Soranus of Ephesus
(1\textsuperscript{st}/2\textsuperscript{nd} Century AD)

Carl Lange (1886)
“Bib-Label Lithiated Lemon-Lime Soda”

John Cade

John Cade

“The sedative but non-hypnotic effect of lithium salts is reported in mania patients as so specific that it leads to speculation as to the possible etiological significance of a deficiency in the body of lithium ions in the genesis of this disorder.”
Translating neurotrophic and cellular plasticity: from pathophysiology to improved therapeutics for bipolar disorder

Ecological studies of lithium levels in drinking water and suicide mortality:

- ‘Protective’ association:
  - United States (Schrauzer 1990; Bluml 2013)
  - Japan (Ohgami 2009)
  - Austria (Kapusta 2011)
  - Greece (Giotakos 2013)

- No association:
  - East of England (Kabacs 2011)
  - Japan (Sugawara 2013)
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Lithium in Drinking Water
and the Incidences of Crimes, Suicides,
and Arrests Related to Drug Addictions

Gerhard N. Schrauzer*\(^1\) and Krishna P. Shrestha\(^2\)

\(^1\)Department of Chemistry and Biochemistry,
University of California at San Diego, Revelle College,
La Jolla, CA 92093, and \(^2\)Department of Chemistry,
University of Oriente, Cumana, Sucre, Venezuela

Received August 3, 1989; Accepted October 20, 1989
• Schruazer et al, 1990:
  

  – ‘No/little lithium’ areas versus areas of 70-170mcg/L

  – Incidence rates of suicide, homicide and rape were higher in ‘No/little lithium’ areas

  – But corrected only for population density
Short report

Lithium levels in drinking water and risk of suicide†

Hirochika Ohgami, Takeshi Terao, Ippei Shiotsuki, Nobuyoshi Ishii and Noboru Iwata

Summary
Although lithium is known to prevent suicide in people with mood disorders, it is uncertain whether lithium in drinking water could also help lower the risk in the general population. To investigate this, we examined lithium levels in tap water in the 18 municipalities of Oita prefecture in Japan in relation to the suicide standardised mortality ratio (SMR) in each municipality. We found that lithium levels were significantly and negatively associated with SMR averages for 2002–2006. These findings suggest that even very low levels of lithium in drinking water may play a role in reducing suicide risk within the general population.

Declaration of interest
None.
Invited commentary on . . .
Lithium levels in drinking water and risk of suicide

Allan H. Young

Summary
Lithium is a well-established treatment in psychiatry. The possibility that lithium from the environment may affect mental health has received little study. However, a recent study and an older report both suggest that higher levels of lithium in drinking water are associated with lower suicide rates. These intriguing data should provoke further research, which ultimately may benefit community mental health.

Declaration of interest
Current grant: AstraZeneca; speaker/advisor: AstraZeneca, BCI, Bristol-Myers Squibb, Eli Lilly, GlaxoSmithKline, Janssen, Pfizer, Sanofi, Servier, Wyeth.
Fig. 1 Lithium levels in drinking water and the average suicide standardised mortality ratio (SMR) for 2002–2006 in 18 municipalities of Oita prefecture.
Only controlled for age, gender and prefecture population size.

Fig. 1 Lithium levels in drinking water and the average suicide standardised mortality ratio (SMR) for 2002–2006 in 18 municipalities of Oita prefecture.
Lithium in drinking water and suicide rates across the East of England

Nikolett Kabacs, Anjum Memon, Thorn Obinwa, Jan Stochl and Jesus Perez

Summary

Lithium can be found naturally in drinking water. In clinical practice, it is widely used in pharmacological doses for the treatment of bipolar disorder, and may also prevent suicidal behaviour in people with mood disorders. In two studies, lithium levels in tap water have been significantly and negatively correlated with suicide. We measured lithium levels in tap water in the 47 subdivisions of the East of England and correlated these with the respective suicide standardised mortality ratio in each subdivision. We found no association between lithium in drinking water and suicide rates across the East of England from 2006 to 2008.

