Investigating spatial mobility and social predictors of common illnesses

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Strategies to prevent common illnesses recommended by public health experts have little empirical basis

Very limited information on epidemiology of influenza, common cold, and gastroenteritis ("stomach flu")

No prior long-term prospective longitudinal studies of time-varying factors associated with illness in general population in natural circumstances

Health Tracking Network

Goals:

1) identify factors related to common illnesses

2) provide personal tracking tools

3) generate donations to charity

Launched April 27, 2011

Respondents recruited online (citizen science, crowdsourcing, volunteering, “click to donate” & classified ad sites); also, friends & referrals

Anonymous, non-identifiable participation

Respondents choose how often to visit, offered independent reminder services and strategies

Surveys

Demographics and health history

Symptom updates

- **up to 7 per week**
- **recall period = since last update or 72 hours**
- **travel > 100 km from home, household members' symptoms also assessed**

Weekly surveys

- **factors possibly related to illness**
- **recall period = since last weekly survey or 7 days**

Measurement

Symptom updates aggregated to week level

New illness definitions:

- **gastroenteritis (vomiting or diarrhea)**
- **influenza-like illness (ILI; cough and fever)**
- **common cold (2+ of cough, sore throat, & nasal symptoms; no ILI)**

Week of observation determined by midpoint of recall period

Continuing illnesses & “non-susceptible” periods = missing data

Period for analysis: Nov. 27, 2011 – March 4, 2012

49 respondents living in households North America or Europe with 2+ weeks of observations

Region: 67% USA, 14% Canada, 18% Europe

Sex: 57% female

Age: median = 37, IQR = 25 – 58, min = 18, max=65+

14% had children under age 18 at home; 10% primary caregivers

Household size: 16% one, 45% two, 31% 3-4, 8% 5+

Education: 69% bachelor's degree+ (all graduated high school)

Occupation:
4% in healthcare, 8% potentially exposed to gastrointestinal pathogens

Body mass index: 35% overweight/obese

Chronic respiratory disease = 10%
Chronic gastrointestinal disease = 18%

10% smoked

12% were vegetarian

65% had indoor pets

86% were pretty or very happy

474 person-weeks of observations included

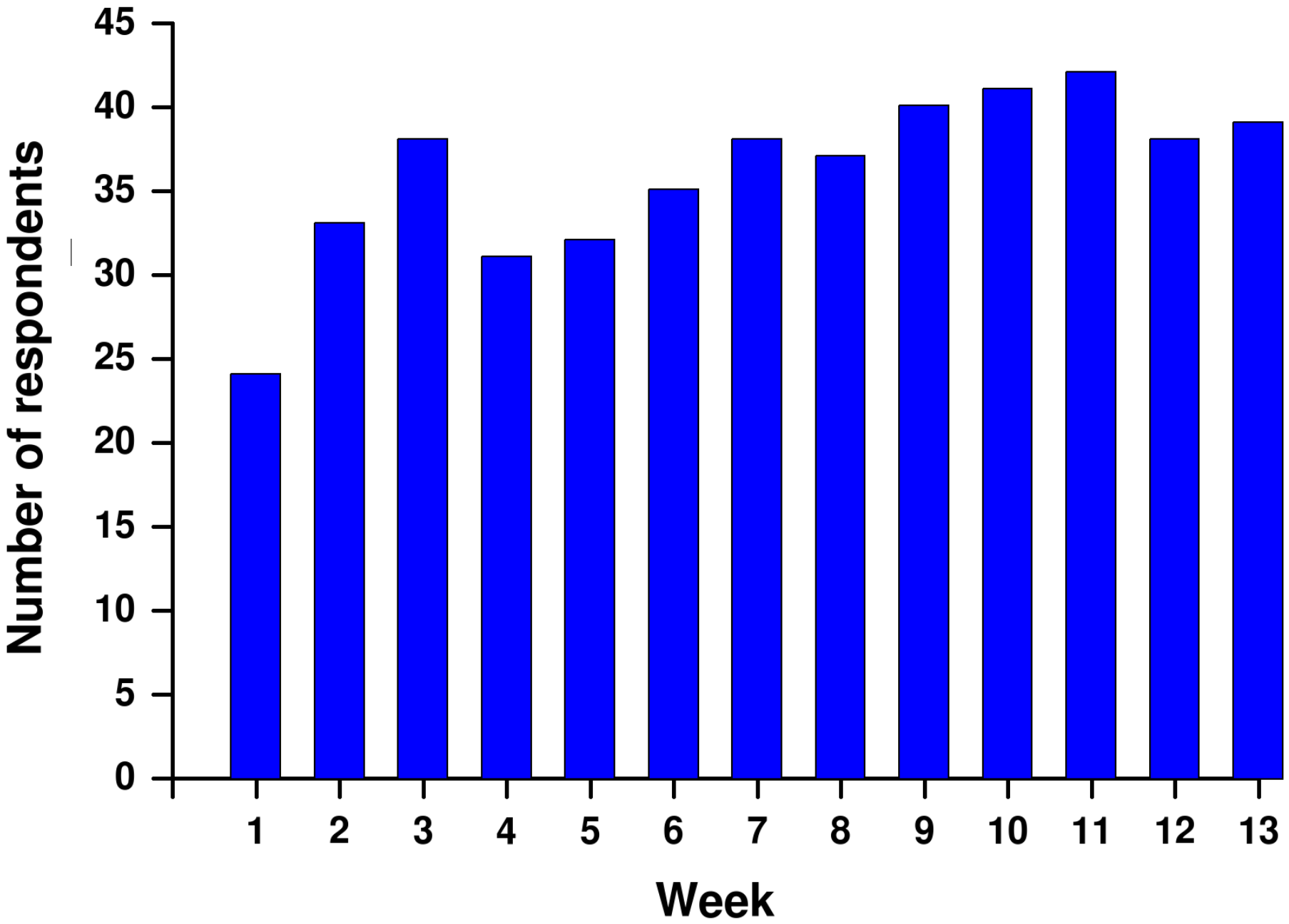
- **per respondent: min = 2, max = 13, median = 11, mean = 9.7**

