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WELCOME

# What can (and can't) household surveys tell us about nutrition and diarrhea interventions in LMICs?

Monday, September 12th

10:00 AM – 11:30 AM EDT

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**What can (and can't)  
household surveys tell us  
about nutrition and diarrhea  
interventions in LMICs?**

**Melinda Munos, PhD**

# Introduction

- Household surveys are an important source of **population-representative measures of intervention coverage**
  - Coverage = the proportion of individuals in need of an intervention who receive that intervention
  - Data are collected directly from individuals, allowing for measurement of indicators that are not possible through other methods
- Intervention coverage is used at global, national, and sub-national levels for prioritization, planning, and evaluation
- There is a need to understand which indicators are best measured in household surveys, to support decisions about indicator inclusion and interpretation

# History of this collaboration

- Child Health Epidemiology Reference Group (CHERG MA 13)
- Improving Coverage Measurement (2013–2018)
- IMPROVE (2017–2022)

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## Improving Measurement & Program Design (IMPROVE)

The Improving Measurement and Program Design project (IMPROVE) aims to improve evidence, estimates, and programming for maternal, newborn, child, and adolescent health and nutrition in low- and middle-income countries around the world.

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# Core Group

- Fred Arnold, DHS/ICF International
- Ann Blanc, (retired) Population Council
- Harry Campbell, University of Edinburgh
- Emily Carter, CDC
- Thomas Eisele, Tulane University
- Sunny Kim, International Food Policy Research Institute
- Joanne Katz, Johns Hopkins
- Margaret Kosek, University of Virginia
- Tanya Marchant, London School of Hygiene and Tropical Medicine
- Melinda Munos, Johns Hopkins
- Jennifer Requejo, United Nations International Children's Emergency Fund
- Ashley Sheffel, Johns Hopkins
- Cindy Stanton, Stanton-Hill Research

## Improve Coverage Objectives

1. Increased availability of evidence for the validity of existing and new MNCAH & Nutrition coverage indicators and questions collected through household surveys
2. Availability of evidence-based tools and protocols for routine national-level linkage of data on care-seeking from household surveys with results from service provider assessments

# Validation methods: basic design

## **Step 1: Observe intervention delivery**



**Step 2: Wait,**  
based on recall  
period in  
DHS/MICS.

## **Step 3: Conduct HH interviews**

1. Standard DHS/MICS questions
2. Additional or modified questions
3. Inclusion of strategies to aid recall

**Step 4: Compare,**  
determining  
validity of  
respondents'  
reports

Electronic supplementary material:  
The online version of this article contains supplementary material.

journal of  
**global**  
health

## Validation studies for population-based intervention coverage indicators: design, analysis, and interpretation

Melinda K Munos<sup>1</sup>, Ann K Blanc<sup>2</sup>, Emily D Carter<sup>1</sup>, Thomas P Elsele<sup>3</sup>, Steve Gesuale<sup>4</sup>, Joanne Katz<sup>5</sup>, Tanya Marchant<sup>6</sup>, Cynthia K Stanton<sup>7</sup>, Harry Campbell<sup>8</sup>, for the Improving Coverage Measurement Group

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<sup>2</sup> Population Council, New York, New York, USA

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**Background** Population-based intervention coverage indicators are widely used to track country and program progress in improving health and to evaluate health programs. Indicator validation studies that compare survey responses to a “gold standard” measure are useful to understand whether the indicator provides accurate information. The Improving Coverage Measurement (ICM) Core Group has developed and implemented a standard approach to validating coverage indicators measured in household surveys, described in this paper.

**Methods** The general design of these studies includes measurement of true health status and intervention receipt (gold standard), followed by interviews with the individuals observed, and a comparison of the observations (gold standard) to the responses to survey questions. The gold standard should use a data source external to the respondent to document need for and receipt of an intervention. Most frequently this is accomplished through direct observation of clinical care, and/or use of a study-trained clinician to obtain a gold standard diagnosis. Follow-up interviews with respondents should employ standard survey questions, where they exist, as well as alternative or additional questions that can be compared against the standard household survey questions.

**Results** Indicator validation studies should report on participation at every stage, and provide data on reasons for non-participation. Metrics of individual validity (sensitivity, specificity; area under the receiver operating characteristic curve) and population-level validity (inflation factor) should be reported, as well as the percent of survey responses that are “don't know” or missing. Associations between interviewer and participant characteristics and measures of validity should be assessed and reported.

**Conclusions** These methods allow respondent-reported coverage measures to be validated against more objective measures of need for and receipt of an intervention, and should be considered together with cognitive interviewing, discriminative validity, or reliability testing to inform decisions about which indicators to include in household surveys. Public health researchers should assess the evidence for validity of existing and proposed household survey coverage indicators and consider validation studies to fill evidence gaps.

Population-based measures of intervention coverage, defined as the proportion of individuals in need of a service or intervention who actually receive the service or intervention, are used at the country and global level to track progress in delivering high impact interventions to populations in need [1] and to evaluate the impact of large-scale health programs. Nationally representative household surveys implemented by The Demographic and Health

# Webinar Outline

Time	Topic	Presenter
<b>10:00am</b> <b>EDT</b>	Welcome & Introduction	Melinda Munos
<b>10:08–</b> <b>10:53am</b> <b>EDT</b>	Key results from validation studies of nutrition and diarrhea interventions <ul style="list-style-type: none"><li>▪ Iron-folic acid supplementation in pregnancy (Nepal)</li><li>▪ Breastfeeding counselling (India, Kosovo, Nepal)</li><li>▪ Diarrhea severity (Peru)</li></ul>	Emily Bryce Sunny Kim Margaret Kosek
<b>10:55–</b> <b>11:25am</b> <b>EDT</b>	Panel discussion	Moderated by Ann Blanc Rasmi Avula Rebecca Heidkamp Patricia Jodrey Sorrel Namaste
<b>11:25–11:30am</b> <b>EDT</b>	Closing	Jennifer Requejo

# Presenters



**Melinda Munos**

Johns Hopkins University



**Emily Bryce**

Jhpiego



**Sunny Kim**

International Food Policy Research Institute



**Margaret Kosek**

University of Virginia School of Medicine



# **Validation of Maternal Recall of Iron-Folic Acid (IFA) supplementation during Antenatal Care**

**Nepal Site  
Emily Bryce, PhD  
Joanne Katz, ScD**

# Study Aims

To assess the validity of maternal report of

- Any IFA receipt during antenatal care
- The number of IFA tablets received during antenatal care