Declaration of interest
None.
Lithium in drinking water and suicide rates across the East of England†

Nikolett Kabacs, Anjum Memon, Thom Obinwa, Jan Stochi and Jesus Torrens

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Lithium can be found naturally in drinking water. In clinical practice, it is widely used in pharmacological doses for the treatment of bipolar disorder, and may also prevent suicidal behaviour in people with mood disorders. In two studies, lithium levels in tap water have been significantly and negatively correlated with suicide. We measured lithium levels in tap water in the 47 subdivisions of the East of England and correlated them with standardised mortality ratios (SMRs) for suicide. No significant association between the two was found.

Fig. 1 Lithium levels in drinking (tap) water and standardised mortality ratios (SMRs) for suicide from 2006 to 2008 (pooled) in the 47 subdivisions of the East of England. The size of the dot represents population size in each subdivision.
Lithium in drinking water and suicide rates across the East of England

Nikolett Kabacs, Anjum Memon, Thom Obinwa, Jan Stochi and Jesu

Summary
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Lithium in drinking water and suicide mortality

Nestor D. Kapusta, Nilufar Mossaheb, Elmar Etzersdorfer, Gerald Hlavin, Kenneth Thau, Matthäus Willeit, Nicole Praschak-Rieder, Gernot Sonneck and Katharina Leithner-Dziubas

Background
There is some evidence that natural levels of lithium in drinking water may have a protective effect on suicide mortality.

Aims
To evaluate the association between local lithium levels in drinking water and suicide mortality at district level in Austria.

Method
A nationwide sample of 6460 lithium measurements was examined for association with suicide rates per 100,000 population and suicide standardised mortality ratios across all 99 Austrian districts. Multivariate regression models were adjusted for well-known socioeconomic factors known to influence suicide mortality in Austria (population density, per capita income, proportion of Roman Catholics, as well as the availability of mental health service providers). Sensitivity analyses and weighted least squares regression were used to challenge the robustness of the results.

Results
The overall suicide rate ($R^2 = 0.15, \beta = -0.39, t = -4.14, P = 0.000073$) as well as the suicide mortality ratio ($R^2 = 0.17, \beta = -0.41, t = -4.38, P = 0.000030$) were inversely associated with lithium levels in drinking water and remained significant after sensitivity analyses and adjustment for socioeconomic factors.

Conclusions
In replicating and extending previous results, this study provides strong evidence that geographic regions with higher natural lithium concentrations in drinking water are associated with lower suicide mortality rates.

Declaration of interest
None.
• **Kapusta et al, 2011:**
  - 99 districts in Austria (population 8.3m)
  - 65.3 samples per district

  – **Controlled for:**
    - Population density
    - per capita income
    - proportion of Roman Catholics
    - availability of mental health service providers
Lithium levels and standardised mortality ratios (SMRs) for suicide within 99 Austrian districts (Kapusta et al, 2011, BJPsych)
Lithium in the Public Water Supply and Suicide Mortality in Greece

Orestis Giotakos • Paul Nisianakis • George Tsouvelas • Vera-Varvara Giakalou

Received: 23 August 2013 / Accepted: 4 September 2013
© Springer Science+Business Media New York 2013
Fig. 1 Scatter plot of lithium values in micrograms per liter and standardized mean rate of suicides per prefecture for the years 1999 to 2010

$R^2$ Linear = 0.029
Fig. 1 Scatter plot of lithium values in micrograms per liter and standardized mean rate of suicides per prefecture for the years 1999 to 2010

No confounding variables assessed
No association when model included unemployment rate and number of medical institutions per 10,000 people
226 counties
13.8 samples per county
Controlled for gender, ethnicity, household income, unemployment rates.
Fig. 1. Average lithium levels in Texas, 1999–2007 (darker areas represent lower levels).

Fig. 2. Annualised suicide rates (SR_adv) in Texas, 1999–2007 (darker areas represent higher SR_adv).

Lithium levels (darker = lower levels)  Suicide rates (darker = higher rates)
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• **Issues:**

  – Inadequate account taken of potential confounders:
    – Dietary lithium (vegetables, grains, spices)
    – Lithium prescribing
    – Consumption of bottled water
    – Social deprivation, unemployment, etc.
    – Quality/intensity of local health services

  – Relatively small number of data points in most studies
  – Associations, not causation.
Suicide mortality and lithium levels in drinking water: Scottish national linkage study
(Smith, Pell, O’Connor, Lewsey, Young)
Lithium in drinking water and suicide mortality

Daniel Smith
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