

Developing a Case Definition for Health Effects from UOGD

A Discussion

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What is a Case Definition?

A case definition is a set of uniform criteria used to define a disease or condition for public health surveillance.

- CDC 2015

Public Health Surveillance

Public health surveillance is the continuous, systematic collection, analysis and interpretation of **health-related** data needed for the planning, implementation, and evaluation of **public health** practice. - WHO

Public Health Surveillance

Public health surveillance is the ongoing systematic collection, analysis, and interpretation of data, closely integrated with the timely dissemination of these data to those responsible for preventing and controlling disease and injury ([Thacker and Berkelman 1988](#)).

What is a Case Definition?

A case definition should not be used by healthcare providers to determine how to meet an individual patient's health needs – CDC

What is a Case Definition?

Types of Case definitions

Infectious diseases

Chemical poisonings

Case Definition for Chemical Poisoning

Case definition for chemical poisonings:

Clinical description

Laboratory criteria for diagnosis

Case classification

Case Definition for Chemical Poisoning

Clinical description:

Physical signs or experienced symptoms compatible with the recognized effects of the exposure of concern.

Typically addresses only acute health symptoms.

Case Definition for Chemical Poisoning

Laboratory criteria:

Presence of the chemical in a biologic
specimen

or

Presence of the chemical in an
environmental specimen

Case Definition for Chemical Poisoning

Case classification:

Confirmed

Probable

Suspect

The case classification is based on the degree of certainty that the case is actually a poisoning.

Example of Case Definition

**Council of State and Territorial
Epidemiologists (CSTE)**

**Case Definition for Carbon Monoxide
(CO) Poisoning (abbreviated)**

Case Definition CO Poisoning

Confirmed Case:

(C1) A carboxyhemoglobin level, as measured by a blood sample, of $> 5\%$ in non-smokers -OR-

(C2) A carboxyhemoglobin level, as measured by a blood sample of $> 10\%$ in smokers or for whom smoking status is unknown. -OR-

(C3) In the absence of laboratory confirmation of an elevated COHb level, signs or symptoms consistent with acute carbon monoxide poisoning AND a positive environmental exposure consistent with CO poisoning.

Case Definition CO Poisoning

Probable Case:

(P1) A carboxyhemoglobin level, as measured by a blood sample, that is $9\% \leq \text{COHb} \leq 10\%$ in smokers or for those whom smoking status is unknown. -OR-

(P2) A carboxyhemoglobin level, as measured by a pulse co-oximeter of $> 10\%$. -OR-

(P3) Loss of consciousness or death without alternative explanation AND exposure to a source of CO.

Case Definition CO Poisoning

Suspect Case:

(S1) A carboxyhemoglobin (COHb) level, as measured by a pulse co-oximeter, of equal to or greater than 9% and less than or equal to 10%.

(S2) In the absence of laboratory confirmation of an elevated COHb, a report of a patient with non-specific symptoms (headache, dizziness, and/or fatigue/weakness) AND environmental monitoring consistent with an exposure to CO. -OR-

Case Definition CO Poisoning

Suspect case: (continued)

(S3) A report of a patient with an environmental exposure consistent with CO poisoning. -OR-

(S4) In the absence of laboratory confirmation of an elevated COHb, a report of a patient with non-specific symptoms (headache, dizziness, and/or fatigue/weakness) AND exposure to a source of CO. 10% in smokers or for whom smoking status is unknown.

Case Definition UOGD Effects

Clinical Description

What are the acute symptoms anticipated from recognized exposure sources?

Air

Water

?Other

What are the acute symptoms that have been reported?

