Chloramine: The correct public choice

June M. Weintraub

In the mid-1800s, physician John Snow removed the handle from a water pump in a London neighborhood, and in so doing put a stop to an outbreak of cholera that had killed more than 500 people in a 10-day period. In the past 150 years, much progress has been made in understanding and preventing the transmission of waterborne diseases.

Public drinking-water providers now know to protect water supplies at the source and to use disinfectants to prevent growth of dangerous bacteria in the water distribution system. The maintenance of what is called a "residual" of disinfectant that stays in the water distribution system while it is delivered to peoples' homes is not just good public health practice; it is required by the Environmental Protection Agency. The EPA offers drinking water providers two disinfectant choices: Chlorine and chloramine.

Like chlorine, chloramine is not new. It has been used extensively throughout the world since the 1930s, and approximately one-third of all U.S. water agencies also use it for residual disinfection. This year the San Francisco Public Utilities Commission became the last large water agency in the Bay Area to make the change from chlorine to chloramine. The primary reason for the shift is a significantly lower level of contaminants formed in the drinking water.

Chlorine and chloramine have many similarities. Both provide effective residual disinfection with minimal risk to public health. Both are toxic to fish and reptiles, since both come in direct contact with the bloodstream through their gills.

The difference is that while chlorine can be allowed to dissipate with time from water added to aquariums and fishponds, chloramine must be chemically removed. Both chlorine and chloramine must be removed from water prior to use in dialysis machines since water comes into direct contact with the bloodstream during treatment. When drinking water, people have no trouble digesting chlorine or chloramine at the levels found in our drinking water because this water is not introduced directly into the bloodstream. A comprehensive search of the medical literature does not reveal any studies showing that those with compromised immune systems, weak livers or medication requirements have any special problems metabolizing chloramine.

The principal advantage of chloramine is the reduction in certain harmful byproducts — especially trihalomethanes and haloacetic acids — formed by reaction with other compounds in the water. It is true that another byproduct — N-nitrosodimethylamine, which is frequently brought up in current discussions of chloramine — is formed by both disinfectants.

However, the NDMA concentration in drinking water is negligible in comparison to other NDMA sources for humans — such as tobacco smoke, chewing tobacco, cured meats, beer, fish, cheese, toiletries, shampoos, cleansers, the interior air of cars and household pesticides.

The San Francisco Public Utilities Commission will consistently monitor for NDMA and other byproducts, now that the switch to chloramine has been completed, as part of its charge to provide a continued supply of healthy, high-quality water. But high levels are not anticipated, given the quality of San Francisco's water source and treatment practices.

In making any decision, the known and unknown risks need to be balanced with the known benefits. In switching from chlorine to chloramine, the SFPUC carefully weighed the choices. It then joined the water utility agencies of Alameda, Contra Costa, Santa Clara and Marin counties to pick the best disinfectant given the most current information available.

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Chloramine is poison

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By Winn Parker

The industrial Material Standard Data Sheets (MSDS) for chloramine show a red skull-and-cross-bones and the word toxin.

This is in response to the June Weintraub chloramine letter in the April 20 edition of the Daily Journal. Her letter is an incomplete picture of ammonia added to water to make a disinfectant chloramine in our drinking water.

The Environmental Protection Agency did not mandate states use this toxin placed in our drinking water. The EPA gave suggestions for alternative ways to disinfect the water and eliminate residual viruses, using ultraviolet light with free ozone and reverse osmosis and membrane technology. The EPA sets the drinking water standards and has determined that chloramine to protect against the risk of these adverse effects.

What was not told were the bio-accumulation effects in the human body. The industrial Material Standard Data Sheets (MSDS) for chloramine show a red skull-and-cross-bones and the word toxin. Its use is only for emergency water disinfecting and may act as a mutagen, creating DNA damage to cells of the body and amino acid breakages essential to life processes.

Ammonia is highly toxic to all and other higher vertebrates convert ammonia to urea. In either case, the initial reaction to amino acid (the basic protein for life) breakdown are provided by liver enzymes.

Concerning the writer downplaying the possible human carcinogen N-nitrosodiumethylamine (NDMA) in drinking water where high-levels of this cancer product are not expected is similar to say you are partially pregnant: NDMA formation can increase with

technology without chemicals. It may cost more but there is no down side of possible wrongful death suits in toxic tort legal actions and maintenance of the water supply to eliminate residuals by alternate technology.

