Water Matters: Drinking Water-Borne Illness in Children Living in *Colonias* on the Border

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Context

We conducted a Health Impact Assessment (HIA) focused on water and sanitation in Vinton, TX, a small rural town on the U.S./Mexico Border. Our HIA and subsequent survey work are presented as a case study, demonstrating the impacts of poor water quality on the health of children living in colonias on the U.S./Mexico border.

Our study was a collaboration among:

Pan American Health Organization
Regional Office of the World Health Organization

BECC
COCEF

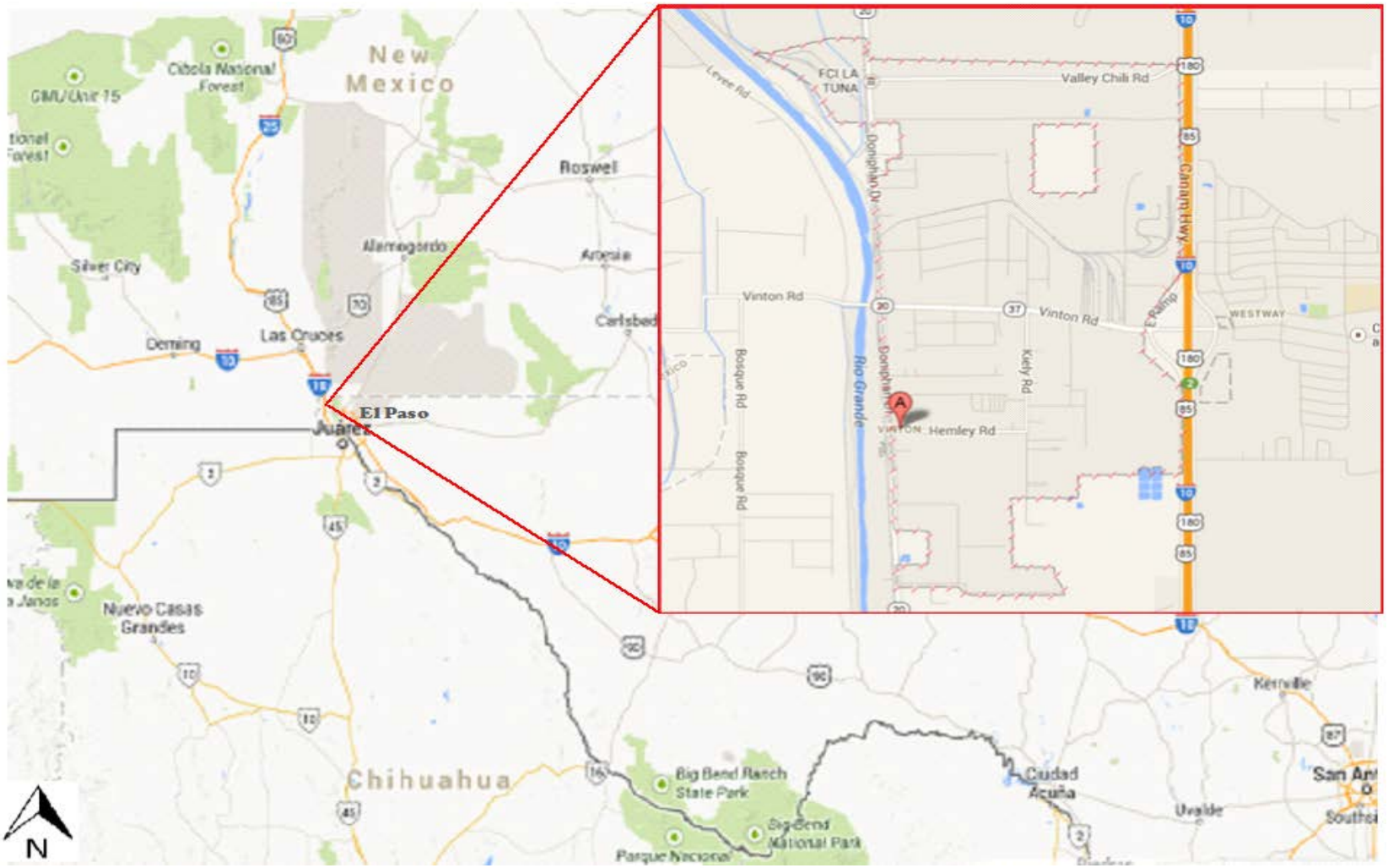
BORDER 2020
FRONTERA 2020

UTEP
The University of Texas at El Paso

Goals of our HIA

- Assess quality of water sources in the community and health of residents
- Identify potential health impacts of improved water and sanitation infrastructure
- Inform decisions by community, local government, and donors regarding proposed infrastructure improvements