Acute Symptoms from Recognized Exposures

Air

“Potential health effects due to inhalation of low-level environmental air contaminants generated by UOGD related activities”

Chemical	Short term Exposures, Acute Health Symptoms
Carbon monoxide (CO)	Decreased exercise tolerance, decreased vigilance, increased risk for cardiac ischemia in individuals with heart disease
Nitrogen oxides (NOx)	Respiratory symptoms, worsening asthma
Particulate Matter 2.5 (PM2.5)	Asthma attacks, acute bronchitis, heart attacks in individuals with cardiac disease
Volatile Organic Chemicals (VOC's)	Varies with individual chemical. See following examples: Benzene, Ethyl Benzene, Toluene, Xylene
Benzene	Headache, dizziness
Ethyl benzene	Eye and throat irritation
Toluene	Headaches, sleepiness, confusion
Xylenes	Eye, nose, throat , and skin irritation
Methylene Chloride	Decreased attentiveness and decreased hand-eye coordination
Formaldehyde	Nose and eye irritation, impaired short term memory, asthma attacks
Diesel Exhaust (contains VOC's and PM2.5)	Eye, nose, throat and lung irritation. Headaches, dizziness, nausea
Hydrogen sulfide	Eye, nose, and throat irritation. Asthma attacks.
Polycyclic Aromatic Hydrocarbons	Eye and skin irritation, asthma attacks, acute cardiac events, adverse effects on developing fetus.
Ozone	Chest pain, coughing, throat irritation, congestion. Increased symptoms in bronchitis, emphysema, and asthma.

Acute Symptoms from Recognized Exposures

Water

Both EPA and PADEP have
acknowledged sporadic water
contamination

Limitations on Water Testing

Need pre and post drilling results

Need to test for expanded panel of chemicals

Unable to test for undisclosed potential
contaminants

No tests available for some potential
contaminants

Contaminants may not have applicable health
standards

Standard collection procedures may be
inadequate

Reported Acute Symptoms

Community surveys

Earthworks 2012

Randomized studies

Rabinowitz, et al 2014

EHP results

2012-2015

Gas Patch Roulette Earthworks 2012

Symptom category	Percent of individuals reporting conditions
Sinus/respiratory	88%
Behavioral/mood/energy	80%
Neurological	74%
Muscles/joints	70%
Digestive/stomach	64%
Ear/nose/mouth	66%
Skin reactions	64%
Vision/eyes	63%

Rabinowitz et al, 2014

“Proximity to Natural Gas Wells and Reported Health Status: Results of a Household Survey in Washington County, Pennsylvania”

Individuals living within 1 km of gas wells reported more skin conditions and upper respiratory symptoms than those living further away.

Environmental Health Project

61 adult residents of Southwest PA living within 1 km of facilities extracting, transporting, processing or storing unconventional natural gas or resulting waste products who had been evaluated by the EHP nurse practitioner.

Excluded individuals with primary occupational exposure to UOGD activities

Environmental Health Project Intake Form

Exposure History

Review of Systems (Symptoms)

Medical History

Psychological Assessment

Environmental Health Project Intake Form

Exposure history

Household

Water Source

Heating source

Other

Occupational

Environmental

Details regarding nearby UOGD activities

Questions regarding other potential
nearby sources

Environmental Health Project Intake Form

Review of Systems (Symptoms)

Details regarding an extensive list of potential recent health symptoms, including dates of onset, worsening, or resolution.

Environmental Health Project Intake Form

Medical History

Current diagnosed medical conditions

Historically diagnosed medical conditions

Medications

Smoking status

Environmental Health Project Intake Form

Psychological Assessment

Current symptoms in Review of Systems
Questions on psychological/emotional
status

EHP Analysis of Symptoms

Case inclusion criteria

61 adults from SWPA evaluated by EHP nurse practitioner for varying reasons. GIS confirmed proximity < 1km to at least one UOGD site at time of intake. Excluded individuals with primary occupational exposures

EHP Analysis of Symptoms

Symptoms were divided into 12 system categories.