Research literature for liver tumor induction, colon cancer, pancreas and bladder cancer, fetal deaths, chromosomal damage and reproductive studies all could not have been researched unless there is a suspicion of further research to be done. In weighing the known benefits against risks, the human bio-accumulation has not been considered for human bodies to process nitrogenous toxins against the risks for the correct public

Water disinfectant

A Prospective Study of Spontaneous Abortion: Relation to Amount and Source of Drinking Water Consumed in Early Pregnancy

Shanna H. Swan,[1] Kirsten Waller,[1] Barbara Hopkins,[1] Gayle Windham,[1] Laura Fenster,[1] Catherine Schaefer,[2] and Raymond R. Neutra[1]

In 1992, we published four retrospective studies, conducted primarily within a single California county,[1] which found higher spontaneous abortion rates among women who drank more tapwater than bottled water in early pregnancy. The current prospective study extends that investigation to other water systems. Pregnant women from three regions in California were interviewed during their first trimester. Multivariate analyses modeled the amount and type of water consumed at 8 weeks' gestation in each region in relation to spontaneous abortion rate. In Region I, which was within the previous study area, the adjusted odds ratio (OR) comparing high (≥6 glasses per day) consumption of cold tapwater with none was 2.17 [95% confidence interval (CI) = 1.22–3.87]. Furthermore, when women with high cold tapwater and no bottled water consumption were compared with those with high bottled water and no cold tapwater consumption, the adjusted odds ratio was 4.58 (95% CI = 1.97–10.64). Conversely, women with high bottled water consumption and no tapwater had a reduced rate of spontaneous abortion compared with those drinking tapwater and no bottled water (adjusted OR = 0.22; 95% CI = 0.09–0.51). Neither tap nor bottled water consumption altered the risk of spontaneous abortion in Regions II and III. Although controlling for age, prior spontaneous abortion, race, gestational age at interview, and weight somewhat strengthened the association in Region I, the distribution of these confounders did not vary appreciably across regions. This study confirms the association between cold tapwater and spontaneous abortion first seen in this county in 1980. If causal, the agent(s) is not ubiquitous but is likely to have been present in Region I for some time. (Epidemiology 1998;9:126–133)

Keywords: spontaneous abortion, drinking water, tapwater, bottled water.

In 1992, a single issue of this journal reported a series of retrospective studies in which the risk of spontaneous abortion was examined in relation to the source and amount of drinking water consumed during early pregnancy.[1–5] These studies included subjects, residing primarily in a single California county, who became pregnant between 1980 and 1987. Study designs differed (two cross-sectional,[1,2] one case-cohort,[3] and two case-control[4,5]), but all had retrospective assessment of water exposure. The strongest associations were seen in the two cross-sectional studies, in which considerable publicity made subjects aware of the study hypothesis. Data from four studies were consistent with a 10–50% greater risk of spontaneous abortion in women who drank tap (or mostly tap) water compared with those who drank no tapwater.[6] One smaller study in the same county did not find this association, although its power was limited.[3] Two accompanying commentaries[7,8] and a discussion on sources of bias and confounding[9] proposed recall bias as a likely explanation.

The current study was conducted to extend this investigation to a later time period and to different water systems, as well as to eliminate recall bias by using a prospective design. We selected three regions in California, representing a range of water systems, for study. Here, we present region-specific results on spontaneous abortion risk by amount and source of drinking water. No analysis of water constituents or water companies is given here; an analysis of chlorination by-products and spontaneous abortion risk in this dataset is published separately.[10]

Subjects and Methods

Study Regions and Populations

The study population was recruited between January 1990 and September 1991. Collaboration with the Division of Research of the Kaiser Permanente Medical

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Editors' note: See related editorial on page 113 of this issue.

Care Program, a large managed health care organization in California, enabled us to identify and interview women early in pregnancy and ensured nearly complete ascertainment of pregnancy outcomes. The areas served by three Kaiser facilities that provide prenatal care constitute the study regions; approximately equal numbers of women were recruited from each. Regions I and II are in northern California, and Region III is in southern California. Region I is located within the county we studied previously,[1-5] in which homes receive a mixture of groundwater and surface water, except for a few small areas served exclusively groundwater. Region II is served primarily by surface water, whereas large areas of Region III receive only groundwater.