Location of Vinton



Water and Sanitation in Vinton

Seven sources of water in Vinton:

- **Domestic wells (about 20% of households)**
- **EPWU (17% of households)**
- **Five privately owned small public water supplies from local wells (63% of households)**

Sanitation in Vinton:

- **Septic tanks**

Assessment Methodology

- Water quality survey (113 samples from kitchen sink)
- Household survey (121 households in Vinton; reference population of 50 households in Westway)
- Focus groups (five representing community leaders, business community, professionals, and government agencies)
- Public meetings (two to present/explain results and obtain feedback)

Demographics of Respondents

	Vinton	Westway
POPULATION		
Total households surveyed	121	50
Median age (respondent)	48	50
Total population of participating households	485	170
Children 17 years or younger	151	49
HOUSING		
Average household size	4.0	3.4
INCOME		
Median household income estimation	$25,500	$18,000
SURVEY		
Household participation (% of total households contacted who agreed to participate)	58	57

Water Quality Results

SAMPLE INFORMATION	ARSENIC		TOTAL DISSOLVED SOLIDS	
Water Sources (# connections)	Range in As Conc., µg/L	Number Samples >MCL (% > MCL)	Range in TDS Conc. mg/L	Number Samples >MCL (% > MCL)
Hillside Water Works (52)	7.4–12.3	22 (96%)	530–830	0 (0%)
Vinton Village Estates (82)	8.9–11.1	4 (25%)	642–692	0 (0%)
Domestic Wells (113)	2.6–15.8	9 (39%)	482–1480	3 (14%)
El Paso Water Utilities (92)	5.8–13.0	1 (5%)	230–802	0 (0%)
Vinton Hills Subdivision (158)	4.6–5.6	0 (0%)	850–946	0 (0%)
Villa Alegre Estates (22)	4.6–5.4	0 (0%)	988–1020	2 (40%)
Total (519)	2.6–15.8	36 (32%)	230–1480	5 (4%)

