

Risks and risk perceptions related to drinking bottled water



MARIPOSA
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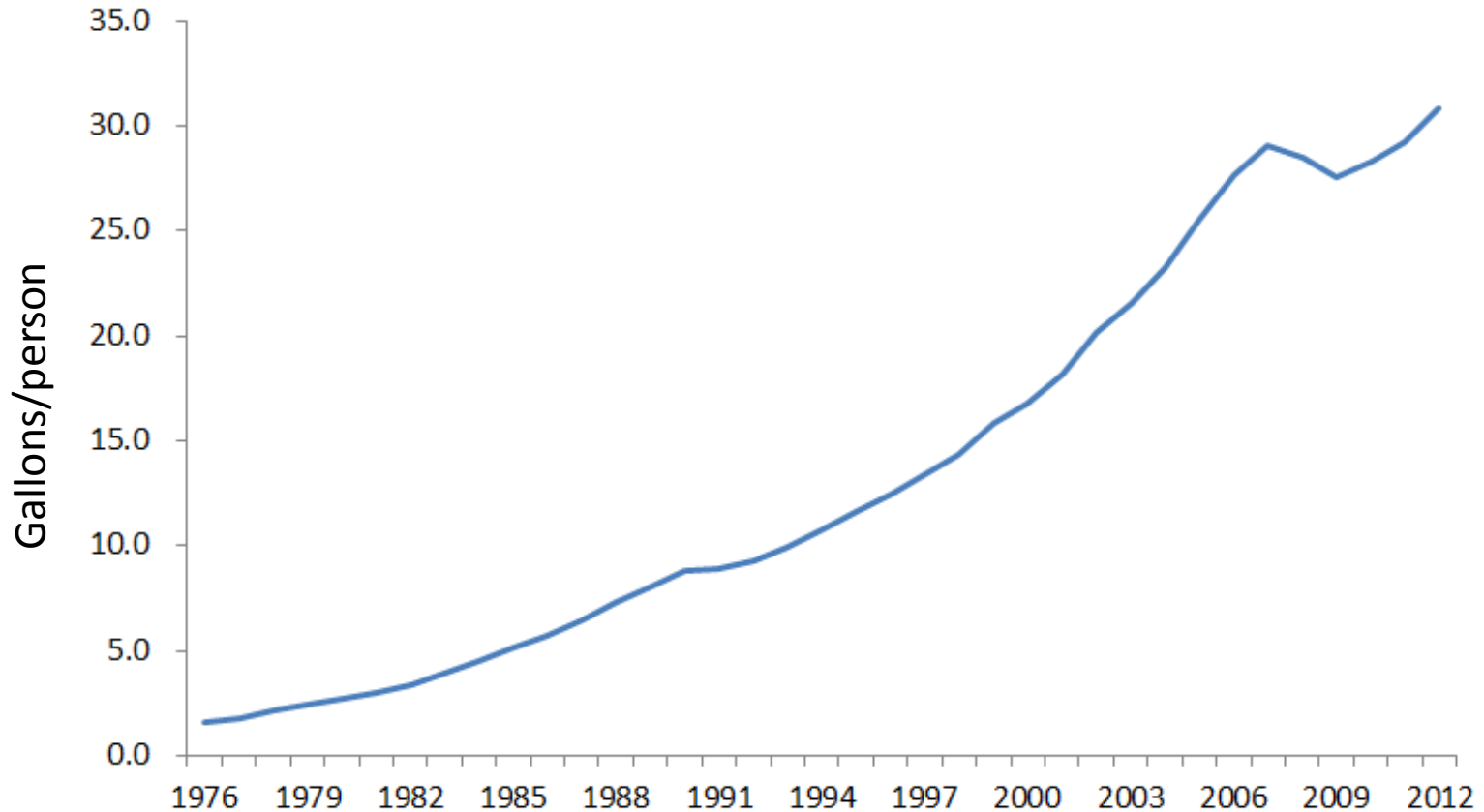
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Outline

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 - Types of bottled water
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 - Perceived health outcomes
 - Drinking-water perceptions and comparison to other activities
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Bottled-Water Consumption in U.S. 1976-2012



Bottled water sales per person in the United States, from 1976 to 2012. Data are from the Beverage Marketing Corporation. Graph by Peter Gleick.