Symptoms were included as potentially related to UOGD exposures if:

- Onset or worsening occurred after onset of potential UOGD exposure

- Symptoms were not as likely to be a result of an underlying medical condition or a different exposure source

SYMPTOMS TEMPORALLY RELATED TO UOGD ACTIVITY (N=61)

SYMPTOM CATEGORY	N	%	SYMPTOM	N	%
UPPER RESPIRATORY SYMPTOMS	39	64%			
			Nose or throat irritation	25	41%
			Sinus pain or infections	17	28%
			Nose bleeds	8	13%
CONSTITUTIONAL SYMPTOMS	33	54%			
			Sleep disruption	26	43%
			Fatigue	13	21%
			Weak or Drowsy	9	15%
NEUROLOGICAL SYMPTOMS	32	52%			
			Head ache	25	41%
			Dizziness	11	18%
			Numbness	9	15%
			Memory loss	8	13%
			Dizziness	11	18%
PSYCHOLOGICAL SYMPTOMS	32	52%			
			Worry	6	10%
			Stress or anxiety	23	38%
			Irritable or moody	12	20%

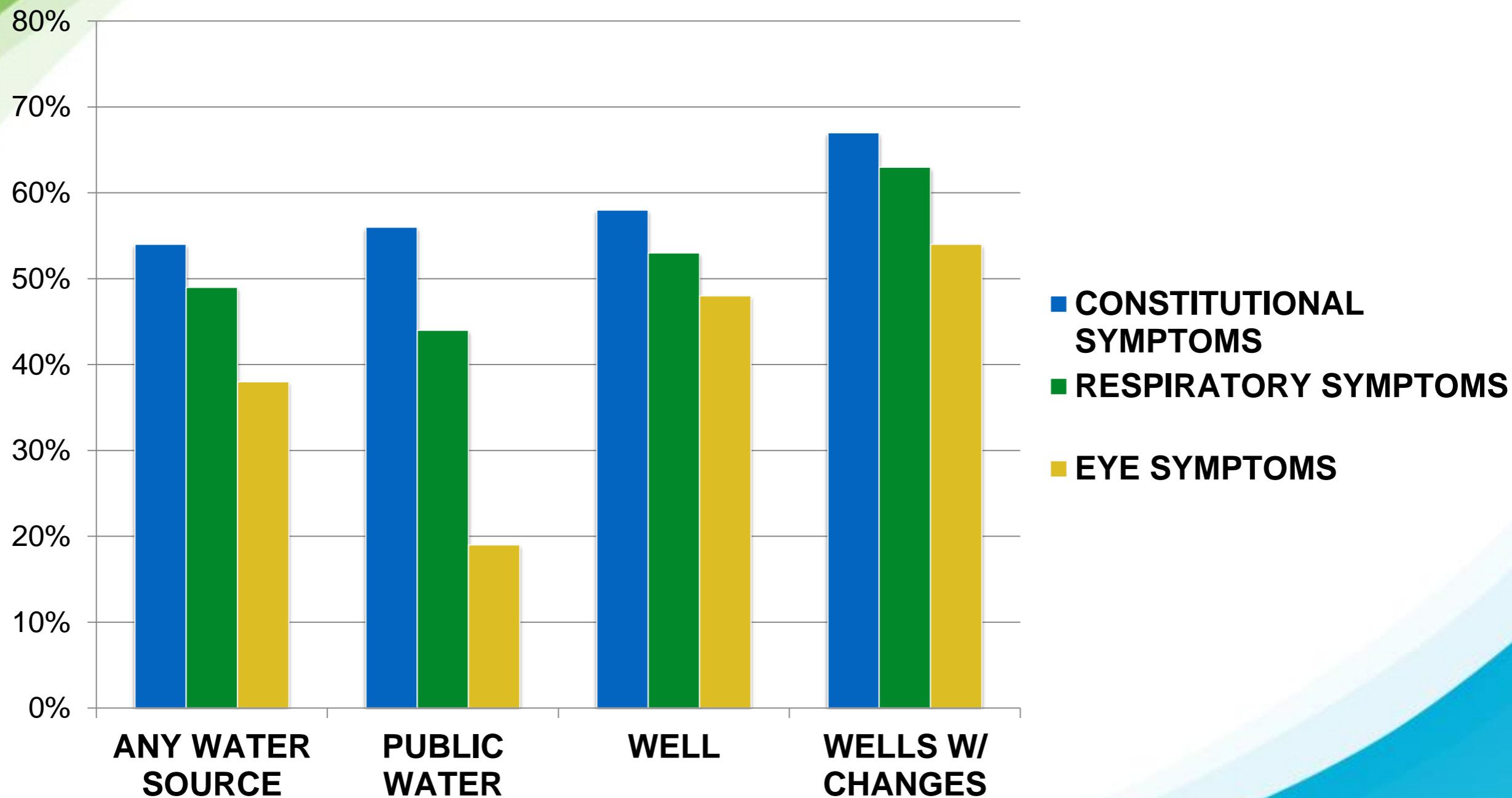
SYMPTOMS TEMPORALLY RELATED TO UOGD ACTIVITY (N=61)