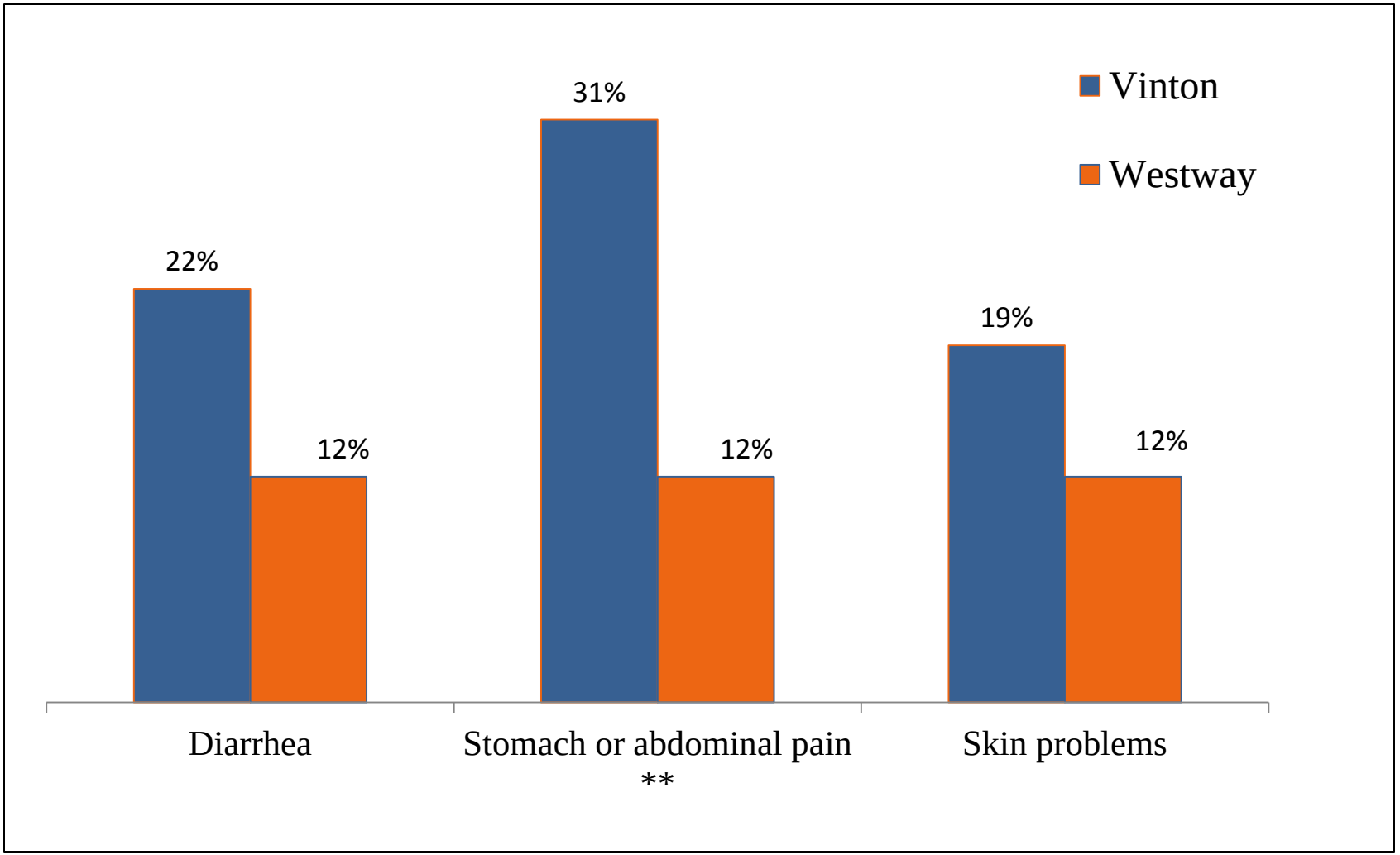
Biological Organisms in Water

- **10 households positive for coliform bacteria**
- **1 household positive for *E. coli***
- **No detection of viruses or pathogenic organisms like *Giardia* or *Cryptospiridium* (oocysts)**