Bottled-Water Consumption

- United States and Mexico largest consumers of bottled water worldwide
- Arizona residents consumed ~ 335 million gallons of bottled water in 2006 (5th overall)
- Increased bottled water use associated with risk perceptions regarding quality of municipal drinking-water supplies

The Arizona Republic. 2007. Thirsty Arizona. Vol. 2014. Arizona Republic

Bottled water consumption among Latinos



- Latino parents more likely than non-Latino parents to give children bottled water
- Tucson, Arizona, Latinos had higher rates of bottled-water consumption than non-Latinos
- Previous study in Nogales, Arizona:
 - 85% of participants primarily drank bottled water
 - 50% cooked with bottled water

Williams et al. 2001. Inter-and intra-ethnic variation in water intake, contact, and source estimates among Tucson residents: implications for exposure analysis

Hobson et al. 2007. Bottled, filtered, and tap water use in Latino and non-Latino children

Beamer et al 2012. Concentration of Trichloroethylene in Breast Milk and Household Water from Nogales, Arizona

Terminology

- “Bottled water sold in the U.S.” is a generic phrase that describes all water sold in containers:



- Spring
- Distilled
- Artesian
- Purified



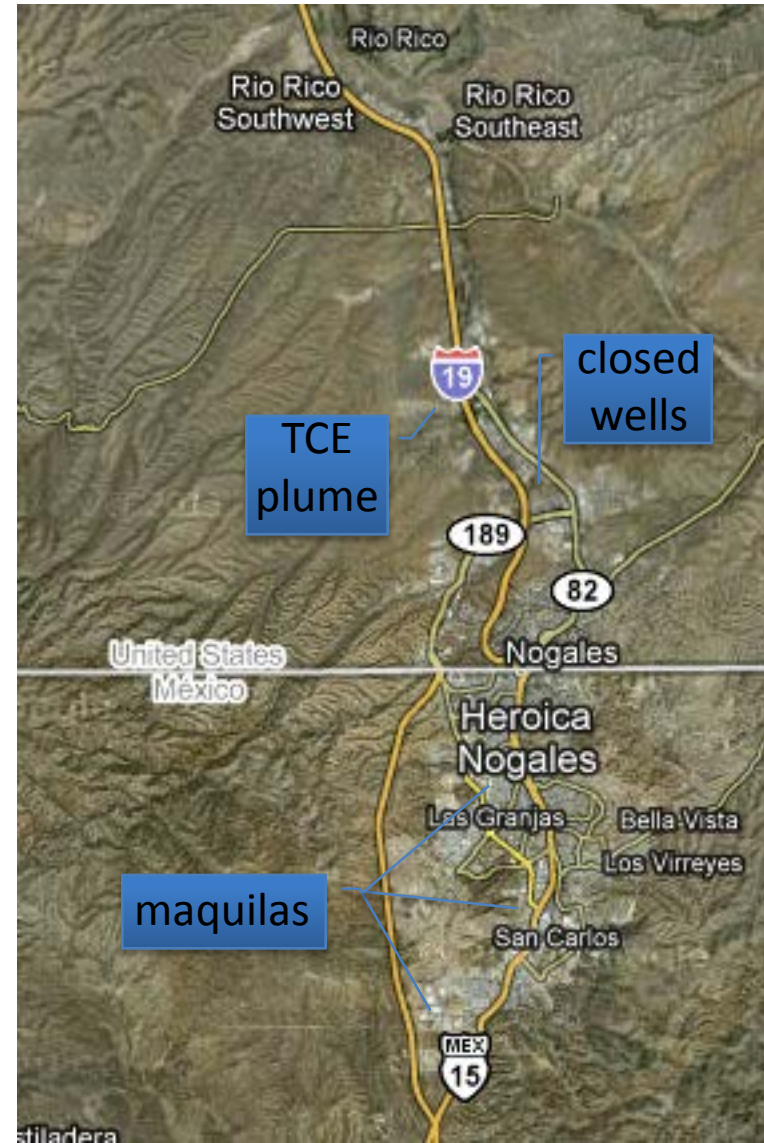
Significance



- Several studies have shown Latinos more likely to use bottled water over tap water
- This study is the first to assess how “risky” families perceive consuming local tap water in relation to other activities that present risk

Study Location: Nogales Metro Region

- Recent well closures (*Froehling et al., 2007*)
- 13 acre TCE Plume (*ADEQ, 1997*)
- 65% of maquiladoras in Nogales, Sonora manufacture electronics (*Bowen et al., 1995; Sanchez et al., 1990*)
- Fluoride is not added to tap water (*NCCDPHP. 2008. My Water's Fluoride. Vol. 2013*)



