High prevalence of rotavirus infection among under five children despite a high rotavirus vaccination coverage in Ethiopia

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Debasu Damtie[*], Aschalew Gelaw, Yitayih Wondimeneh, Yetemwork Aleka, Anastasia N Vlasova, Belay Tessema

Debasu D. Gella, Ass. Prof. UoG , Ethiopia
OHEART PhD Fellow
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Incheon, Republic of Korea

THE OHIO STATE UNIVERSITY

UNIVERSITY OF GONDAR

NIH Fogarty

Background

- Rotavirus is the leading cause of severe diarrhea, contributes to 25% of diarrhea illnesses and 30% of diarrheal deaths [Wang et al 2016, Clark *et al* 2017]

- 95% rotavirus deaths and hospitalizations occur in LMIC [Troeger *et al* 2018]

- Efficacy of Rotarix® (GlaxoSmithKline) and RotaTeq® (Merck & Co., Inc.) vaccines has ranged from

  - 80% to 98% in industrialized countries

  - 39% to 77% in developing countries

- Rotavirus vaccine (Rotarix) has been introduced in Ethiopia in 2013 [FMoH 2015]

https://viralzone.expasy.org/107?outline=all_by_species
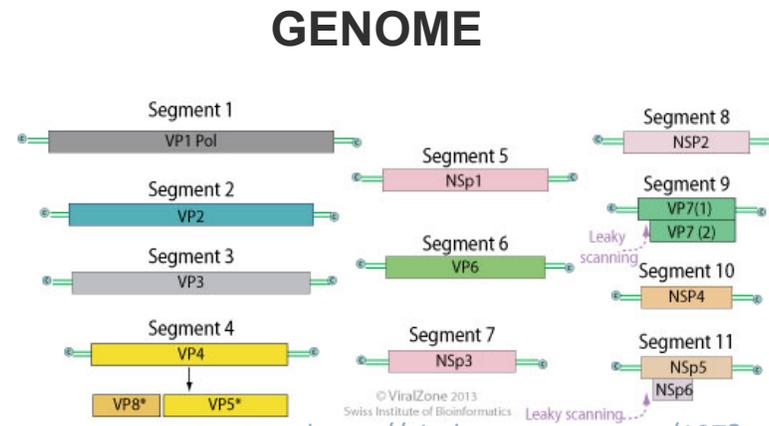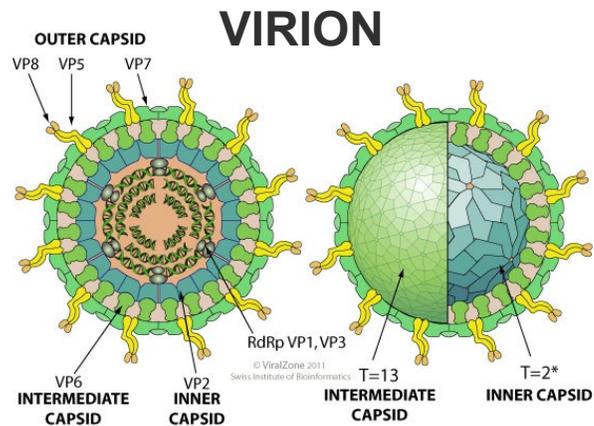
Objective