When a woman called to schedule her first prenatal visit, the appointment clerk determined whether she was eligible (≥18 years old, ≤13 weeks' gestation, and Spanish or English speaking) and willing to participate. Of 7,881 women evaluated, 6,179 (78.4%) were eligible and willing to be interviewed. Interviews were completed by 5,342 of these women (86.5%). Among the 837 women without completed interviews, 268 were no longer pregnant when reached for an interview, including 186 who had miscarried in the short time (8 days on average) since initial contact. To maintain the prospective nature of the study, these women were not interviewed. The median gestational age at interview was 8 weeks.

Ascertainment and Definition of Pregnancy Outcomes

Pregnancy outcomes were first ascertained from computerized hospital records (73%) and medical records (18%). Follow-up telephone interviews, mailed questionnaires, or matches to California vital records provided the remaining outcomes. Less than 1% (N = 35) of outcomes could not be determined. The majority of spontaneous abortions (about 84%) were validated by medical record review. We used the first day of the last menstrual period, as given in the interview, to calculate gestational age. We verified extreme gestational ages at outcome (<4 or >45 weeks) against medical records, when possible, and corrected them if warranted. We defined pregnancies ending before 21 completed weeks of gestation as spontaneous abortions (N = 499), and fetal losses between 21 and 27 weeks as stillbirths (N = 32). We excluded elective terminations (N = 128), ectopic (N = 13), and molar pregnancies (N = 4) from analysis. We considered multiple births (N = 55) a single pregnancy outcome. The spontaneous abortion rate is the ratio of spontaneous abortions to the sum of livebirths, stillbirths, and spontaneous abortions.

Interview and Assessment of Water Exposure

The interview, conducted using a computer-assisted telephone interview, queried women regarding demographics; medical and reproductive history, including date of last menstrual period; use of alcohol, tobacco, and caffeine-containing beverages; occupation-, industry-, and job-related exposures such as physical exertion; psychosocial stress; and life events. Questions concerning water (and other) consumption were asked with respect to both the week beginning with the last menstrual period and the week before interview. If, for any consumption variables, the amount consumed before and during pregnancy differed, women were asked when the change occurred. Consumption was ascertained for four types of water: cold tapwater (or drinks made from cold tapwater) at home, heated tapwater (or drinks made from heated tapwater) at home, bottled (noncarbonated) water, and carbonated water. Since women often reported soda as carbonated water, and water source for most soda is unknown, carbonated water was not included in these analyses. Women reporting consumption of any tapwater in either week were asked how they usually drank their tapwater (straight from the tap, let it stand, or refrigerated it first), as well as their use of a water filter/purifier (and type). All women were asked to identify the water company and brand of bottled water when relevant. In addition, number of showers weekly, and their average length, was asked of all subjects. We calculated weekly duration of showering as frequency times average length of showering.

Statistical Analyses

We estimated water consumption (glasses per day) at 8 weeks, the average gestational age at interview. If the interview occurred before that time, we assumed that consumption at 8 weeks was equal to consumption in the week before interview. If the interview occurred at 8 weeks or later, and there was no change in water consumption before 8 weeks, we set consumption equal to that in the last menstrual period week. Otherwise, consumption equaled the amount consumed after the change. We explored the sensitivity of the analysis to this choice of exposure time by also modeling the association between spontaneous abortion and water consumed before pregnancy, and in the last menstrual period week.

We stratified water consumption into none, moderate, and high. Consumption of 6–8 glasses a day of water is often recommended to pregnant women. Nevertheless, the proportion of women drinking ≥8 or more glasses of cold tapwater per day was small (5.5%). Therefore, we selected ≥6 glasses per day as the cutoff defining "high consumption." The selection of ≥6 glasses per day classifies 10.2%, 15.4%, and 14.4% of women as "high" consumers of cold tap, total (hot and cold) tap, and bottled water, respectively, across all regions. We also report results of multivariate models that use alternative cutpoints to define "high" consumption.