# Study Population

Five public health posts & providers in NNIPS study area

- All five provided basic ANC services & two provided delivery services

Pregnant women presenting for their first ANC visit at one of the five health posts

- Inclusion criteria: married, over fifteen years of age or older, living in NNIPS study area, planning to return to study health post(s)
- Exclusion criteria: previously attended an ANC visit or received an ultrasound scan, planning to leave the study area during or six months after pregnancy

# Data Collection



Enrollment (N=441)

Direct Observation of ANC visits

December 2018



Postpartum Interviews (N=434)

November 2020

# Important Definitions

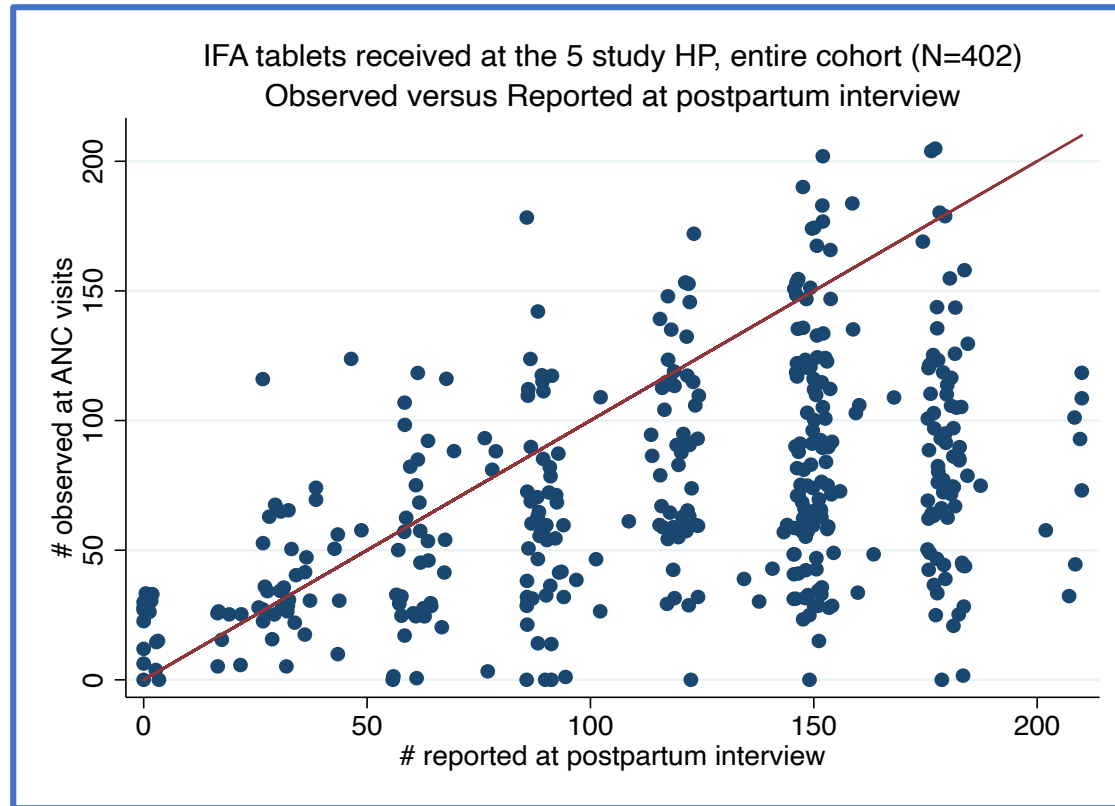
Measure	Definition
IFA Gold Standard	The number of IFA tablets provided, established by direct observation at each ANC visit at the study health posts
IFA Reported Received	The number of IFA tablets provided at study health posts during entire pregnancy, as reported by the woman at the post-partum interview
<i>Sub-cohort for sensitivity analysis</i>	<i>There were 248 women who never reported receiving or buying IFA between observations</i>

# Validation Measures

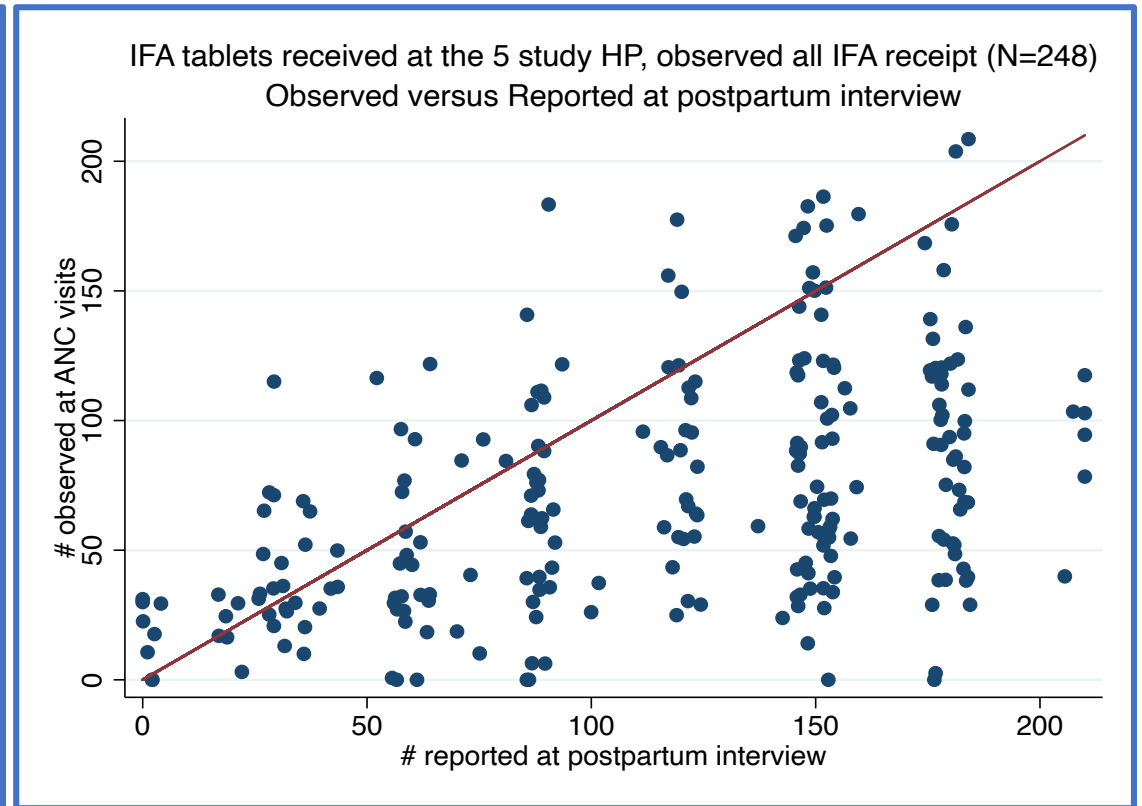
- Individual-level validity
  - Sensitivity:  $TP / (TP + FN)$
  - Specificity:  $TN / (TN + FP)$
  - Area under the operating curve (**AUC**): plot of sensitivity versus (1-specificity)
- Population-level validity
  - **Inflation factor**: survey coverage / true coverage

