

Diarrheal illness detected through syndromic surveillance after a massive blackout, New York City

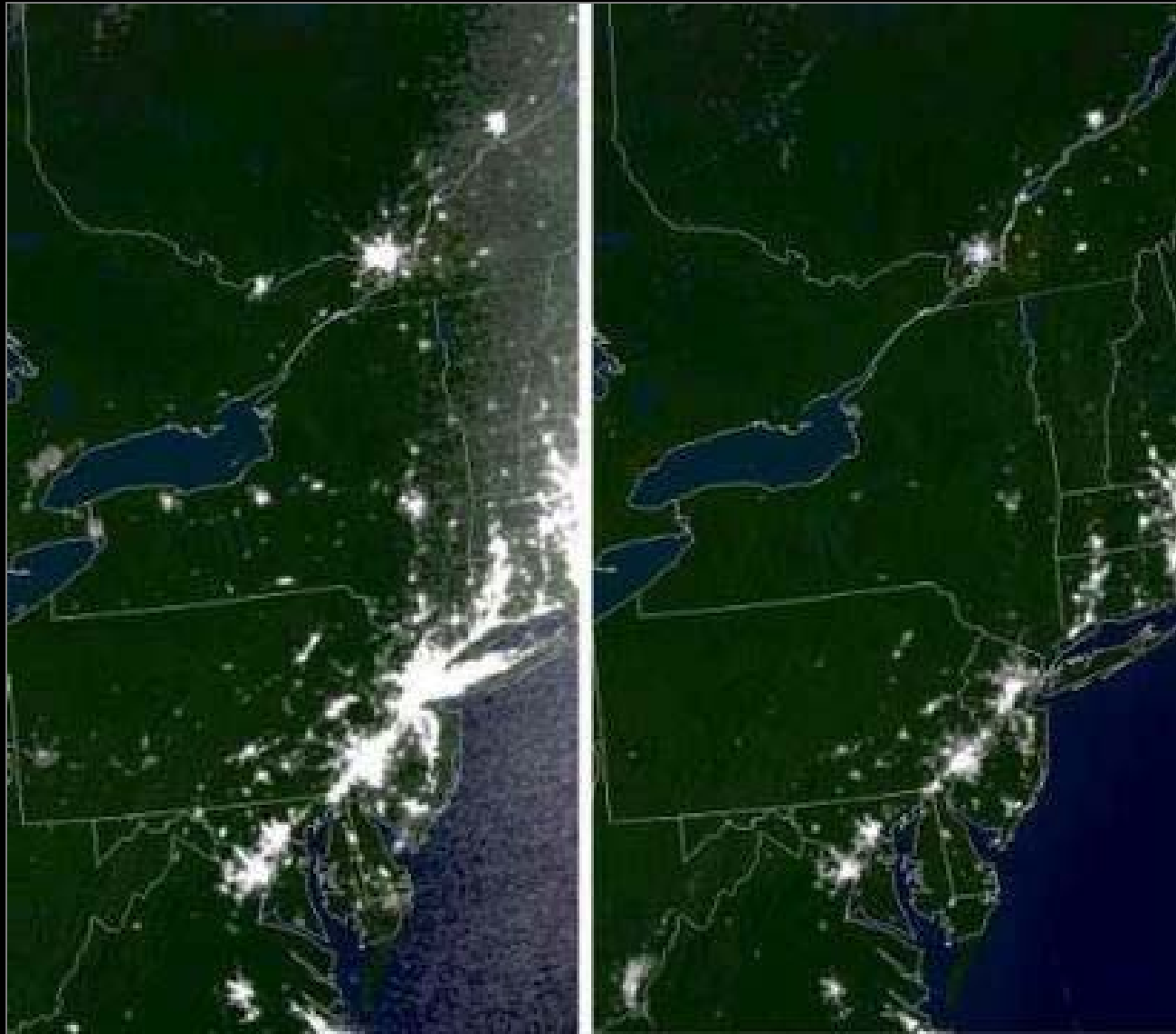
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New York City Department of Health and Mental Hygiene





Normal vs. Blackout





Left in the Dark

Yesterday's blackout possibly originated at a Niagara power station and spread across several states and Canada, closing airports, snarling traffic and causing all types of misery.

How It Unfolded

4:00 p.m. Financial markets close without incident.
4:11 Power goes out.
5:30 Gov. George Pataki declares state of emergency.
6:00 Power restored to some parts of New York State, including Albany.
8:00 City subway service partially restored.

SOURCES: The Associated Press; staff reporting

Total Affected

7 U.S. states
9,300 square miles
1 million customers in New Jersey
9 million customers in New York State
10 million customers in Canada
50 million customers in entire U.S.

New York Metro Area

City subways and LIRR grind to halt and are evacuated. Amtrak stops service between New Haven, Conn., Newark and Penn Station. Manhattan bridges and tunnels closed to inbound traffic. Kennedy, LaGuardia, Newark and MacArthur Airports closed. No reported power problems in eight south New Jersey counties.

Purpose of Syndromic surveillance

- **To provide early warning of public health emergencies**
 - **Naturally-occurring outbreaks**
 - **Illness from intentional releases**
- **Characterize magnitude and tempo of outbreaks**

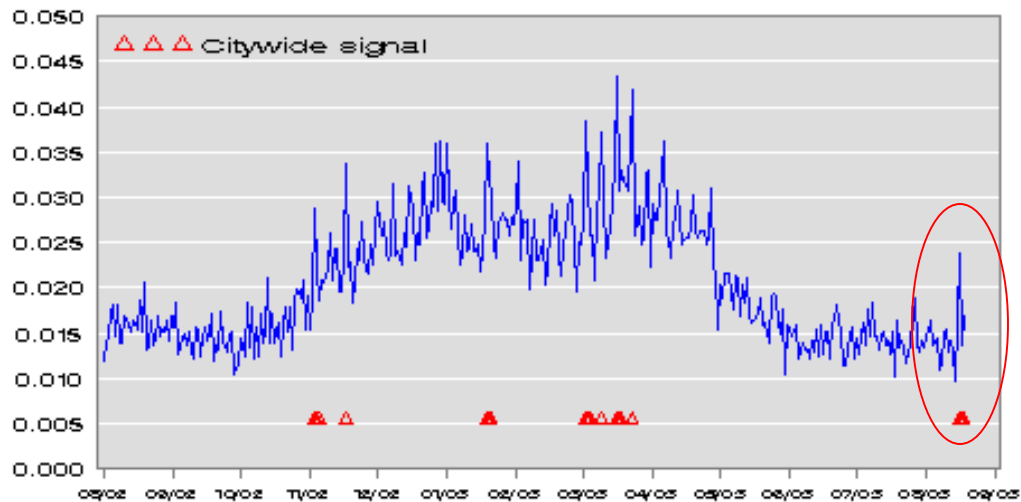
Data Sources

	Key field	Approximate daily volume	Estimated coverage
Emergency Medical Services	Call-type	3,500	>95%
Hospital Emergency Departments	Chief complaint	7,000	75%
Pharmacy chain	Drug name	6,000 Rx 32,000 OTC	30%
Pharmacy (RODS)	Drug category	20,000 OTC	30%
Worker Absences	Reason for absence	200	100%