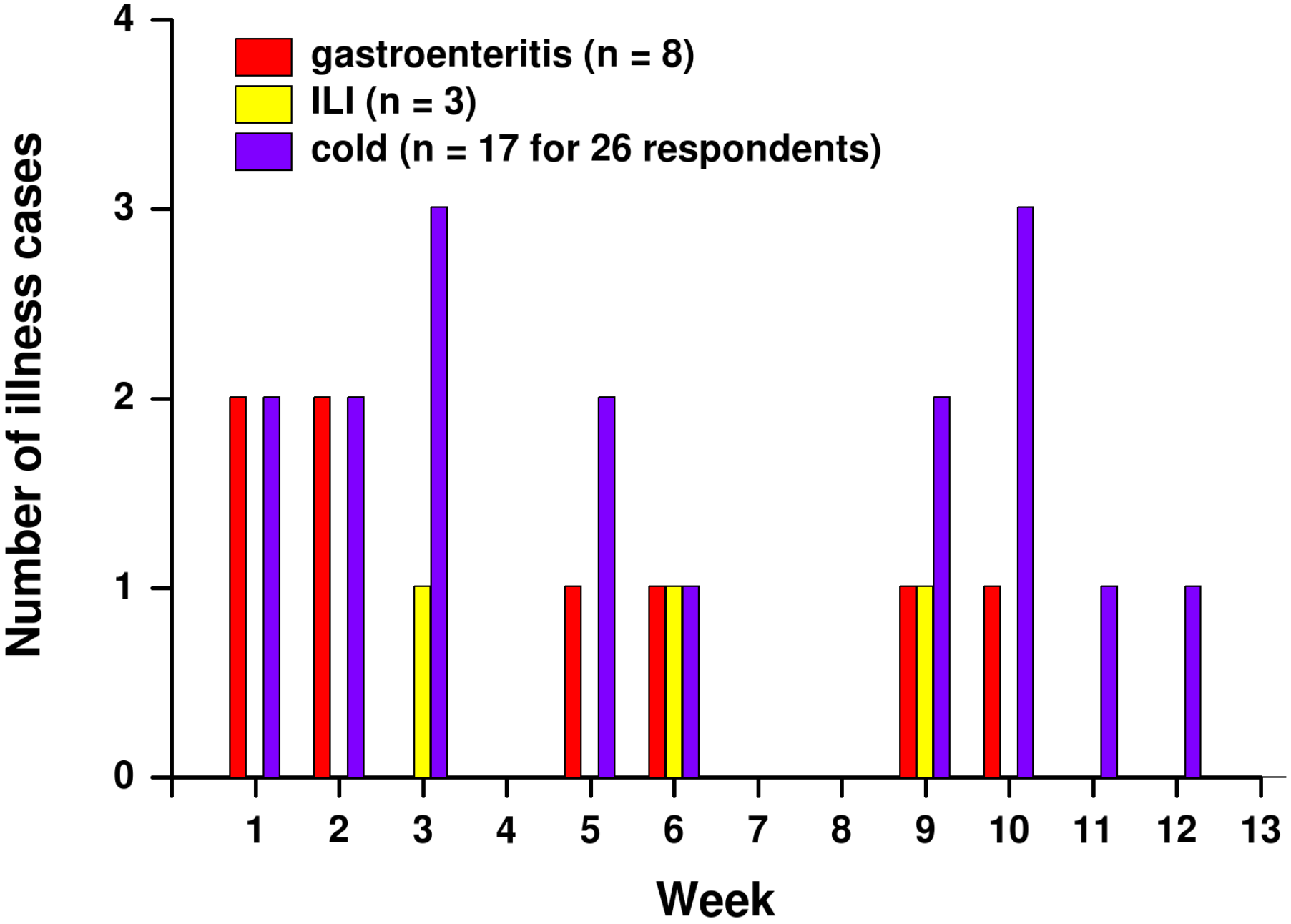
Total of 1,304 symptom reports

- **per respondent: mean = 26.6; mean per week = 2.7**

Symptom update coverage of time within weeks when reporting

- **per respondent: mean = 70%, median = 67%, min = 43%, max = 98%**


Number of respondents
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
8
9
10
11
12
13
Week


gastroenteritis (n = 8)
ILI (n = 3)
cold (n = 17 for 26 respondents)
Number of illness cases
0
1
2
3
4
1
2
3
4
5
6
7
8
9
10
11
12
13
Week