SYMPTOM CATEGORY	N	%	SYMPTOM	N	%
LOWER RESPIRATORY SYMPTOMS	30	49%			
			Cough	21	34%
			SOB	19	31%
			Wheezing	14	23%
GASTRO-INTESTINAL SYMPTOMS	27	44%			
			Nausea	13	21%
			Abdominal pain	12	20%
EYE SYMPTOMS	23	38%			
			Itchy eyes	11	18%
			Painful or dry	10	16%
DERMATOLOGICAL SYMPTOMS	19	31%			
			Rash	10	16%
			Itching	7	11%
			Lesions or blisters	6	10%

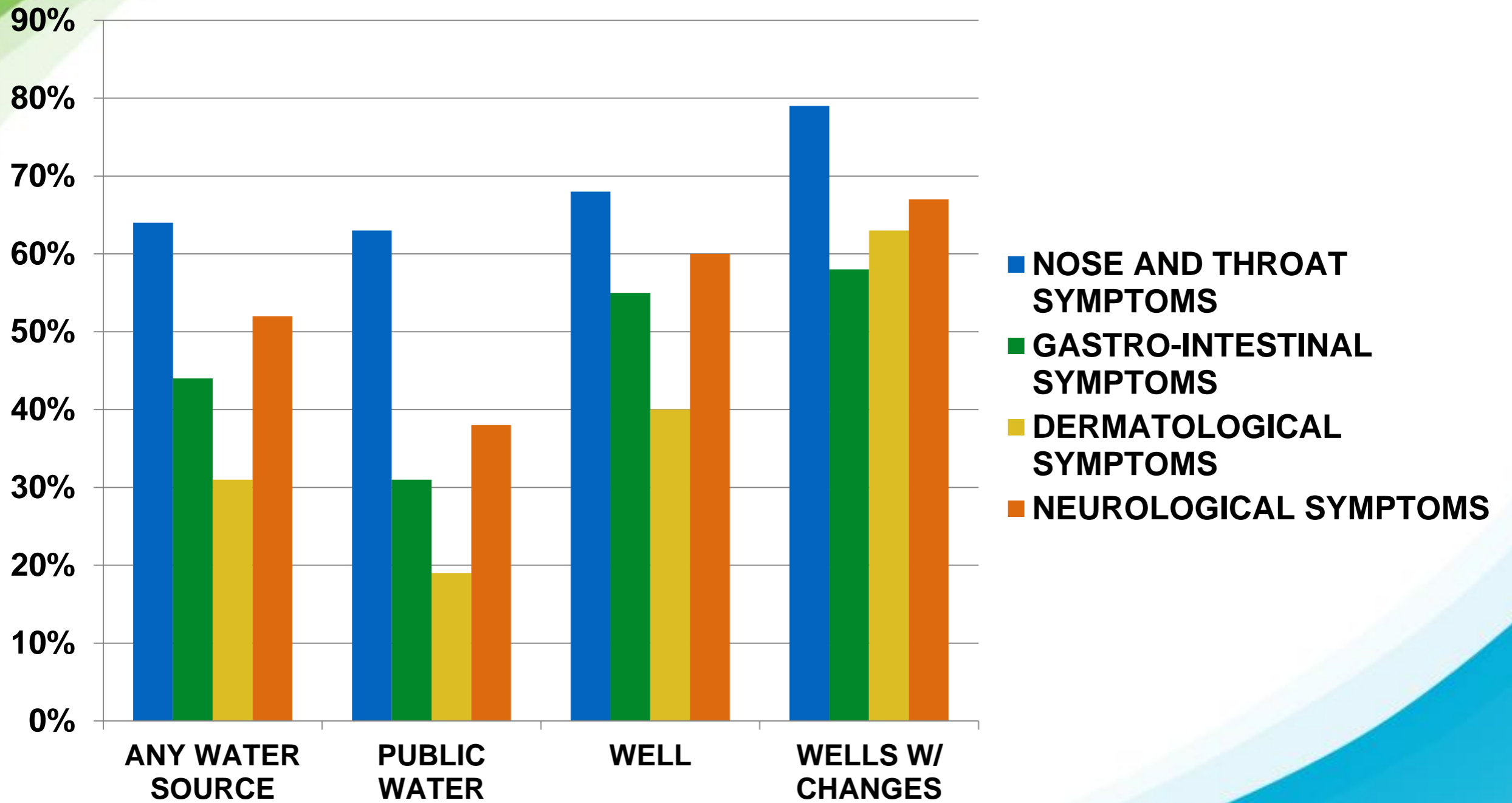
What about Water?

