tilda
Staidéar Fadaimseartha na hÉireann um Dhul in Aois
The Irish Longitudinal Study on Ageing

RESEARCH BRIEF

WATER FLUORIDATION, ORAL STATUS AND BONE HEALTH OF OLDER PEOPLE IN IRELAND

VINCENT O'SULLIVAN AND BRIAN C. O'CONNELL

FEBRUARY 2015

TILDA Research Briefs provide short summaries of published, peer-reviewed papers authored by TILDA staff. The full list of TILDA research briefs is available from http://tilda.tcd.ie/publications/bulletins/

WATER FLUORIDATION, ORAL STATUS AND BONE HEALTH OF OLDER PEOPLE IN IRELAND

VINCENT O'SULLIVAN[1] AND BRIAN C. O'CONNELL[2]

SUMMARY

The purpose of this study was examine the relationship between bone health, maintenance of natural teeth and exposure to fluoridated water in Irish adults over 50 years of age[1]. The main outcome assessment was bone density measurements from 4977 adults participating in the Irish Longitudinal Study of Ageing (TILDA). Bone density was compared to the level of fluoridation in the participants' local district. No significant difference was found in the bone health of people living in areas with a low or high prevalence of water fluoridation. Participants were also asked to report how many natural teeth they had. Adults living in areas with greater water fluoridation were more likely to have maintained their natural teeth.

INTRODUCTION

The fluoridation of drinking water was described by the US Centers for Disease Control and Prevention as one of 10 Great Public Health Achievements of the 20th Century and this intervention has been widely endorsed as an effective means of reducing tooth decay[2, 3]. Fluoridation of public water supplies began in Ireland in 1964 and was extended to major cities and towns by 1970; the positive effects on oral health have been documented in a series of surveys[4, 5]. The safety of water fluoridation has been extensively reviewed and it was found to have either no detrimental effect on general health or no clear evidence of toxicity[6, 7]. Nonetheless, fluoridation is controversial in some communities and suspicion remains that it represents a significant health risk[8].

In relation to older people, it is also important to understand the effect of fluoridation on bone density. Specifically, osteoporosis is a common condition, especially in older women, and

[1] Lancaster University Management School, Lancaster University, Lancaster, United Kingdom
[2] Dublin Dental University Hospital, Trinity College Dublin, Dublin 2, Ireland.
Corresponding Author: brian.oconnell@dental.tcd.ie

predisposes for fractures of the spine, hip, wrist, humerus and pelvis. At a molecular level, it is known that fluoride can increase bone mass, although this does not always confer greater fracture resistance[9]. Assessing the benefit of fluoridation in older adults is difficult, as the main outcome—tooth loss—could be the result of other processes, notably periodontal (gum) disease, wear, trauma and access to dental care[10].

The aim of this study was to use data from The Irish Longitudinal Study on Ageing (TILDA) and Census 2006 on the type of water supply in a person's local area in order to assess the relationships between water fluoridation and oral health and bone density in older adults.

Sample

This study used the Health Assessment sub-sample from the first wave of TILDA, collected from 2009 to 2011[11]. For those who participated in the health assessment, the respondents' bone mineral density was measured using quantitative ultrasound (Achilles Heel Ultrasound, Lunar, Madison, USA). The results of this scan enabled us to categorise bone density as follows: indicative of osteoporosis, indicative of osteopenia and indicative of normal bone density. Oral health was assessed by asking the participants to choose from the following responses: I have all my own natural teeth—none missing; I have my own teeth, no dentures—but some missing; I have dentures as well as some of my own teeth; I have full dentures; I have no teeth or dentures.

Water Supply in Ireland

In Ireland, water supplied by local government is required by law to be fluoridated. However, water supplied by local community "group schemes", or from private wells, is nearly always non-fluoridated. As a result, less urbanised regions of Ireland have a patchwork of fluoridated and non-fluoridated water supplies serving communities in close proximity. According to Census 2006, around 84% of households have fluoridated water supplies, which is unsurprising given that all urban areas receive local government water supplies.

In this study it was not possible to ascertain the fluoridation status of each respondent's water supply, so instead for each individual we calculated the proportion of households in their electoral district with fluoridated water using data from the 2006 Census of Ireland. The

3,440 electoral districts are small enough in population and area to capture local area effects.

