

# Validating questionnaire-based measures of low birth weight and preterm in rural Nepal



Photo: Luke Mullany

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

# Low birthweight and preterm birth



- ~20 million LBW babies/year globally
- ~15 million preterm babies/year globally

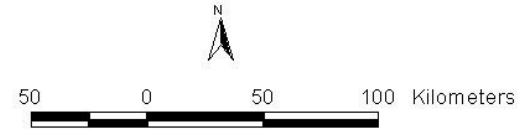
LBW and preterm infants have high mortality

LBW used to track progress by WHA



# NEPAL

(Ecological Zone Map)



**Legend**

- Boundary
  - International boundary
  - Regional boundary
  - District boundary
- Ecological Zone
  - Mountain
  - Hills
  - Terai

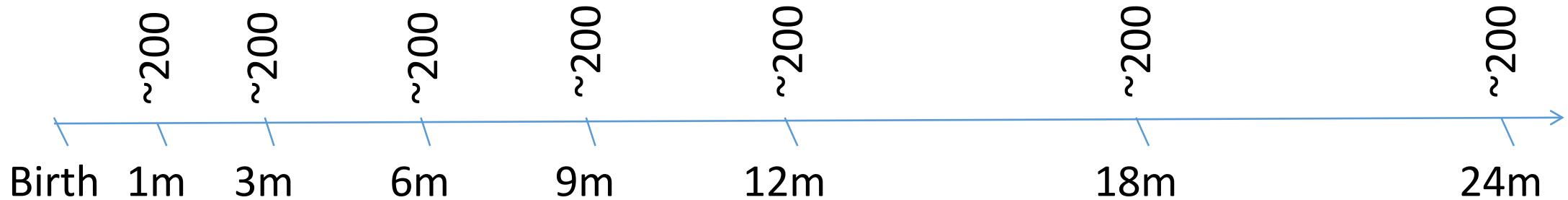
Sarlahi

# Parent study



- Community randomized trial to assess impact of newborn massage with sunflower or mustard seed oil on neonatal morbidity and mortality
  - Surveillance for pregnancies every 5 weeks
  - Last menstrual period (LMP) with up to 5 weeks recall
  - If pregnant, enrolled and followed through 28 days pp
  - Newborns weighed as soon as possible after birth using a digital scale precise to 10g

# Study design



- Women selected from parent trial for one additional household visit at staggered follow-up times 1, 3, 6, 9, 12, 18, 24 months after birth
- Ask to recall birthweight, birth size, and length of gestation



# Questions

How much did your child weigh at birth?

When your child was born, was he/she very small, smaller than average, average, larger than average, very large?

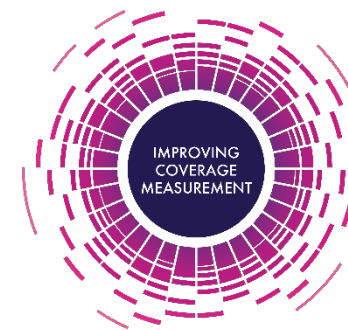
Do you have a birth record or certificate with your child's birth weight recorded?

When your child was born, was he/she born very early, early, on time, late, or very late?\*

\*Not asked in DHS and MICS



# Analysis



Indicator	Gold Standard	Maternal report
LBW	Birthweight <2500g (measured <72 hrs of birth)	Birthweight <2500g (reported 1-24 months after birth)
LBW	Birthweight <2500g (measured <72 hrs of birth)	Birth size* very small, smaller than average (reported 1-24 months after birth)
Preterm birth	Gestational age <37 wks (last menstrual period)	Gestation* very early, early (reported 1-24 months after birth)

\* Birth size: very small, smaller than average, average, larger than average, very large  
Gestation: very early, early, on time, late, very late