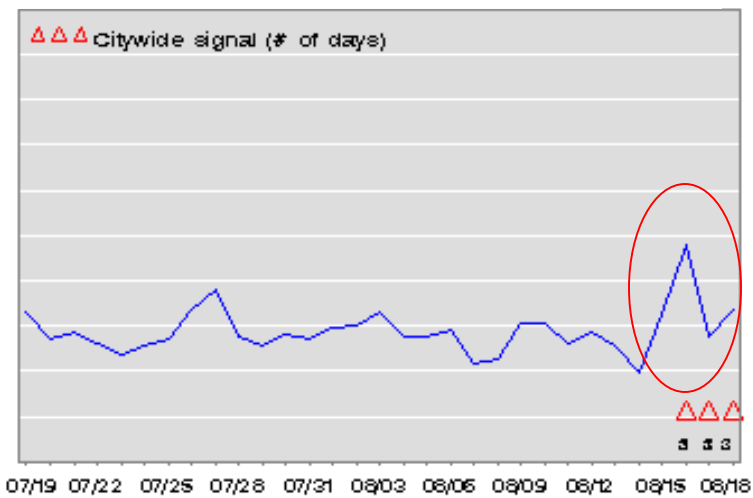
NYC Emergency Department Surveillance

Citywide trends in the ratio of syndrome visits to other visits through Aug 18, 2003

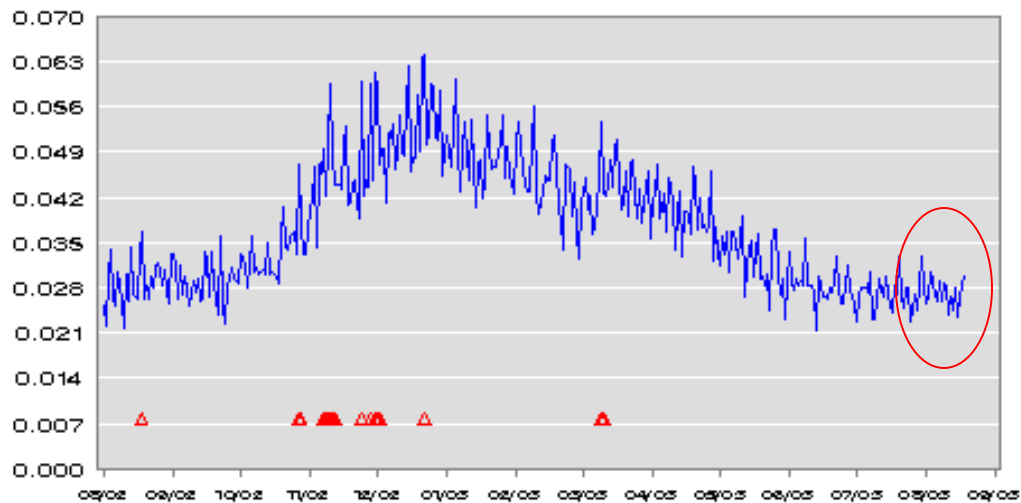
Diarrhea syndrome, all ages, past 12 months



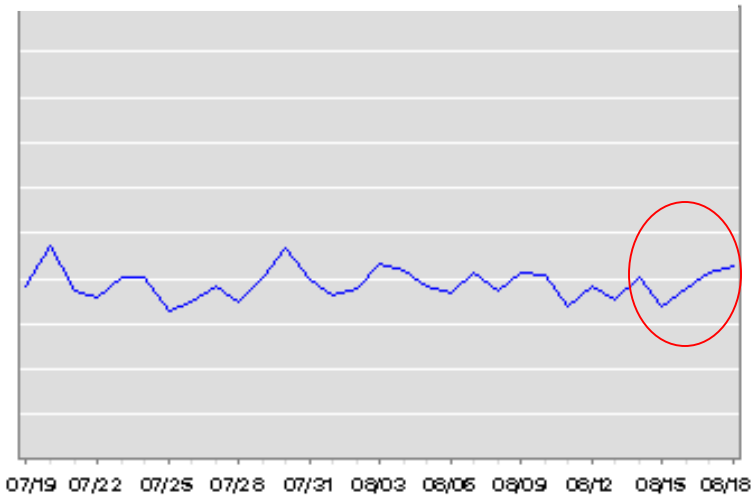
Diarrhea, all ages, past 30 days



Vomiting syndrome, all ages, past 12 months



Vomiting, all ages, past 30 days



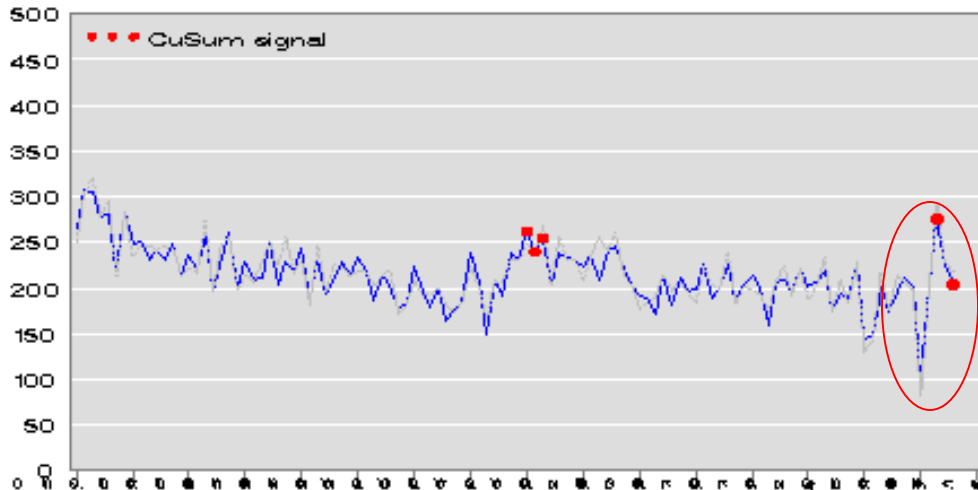
Summary of ED signals

Date	Citywide Signal Obs./Exp. visits	Citywide p-value	Days of citywide signal	Spatial signal
8-16-03	117/76	<0.01	1	Hosp p<0.01
8-17-03	275/227	<0.05	3	None
8-18-03	298/244	<0.01	3	Hosp p<0.05 Zip p<0.05
8-19-03	205/179	>0.05	2	Zip p<0.05