Statistical Methods

Using a sample of 4977 TILDA participants, statistical models were estimated to see the effect of the prevalence of households with fluoridated water supplies in the local area on the probability of having all one's own teeth and the probability of having normal bone mineral density.

A variety of other individual characteristics that may be expected to impact oral health and bone mineral density were also controlled for: objectively measured body mass index, years spent outside the Republic of Ireland, whether or not the respondent exercises at least one day per week, if the respondent ever smoked or currently smokes, self-report of growing up in a rural area, gender, coverage by private medical health insurance or public means-tested free medical care, age, residing in a non-completely urbanised electoral district (more than 1% of local labour force engaged in agriculture), the value of the respondent's home, highest level of education completed, self-reported poor health when aged 14, self-report of family finances when aged 14 and local authority of residence.

Results

This study found that a higher prevalence of households with fluoridated water in the local electoral district was associated with an increased probability of an older person having all their own teeth. There was no association found between the prevalence of fluoridated water and bone density.

Currently, the proportion of those over 50 years with all their own teeth is 10.4%. Hypothetically, if the entire country was completely non-fluoridated, but all other individual factors were held constant, the proportion of those over 50 years with all their own teeth would be 8.6%. Similarly, if all households in the country were to have a fluoridated water supply, the estimated proportion with all their own teeth would be 12.9%.

In relation to bone health, the models that estimate the effects of complete water fluoridation or non-fluoridation do not predict a significant effect on bone density.

Conclusions

- In this study the prevalence of fluoridated water was not significantly associated with osteopenia and osteoporosis.
- People living in areas with a higher prevalence of water fluoridation were more likely to maintain their natural teeth.
- The relative importance of fluoridated water compared to other sources of fluoride, such as diet, toothpaste, mouth rinses and professionally applied topical fluoride could not be assessed, and is largely unknown in adults.
- Wave 3 of TILDA includes an objective measure of oral health status and individual lifetime assessment of exposure to fluoridated drinking water. This will facilitate further research on the health effects of exposure to fluoridated water supplies.
- As with any public health measure, water fluoridation should be subjected to a lifetime cost-benefit analysis and should be accompanied by public engagement and education.

REFERENCES

[1] O'Sullivan V, O'Connell BC. Water fluoridation, dentition status and bone health of older people in Ireland. *Comm Dent Oral Epidemiol*, 2014.

[2] MMWR. Ten great public health achievements--United States, 1900-1999. 1999.

[3] Petersen PE, Lennon MA. Effective use of fluorides for the prevention of dental caries in the 21st century: the WHO approach. *Community dentistry and oral epidemiology*. 2004;**32**: 319-321.

[4] O'Mullane DM, Whelton H. *Oral health of Irish adults, 1989-1990 : a survey*. Dublin: Stationery Office, 1992.

[5] Whelton H, Crowley E, O'Mullane D*, et al. Oral Health of Irish Adults 2000-2002*. Dublin: Department of Health and Children, 2007.

[6] Fottrell PF. *Forum on Fluoridation 2002: Report Presented to Micheál Martin TD, Minister for Health and Children*. Dublin: The Stationery Office, 2002.

[7] McDonagh MS, Whiting PF, Wilson PM*, et al.* Systematic review of water fluoridation. *Bmj*. 2000;**321**: 855-859.

[8] Howard A. Fluoride in the media: a review of newspaper articles from 1999 to 2009. *Dental update*. 2011;**38**: 86-88, 90-82.

[9] Kleerekoper M. Fluoride and the skeleton. *Critical reviews in clinical laboratory sciences*. 1996;**33**: 139-161.

[10] Slade GD, Sanders AE, Do L, Roberts-Thomson K, Spencer AJ. Effects of fluoridated drinking water on dental caries in Australian adults. *Journal of dental research*. 2013;**92**: 376-382.

[11] Barrett A, Burke H, Cronin H*, et al.* Fifty Plus in Ireland 2011: First results from The Irish Longitudinal Study on Ageing (TILDA). Dublin: Trinity College Dublin, 2011.

Researchers interested in using TILDA data may access the data for free from the following sites:

- Irish Social Science Data Archive (ISSDA) at University College Dublin
  http://www.ucd.ie/issda/data/tilda/
- Interuniversity Consortium for Political and Social Research (ICPSR) at the University of Michigan
  http://www.icpsr.umich.edu/icpsrweb/ICPSR/studies/34315