Mariposa Community Health Center (MCHC)

- Project completed through partnership between UA and MCHC
- MCHC a Federally Qualified Health Center and the major provider of medical, dental, and preventive care in Santa Cruz County
- MCHC *Promotoras* serve as conduit for health education



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Study Design: Recruitment

Eligibility Criteria

- Annual income under \$30K
- Latino descent
- Connected to municipal tap water
- Drink bottled water
- \geq one child

Questionnaire administered

- Study population (N=90)
- Administered during business hours
- 25-35 minutes to complete
- Compensation (\$20)

Study Design: Questionnaire



Risk perception

- Fear of drinking contaminated water
- Health outcomes
- All questionnaire responses hand-coded into STATA®



Dental history and use of fluoride

- Caries
- Fluoride use



Demographics

- Race
- Income
- Birthplace
- Education

Likert-Type Scale

Activity	Strongly Disagree Neutral Strongly Agree				
6g. I trust my tap water company to provide me with safe drinking water	1	2	3	4	5
6h. I drink my tap water	1	2	3	4	5
6i. It is safe to drink bottled water	1	2	3	4	5
6j. I use bottled water or other sources of water (not tap) for drinking	1	2	3	4	5
6k. It is safe to drink water vended at water stations or at the store	1	2	3	4	5
6q. It is safe to drink my tap water	1	2	3	4	5

Likert-Type Scale

Health Effect	Not Likely	2	Likely	4	Very Likely
1. <i>Cancer</i>	1	2	3	4	5
2. <i>GI illnesses</i>	1	2	3	4	5
3. <i>Dental diseases</i>	1	2	3	4	5
4.	1	2	3	4	5
5.	1	2	3	4	5