- To determine the prevalence of rotavirus A infection among under five children 8-years post-rotavirus vaccine introduction in Ethiopia
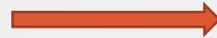
Methods and Materials
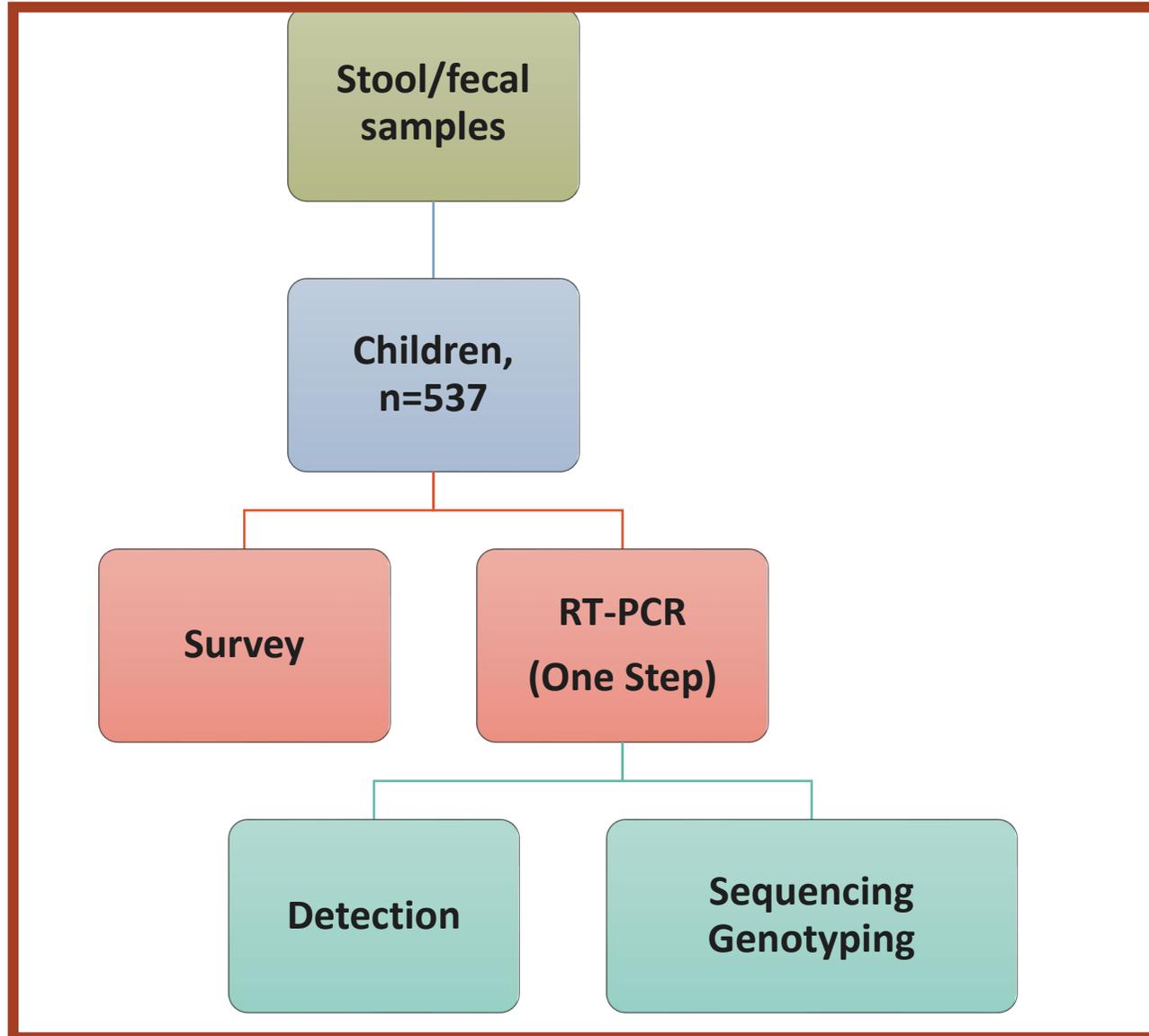
- Multi-center hospital based cross sectional study design
- Amhara National Regional state, Ethiopia
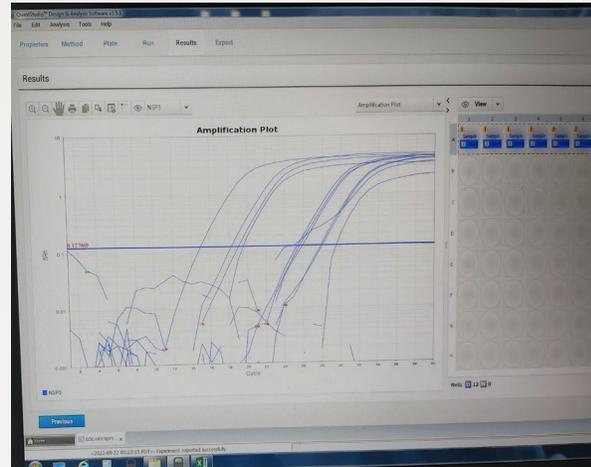- February 2021-December 2021