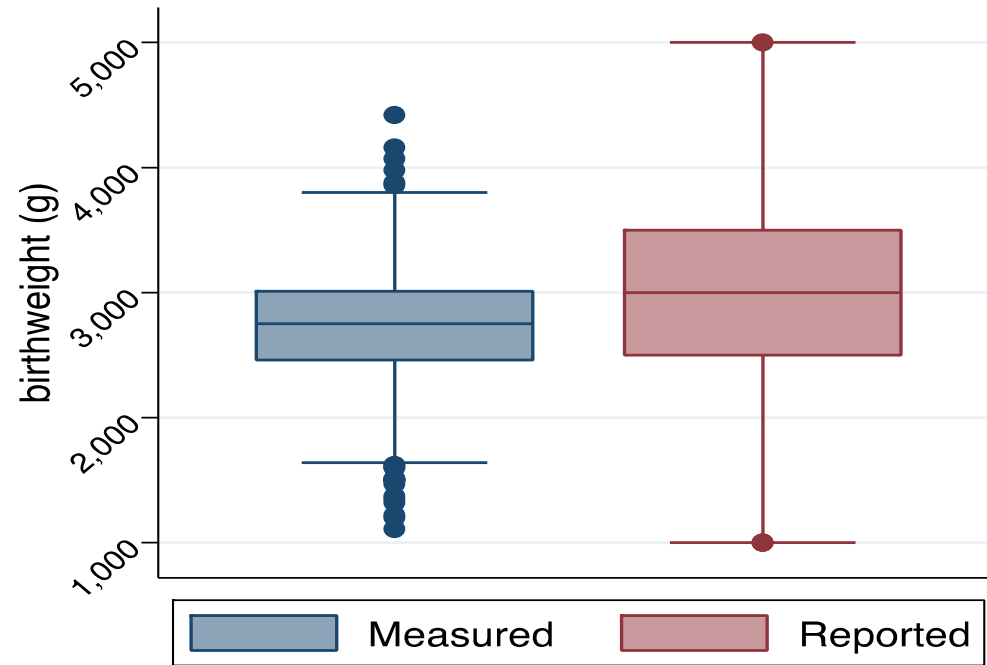
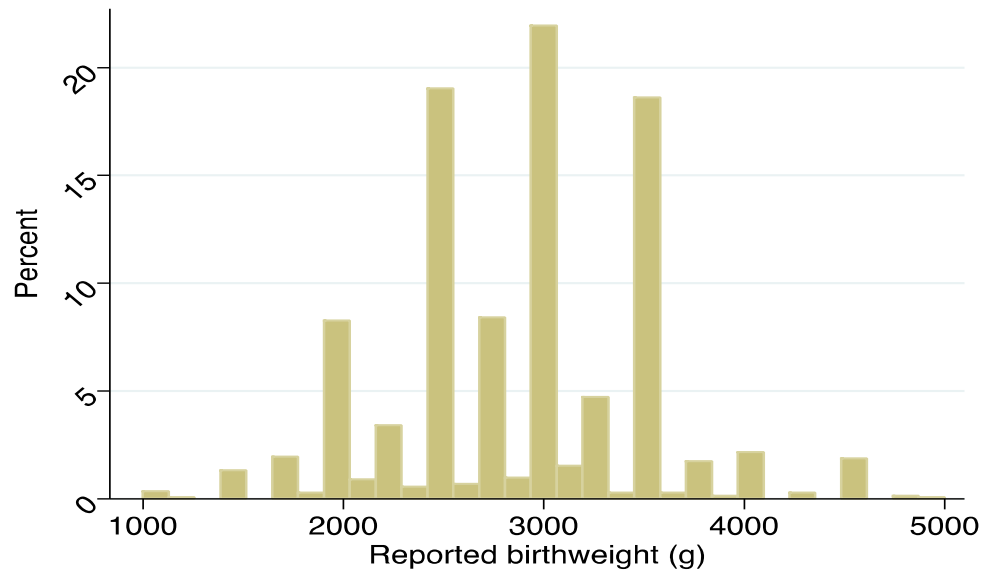
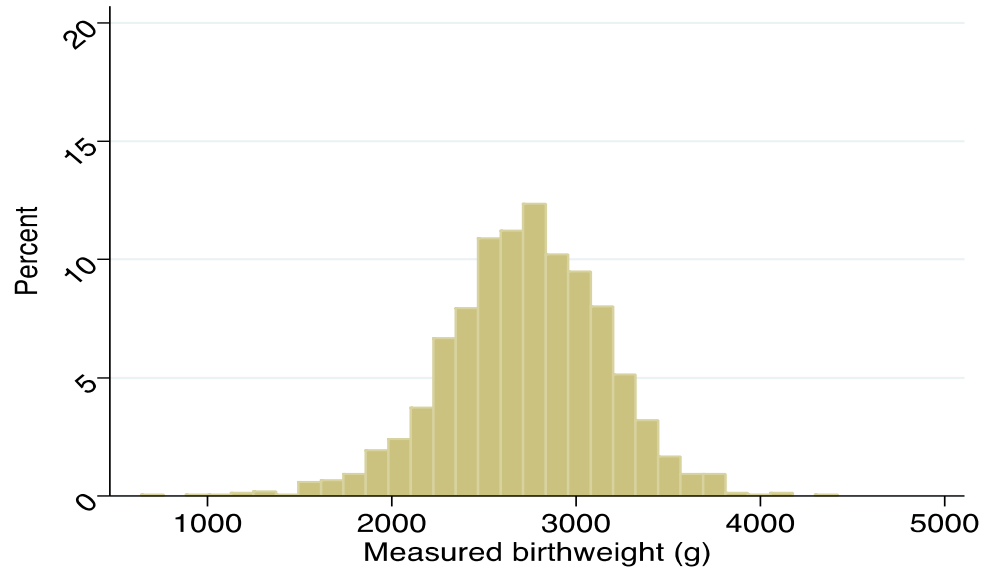
# Results