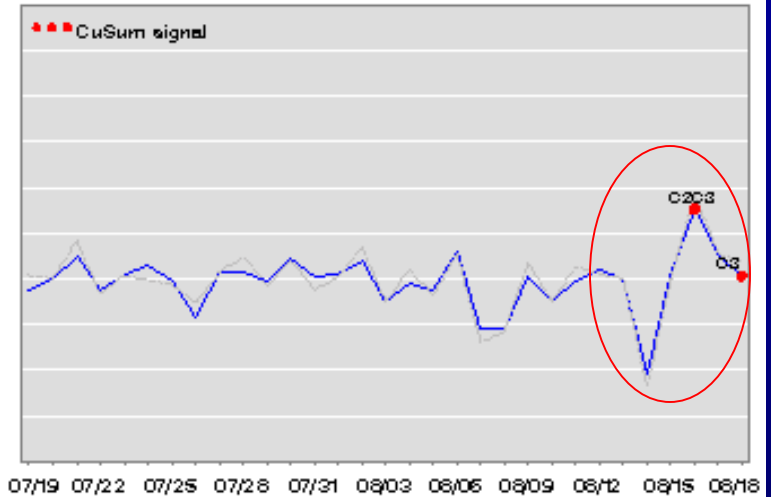
RODS/NRDM OTC Pharmacy Sales

Citywide trends in adjusted total units sold through Aug 18, 2003

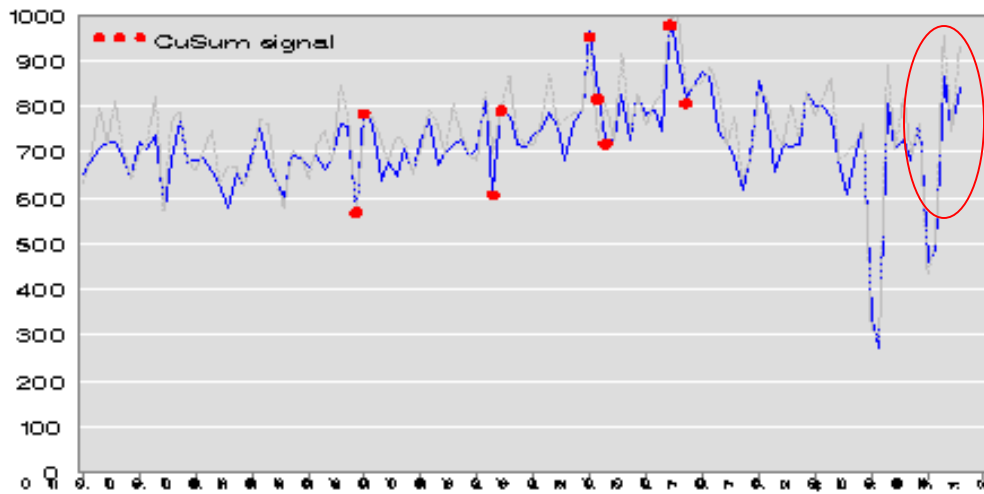
Electrolytes sold since May 1, 2003



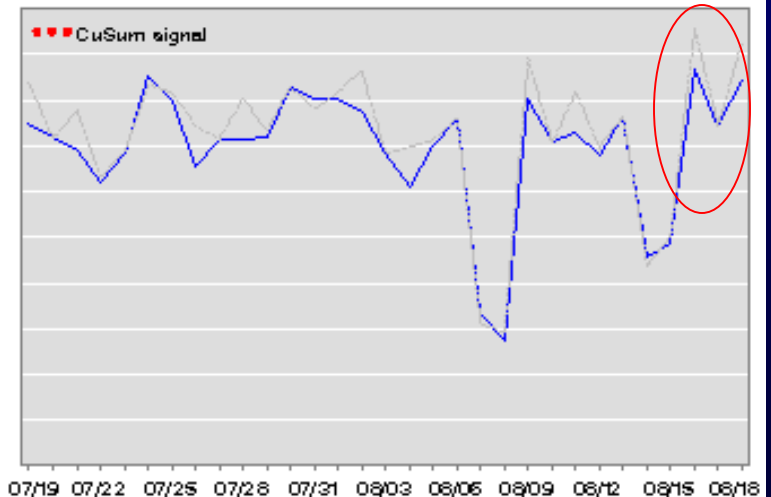
Electrolytes sold, past 30 days



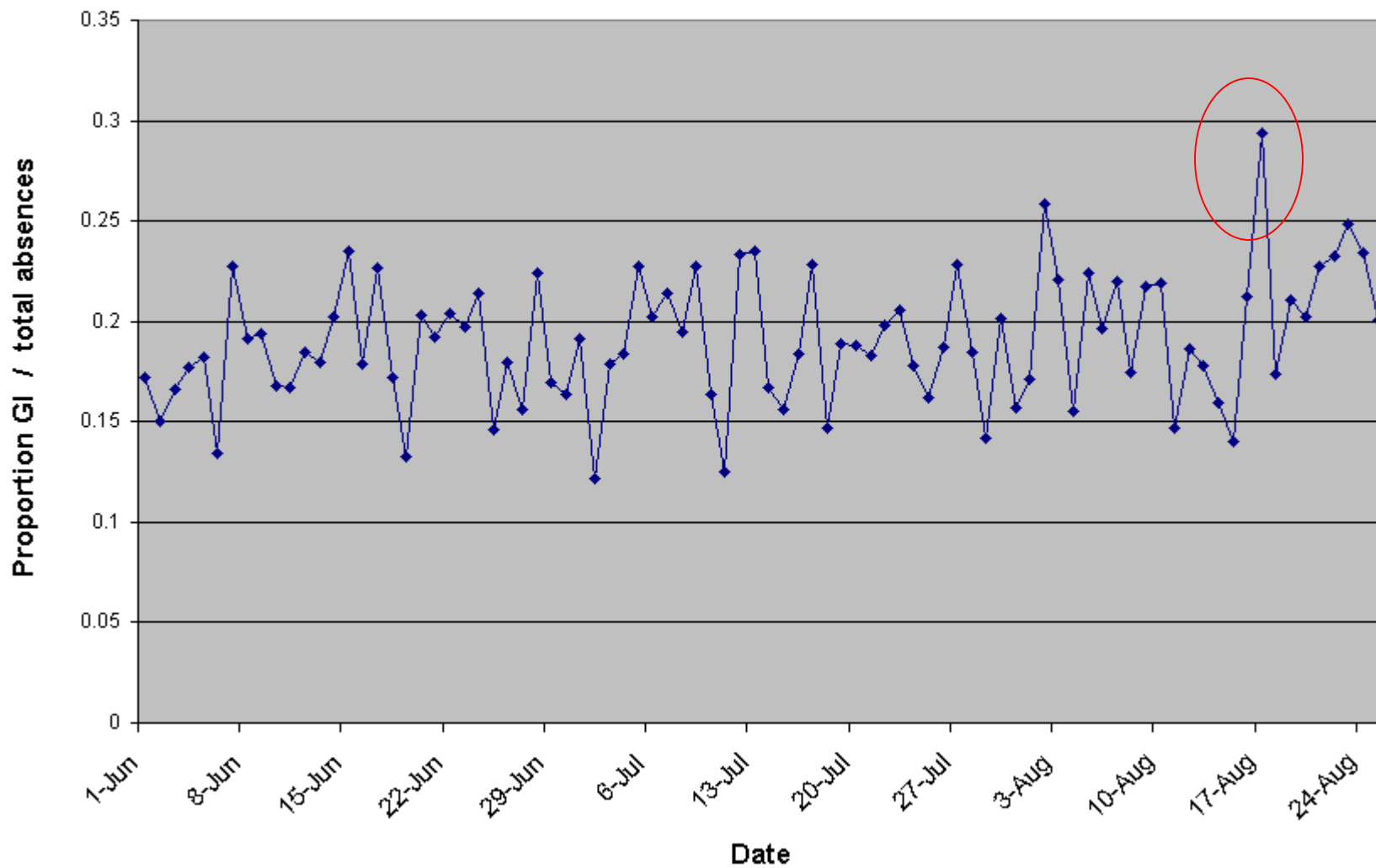
Stomach remedies sold since May 1, 2003



Stomach remedies sold, past 30 days



Absences due to GI illness in large city workforce



Legal Mandate for Surveillance in New York State

“Local health officers shall exercise due diligence in ascertaining the existence of outbreaks of illness or the unusual prevalence of diseases, and shall immediately investigate the causes of same.”

