years contribute 18% - over 8 million
- Burden of malnutrition
  - Stunting 2.5 million children
  - Over 8 million children develop child wasting
- Mortality per 1000 livebirths
  - Neonatal stagnated at 27 for over 20 years
  - Under-five 64





# Makerere University Site – Mulago National Referral Hospital

- Mulago National Referral Hospital site:
  - 1500 General In-Patients/Day
  - 39,000 OPD Children/ Yr = 160/Day
  - Inpatient load children – 300 hospitalized/day
  - ~3% die
  - Neonatal mortality – 20%
  - <5 common causes of Death

## Causes of Death

- Pneumonia 23 %
- Diarrhoea 14%
- Malaria 13%
- Malnutrition 13%
- Measles 12%
- Meningitis 6%
- Anaemia 4%
- TB 4%

- No study on post-discharge mortality prior to CHAIN



# Makerere University Site – Mulago National Referral Hospital

## Trainees – People

### Challenges and Opportunities

- Patient volumes vs staffing levels to cover day, evening and night shifts
- Characteristics of a large National referral Teaching hospital:
  - Recurrent enrolment of new resident/postgraduate and intern doctors, nurses and undergraduates
  - Need for robust system to train and retrain
  - Possession of handheld smartphones
  - Fragmented facility healthcare services – general, specialized wards, and assessment center
  - Patient congestion/overcrowding



- >170/day in OPD assessment



# Admission and Discharge Process

- Screening at assessment center – outpatient and inpatients during day
  - Late afternoon, evening and night screening, triage at Acute Care Unit (ACU)
- ACU is a 24-hour withholding emergency ward – resuscitation and 24-hour initial treatment
  - Stable children are discharged following day
  - Sicker patients are admitted to general and specialized wards for continued inpatient care
- Children with specialized chronic conditions such as SCA, cardiovascular, asthma, etc are discharged to attend with appointments to >10 specialized ambulatory clinics
  - Minimal guidance on-discharge for children recovering from common acute illnesses
  - Some advised to return – assessment center, ACU, or general ward by individual clinician