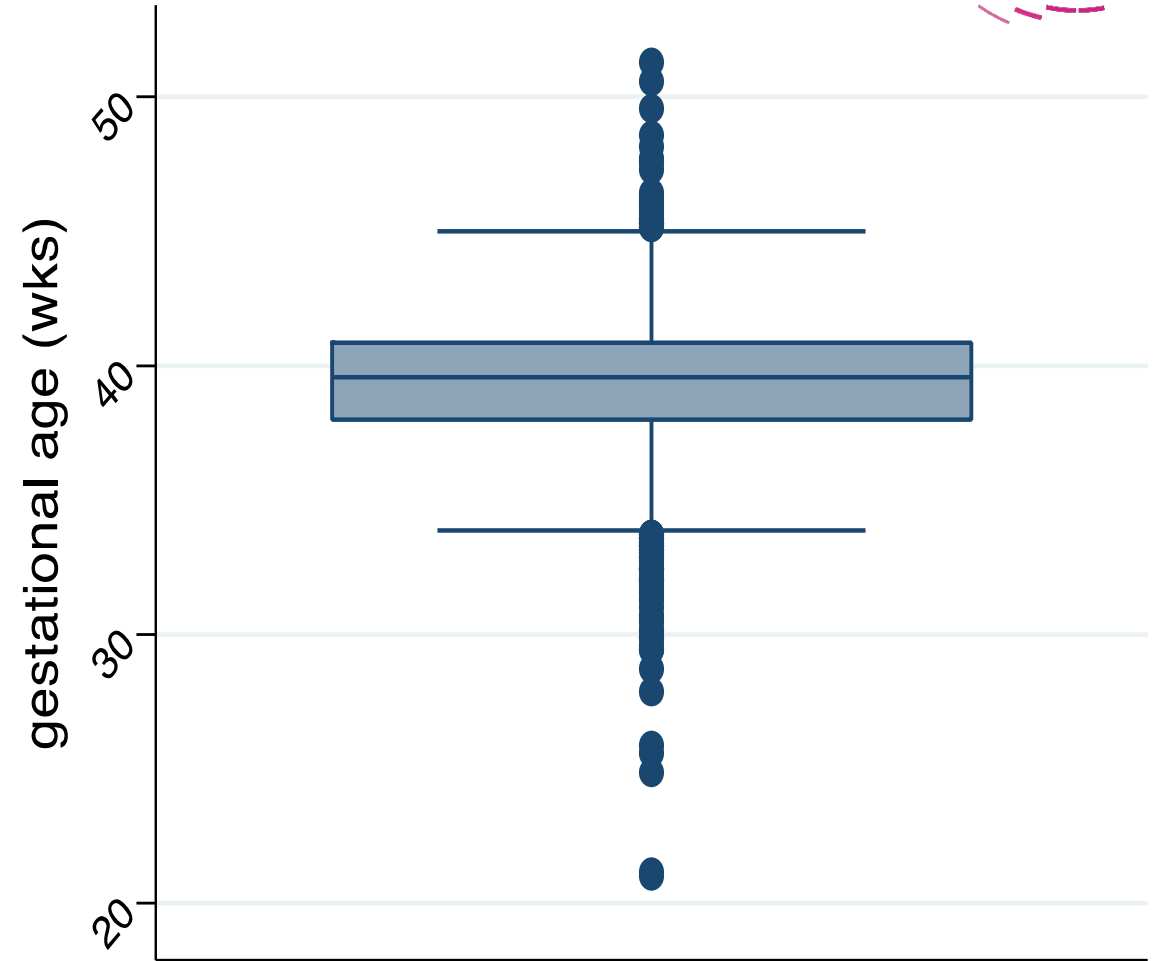
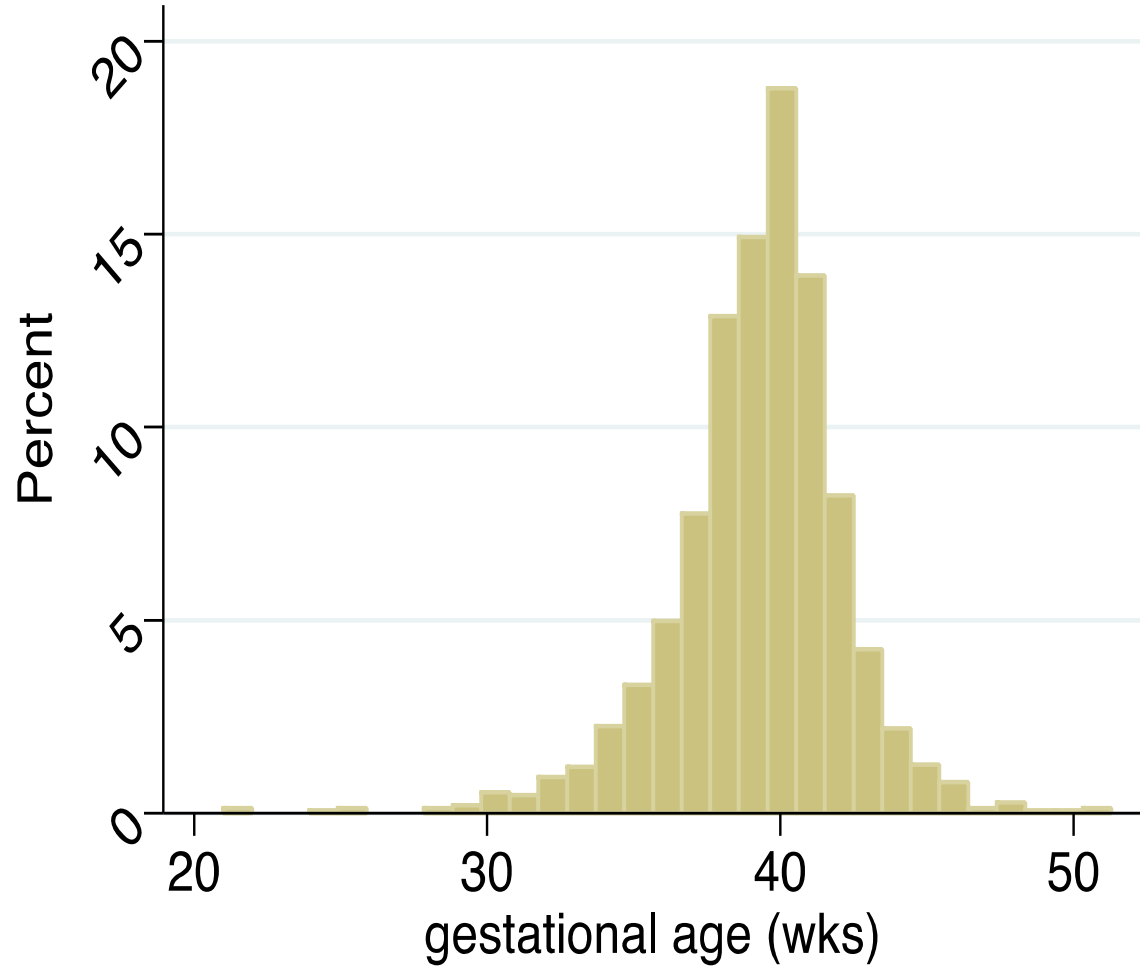
	N	% or Mean	95% CI
Child Sex			
Male	839	55.5	(52.9, 57.9)
Female	674	44.5	(42.1, 47.1)
Place of Delivery			
Home	755	53.8	(51.3, 56.3)
Facility	662	46.3	(43.7, 48.7)
Maternal Age (years)	1513	24.8	(24.6, 25.1)
Maternal Education			
No Schooling	1035	68.4	(65.9, 70.7)