WATER SOURCES FOR 61 CASES	
Water Source	N
Any	61
Unknown	5
Public	16
Well	40
Well with changes or contamination	24

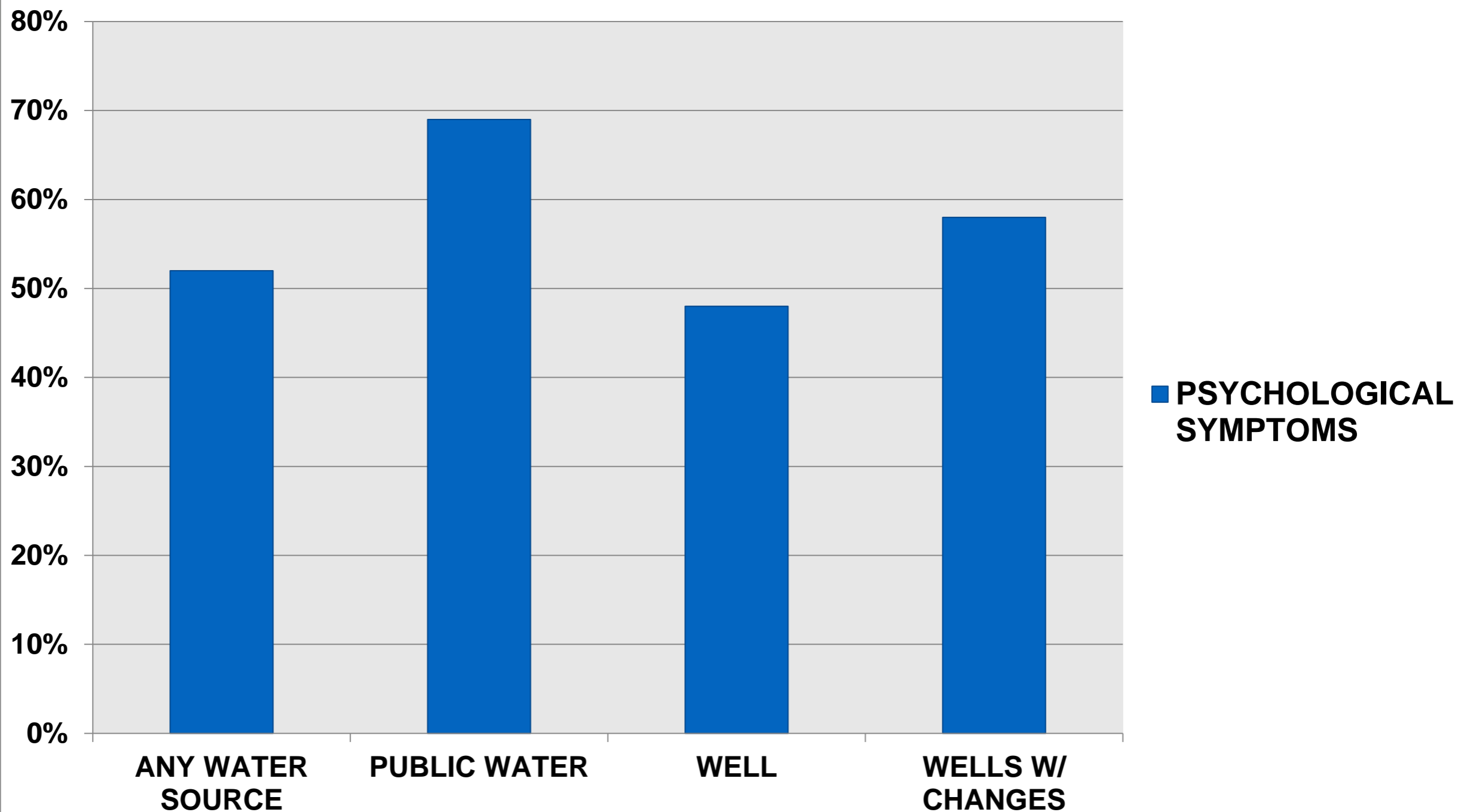
SYMPTOMS BY WATER SOURCE



SYMPTOMS BY WATER SOURCE



SYMPTOMS BY WATER SOURCE



What Symptoms Should be Included in a Case Definition?