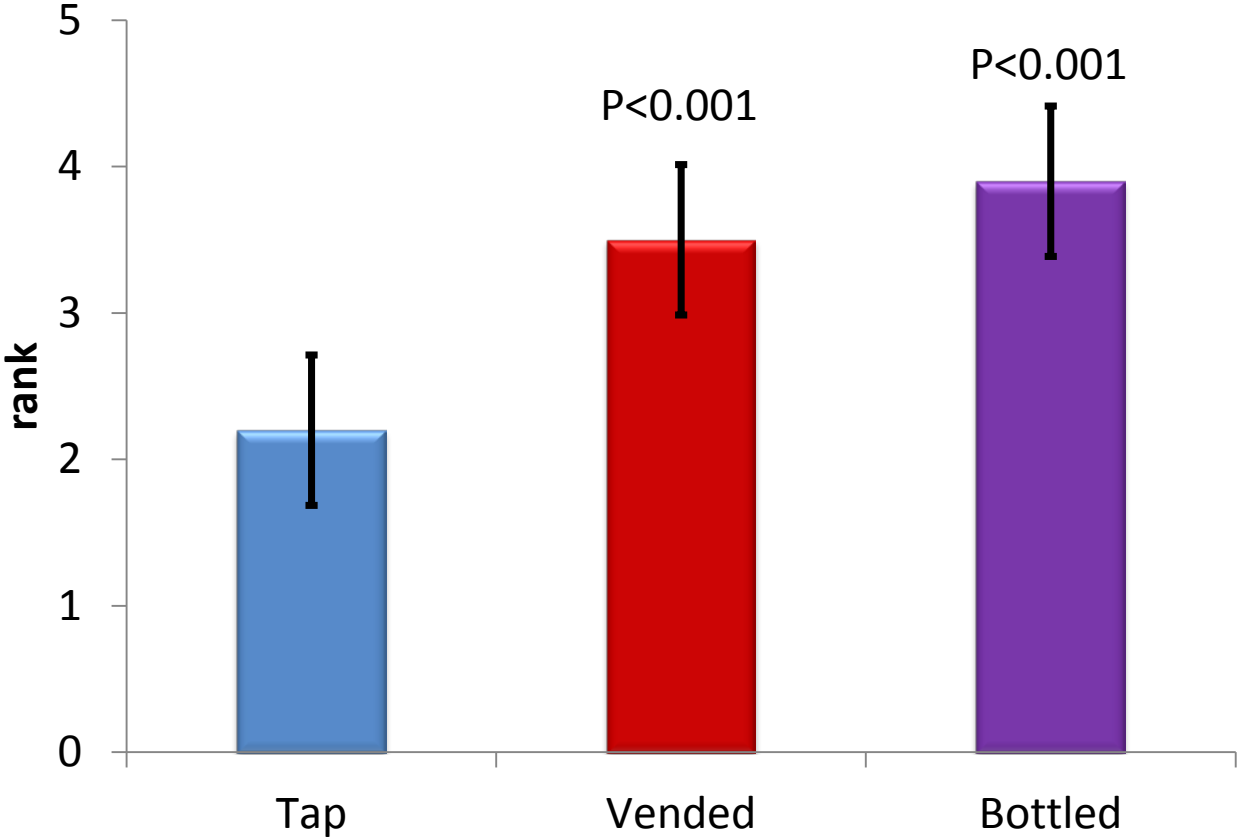
Statistical Analysis

- Unpaired t-tests used:
 - differences in perceived risk between tap and purchased water sources
 - differences occurred by demographic characteristics
- One-way ANOVA followed by Scheffe's post-hoc test to assess differences in perceived risk of drinking and willingness to drink local tap water in comparison to:
 - other geographic locations
 - other risky activities (e.g., drinking and driving)

Study Population

Characteristics	n	%
Gender		
Female	75	83
Male	15	17
Age		
< 35 years	44	49
≥ 35 years	46	51
Immigration Status		
Immigrant (born outside U.S.)	44	49
Non-Immigrant (born in U.S.)	46	51
Annual household income		
<15K	48	53
15K ≥ 30K	42	47
Education level		
≤ 8th grade	43	48
9-12th grade	27	30
Some college	20	22
Years lived in the U.S.		
0-10 yrs	22	24
11-20 yrs	35	39
> 20 yrs	33	37

Perceived Safety of Bottled Water Compared to Tap Water



On a Likert scale from 1 (strongly disagree) to 5 (strongly agree)

Health Outcomes

Outcome	n	%
GI illnesses	74	45
Lupus	21	13
Parasites/Microbes	16	10
Cancer	15	9
Other	10	6
Chemicals	9	5
General infections	8	5
Allergic reactions	8	5
Dental problems	5	3

Risk Perception: Geographic Location

Activity	Mean	SD	Mean difference	p-value
<i>Drinking-water activities</i>				
Drinking tap water in Nogales, AZ, USA	4.7	0.8	Ref	Ref
Drinking tap water in Guadalajara, Jalisco, México	4.1	1.1	0.6	0.431
Drinking tap water in Nogales, Sonora, México	4.8	0.6	-0.1	0.972
Drinking tap water in San Francisco, CA, USA	3.4	1.4	1.3	<0.001*
Drinking tap water in Vancouver, British Columbia, Canada	3.4	1.3	1.3	<0.001*

*P<0.05

On a Likert scale from 1 (low risk) to 5 (high risk)

Risk Perception: Other Activities

Activity	Mean	SD	Mean difference	p-value
<i>Drinking-water activities</i>				
Drinking tap water in Nogales, AZ, USA	4.7	0.8	Ref	Ref
<i>Other activities</i>				
Drinking and driving	4.8	0.6	-0.2	1.00
Driving a car	3.1	1.3	1.6	<0.001*
Riding a motorcycle	2.6	1.3	2.1	<0.001*
Smoking	3.5	1.2	1.2	<0.001*
Using Raid™ (insecticide)	3.3	1.3	1.4	<0.001*

*P<0.05

On a Likert scale from 1 (low risk) to 5 (high risk)

Open-Ended Questions

- 98% (88/90) feared drinking local tap water could result in adverse health effects
- 79% (71/90) did not drink local tap water because of fear of contamination
- 73% (66/90) would drink local tap water if they knew it was safe, regardless of the taste
- 94% (85/90) reported that friends or family have told them not to drink local tap water

Self-Protective Behavior

- 77% (69/90) reported using faucet filters prior to drinking or cooking
- 8% (7/30)* were more likely to boil their tap water before using it for drinking and cooking

* Supplied with water from a purveyor that had received several drinking-water violations

Fluoride Education

- 78% (25/32) received fluoride education from a dentist
- 13% (4/32) received this information in schools
- 9% (3/32) received this information from other sources
- None of the participants received recommendations from healthcare providers about fluoride supplementation

Conclusions

- Residents perceived tap water unsafe for drinking
- Participants viewed consumption of local tap water to be a “high-risk activity”
- Fear of illness from tap water might be contributing to increased use of bottled water in this community
- Potential risk of developing dental caries related to drinking unfluoridated water

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