# Distribution of measured and reported birthweight



# Distribution of gestational age



# Overall sensitivity, specificity, AUC, IF



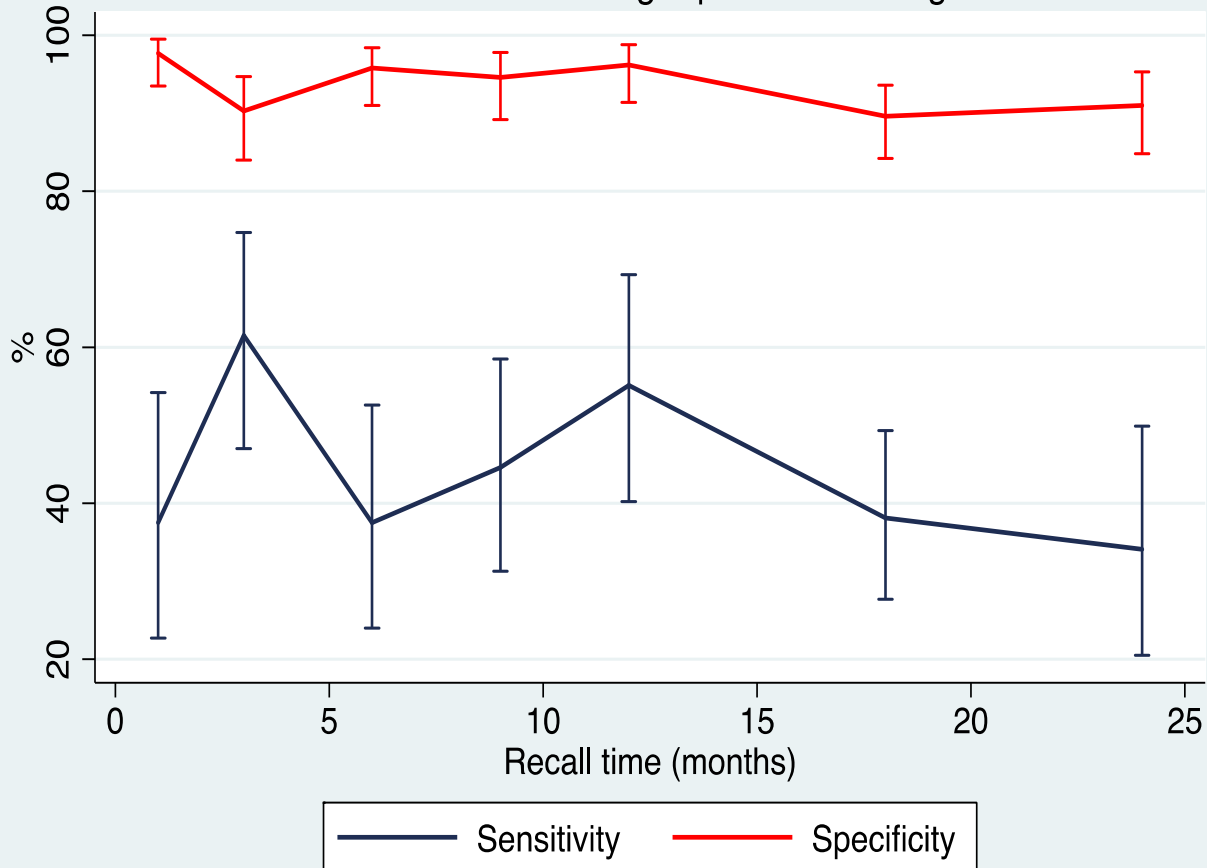
Indicator	n	Sensitivity (%) (95% CI)	Specificity (%) (95% CI)	AUC (95% CI)	'True' prevalence (%) (95% CI)	Estimated survey-based prevalence (%) (95% CI)	IF (95% CI)
A) LBW using reported birthweight	1434	45.0 (40.0-50.1)	93.5 (91.8-94.9)	0.69 (0.67-0.72)	27.3 (25.0-30.0)	17.0 (15.1-19.1)	0.62 (0.52-0.72)
B) LBW using reported birth size	1497	19.1 (15.4-23.2)	96.7 (95.4-97.7)	0.58 (0.56-0.60)	27.7 (25.5-30.1)	7.7 (6.4-9.1)	0.28 (0.22-0.34)
C) Preterm using reported length of gestation	1507	14.8 (10.6-19.9)	96.1 (94.9-97.1)	0.56 (0.53-0.58)	16.1 (14.3-18.1)	5.7 (4.6-7.0)	0.35 (0.27-0.44)