Maternal report	Direct observation	
	Yes	No
Yes	True positive (TP)	False positive (FP)
No	False negative (FN)	True negative (TN)

# IFA Supplementation Received vs Reported Received



Mean # tablets observed = 73.1 tablets (SD=43.8)  
Mean # reported received = 118.5 tablets (SD=53.3)  
Mean difference = 45.4 tablets



Mean # tablets observed = 71.5 tablets (SD=45.5)  
Mean # reported received = 115.4 tablets (SD=55.7)  
Mean difference = 43.9 tablets

# Validation Results

- Any iron folic acid (IFA) receipt had moderate individual accuracy and low population bias
- Maternal report of # IFA tablets received had low to moderate individual accuracy and high population bias
- The sensitivity analysis did not show any improvement in individual or population-level accuracy

	Sensitivity (%) 95% CI	Specificity (%) 95% CI	AUC 95% CI	"True" coverage 95% CI	Estimated survey coverage %	Inflation factor
Receipt of any IFA	97.1* (94.9-98.6)	23.5* (6.8-49.9)	0.60* (0.50-0.71)	95.8 (93.3-97.5)	96.2%	1.01
Number of IFA tablets						
0	23.5* (6.8-49.9)	97.1* (94.9-98.5)	0.60* (0.50-0.71)	4.22 (2.5-6.7)	3.8%	0.89
1 to < 30	16.7* (4.7-37.4)	99.2* (97.7-99.8)	0.58* (0.50-0.66)	5.9 (3.9-8.8)	1.7%	0.29
30 to < 60	18.1 (11.3-26.8)	94.6 (91.4-96.9)	0.56 (0.52-0.60)	26.1 (21.9-30.7)	8.7%	0.33
60 to < 90	5.6 (2.1-11.7)	89.1 (84.9-92.4)	0.47 (0.45-0.50)	26.9 (22.6-31.5)	9.5%	0.35
90 to < 120	16.2 (8.4-27.1)	86.5 (82.4-90.0)	0.51 (0.47-0.56)	16.0 (13.4-20.9)	13.9%	0.87
120 to < 180	66.2 (53.7-77.2)	61.7 (56.2-66.9)	0.64 (0.58-0.70)	16.9 (13.4-20.9)	43.0%	2.55
180+	33.3* (9.9-65.1)	81.0* (76.8-84.8)	0.57* (0.43-0.71)	2.9 (1.6-5.2)	19.4%	6.69



# Key Findings & Implications

- In areas of similarly high coverage, maternal report of any IFA receipt produces accurate population measures
- Maternal report of the number of IFA tablets has low individual-level validity and high population bias
  - Possibility of social desirability bias
  - How women estimate the number of tablets they are given
- Considerations for how the indicator is defined and measured going forward
  - Policy, biologic and programmatic considerations
- Additional research in different settings with more variable IFA coverage

**Thank you!**

**Q&A**

# Validation of maternal recall of counseling about breastfeeding and infant and young child feeding: Results from Nepal, Kosovo, and India



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Sunny S. Kim, PhD, MPH

IMPROVE-Coverage webinar | September 12, 2022

# Overall objective

To validate measures of breastfeeding counseling received during pregnancy and for children

- Conduct quantitative validation studies in 3 settings (Nepal, Kosovo, and India), with cognitive testing of survey questions in Nepal and India



# Survey questions: DHS8\_Womans\_QRE\_EN\_8Apr2022

SECTION 4. PREGNANCY AND POSTNATAL CARE					
NO.	QUESTIONS AND FILTERS	CODING CATEGORIES			SKIP
418	As part of your antenatal care during this pregnancy, did a healthcare provider do any of the following:  f) Talk with you about breastfeeding?	YES	NO	DK	
		f) BREASTFEED..... 1	2	8	
473	During the first 2 days after (NAME)'s birth, did any healthcare provider do the following:  d) Talk with you about breastfeeding? e) Observe (NAME) breastfeeding to see if you are doing it correctly?	YES	NO	DK	
		d) TALK ABOUT BREASTFEEDING... 1	2	8	
		e) OBSERVE BREASTFEEDING....12	8		
SECTION 6. CHILD HEALTH AND NUTRITION					
641	In the last 6 months, did any healthcare provider or community health worker talk with you about how or what to feed (NAME)?	YES.....1	NO.....2	DON'T KNOW.....8	

# Summary of study designs

	Nepal	Kosovo	India
<b>Type of visits</b>	ANC by nurses and midwives	Immunization, PNC, well-baby, acute care by nurses	Routine home visits by community-based workers (ASHA and AWW)
<b>Location of visits</b>	Health facility	Health facility	Home visits and community events
<b>Age of children</b>	NA	0-12 months	0-11 months
<b>Type of indicators assessed</b>	Counseling on breastfeeding, maternal nutrition and weight gain; other ANC services	Breastfeeding counseling and interpersonal counseling skills	IYCF counseling, other well-child services
<b>Recall period</b>	6 months after delivery	Exit interviews	2 weeks
<b>Sample size</b>	401 women	609 women	444 women