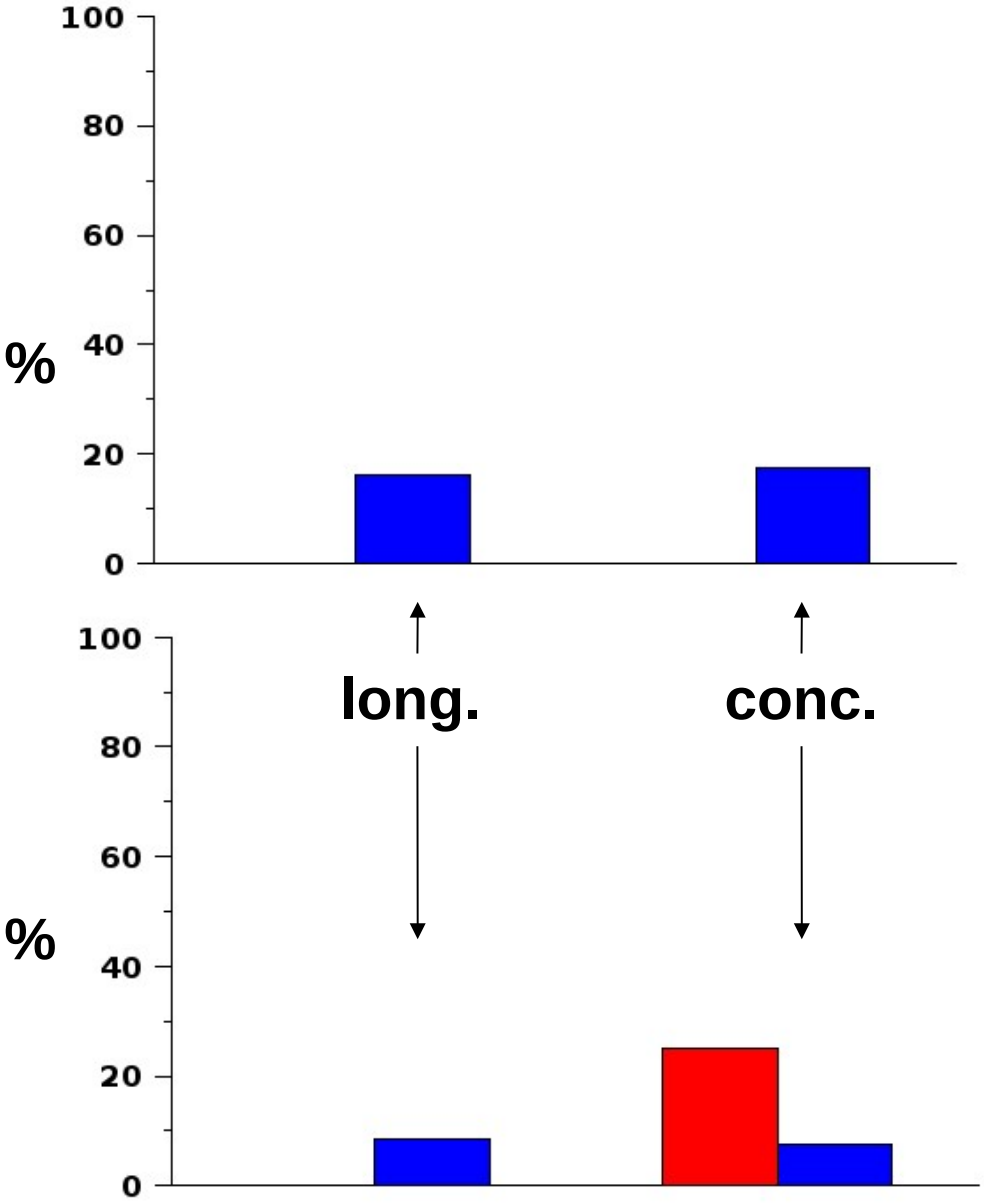
Longitudinal (T-1 x T) and concurrent (T x T) associations (excluding continuing illnesses and non-susceptible periods)