New York State Sanitary Code,
10 NYCRR Chapter 1, Section 2.16(a)

Objective

to determine whether an apparent increase in diarrheal illness was potentially associated with consumption of food that had spoiled after the blackout

Case-Control Study Methods

Eligibility: patients presenting August 16-18 to EDs participating in syndromic surveillance

- **Cases:** patients with chief complaints coded as “diarrhea” syndrome
- **Controls:** a sample selected at random by age group from all patients with chief complaints coded as “other” syndrome (at approx 2.5/case)

Data Collection

- **Structured surveys addressed**
 - **Symptoms and symptom onset**
 - **Food consumed after the blackout**
 - **Food discarded after the blackout**
 - **Awareness of prevention messages**
 - **Source of prevention messages**
- **Surveys administered by phone by NYCDOHMH staff to adults or guardians if patient was <16 years of age**
- **Interviews discontinued if symptom onset occurred *pre-blackout***

Data Analysis

- **“Cases” and “controls” were redefined as participants reporting and not reporting diarrhea, respectively**
- **Analyses were stratified by age**
- **Statistical significance of differences in exposures tested with chi-squared, Fisher exact, student t-tests and Wilcoxon rank sum tests**
- **Associations were quantified with logistic regression**

Comparison of selected cases vs. selected controls (N=759)

	Cases (N=213)	Controls (N=546)	p-value
Female sex (%)	58%	51%	0.12 ¹
Age (median)	23.0	21.0	0.14 ²
Proportion < High School education ⁴	0.31	0.32	0.27 ³
Proportion below poverty line ⁴	0.21	0.21	0.20 ³

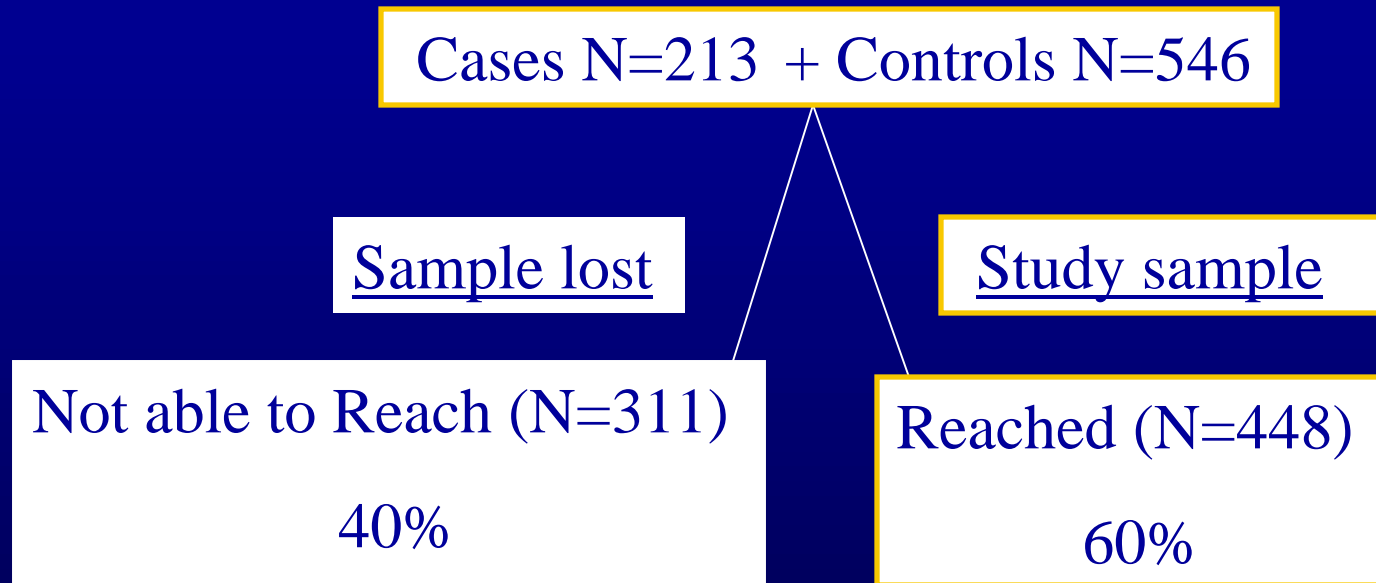
¹chi-squared test

²wilcoxon rank sum test

³t-test

⁴ from population-based data

Diagram of participation



Comparison of patients reached vs. not reached (Total N=759)

	Reached (N=448)	Not reached (N=311)	p-value
Female sex (%)	52%	55%	0.36 ¹
Age (median)	11.0	31.0	<0.01 ²
Proportion < High School education ⁴	0.32	0.32	0.97 ³
Proportion below poverty line ⁴	0.24	0.24	0.88 ³