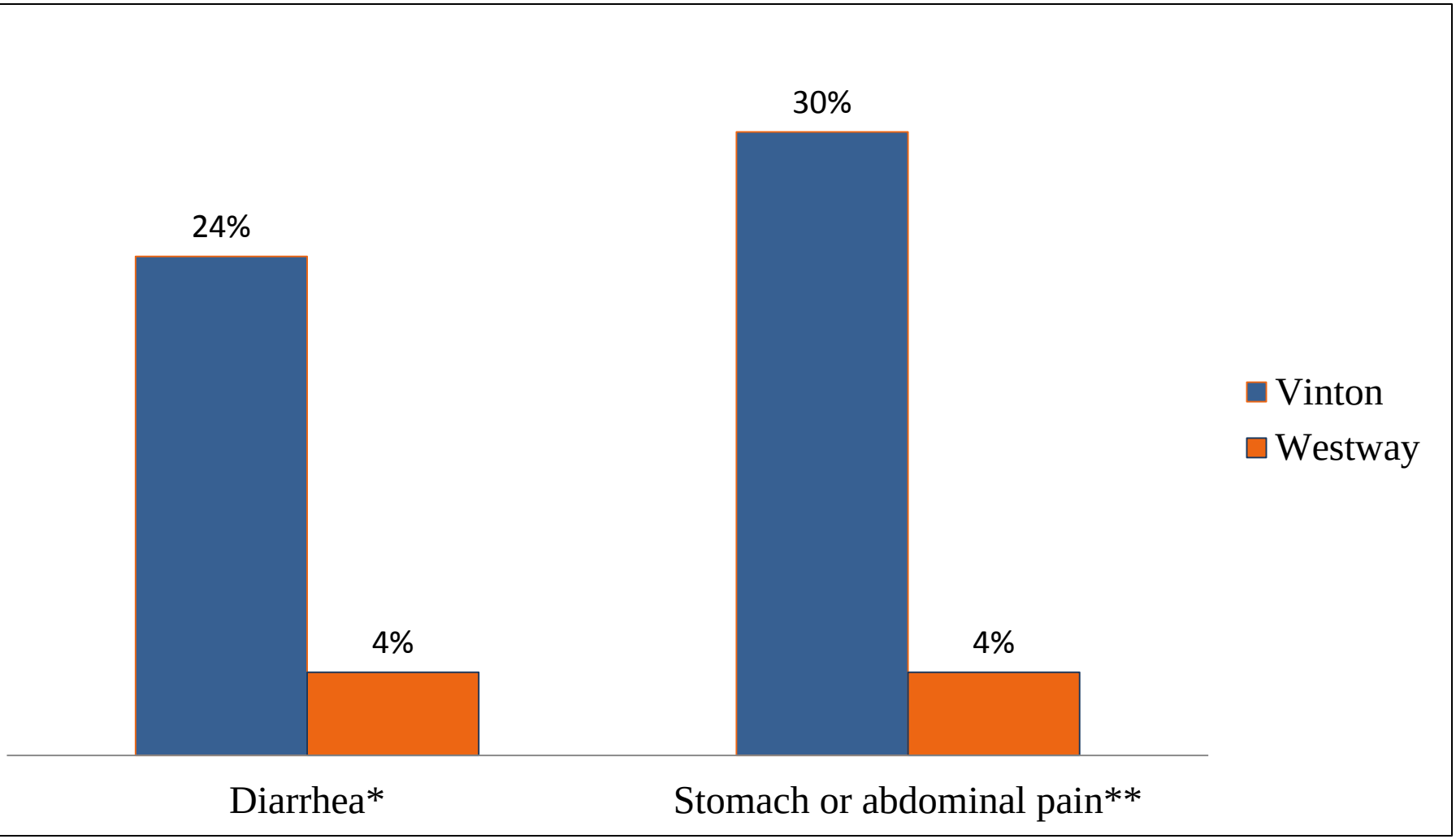
Septic Tank Survey

- 40% of household septic tanks deemed at risk due to odors or standing water in septic drain field
- Average age of septic tanks was 20 years
- 31% of residents knew nothing about septic tank and 67% never received any information on how to manage it
- 73% never had an inspection or had a certificate of compliance
- About half never had it pumped out; several had been cited by the county

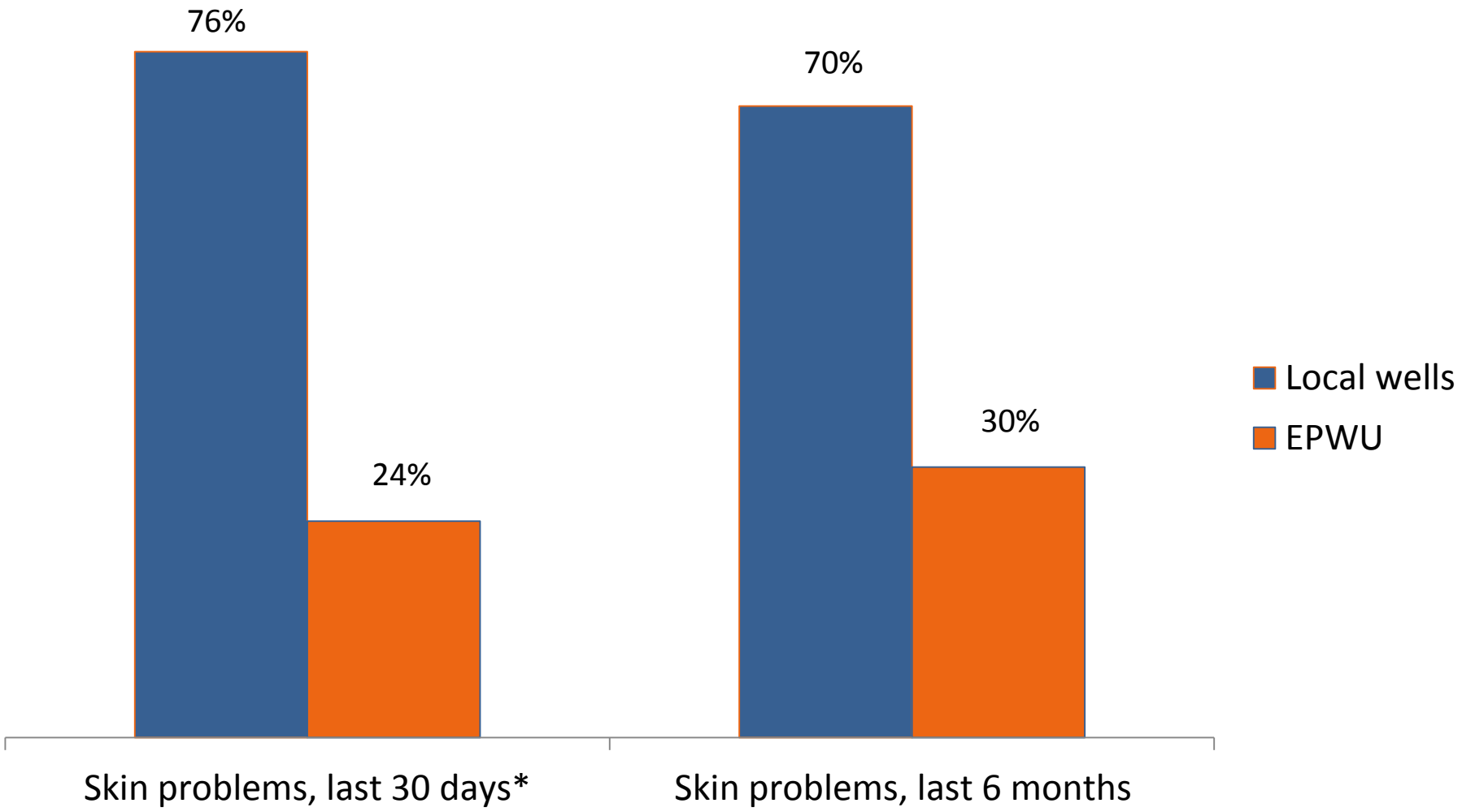
Public Health Conditions: Self-Reported Illnesses Past 30 Days