Gastroenteritis

Travel > 100 km from home

Red = ill
Blue = well

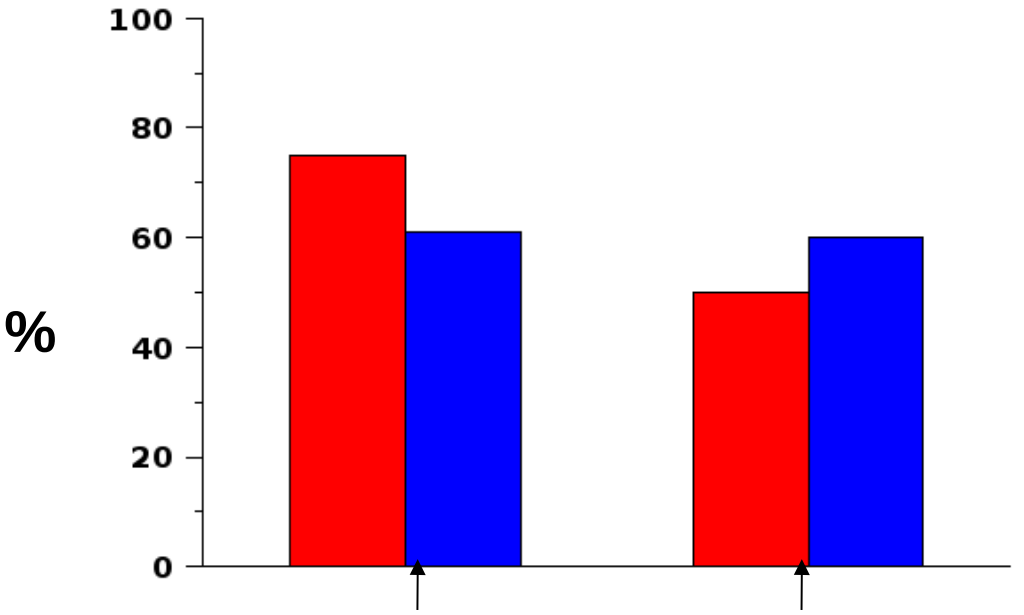
Exposed to symptomatic household member



Longitudinal (T-1 x T) and concurrent (T x T) associations (excluding continuing illnesses and non-susceptible periods)