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Methods and Materials
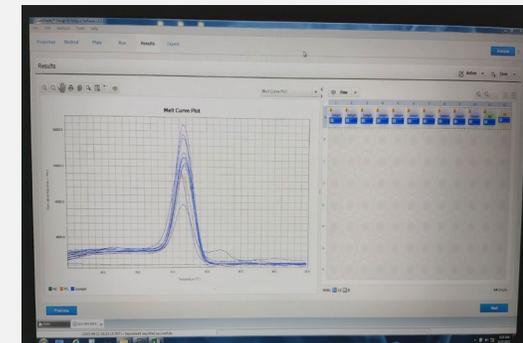
RNA extraction

QIAamp Mini spin RNA extraction protocol

One step RT-PCR

Stage	Step	Temp C	Time
Holding	Reverse Transcription	50	30min
Holding	Hot start	95	10min
Cycling (40 cycles)	Denature	94	30sec
	Anneal	56	30sec
	Extension	72	30sec
Melt curve	Denature	95	15 sec
	Anneal	60	15 sec
	Denature	95	15 sec

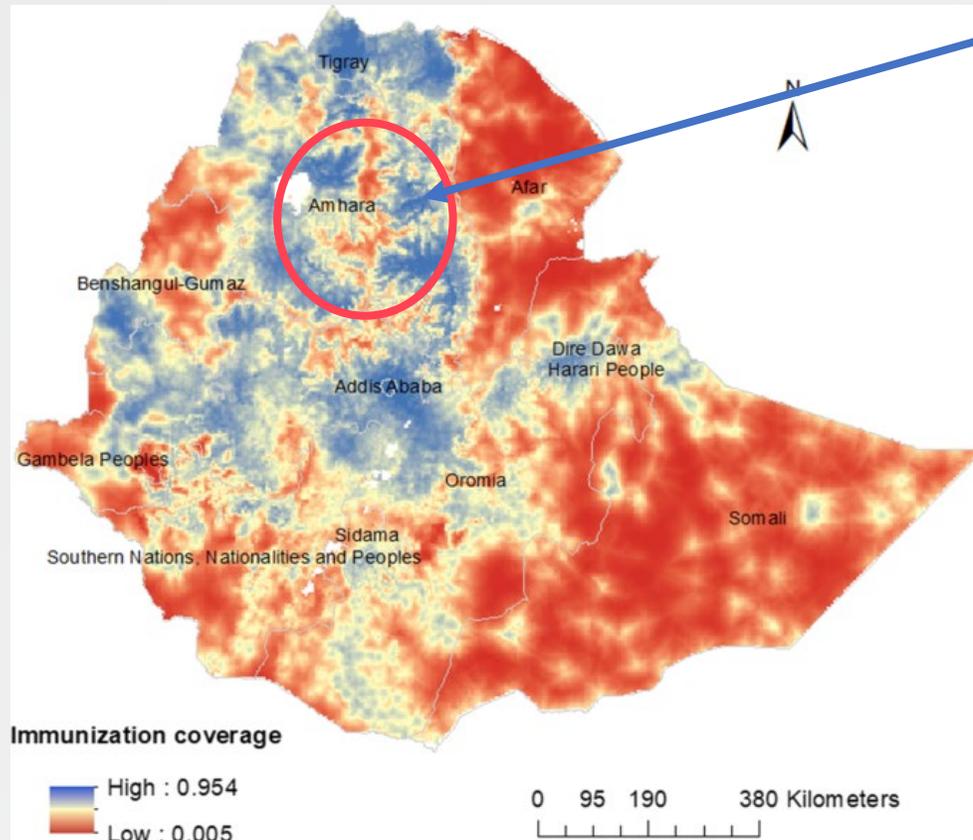Target gene NSP3
Amplicon size 87bp

5
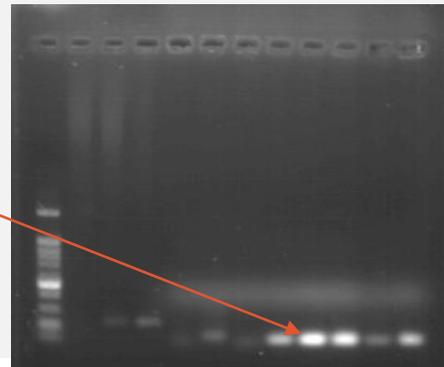
Results and Discussion

- Age in months (mean $\pm$ SD) 25.5$\pm$15.2

- Rotavirus A infection

  - Overall prevalence 94/537 (17.5%, 95% CI= 14.0%-20.9%)

  - Among hospitalized 24.4 %

- Highest prevalence

  - Bahir Dar city

  - 12-23 months old children

- Clinical severity was correlated with rotavirus A infection

Variables	Rotavirus A		
	Positive (%)	Negative (%)	P-value
Study site			0.001
Gondar	44(16.9)	217(83.1)	
Bahir Dar	41(29.3)	99(70.7)	
Debre Markos	9(6.6)	127(93.4)	
Age (in months)			0.04
0-11	16(19%)	68(81)	
12-23	42(22.6)	144(77.4)	
24-59	31(12.2)	224(87.8)	
Vomiting			0.003
Yes	52(22.7)	177(77.3)	
No	37(12.5)	258(87.5)	
Sunken eyes			0.019
Yes	21(25.9)	60(74.1)	
No	68(15.3)	376(84.7)	
IV fluid given			0.026
Yes	16(28.1)	41(71.9)	
No	73(15.6)	395(84.4)	

Results and Discussion

Spatial distribution of rotavirus immunization coverage in Ethiopia [Atalell, K.A *et al* 2022]