Public Health Conditions: Self-Reported Illnesses Last 30 days and Drink Tap Water



Public Health Conditions: Self-Reported Illnesses



Survey of Children's Blood Arsenic Levels

- **Follow-up survey work on As levels in children's blood was conducted by MPH student Michelle Del Rio, under direction of Dr. Christina Sobin, College of Health Sciences, UTEP**
- **104 children from Vinton and Westway, ages 5-11, were sampled**
- **As levels were determined from finger-stick blood samples**
- **The reference value for As levels in blood from CDC (regardless of age) is 12 µg/L**
- **Child behavior also assessed using child "Strengths and Difficulties Questionnaire", a reliable screening tool for negative and positive child behavior patterns; completed by parents**

As Concentration in Blood and Household Water, 2014

Variable	Vinton	Westway
	N=40	n=64
	µg/L	
Mean As in Blood ±St Dev	14.3 ±4.1	12.0 ±4.2
Mean As in Tap Water ±St Dev	7.1 ±3.4	3.7 ±3.2

Reference value for As in blood = 12.0 µg/L
MCL for As in drinking water = 10.0 µg/L

Relationship of Household Water As to Blood As and its Impacts

- As in blood was significantly correlated to As in household water.
- For every unit increase in water-As (1 µg/dL), blood-As increased by 0.26 µg/dL; water accounted for about 30% of As in blood.
- There was no relationship of blood-As with child behavior, as measured by the child "Strengths and Difficulties" questionnaire.
- A preliminary assessment of other sources of As in the environment resulted in no significant levels of As in airborne dust or soil
- A survey of rice samples obtained from local grocery stores showed some high arsenic levels in some brands of rice; 2 samples out of 9 had As concentrations of 300-500 µg/kg; the remainder, 200-300 µg/kg.

WATER IS A SIGNIFICANT CONTRIBUTOR, BUT MUCH MORE WORK NEEDS TO BE DONE TO ASSESS ALL THE ENVIRONMENTAL SOURCES OF As

Existing Conditions and their Impacts

Existing Condition	Impacts
Poor water quality: As, TDS, Coliform Bacteria	**High As blood levels in children** **Gastrointestinal ailments** **Skin problems**
Reliance on bottled water for drinking	High cost of drinking water
Poor septic tank management	**Risk of overflows leading to:** **Exposure/gastrointestinal ailments** Odors Contamination of groundwater
Inadequate fire hydrants	High cost of fire insurance Inability to fight fires
Lack of local health clinics	Lack of local access to health care, especially preventative care
Lack of water availability at local parks	Lack of drinking water fountains and shade lead to less use
Prolonged drought	Unreliability of water supply; periods of no service
Lack of retail businesses	Lack of economic vitality Poor job opportunities locally

Acknowledgements

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- The results of the Health Impact Assessment are published:
  William L. Hargrove, Patricia M. Juárez-Carillo, and Marcelo Korc. 2015. "*Healthy Vinton*: A Health Impact Assessment Focused on Water and Sanitation in a Small Rural Town on the U.S.-Mexico Border". *Int. J. Environ. Res. Public Health 12*, 3864-3888; doi:10.3390/ijerph120403864

- The results for As blood levels are from the thesis of Michelle Del Rio:
  Michelle Del Rio. 2015. A Pilot Study of Arsenic in Young Children from Two Rural West Texas Communities: Blood levels, Household Water Levels, and Behavioral Outcomes. Thesis, Master of Public Health, College of Health Sciences, The University of Texas at El Paso. 70 pp. (Directed by Dr. Christina Sobin)