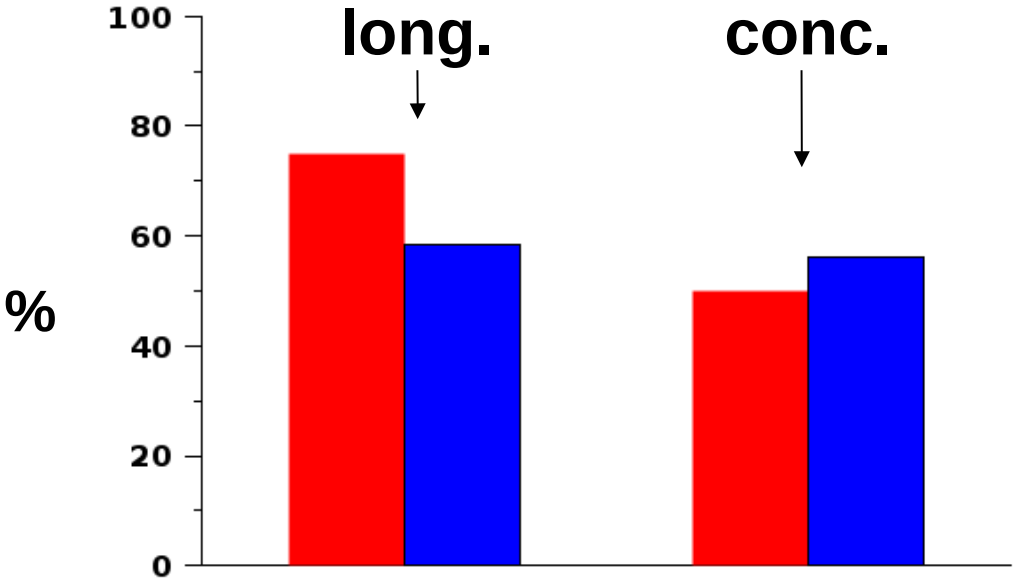
Gastroenteritis

Visitors to own home



Red = ill
Blue = well

Visited others' homes

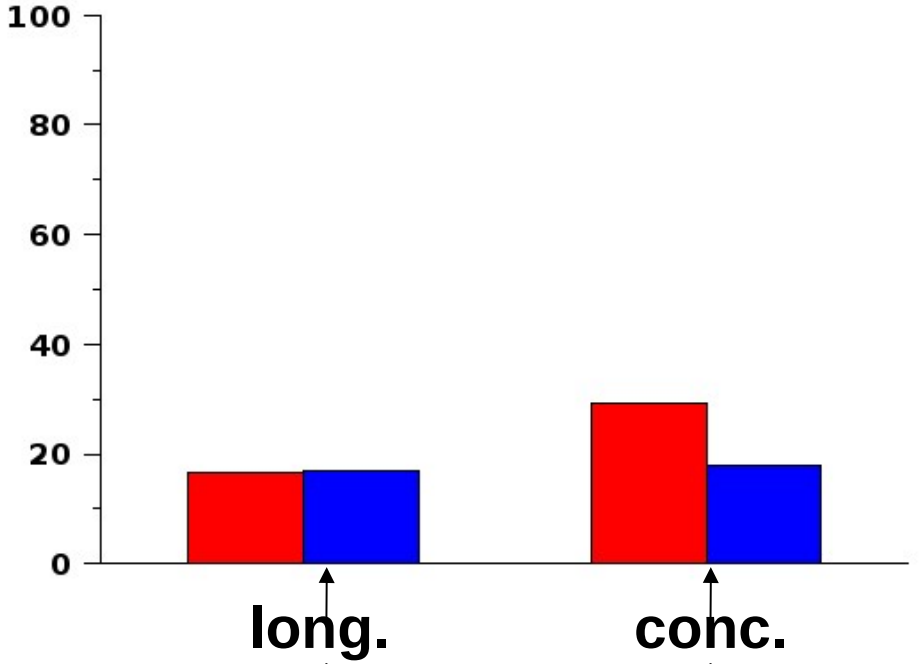


Longitudinal (T-1 x T) and concurrent (T x T) associations (excluding continuing illnesses and non-susceptible periods)

Common cold

Travel > 100 km from home

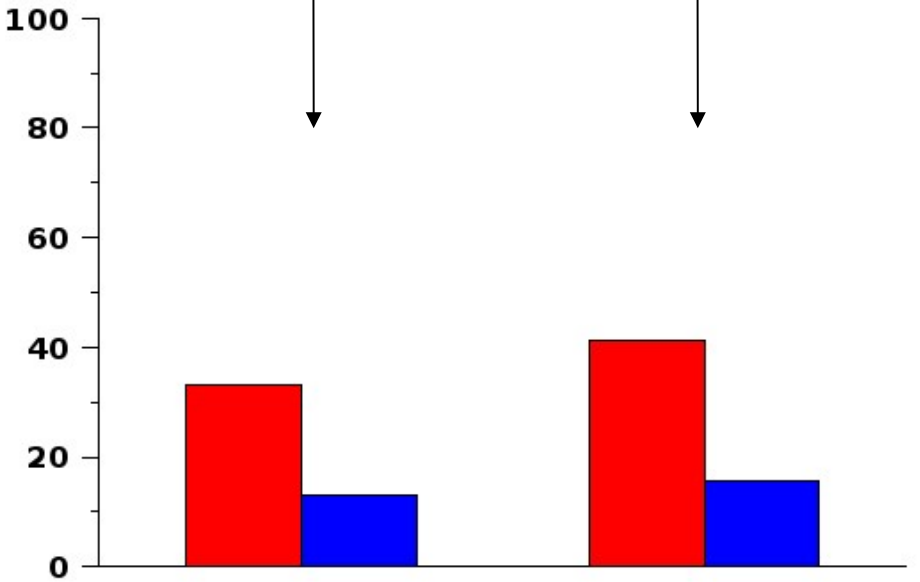
%



Red = ill
Blue = well

Exposed to symptomatic household member

%

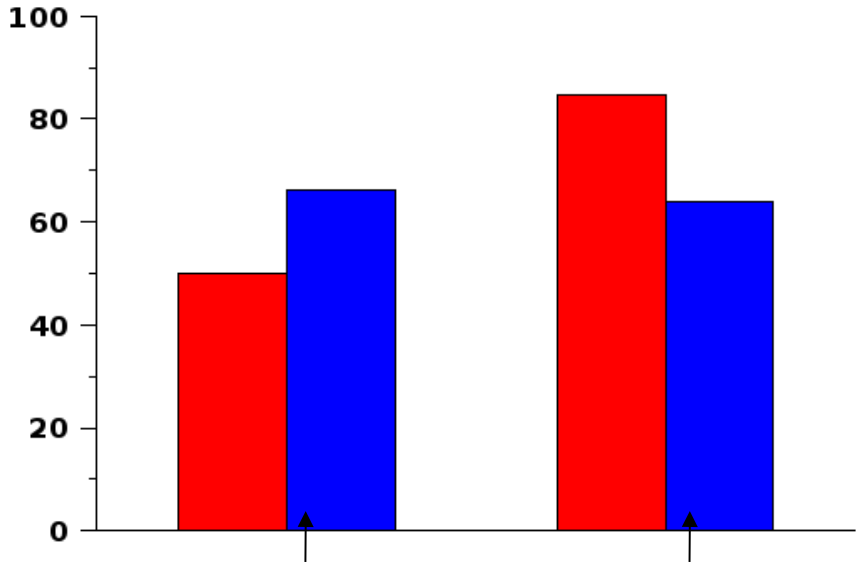


Longitudinal (T-1 x T) and concurrent (T x T) associations (excluding continuing illnesses and non-susceptible periods)