# Summary results: Receipt of any breastfeeding/IYCF counseling

Indicator	Observed prevalence, %	Sensitivity, % 95% CI	Specificity, % 95% CI	AUC 95% CI	IF
<b>NEPAL</b>					
Received breastfeeding counseling	31.4	81.7 (73.9–88.1)	44.7 (38.8–50.8)	0.63 (0.59–0.68)	2.03
<b>KOSOVO</b>					
Received counseling on breastfeeding or infant feeding	90.0	90.7 (88.0–93.0)	52.5 (39.1–65.7)	0.72 (0.65–0.78)	0.97
<b>INDIA</b>					
Received any IYCF counseling	90.1	83.0 (78.9–86.5)	36.4 (22.4–52.2)	0.60 (0.52–0.67)	0.90
Received any breastfeeding counseling (open-ended)	65.5	63.5 (57.0–69.7)	61.8 (52.6–70.4)	0.63 (0.57–0.68)	0.84



# Summary results: Receipt of specific breastfeeding information/support

Indicator	Observed prevalence, %	Sensitivity, % 95% CI	Specificity, % 95% CI	AUC 95% CI	IF
<b>NEPAL</b>					
Received counseling on early initiation of breastfeeding	31.2	82.4 (74.6–88.6)	47.8 (41.8–53.9)	0.65 (0.61–0.70)	1.98
Received counseling on exclusive breastfeeding	26.9	84.3 (76.0–90.6)	48.5 (42.6–54.3)	0.66 (0.62–0.71)	2.24
<b>KOSOVO</b>					
Provider observed mother breastfeeding	14	63.1 (51.9–73.4)	94.5 (92.0–96.3)	0.79 (0.73–0.84)	1.00
<b>INDIA</b>					
Received message about exclusive breastfeeding to 6 months of age	50.7	72.7(66.3–78.5)	38.3(31.8–45.2)	0.56 (0.51–0.60)	1.33

# What have we learned about measuring breastfeeding/IYCF counseling coverage? (1 of 2)

## Study design limitations

- Obtaining gold standard measures is challenging, particularly over longer recall periods, due to many sources of counseling

## Validation results: good sensitivity, population bias will depend on true prevalence

- High sensitivity, so we are capturing most of the counseling that is taking place.
- Relatively low specificity, meaning that counseling is over-reported in some cases, possibly reflecting social desirability bias.
- Results were relatively consistent across countries, facility/community setting, and question formulation.

## General topic vs. specific message

- Recall of specific visit/information had poorer accuracy than questions about any breastfeeding/IYCF counseling.
- Qualitative results support that more detailed questions are harder for respondents to answer.

# What have we learned about measuring breastfeeding/IYCF counseling coverage? (2 of 2)

## Recall periods

- Exit interviews had good reporting accuracy (Kosovo) – implications for facility assessments.
- Longer recall periods (2 weeks and up to 6 months postpartum) had moderate accuracy (Nepal and India).

## Measurement of BF/IYCF counseling in household surveys

- Counseling is an essential intervention for increasing positive breastfeeding practices.
- Household surveys provide an opportunity to capture counseling received in various settings.
- Although reporting accuracy was moderate, survey-based questions are still useful for measuring BF/IYCF counseling coverage.



# Thank you!

## Related publications:

- Bryce E, Katz J, Heidkamp R, Lama TP, Khatri SK, LeClerq S, Munos M. **Validation of maternal report of nutrition-related interventions and counselling during antenatal care in southern Nepal.** *Maternal & Child Nutrition.* 2022 Apr;18(2):e13303.
- McKay M, Munos MK, Kim SS, Bryce E, Bucina H, Marchant T. **Assessing the validity of maternal report on breastfeeding counseling in primary health facilities in Kosovo.** *Under review.*
- Kim, SS, Ashok S, Mahapatra T, Gokhale P, Munos MK, Heidkamp R, Avula R. **Moderate accuracy on survey responses about infant and young child feeding counseling reported by mothers with children less than one year of age in India.** *In submission.*
- Ashok S, Kim SS, Heidkamp RA, Munos MK, Menon P, Avula R. **Using cognitive interviewing to bridge the intent-interpretation gap for nutrition coverage survey questions in India.** *Maternal & Child Nutrition.* 2022 Jan;18(1):e13248.
- Andrew L, Lama TP, Heidkamp RA, Manandhar P, Subedi S, Munos MK, Bryce E, Khatri SK, LeClerq SC, Katz J. **Cognitive testing of questions about antenatal care and nutrition interventions in southern Nepal.** *Social Science & Medicine.* 2022 Aug 30:115318.

**Q&A**

# Caregiver Recall of Diarrheal Episode Severity in Children: A Nested Validation Study

**Margaret Kosek, MD**

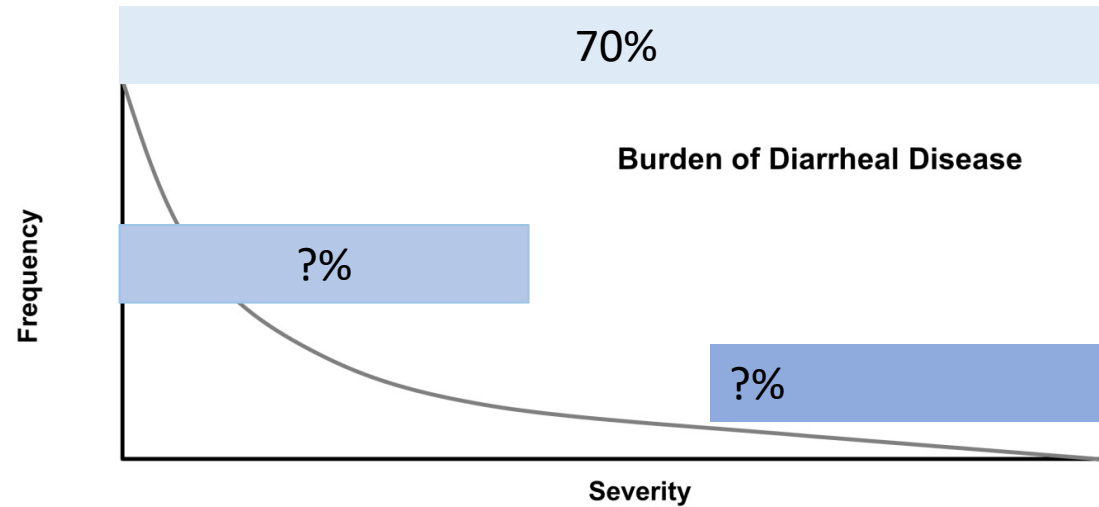
**UVA School of Medicine, Division of Infectious  
Diseases and International Health**