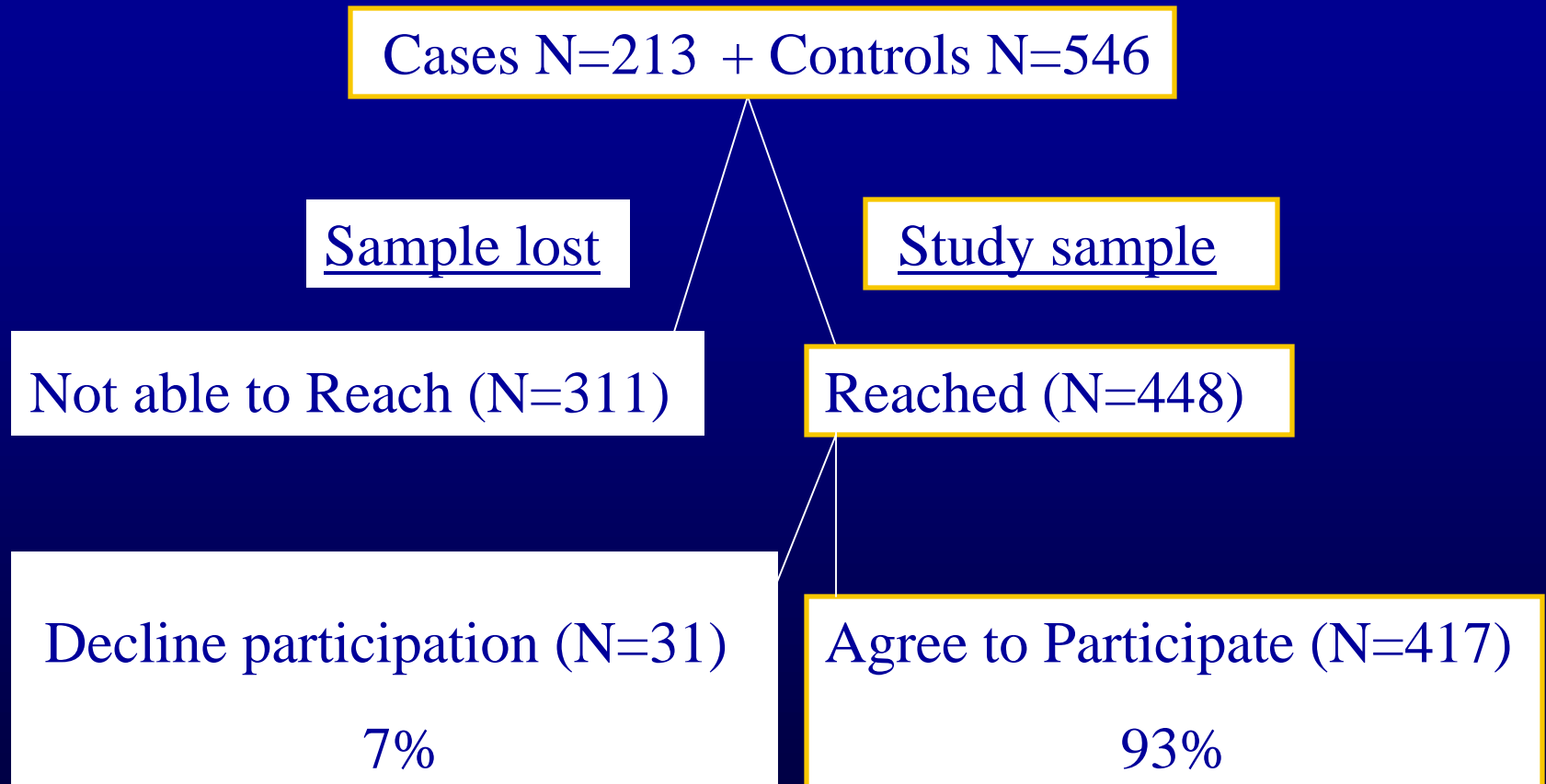
¹chi-squared test

²wilcoxon rank sum test

³t-test

⁴ from population-based data

Diagram of participation



Comparison of patients agreeing vs. declining to participate (Total N=448)

	Completed (N=417)	Declined (N=31)	p-value
Female sex (%)	51%	60%	0.35 ¹
Age (median)	11.0	28.0	0.09 ²
Proportion < High School education ⁴	0.32	0.33	0.48 ³
Proportion below poverty line ⁴	0.24	0.25	0.86 ³

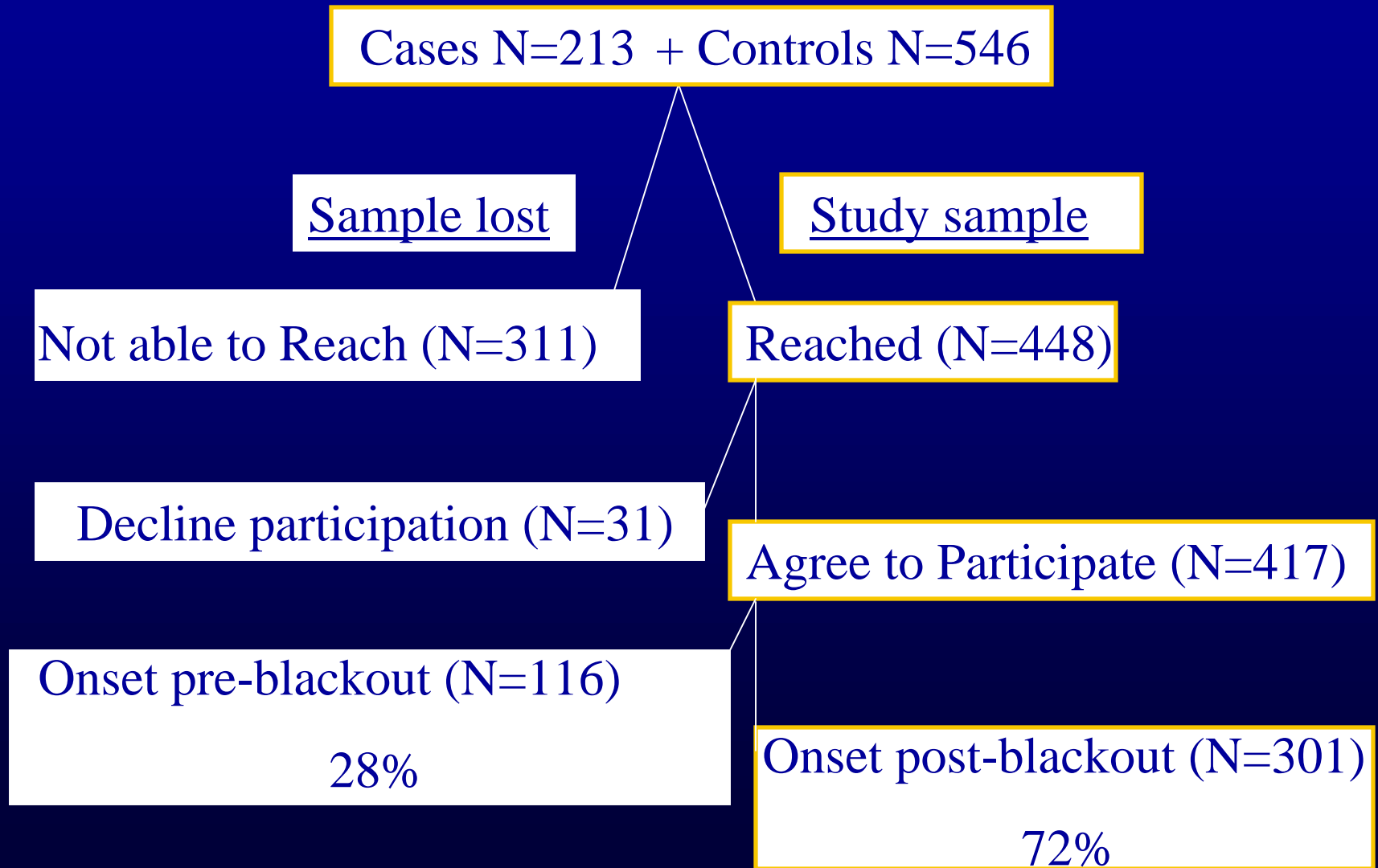
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Diagram of participation



Comparison of patients with symptoms post- vs. pre- blackout (Total N=417)

	Post-blackout (N=301)	Pre-blackout (N=116)	p-value
Female sex	50%	54%	0.54 ¹
Age	11.0	13.5	0.84 ²
Proportion < High School education ⁴	0.31	0.34	0.03 ³
Proportion below poverty line ⁴	0.23	0.26	0.01 ³

