Rapid Active Sampling (RAS) Surveys as a Tool to Evaluate Factors Associated with Acute Gastroenteritis and Norovirus Infection among Children in Rural Guatemala

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Background

- Norovirus (NoV)-associated acute gastroenteritis (AGE) accounts for 212,000 deaths annually.
- Resource-limited countries account for 85% of NoV AGE and 99% of deaths.
- Tools are needed to determine the burden and risk groups of NoV infection and disease, and to better determine the need and potential impact of upcoming vaccines.
- Rapid active sampling (RAS) surveys represent a potential tool to quickly assess NoV disease burden and identify high risk populations.

Objectives

- To identify risk groups and factors for NoV infection and NoV-associated AGE among children living in rural Guatemala.
- To assess the utility of rapid active cross-sectional sampling (RAS) surveys as a tool to identify priority populations for NoV control.

Methods

- Households with children 6 weeks-18 years were screened by 2-stage cluster sampling and enrolled into one of 2 surveillance arms:
1) A prospective participatory surveillance (PSS) system (included enrollment visit only)
2) Two separate RAS surveys
- Clinical + known AGE risk factors were collected.
- Stool/rectal swab samples tested for NoV by PCR.
- AGE defined as ≥3 days of vomiting *or* diarrhea or ≥1 day of both.
- We compared associated factors for the following:
  - AGE vs no AGE
  - NoV(+) AGE vs NoV(-) AGE
  - All NoV(+) vs All NoV(-)
  - NoV(+) AGE vs NoV(+) no AGE

Results

- 1,239 children from 627 households were included in the PSS enrollment (Apr-Sep 2015), RAS Cycle 1 (Oct-Nov 2015), and RAS Cycle 2 (Jan-Feb 2016).
- Study groups had similar characteristics.
- Stool sample available on 76% of AGE and 51% of non-AGE participants.
- Clinically, there were no statistically significant differences between NoV(+) AGE and NoV(-) AGE.

Factors Associated with Acute Gastroenteritis in Children

Risk Factor	AGE (n=134)	No AGE (n=1,105)	Crude PR (CI)	Adjusted PR (CI)**
# children per HH < 5 years, mean (SD)	1.4 (1.0)	1.1 (0.9)	0.26 (0.10 – 0.43)*†	1.0 (-0.09 – 0.30)
# adults per HH ≥18 years, mean (SD)	3.1 (1.5)	2.8 (1.3)	0.14 (0.03 – 0.24)*†	**0.12 (0.02 – 0.22)***
Other child in HH with AGE, n (%)	36 (26.9%)	114 (10.3%)	0.98 (0.64 – 1.32)*†	**1.18 (0.69 – 1.67)*‡**
Type of house				
- Aluminum, n (%)	11 (8.2%)	44 (4.0%)	0.66 (0.10 – 1.22)*†	0.53 (-0.03 – 1..08
- Cement/cinder block, n (%)	95 (70.9%)	822 (74.4%)	ref	ref
Water source				
- Waterline, n (%)	34 (25.4%)	204 (18.5%)	0.41 (0.04 – 0.77)*†	**0.49 (0.04 – 0.94)*‡**
- Bottled water, n (%)	4 (3.0%)	6 (0.5%)	1.44 (0.65 – 2.22)*†	**1.52 (0.21 – 2.83)*‡**
- Well, n (%)	93 (69.4%)	885 (80.1%)	ref	ref
Property Exposures				
- Well, n (%)	93 (69.4%)	892 (80.7%)	-0.54 (-0.88 - -0.20)*†	**-0.64 (-0.99 - -0.29)***
- Septic tank, n (%)	78 (58.2%)	754 (68.2%)	-0.38 (-0.71 - -0.06)*†	-0.27 (-0.59 – 0.06)
Age	5.0 (4.1)	7.3 (4.9)	-0.10 (-0.14 – -0.06)*†	-0.09 (-0.13 - -0.04)*

Factors Associated with Norovirus Infection in Children

Risk Factor	All NoV(+) (n=75)	All NoV(-) (n=588)	Crude PR (CI)*	Adjusted PR (CI) **
Breastfed (if age < 2 years), n (%)	67 (89.3%)	559 (95.4%)	-0.79 (-1.48 - -0.11)*†	**-1.19 (-2.23 - -0.16)*‡**

Factors Associated with Norovirus-Associated AGE in Children

Risk Factor	NoV(+) AGE (n=15)	NoV(-) AGE (n=87)	Crude PR (CI)*	Adjusted PR (CI)**
Property Exposures				
- Natural water, n (%)	6 (40.0%)	12 (13.8%)	1.14 (0.24 – 2.03)*†	**1.82 (0.45 – 3.19)***
- Bottled water, n (%)	2 (13.3%)	1 (1.1%)	1.54 (0.56 – 2.53)*†	2.10 (-0.44 – 4.65)

*p value < 0.05. For Prevalence Ratios, 0 is null
†p < 0.2, thus tested in the multivariate model
**adjusted for age, number of adults and number of children < 5 years old in the household
‡Used the Logit function to estimate OR, since the PR was not estimable in the multivariate model

Conclusions

- The rapid active cross-sectional sampling (RAS) surveys were effective in identifying several known factors associated with AGE and norovirus infection.

- In our population, younger children and children with greater household crowding were at increased risk of AGE.

- Having natural water on one's property was a factor associated with NoV-associated AGE and wells were protective against AGE.

- Breastfeeding was protective against NoV infection.

- RAS surveys could be used as a cost-effective method to estimate burden of disease and identify at-risk populations for AGE and NoV.

References

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Disclosures