[mkosek@virginia.edu](mailto:mkosek@virginia.edu)

**Aim: Can we pick out, in global surveys, diarrhea episodes that are severe and focus on these for coverage effectiveness assessments?**



# The overlay of intervention on the severity is key in understanding if interventions have impact



<b>Study Type</b>	Community Setting		Healthcare Setting	
<b>Type of diarrhea study will find</b>	Mild	Moderate	Severe	
<b>Episodes can be gradated by symptoms such as:</b>	stomach pain, anorexia	Moderate dehydration, dysentery	Severe dehydration, need for IV hydration	
<b>"Severity index" should correlate to:</b>	Poorer growth, risk of MN deficiency, risk of future illness		Risk of short-term mortality	



# CODA Score

Symptom	Category	Points
Diarrhoea	≥3 liquid or semiliquid stools per day, for 1–13 days, with gaps of no more than 2 days	
Fever	No fever	+0
	Fever for 1–2 days	+1
	Fever for 3–4 days	+2
	Fever for 5+ days	+3
Anorexia	No anorexia	+0
	Anorexia for 1–2 days	+1
	Anorexia for 3–4 days	+2
	Anorexia for 5+ days	+3
Vomiting	No vomiting	+0
	Vomiting for 1–2 days	+1
	Vomiting for 3–4 days	+2
	Vomiting for 5+ days	+3
Liquid stools	No days with ≥4 liquid stools	+0
	1–2 days with ≥4 liquid stools	+1
	3–4 days with ≥4 liquid stools	+2
	5+ days with ≥4 liquid stools	+3
	Maximum number of stools in a 24 h period during the episode	3
	4–5	+1
	6–7	+2
	≥8	+3
Total		0–15

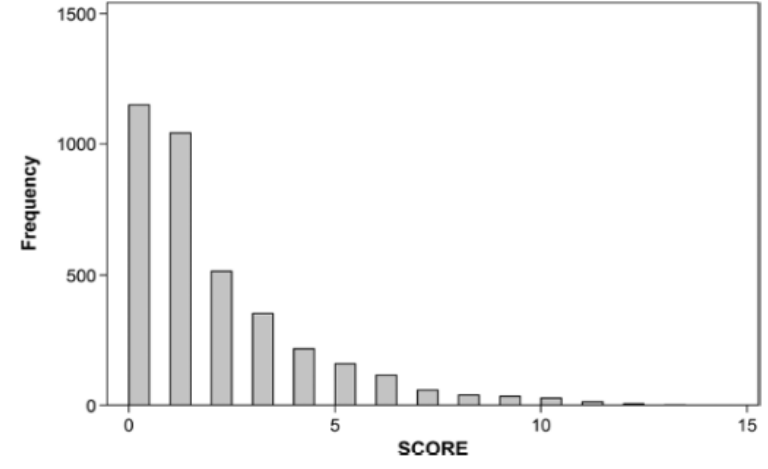
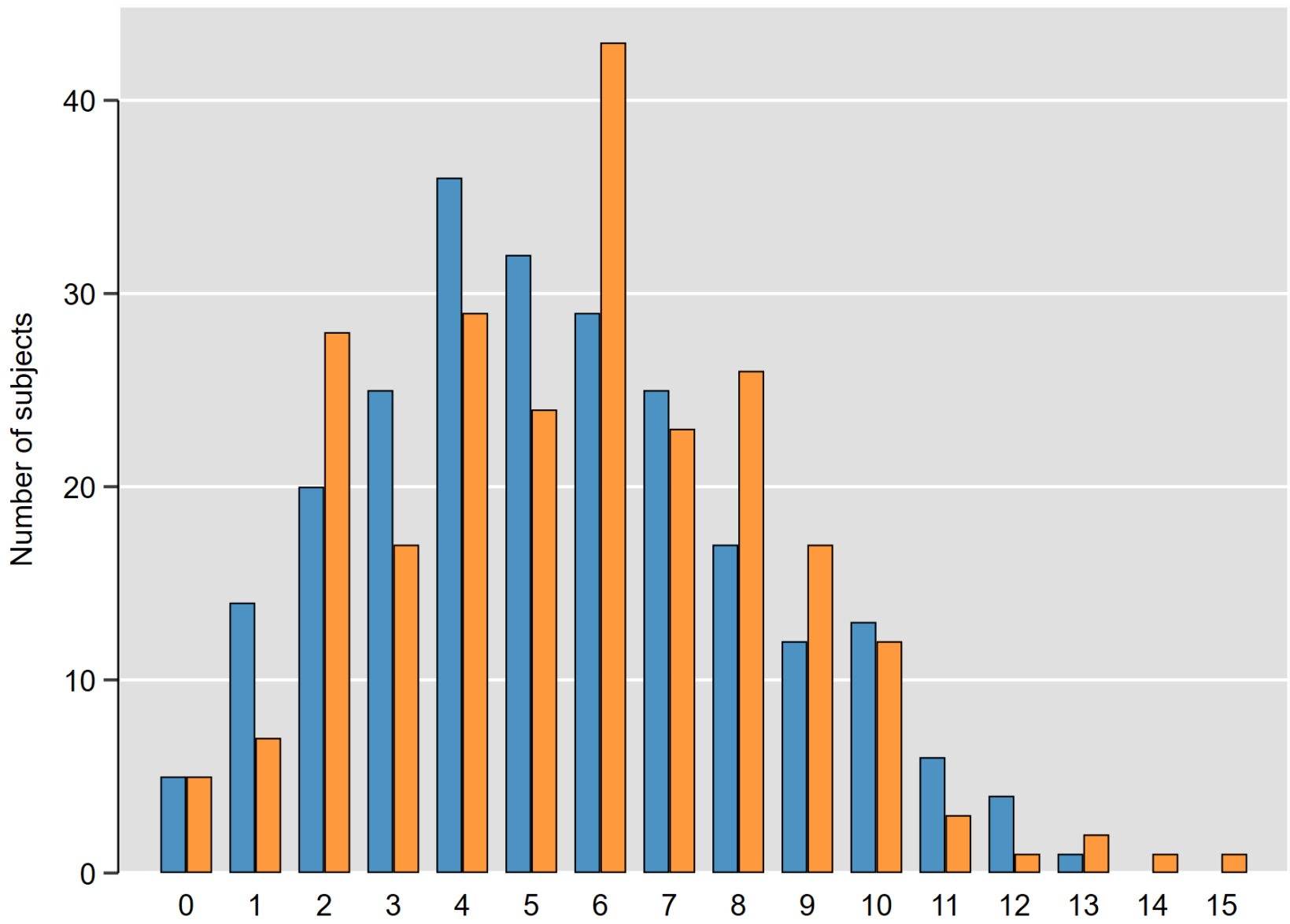
Mild diarrhea: 0–3  
 Moderate: 4–6  
 Severe: 7+