Include symptoms consistent with recognized exposure sources:

Air

Water

Noise?

What Symptoms Should be Included in a Case Definition?

Many symptoms are consistent with exposure to recognized air emissions.

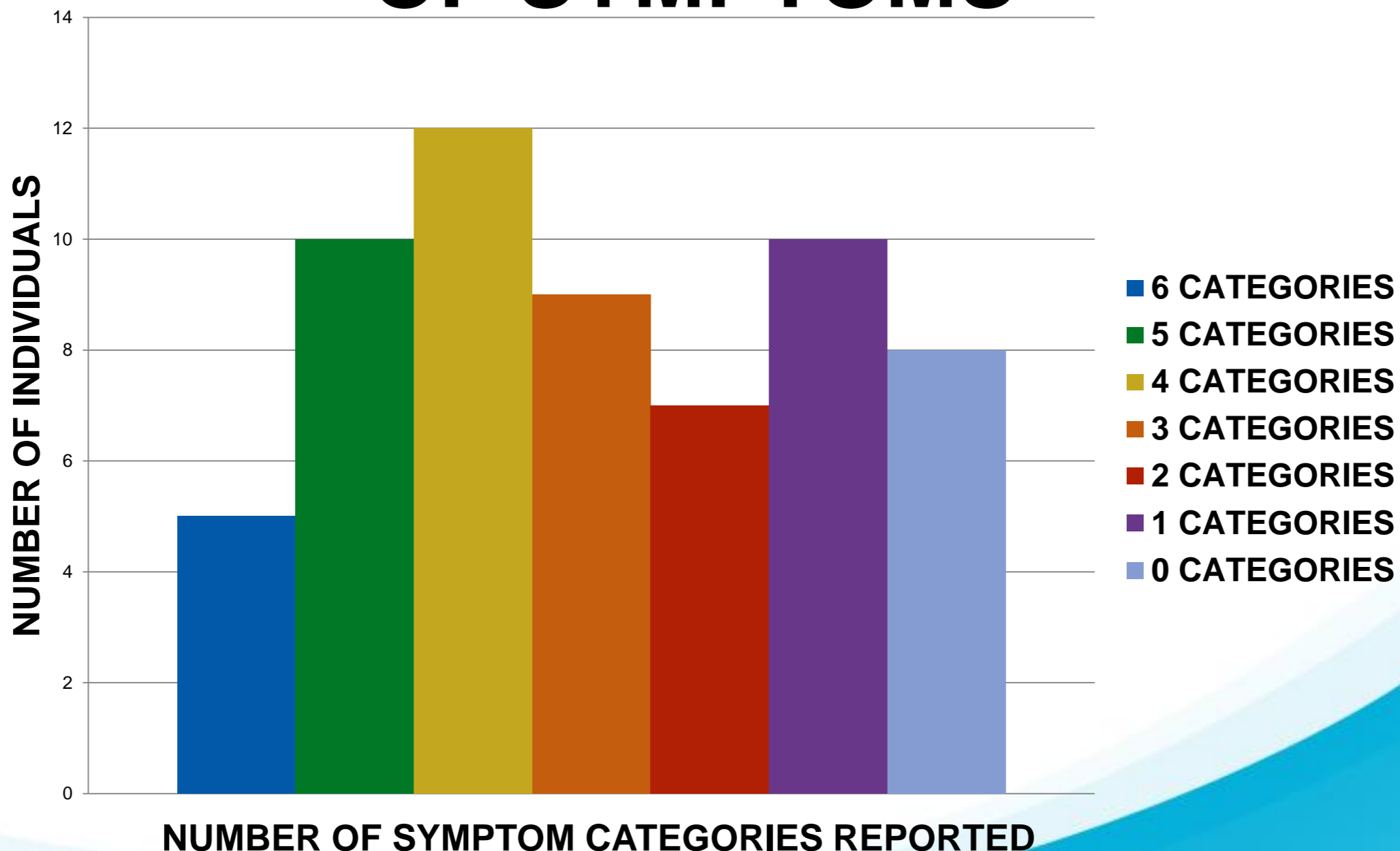
Water exposure is probably an independent contributor to symptoms.