Common cold

Visitors to own home

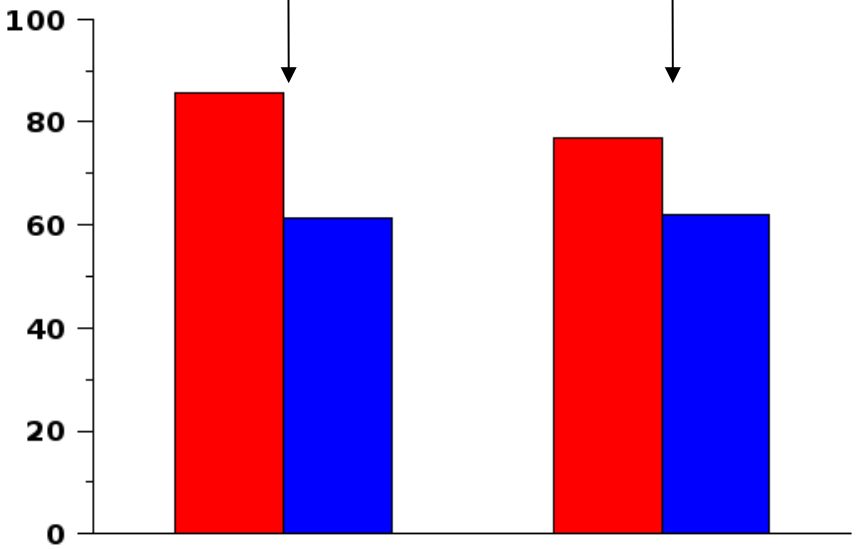
%



Red = ill
Blue = well

Visited others' homes

%



Mixed model (fixed effects and random intercept) logistic regressions

- **account for non-independence of observations within respondents**
- **too few cases of ILI and gastroenteritis**

Common cold "bivariate" odds ratios:

	longitudinal	concurrent
travel > 100 km	1.00	2.00
symptomatic HH	3.49	3.79*
visitors to home	0.66	6.91
visited other homes	5.45	2.46

* p<.05

Mixed model logistic regressions (continued)

Common cold multivariate adjusted odds ratios, longitudinal:

	model		
predictor	A	B	C
Symptomatic HH member	3.49	3.90+	3.72+
Age	---	0.96	0.96
Children at home	---	---	1.17

+p < .10

Mixed model logistic regressions (continued)

Common cold multivariate adjusted odds ratios, concurrent:

	model		
predictor	A	B	C
Symptomatic HH member	3.79*	3.82*	3.91*
Age	---	0.96+	0.96+
Children at home	---	---	0.86

*p < .05
+p< .10

Preliminary conclusions

Travel not consistently associated with concurrent or subsequent illness

Exposure to symptomatic household members generally associated with illness, especially concurrently

- **may reflect acquisition, transmission, or common exposure to another source**

Large majority of ill persons not exposed to a symptomatic household member

Receiving home visitors and visiting homes related to colds, but not consistently with gastroenteritis