# Study Design

- Health facilities (hospitals and health centers in the area of Iquitos)
- Eligibility: <24 months of age, visiting health facility seeking care for diarrhea and/or severe vomiting (parent study)
- 14-day follow-up visit: Caregiver asked about concurrent symptoms (“smokescreen”) and to recall symptoms reported at baseline



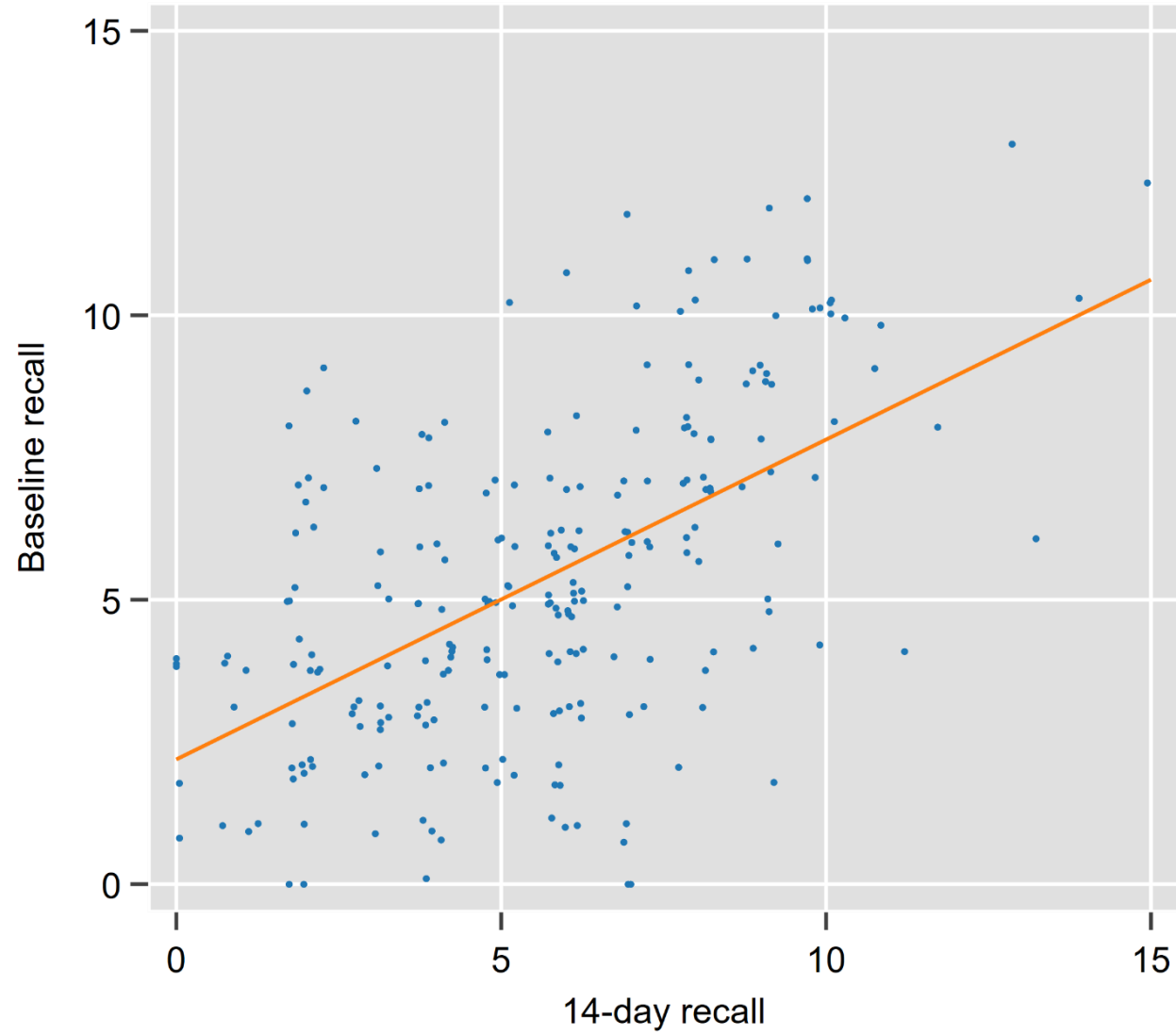
# CODA score



**Figure 4** Histogram of severity score distribution: the y-axis (frequency) indicates the number of episodes assigned to the score (N=3915).