Psychological symptoms most likely not caused by chemical exposures.

Noise and/or psychological factors may contribute to sleep disruption.

Upper and lower respiratory can be combined.

NUMBER OF INDIVIDUALS REPORTING DIFFERENT NUMBERS OF SYMPTOMS



Laboratory Criteria

Presence of the chemical in a biologic specimen

OR

Presence of the chemical in an environmental specimen

Presence of the Chemical in a Biologic Specimen

Chemical or metabolite present in blood
or urine

Chemical unique to UOGD processes

Metabolite unique to chemical

Half-life sufficiently long to avoid false
negatives

Presence of the Chemical in an Environmental Specimen

Positive environmental sampling

Air testing

Water sample

Proximity to source

1 km (approximately ½ mile)

Rabinowitz et al, 2014

McKenzie et al, 2012

UOGD CASE DESCRIPTION

**Environmental exposure
PLUS
Clinical symptoms**

CONFIRMED CASE

Environmental Exposure:

A documented air and/or water exposure*
to an emission or contaminant originating
from a UOGD site

****Instrument or laboratory
measured air contaminant.
Laboratory confirmed water
contaminant***

CONFIRMED CASE

Clinical symptoms

The development of symptoms or worsening of pre-existing symptoms from two or more of the following systems:

1. Respiratory (cough, SOB, throat soreness or irritation, sinus problems, or nosebleeds)
2. Dermal (rash or pruritus)
3. Neurological (headache or dizziness)
4. Gastrointestinal (nausea or abdominal pain)
5. Constitutional (sleep disruption or fatigue)
6. Eye Symptoms (pruritic, painful or dry)

PROBABLE CASE

Environmental Exposure:

A presence for a period of at least 20 hours/week during a minimum of at least one month within one kilometer of one or more facilities extracting, transporting, processing or storing shale gas or waste.

PROBABLE CASE

Clinical symptoms

The development of symptoms or worsening of pre-existing symptoms from two or more of the following systems:

1. Respiratory (cough, SOB, throat soreness or irritation, sinus problems, or nosebleeds)
2. Dermal (rash or pruritus)
3. Neurological (headache or dizziness)
4. Gastrointestinal (nausea or abdominal pain)
5. Constitutional (sleep disruption or fatigue)
6. Eye Symptoms (pruritic, painful or dry)

SUSPECT CASE

Environmental Exposure:

A presence for a period of at least 20 hours/week during a minimum of at least one month within one to two kilometers of one or more facilities extracting, transporting, processing or storing shale gas or waste.

SUSPECT CASE

Clinical symptoms

The development of symptoms or worsening of pre-existing symptoms from two or more of the following systems:

1. Respiratory (cough, SOB, throat soreness or irritation, sinus problems, or nosebleeds)
2. Dermal (rash or pruritus)
3. Neurological (headache or dizziness)
4. Gastrointestinal (nausea or abdominal pain)
5. Constitutional (sleep disruption or fatigue)
6. Eye Symptoms (pruritic, painful or dry)

THE END