Defined high individual-level accuracy as  $AUC > 0.7$  and low population-level bias as  $0.75 < IF < 1.25$

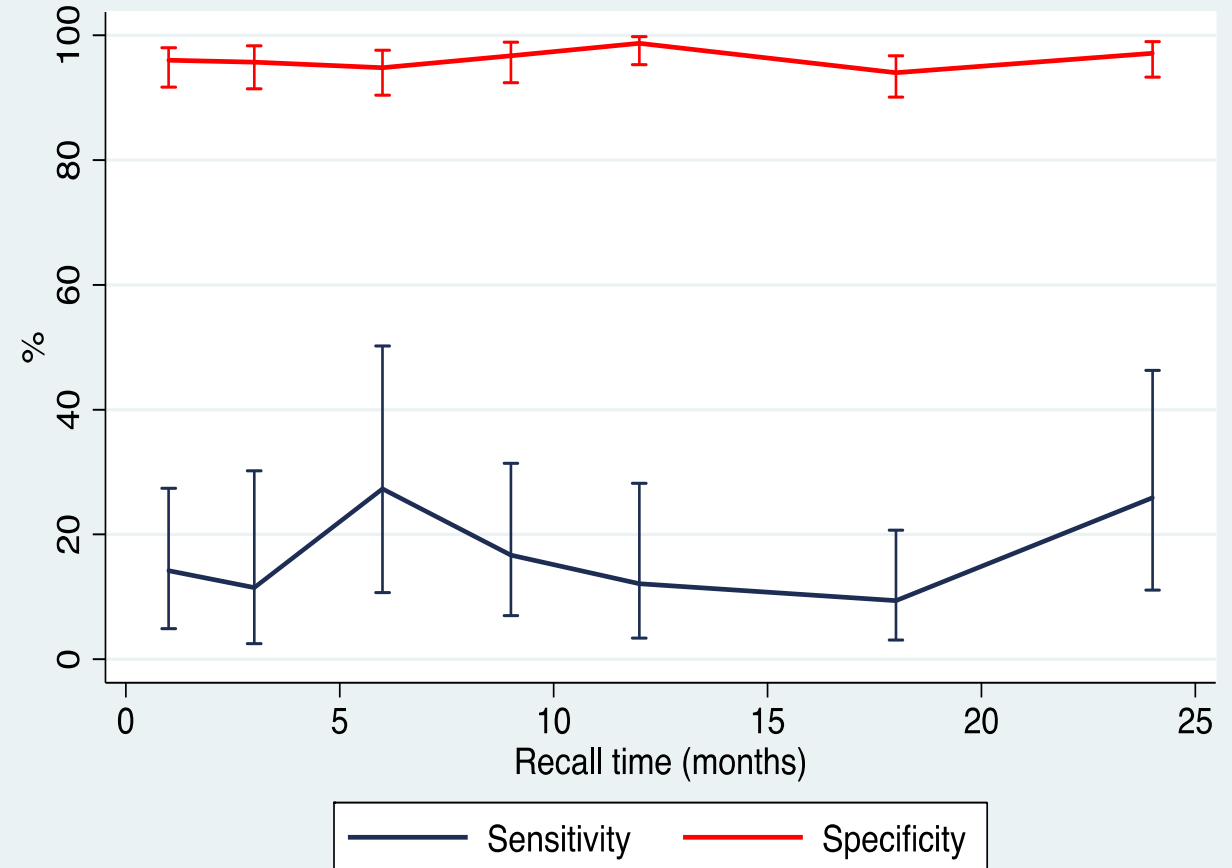
# Sensitivity / specificity by recall period



Sensitivity/Specificity  
LBW newborns using reported birthweight



Sensitivity/Specificity  
Preterm births



# Summary of results



- Setting where women did not save birth cards with weight
- Women overestimate birthweight/size
- High specificity but poor sensitivity for all 3 indicators
  - Low individual-level accuracy
  - Population-level underestimation of LBW and preterm births
- Length of recall did not affect accuracy of indicators
- SES, maternal age, parity, sex of infant, education did not predict accuracy of recall
- Consider refining measure of questionnaire based LBW/preterm measures