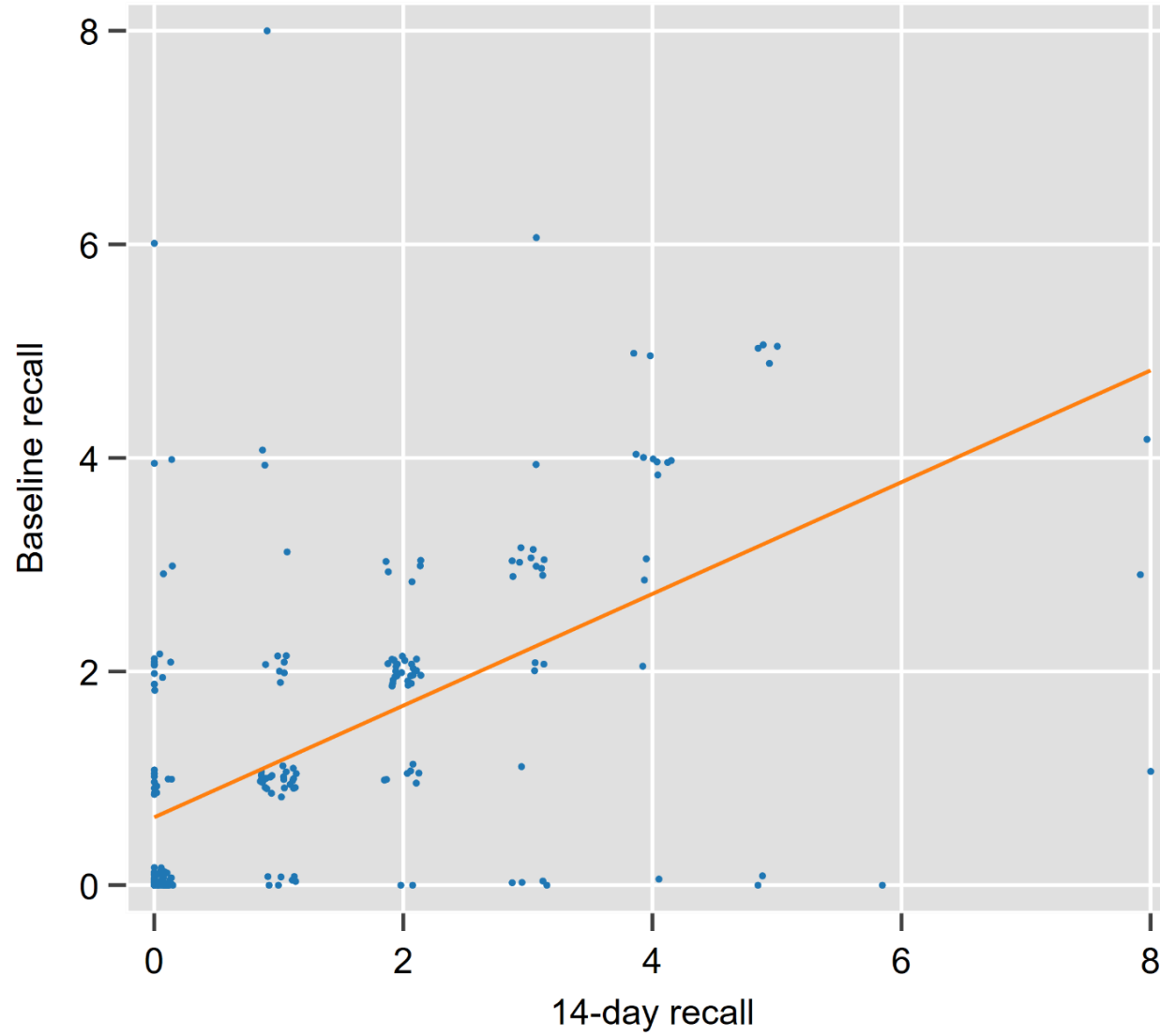
- Baseline
- 14-day follow-up

# CODA score



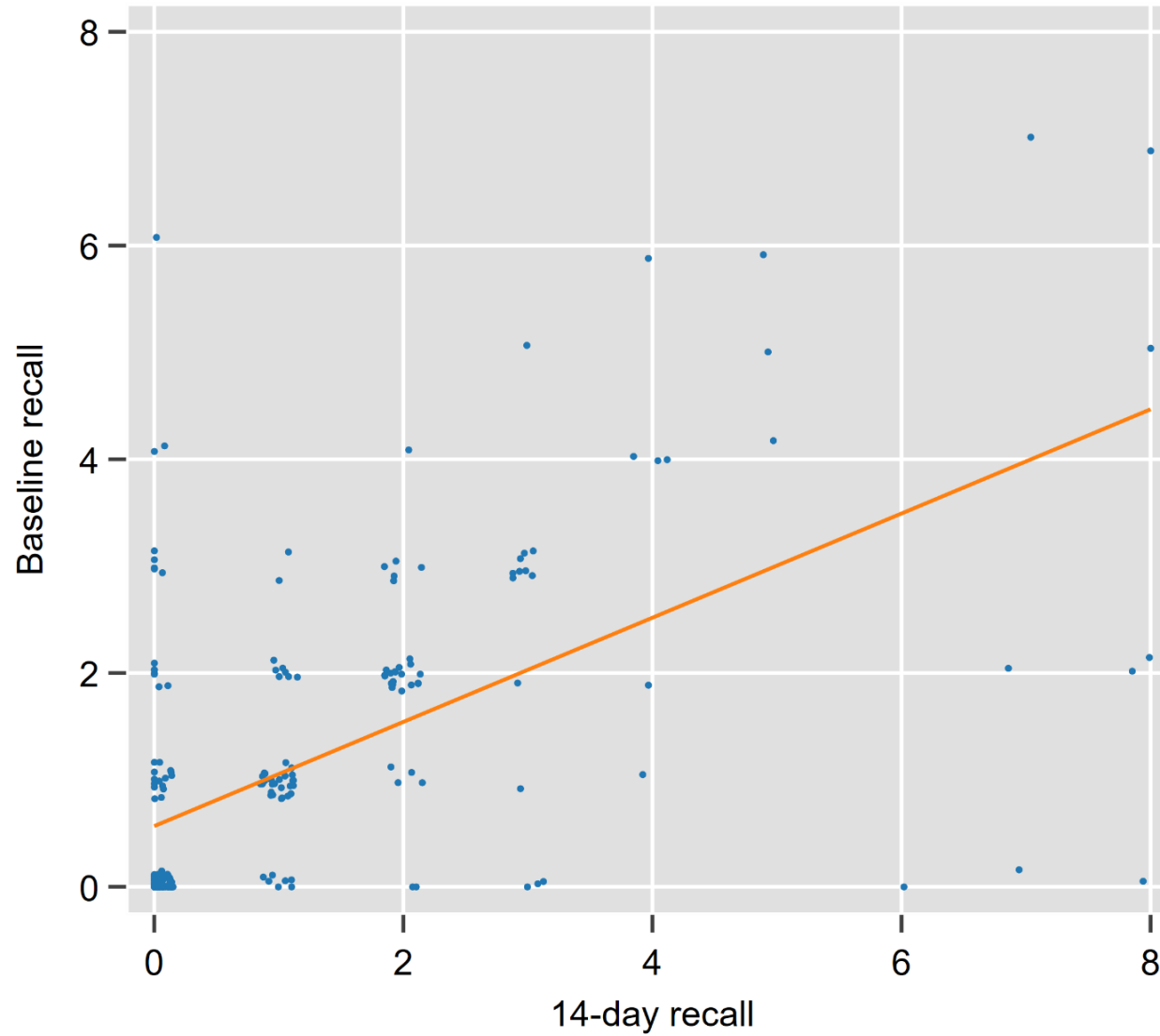
$0.56^{***}$  (0.46, 0.67),  $r = 0.56$

# Number of days with fever



$0.52^{***} (0.42, 0.62), r = 0.56$

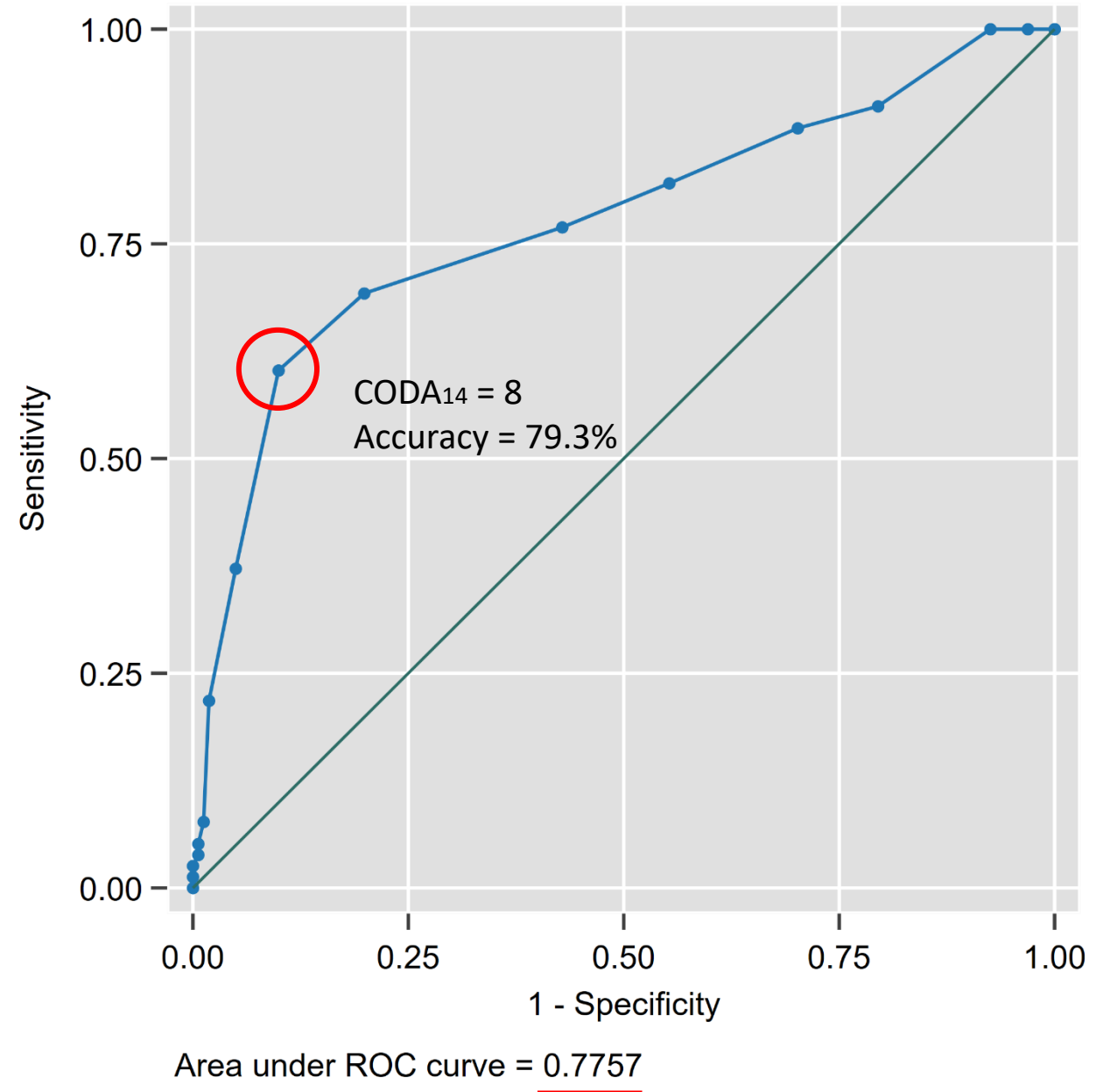
# Number of days with vomiting



$0.49^{***} (0.40, 0.57), r = 0.58$

# ROC analysis

- “Gold standard” – CODA<sub>0</sub> (measured at baseline)
- CODA<sub>0</sub> < 7 = mild/moderate, ≥ 7 = severe (Lee et al. 2016)
- Binary classifier – CODA<sub>14</sub> (CODA calculated based on 14-day recall of symptoms)



# ROC analysis: Specific symptoms vs CODA $\geq 7$

Symptom	Baseline (concurrent)			Follow-up (2 weeks later)		
	Optimal Cutoff	Accuracy	ROC	Optimal Cutoff	Accuracy	ROC
Days with fever	3	74.5%	0.74	3	68.6%	0.64
Days with anorexia	5	73.6%	0.75	6	67.8%	0.62
Days with vomiting	3	76.2%	0.71	3	70.1%	0.63
Days with $\geq 4$ liquid stools	3	86.2%	0.90	5/6	72.0%	0.68
Maximum # stools in 24 hrs	6	78.1%	0.81	7	71.1%	0.67



# Conclusions

- Applying a cutoff of  $CODA_{14} = 8$  to recalled symptoms gives acceptable accuracy in classifying severe diarrhea ( $CODA_0 \geq 7$ )
- We suggest 3 questions to differentiate between all diarrhea (mostly non-severe) for severe diarrhea (more likely to be a priority for lifesaving interventions and better to include in coverage estimate)

## 3 questions

- 1) days with  $\geq 4$  liquid stools
- 2) maximum number of stools in 24 hours
- 3) days with vomiting

**Q&A**

## Panelists



**Rasmi Avula**  
International Food Policy  
Research Institute



**Patricia Jodrey**  
United States Agency for  
International Development



**Rebecca Heidkamp**  
Johns Hopkins Bloomberg  
School of Public Health

## Moderator



**Ann Blanc**  
Population Council  
(retired)



**Sorrel Namaste**  
The DHS Program/  
ICF

# Panel Discussion

# Closing

**Jennifer Requejo, UNICEF**

# Thank you for joining!

Please visit our website at:

[improvecoveragemasurement.com](https://improvecoveragemasurement.com)



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