¹chi-squared test

²wilcoxon rank sum test

³t-test

⁴ from population-based data

Results

Comparison of patients with diarrhea vs. non-diarrhea⁵ complaints (total N=301)

	Diarrhea (CASES) (N=116)	Non-diarrhea (CONTROLS) (N=171)	p-value
Female sex	51%	51%	0.92 ¹
Age	12.5	9.0	0.93 ²
Proportion < High School education ⁴	0.30	0.32	0.19 ³
Proportion below poverty line ⁴	0.23	0.24	0.45 ³

¹chi-squared test

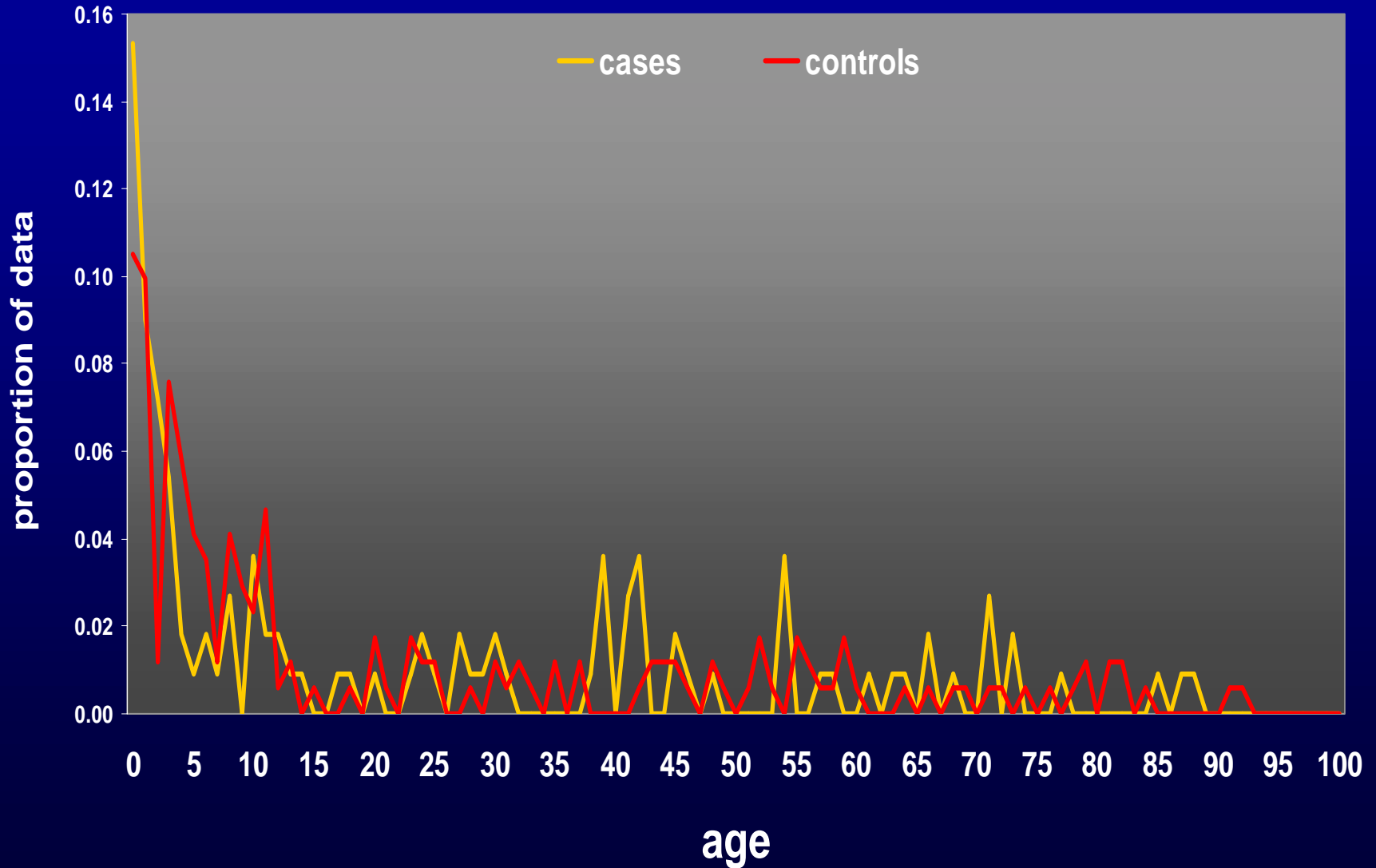
²wilcoxon rank sum test

³t-test

⁴ from population-based data

⁵14 patients missing diarrhea status

Age distribution of cases and controls



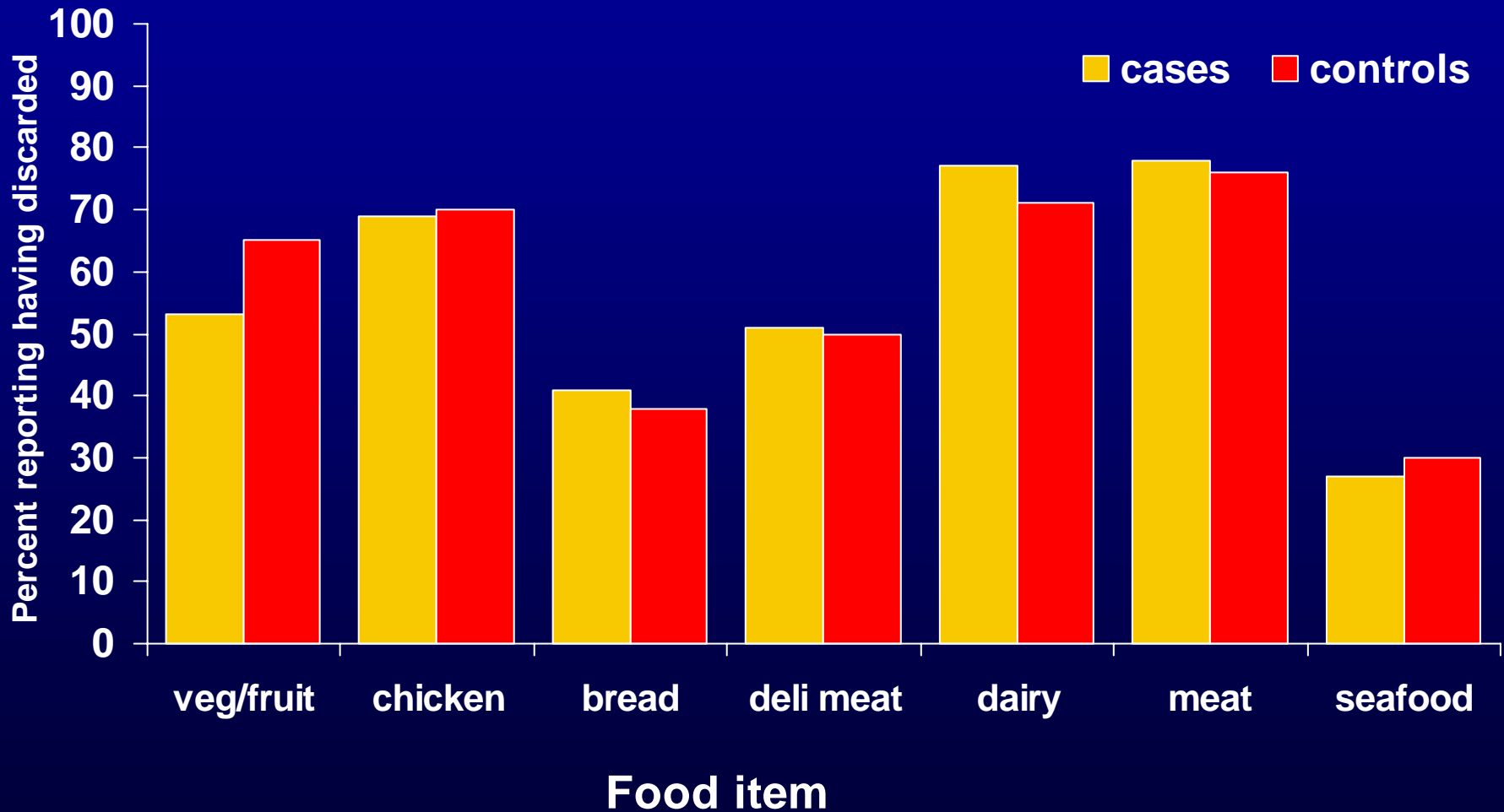
Foods eaten between blackout and illness in patients < 13 years of age by case status