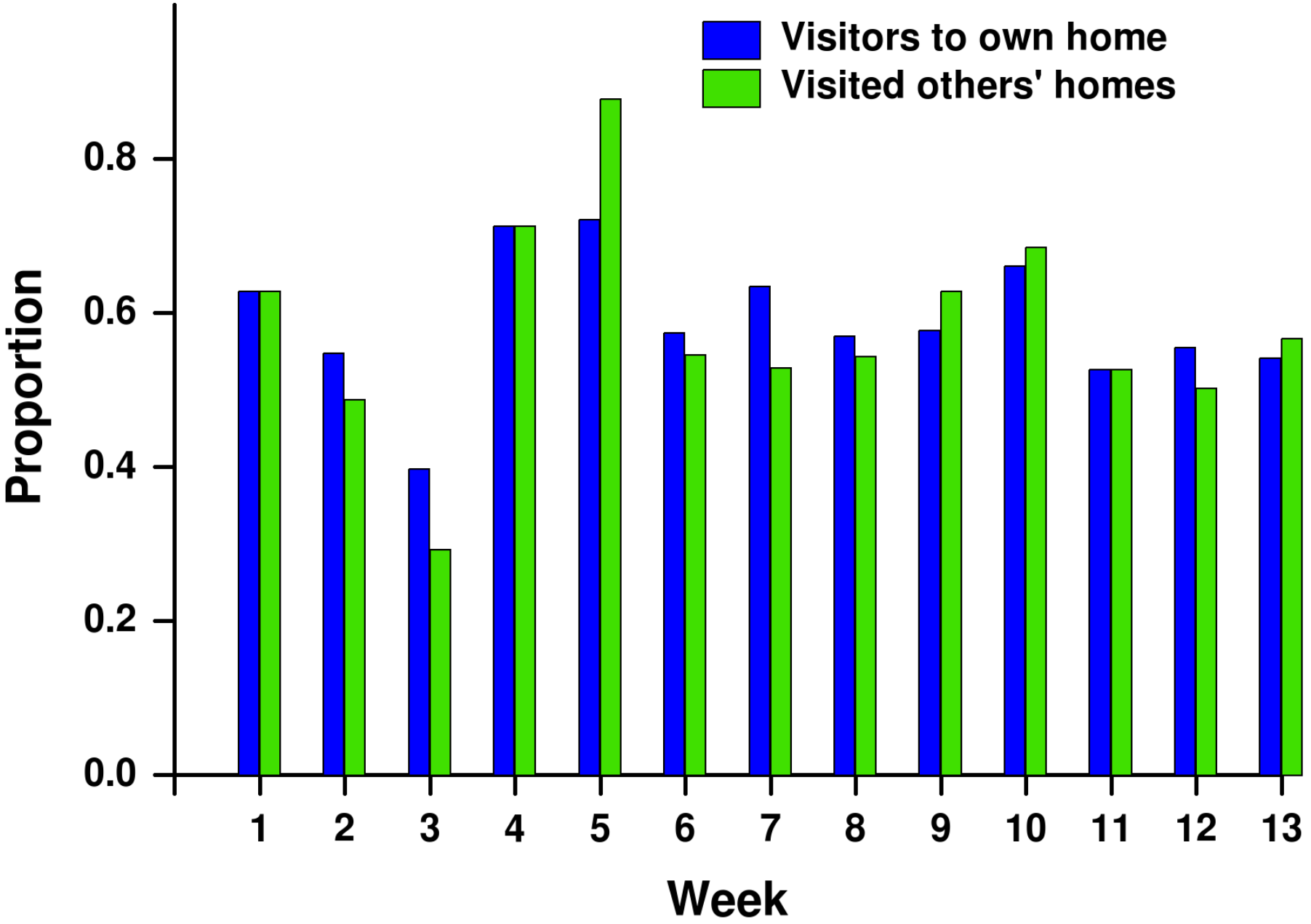
Caveats and limitations

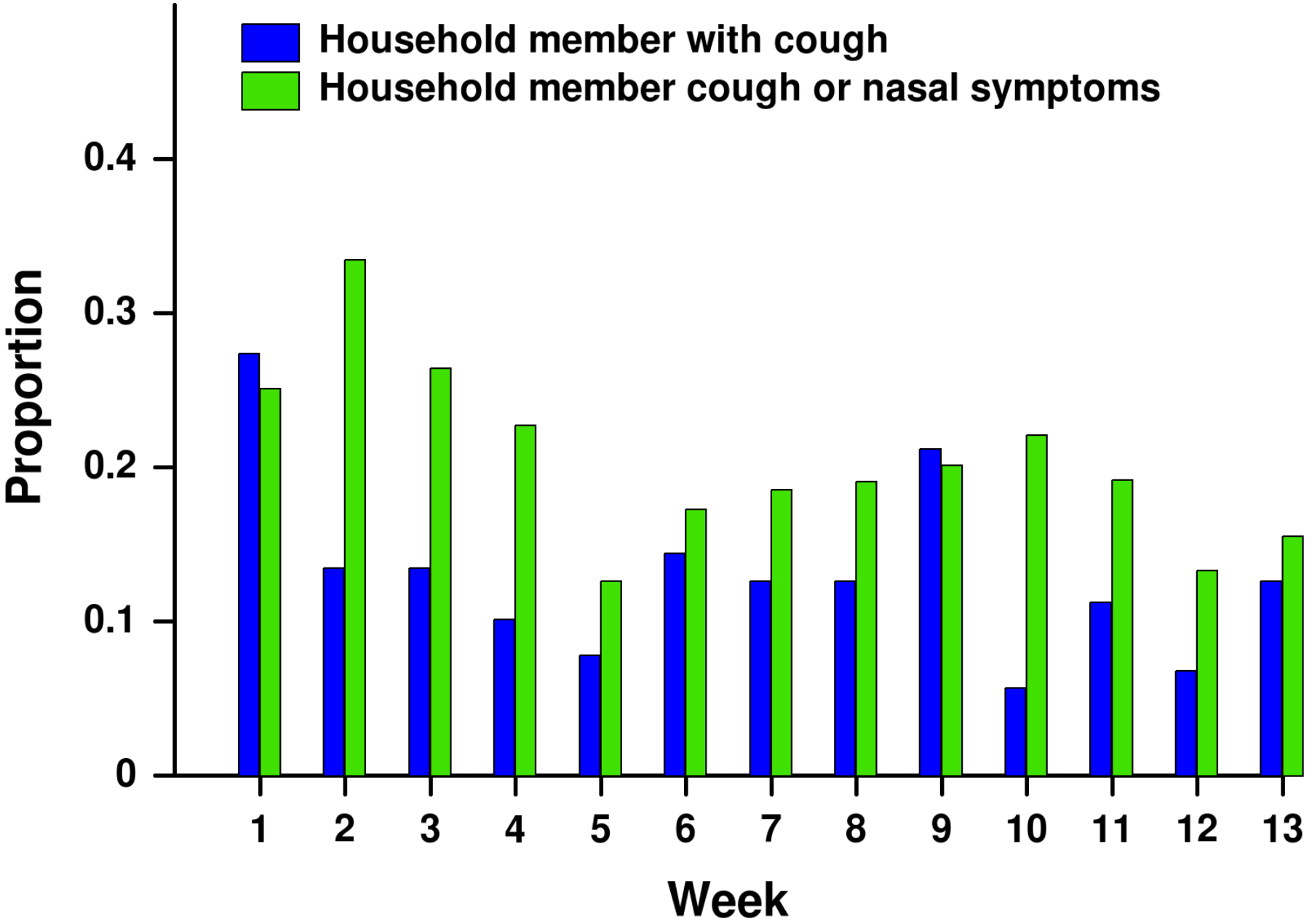
- Relatively low incidence of illness
- N. American/European respondents in winter only
- Coarse temporal measurement of some predictors
    - Some longitudinal associations may represent same-week associations
- Respondents may not be aware of household members' symptoms
- Multiple illnesses in household may reflect different infections, or genetically unrelated infections
- Immunity-related factors not included in analysis