# CHAIN Implementation

## Social Experiences

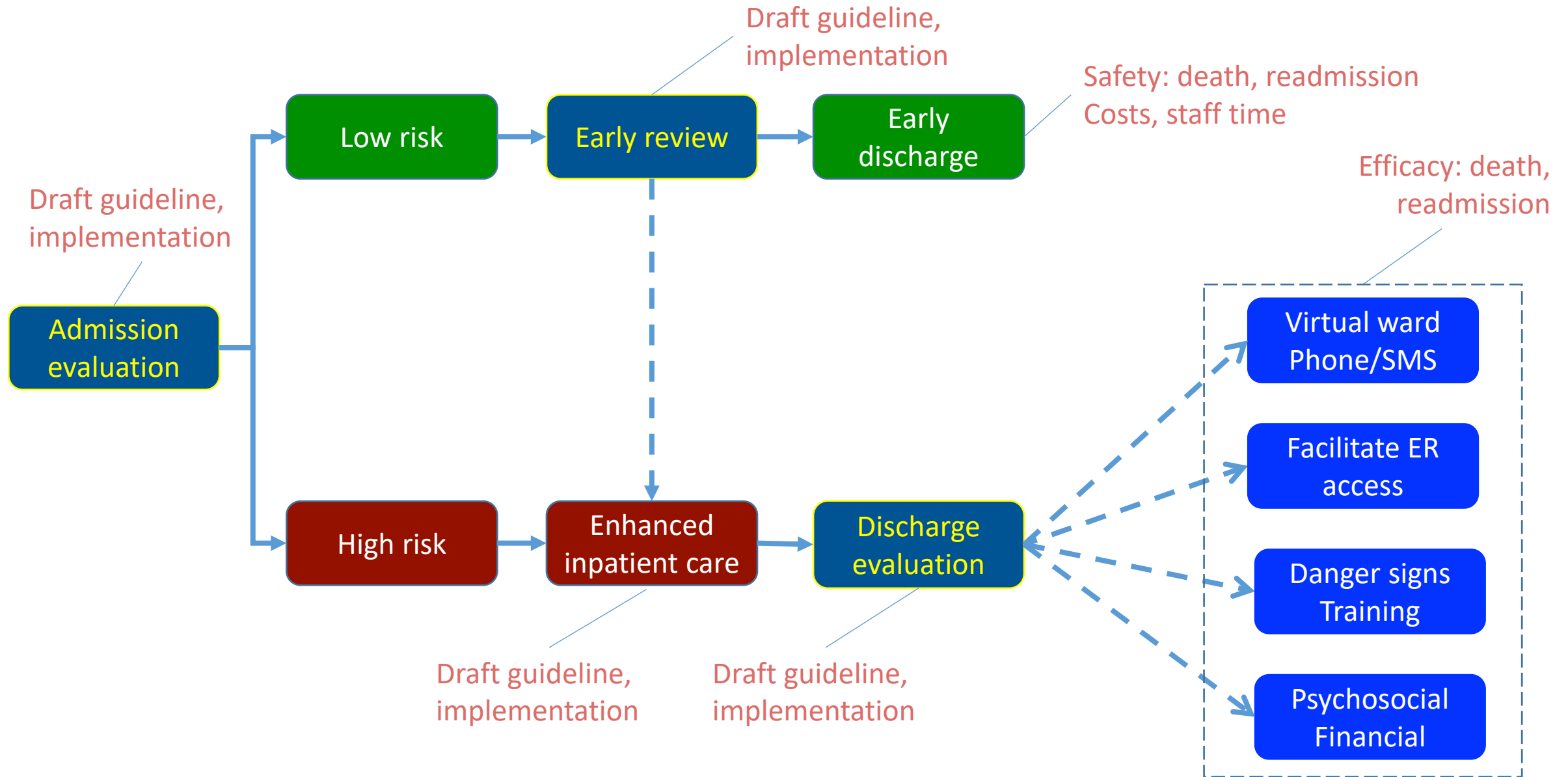
- Children experiencing or living under multiple social disruptions
- Households with social disruptions prominent for children with severe wasting
- Parents leaving farther apart or separated
- Mothers or parents with limited skill in parenting
- Single young mothers
- Broken young families and children - grandmas or other extended family members
- A number of mothers replacing childcare for income generating activities
  - Children are left with nannies who have limited skill or passion in child care throughout the day
- Limited father engagement in child care
- Changing residents rural vs urban in an effort to survive
- Abscondment from inpatient care – runaways

# CHAIN Implementation

## Lessons Learnt

- Recognition of post-discharge mortality burden – 1<sup>st</sup> study
- Need to formalize guidelines for observation ward and standardize risk stratification
- Need for quality improvement teams and systems to improve quality of care
- Recognized existing gap in follow-up care to avert post-discharge mortality

# Implications and Target Opportunities for care



# Health Facility and Community Level Opportunities

- Develop and standardize:
  - Criteria for risk stratification for frontline health care providers
  - Guidelines for discharge and enhanced inpatient care
- Target opportunities of follow-up care using:
  - Counseling and training caregivers at discharge on child illness and process of recovery, danger signs, key family care practices (KFCPs) for prevention, Family Caregiver MUAC use
  - SMS messaging,
  - Outreach sites for immunization programs as healthcare workers can be accessed to review,
  - Community health workers (CHWs),
  - Nearby health facility for review
- Targeted peer social and income security support for caregivers discharged having children with severe wasting
  - Community interventions and linkages – Optimize community family care groups

# Health Facility and Community Level Opportunities

- Digitalize into mobile application to enable implementation, transition and scale-up processes :
  - Risk stratification,
  - Discharge guidelines
  - Counseling and training for caregivers and
  - Monitoring or tracking beneficiaries
- Develop simplified job aids for caregivers/mothers and integrated CHW job aid, user manual (Post-dis, iCCM, KFCPs, Family MUAC)
  - Integration reduces parallel programming
- Conduct implementation research to guide:
  - Uptake, Acceptability, Self-efficacy
  - Adaptations and
  - Sustainability



**THANK  
YOU**

**Q & A**