Association of diarrhea symptoms and foods eaten between blackout and illness in patients < 13 years of age

	Cases (N=58)	Controls (N=100)	OR	95% CI
Vegetables/fruit	28%	37%	0.7	0.3 – 1.3
Chicken	26%	34%	0.7	0.3 – 1.4
Bread	31%	41%	0.6	0.3 – 1.3
Deli meats	14%	20%	0.7	0.3 – 1.6
Dairy	52%	52%	1.0	0.5 – 1.9
Meat	26%	25%	1.1	0.5 – 2.2
Seafood	5%	3%	1.7	0.3 – 8.8

Foods *discarded* between blackout and illness in patients < 13 years of age by case status



Association of diarrhea symptoms and foods *discarded* after the blackout in patients < 13 years of age

<i>Food discarded</i>	Cases (N=58)	Controls (N=100)	OR	95% CI
Vegetables/fruit	53%	65%	0.6	0.3 – 1.2
Chicken	69%	70%	1.0	0.5 – 2.1
Bread	41%	38%	1.1	0.6 – 2.3
Deli meats	51%	50%	0.7	0.3 – 1.6
Dairy	77%	71%	1.4	0.6 – 3.1
Meat	78%	76%	1.1	0.5 – 2.5
Seafood	27%	30%	0.8	0.4 – 1.9

Foods eaten between blackout and illness in patients ≥ 13 years of age by case status



* Statistically significantly different at $p < 0.05$

Association of diarrhea symptoms and foods eaten between blackout and illness in patients ≥ 13 years of age

	Cases (N=58)	Controls (N=71)	OR	95% CI
Vegetables/fruit	43%	43%	1.0	0.5 – 2.0
Chicken	43%	39%	1.2	0.6 – 2.4
Bread	58%	52%	1.3	0.7 – 2.7
Deli meats	25%	19%	1.5	0.6 – 3.4
Dairy	46%	36%	1.6	0.8 – 3.2
Meat	36%	17%	2.7	1.2 – 6.1
Seafood	27%	7%	4.8	1.6 – 14.1

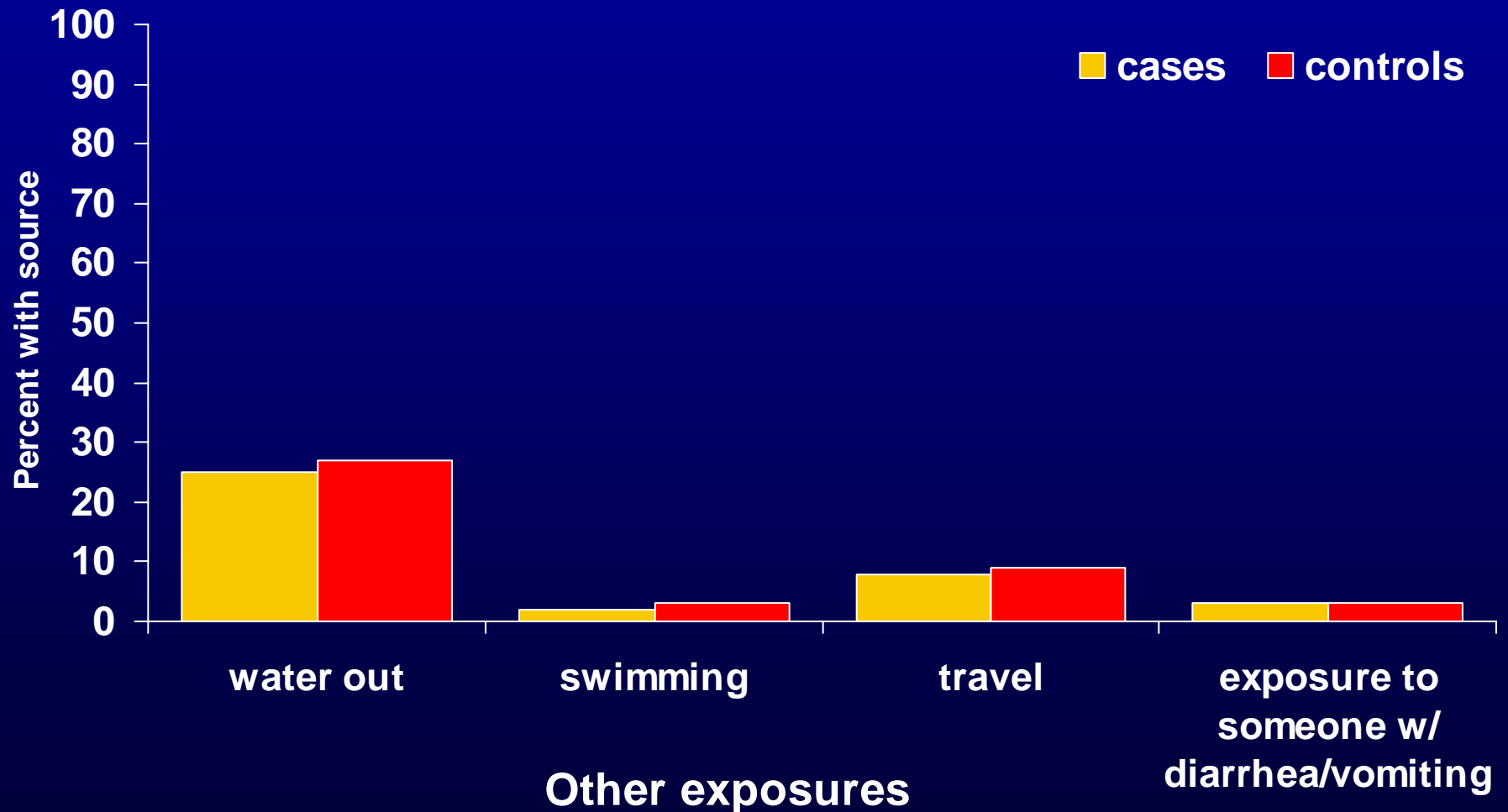
Foods *discarded* between blackout and illness in patients ≥ 13 years of age by case status