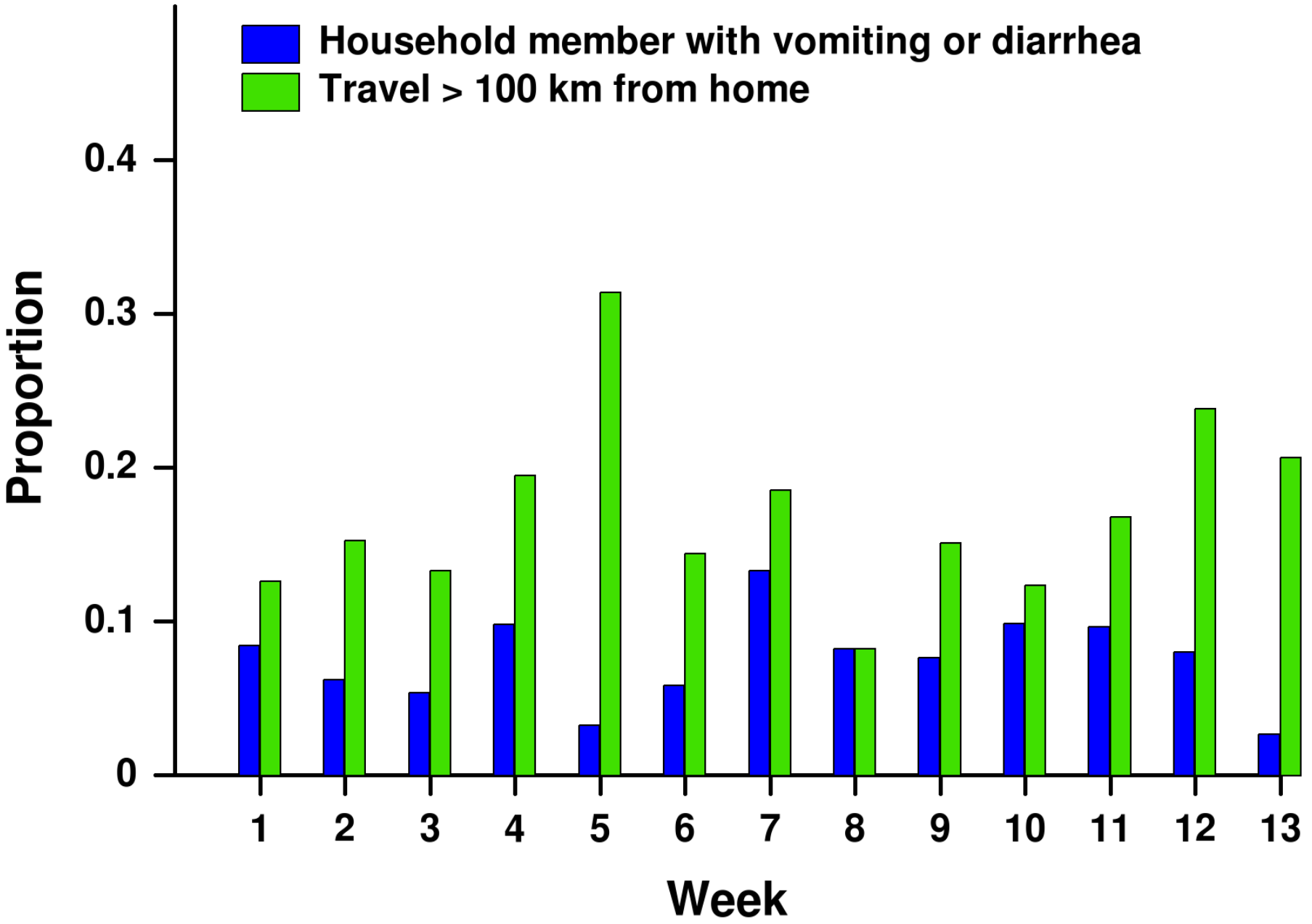
Volunteers needed

worldwide

www.healthtracking.net


Visitors to own home
Visited others' homes
Proportion
0.0
0.2
0.4
0.6
0.8
1
2
3
4
5
6
7
8
9
10
11
12
13
Week


Household member with cough
Household member cough or nasal symptoms
Proportion
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
10
11
12
13
Week


Household member with vomiting or diarrhea
Travel > 100 km from home
Proportion
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7
8
9
10
11
12
13
Week