Study area (ANRS)

- The immunization coverage was
  - One dose: 513/525 (97.7%)
  - Full dose: 506/513 (96.3%)

- National level coverage
  - One dose= 60.77%
  - two doses =52.3%

- Substantial variations at sub-national levels [Atalell, K.A *et al* 2022]

- ANRS coverage
  - One dose= 75.78
  - Two doses= 68.86%

- A decline of rotavirus associated hospitalization by 17% post-vaccine introduction era [Abebe *et al* 2018]

Results and Discussion

- The rotavirus vaccine effectiveness in Africa is generally low

  - HBGAs and secretor status of children [Nordgren et al 2012, Kazi et al 2017, Armah et al 2019).

  - The variability in the abundance and diversity of gut microbiota [Rajilić-Stojanović et al 2009, Harris et al 2017]

  - Very high prevalence of malnutrition [Mora et al 2008, Ibs et al 2003]

  - Environmental enteropathy [Naylor et al 2015, Becker-Dreps et al 2017]

  - Vaccine pressure induced replacement of rotavirus genotypes and emergence of unusual types (G5, G8 and G12) [Castello et al 2006, Adah et al 2001, Van Damme et al 2007]

Conclusions and recommendations

- Despite the high rotavirus immunization coverage, the rotavirus infection among diarrheic children is still considerably high.

- Further investigation to dissecting the reasons why the vaccine is not effective in developing countries shall be considered including host genetic studies

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