Association of diarrhea symptoms and foods discarded after the blackout in patients ≥ 13 years of age

<i>Food discarded</i>	Cases (N=58)	Controls (N=71)	OR	95% CI
Vegetables/fruit	61%	57%	1.2	0.5 – 2.7
Chicken	59%	51%	1.4	0.6 – 3.1
Bread	43%	31%	1.6	0.7 – 3.7
Deli meats	51%	41%	1.5	0.7 – 3.3
Dairy	78%	78%	1.0	0.4 – 2.6
Meat	71%	61%	1.1	0.5 – 2.2
Seafood	41%	24%	2.2	0.9 – 5.3

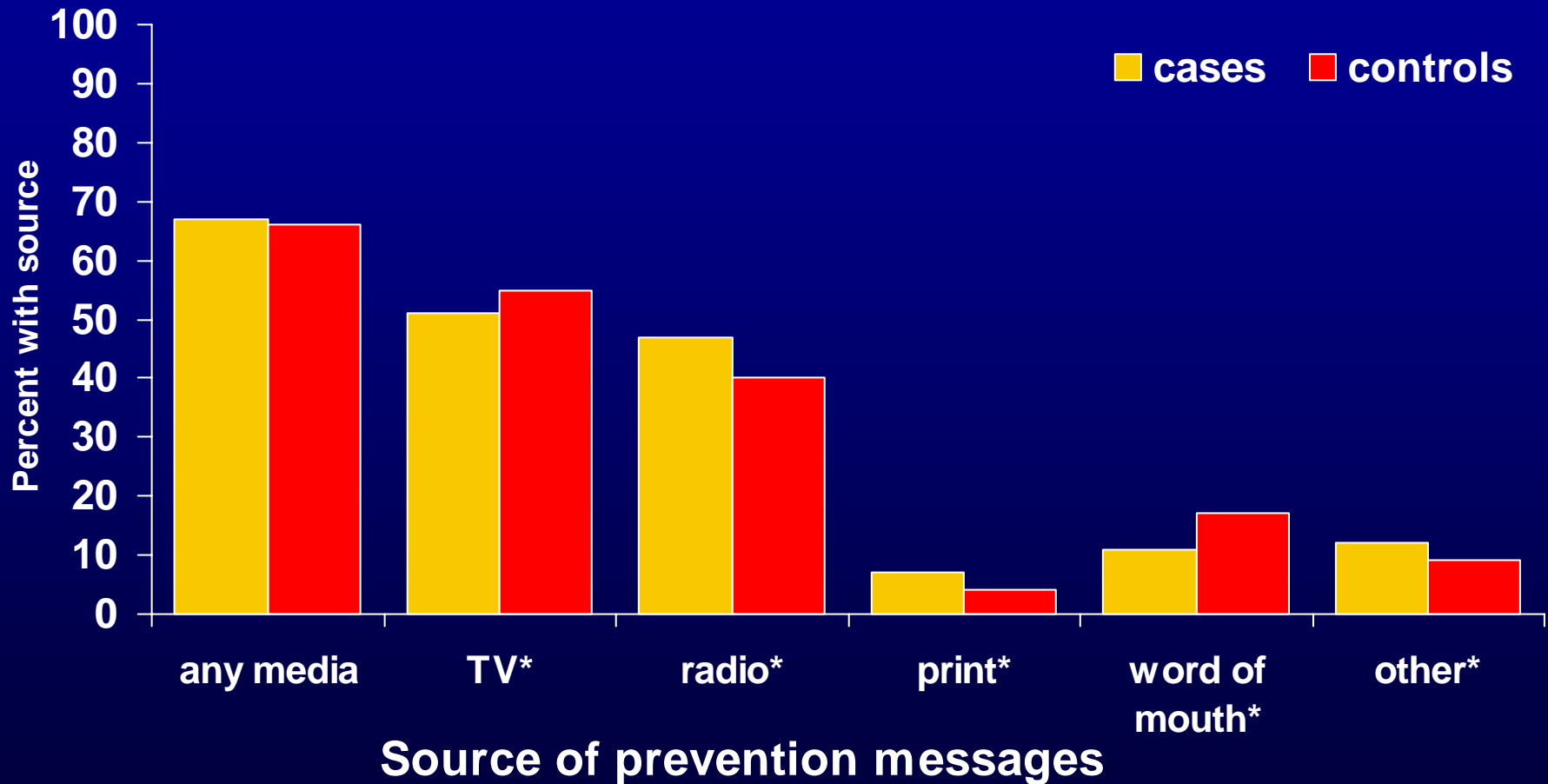
Comparison of proportion of cases with controls with other exposures (all ages)



Comparison of proportion of cases with controls with other exposures (all ages)

Other Exposures	Cases (N=116)	Controls (N=171)	OR	95% CI
Water out	25%	27%	0.9	0.5 – 1.6
Admitted	22%	14%	1.7	0.9 – 3.1
Swimming	2%	3%	1.2	0.3 – 4.4
Travel	8%	9%	0.9	0.4 – 2.2
Exposure to person w/ diarrhea/vomiting	3%	3%	1.0	0.2 – 4.8

Percent of people hearing prevention messages and through which media they heard them (all ages) by case status



* Of those who heard any media (N=175)

Percent of people hearing prevention messages and through which media they heard them (all ages)

	Cases percent	Controls percent	OR	95% CI
Any media (N=175)	67%	66%	1.0	0.6 – 1.8
Television	51%	55%	0.9	0.5 – 1.5
Radio	47%	40%	1.3	0.7 – 2.4
Print	7%	4%	1.8	0.5 – 6.1
Word of mouth	11%	17%	0.6	0.3 – 1.4
Posters or Internet	0%	0%	n/a	
Other (e.g., “common sense”, “just knew it”)	12%	9%	1.3	0.5 – 3.3

Conclusions

- **Adults visiting the ED with diarrhea ate meat 3x, and seafood 5x as often following the blackout as adults visiting the ED for other reasons**
- **Diarrhea may have been linked to consuming food spoiled after the power outage**
- **A majority of patients heard messages to throw away food, but hearing messages was not associated with whether patients had diarrhea or not**
- **The messages were heard most often on television and radio**

A few of the study Limitations

- **No microbiological data**
- **Participation rate**
- **Recall bias**
- **No information on when participants heard prevention messages**
- **Potential misclassification
(redefining cases and controls)**

Public Health Implications

In the context of specific potential exposures, syndromic surveillance systems can be used

- to detect increases in illnesses of public health importance**
- to frame studies to investigate outbreaks**

And can help us fulfill our mandate