Because the three study regions differed in demographic composition, water consumption patterns, and water source, we conducted separate analyses in each study region. Covariates considered for inclusion in multivariate models were those previously associated with spontaneous abortion. We initially considered: age, parity, prior fetal loss, body weight, smoking, alcohol, cal-

The Independent April 11, 2015

Virus that 'makes humans more stupid' discovered

A virus that infects human brains and makes us more stupid has been discovered, according to scientists in the US.

The algae virus, never before observed in healthy people, was found to affect cognitive functions including visual processing and spatial awareness.

Scientists at Johns Hopkins Medical School and the University of Nebraska stumbled upon the discovery when they were undertaking an unrelated study into throat microbes.

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Surprisingly, the researchers found DNA in the throats of healthy individuals that matched the DNA of a virus known to infect green algae.

Dr Robert Yolken, a virologist who led the original study, said: "This is a striking example showing that the 'innocuous' microorganisms we carry can affect behavior and cognition.

Wynn Grath
Public Comments

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PENINSULA PEOPLE & OPINIONS

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Chloramine causes collateral health damage

CHLORAMINE IS A TOXIN added to drinking water we receive from the Hetch Hetchy system. Chloramine is ammonia added to chlorine to make chloramine. Listed in the MSDS industrial chemistry book, chloramine is to be used in an emergency and does not have an antidote. Chloramine cannot be boiled out of the water and can kill fish in hobby tanks and as shown from research, can cause canine hysteria.

GUEST OPINION
BY WINN PARKER

Hemodialysis patients have a special consideration not to have chlormaine in their blood. They could die in minutes.

Chronic kidney disease causes the organs to slowly lose their ability to filter waste out of the bloodstream. Many of the 20 million people estimated to have kidney disease do not know it. The Public Utility Commission is asking humans to be a human processing plant for the chloramine in the body.

Charcoal filters cannot take out the nitrogen in the ammonia. The PUC's requested human processing plant – which is us – can bioaccumulate the nitrogern-toxins from an impaired kidney, liver or impaired immune system. The bioaccumulation of amine toxins and secondary cancer products are going to accumulate even in various dosages of ammonia to chlorine in the drinking water.

Chlolramine in drinking water can enter the digestion and blood stream in another form called a nitrogen balance. Nitrogen balance refers to the difference between nitrogen intake and total nitrogen loss in urine, sweat and bowel elimination. Ammonia, derived mainly from breakdown of amino acids, is toxic to all animals. Human tissues, therefore, initially detoxify ammonia by converting it to glutamine for transport to the liver. Collateral health damage from ammonia upsets the pH balance of the body. If the liver is functioning properly, it releases ammonia converted into the non-toxic nitrogen-rich compound urea in the urine. If the amine of the liver is compromised, ammonia accumulates in the blood and generates serious consequences.

DOUG OAKLEY
Winn Parker of Millbrae is campaigning against the use of chloramine in Bay Area water supplies.

N-nitrosodiumethyamine (NDMA), a probably carcinogen, is a likely by-product of cloramination of drinking water. Collateral health damage from this secondary cancer by-product, NDMA, will probably decrease immunity in the human body. Journal AWWA, Feb. 2001, Vol. 93, No. 2, pp. 92-99.

There are other examples of possible collateral health damage from chloramine explained in other scientific journals, one affecting thyroid metabolism in healthy men and another affecting white blood cells that are needed for a healthy immune system.

Research shows there is also collateral health damage when chloramine interacts with certain medicines. For example, chloramine can change the interaction in the body from taking antidepressants with the drinking water. Statins, which reduce cholesterol levels, are influenced by-chloramine drinking water entering the cells of the body. Propecia, for male pattern baldness, is interactive with chloramine.

Chloramine has been known to cause corrosive pipe deterioration releasing lead and other toxins from pipes eaten away by chloramine. This could cost consumers billions of dollars a years and adversely impact public health.

For a short-term solution, consumers should have filters to remove lead from the water. The long-term solution is to eventually replace all significant lead-bearing materials that are used in the water system. This will take generations to implement. Rather, we must NOW remove chloramine, which is a toxin and produces secondary cancer by-products, and has uncertainties and risks. Since chloramine is a toxin added to the water, water qualifies to be labeled as a toxin under Proposition 65.

If it costs close to $400 million to have alternative technologies for our water to be chemically free, it is a small price to pay compared to the $3.5 billion 13-year build-out of the Hetch Hetchy water system.

After the installation of alternative technologies, we will not have to worry about setting caps on tort damage lawsuits resulting from wrongful death suits against the state, county, and city councils.

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COPY AND PASS ON

Contaminated Water a Problem

Continued from Page B-1

toxic heavy metal.

The Washington Post reported in October 2004 that the D.C. Water and Sewer Authority knew in 2001 that its water contained unsafe lead levels, but "withheld six high test results and said the water was fine."

While the *Post* article did not mention chloramines, it did say that other cities have similar problems dealing with unacceptably high levels of lead in their water:

"Cities across the country are manipulating the results of tests used to detect lead in water, violating federal law and putting millions of Americans at risk," the *Post* reported. "Some cities, including Philadelphia and Boston, have thrown out tests that show high readings or have avoided testing homes most likely to have lead."

"In New York City," the *Post* wrote, "the nation's largest water provider has for the past three years assured its 9.3 million customers that its water was safe because the lead content fell below federal limits. But the city has withheld from regulators hundreds of test results that would have raised lead levels above the safety standard in two of those years."

The American Water Works Association (AWWA), an international nonprofit scientific society dedicated to the improvement of drinking water quality, reported that samples of Washington water collected after flushing were as high as 48,000 parts per billion (ppb). Some of the highest lead concentrations came from taps after one minute of flushing.

The EPA's "action level" for lead in drinking water is 15 ppb, while the UN's World Health Organization recommends that lead not exceed 10 ppb.

According to the EPA, "If the lead concentration of the drinking water at the tap is above the action level, the water supplier may be required to install corrosion-control equipment, monitor the water source, and replace lead service lines, as well as undertake a public education program."

After switching to chloraminated water, children in Washington ingested more than 60 times the EPA's maximum level of lead with one glass of water.

> ***"Cities across the country are manipulating the results of tests used to detect lead in water. . . . Some cities . . . have thrown out tests that show high readings."***

"[Lead] contaminated water is a greater risk to youth," the EPA notes. A 2-year-old's estimated daily intake of lead from all sources should not exceed 190 ppb per day, according to EPA guidelines.

In March 2004, after a number of 2-year-olds in Washington were found to have high levels of lead in their blood, D.C. City Administrator Robert Bobb said that 23,000 homes with lead service lines would receive filters within 30 days.

Lead in the drinking water was a problem that plagued ancient Rome.

Vitruvius, Roman architect and engineer, warned of lead in his 1st Century B.C. opus *De Architectura*: "Water from clay pipes is much more wholesome than that which is conducted through lead pipes, because lead is found to be harmful . . . hurtful to the human system.

"Hence, water ought by no means to be conducted in lead pipes, if we want to have it wholesome," Vitruvius wrote.

TOXIC BYPRODUCTS

The chlorination of water also creates a host of known and unknown organic byproducts, which experts say are "the chemicals of greatest concern" due to their toxicity and carcinogenic potential.

To reduce the level of harmful DBPs and the odor in the water, the EPA began promoting chloramination of water in 1994.

While the chloramines reduce the level of known DBPs, they create a host of unknown DBPs, some of which are extremely toxic.

In Corpus Christi, Texas, for example, where the water is treated only with chloramines, the reaction with the bromide and iodide laden source water creates some of the "most toxic and genotoxic DBPs" ever found.

Although chlorine has been used to disinfect water for over 100 years, less than 50 percent of the DBPs in chlorinated drinking water are known. With chloramines, only 17 percent of the DBPs have been identified.

"The unintended generation of DBPs poses a chronic health risk," Dr. Michael J. Plewa, a genetic toxicology expert at the University of Illinois, wrote. Plewa authored a 2004 EPA-funded study of the effects of chloramines in the water of Corpus Christi.

In the chloramine-treated water of Corpus Christi, Plewa's study discovered a number of new and extremely toxic DBP's: iodoacids.

"The iodoacetic acid is the most toxic and genotoxic DBP in mammalian cells reported in the literature," Plewa wrote. Of the known DBPs, the iodoacetic acid found in the drinking water of Corpus Christi was "the most toxic and DNA-

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