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MINISTRY OF HEALTH
MANATŪ HAUORA

Australian and New Zealand Nutrient Reference Values for Fluoride

Supporting Document 1

Fluoride intake estimates

Enquiries

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Fluoride intake estimates

Fluoride intake estimates for the Australian and New Zealand populations were obtained from several sources. FSANZ previously produced fluoride intake estimates for Australia and New Zealand as part of its consideration of an application to allow fluoride addition to bottled water (FSANZ 2009a), and for the 23rd Australian Total Diet Study (FSANZ 2011a). Cressey et al (2010) also produced fluoride intake estimates for the New Zealand population. FSANZ updated its intake estimates for the pilot NRV review. This document outlines the estimates of fluoride intake across these studies.

Intake assessment techniques

In order to estimate dietary intake of fluoride, data are required for the concentration of fluoride in water, food and other fluids, and for consumption of these items. The sources of fluoride concentration data used in this assessment are set out below.

In all studies outlined in this document, fluoride concentration data for foods was combined with food consumption records for individuals, as recorded in national nutrition surveys in each country, to estimate fluoride intakes for different age/sex groups. In some cases model diets needed to be developed where food consumption records were not available (children under 2 years of age in Australia, children under 5 years of age in New Zealand). In all cases a 'mapping' process was undertaken to give the best estimate of fluoride intakes, whereby the known fluoride content of individual foods was matched to a wider food group of a similar nature. For example, the analysed value for fluoride in apples may have been assigned to all pome fruits in the mapping process and multiplied by the total consumption amount for pome fruits from the national nutrition survey for individual children in the nominated age group, to derive individual fluoride intakes from all pome fruits. Fluoride intakes from individual foods were then summed for each respondent in the survey and population statistics derived.

Further details on dietary intake assessment techniques are available (FSANZ 2009b).

Fluoride content – water

The 23rd Australian Total Diet Study (ATDS) reported analysed values for the fluoride content of tap water of 0.8 mg/L, which was used to estimate fluoride intakes in that report (FSANZ 2011a). Other estimates by Cressey et al (2010) and FSANZ (2009a) assumed either a non-fluoridated water value (0.1 mg fluoride/L) or fluoridated water value (0.6 and/or 1.0 mg fluoride/L). Table 1 summarises available data on the fluoride content of tap water and drinking water guideline levels, giving values for Europe and the US for comparison.

Table 1: Fluoride content of drinking water/guideline levels*

Country	Fluoride content tap water mg F/L	Guideline levels mg F/L	Comment
Australia	0.8 23rd ATDS 0.8025 NUTTAB10 (FSANZ 2011a,b analysed values)	1.5 Maximum (Drinking Water Guidelines NHMRC 2013)	NHMRC quote range for unfluoridated water 0.1–1.5 mg F/L; target for fluoridation 0.7–1.0 mg F/L (NHMRC 2013) Note NHMRC 2007 Statement on Fluoridation has target range from 0.6-1.1 mg F/L, depending on climate, with lower level applying where climate is hot (NHMRC 2007)
NZ	0.9 1990/91 NZTDS (Hannah et al 1995)	1.5 Maximum Accepted Value (NZ Drinking Water Standards MOH 2005)	0.7–1.0 recommended
US	0.7–1.0 (EPA 2010a)	0.7 maximum proposed in 2010 (EPA 2010a)	Current range 0.7–1.2 mg/L
EU	0.1–6.0 across various countries (EFSA 2013)	1.5 maximum (EFSA 2013)	Council Directive 98/83/EC

* Data derived from a number of sources as indicated in '( )' in the table cells above.

Fluoride content – foods

The most up to date reference database for fluoride content of foods and beverages in Australia (NUTTAB10) is held by FSANZ and is available as an online reference nutrient database on the FSANZ website (FSANZ 2011b). Some of the fluoride content values in NUTTAB10 were based on those reported in the 23rd Australian Total Diet study (FSANZ 2011a). The New Zealand Food Composition tables do not report fluoride content. However, fluoride was analysed in foods and reported in the 1987–88 and 1990–91 New Zealand Total Diet Surveys (NZTDS) (IESR & MOH 1994, Hannah et al. 1995).

Water and fluid consumption

For the purposes of this NRV review, FSANZ derived total water consumption from all sources for young children in Australian aged 2–10 years from the 2007 Australian National Children's Nutrition and Physical Activity Survey (ANCNPAS) and for children aged 5–10 years from the 2002 New Zealand Children's NNS, as given in Tables 2 and 3 respectively. Figures 1 and 2 give mean total water consumption by body weight for these two surveys. Tap water consumption was also derived for Australian children (Table 5). The total fluid and tap water values were used in the review for comparison with water consumption figures reported for Dean's study in the US in 1943 by McClure and more recent US figures reported in the EPA 2010 reports (Dean 1942, McClure 1943, EPA 2010a,b) (see Section 5.5.2 in the main report).

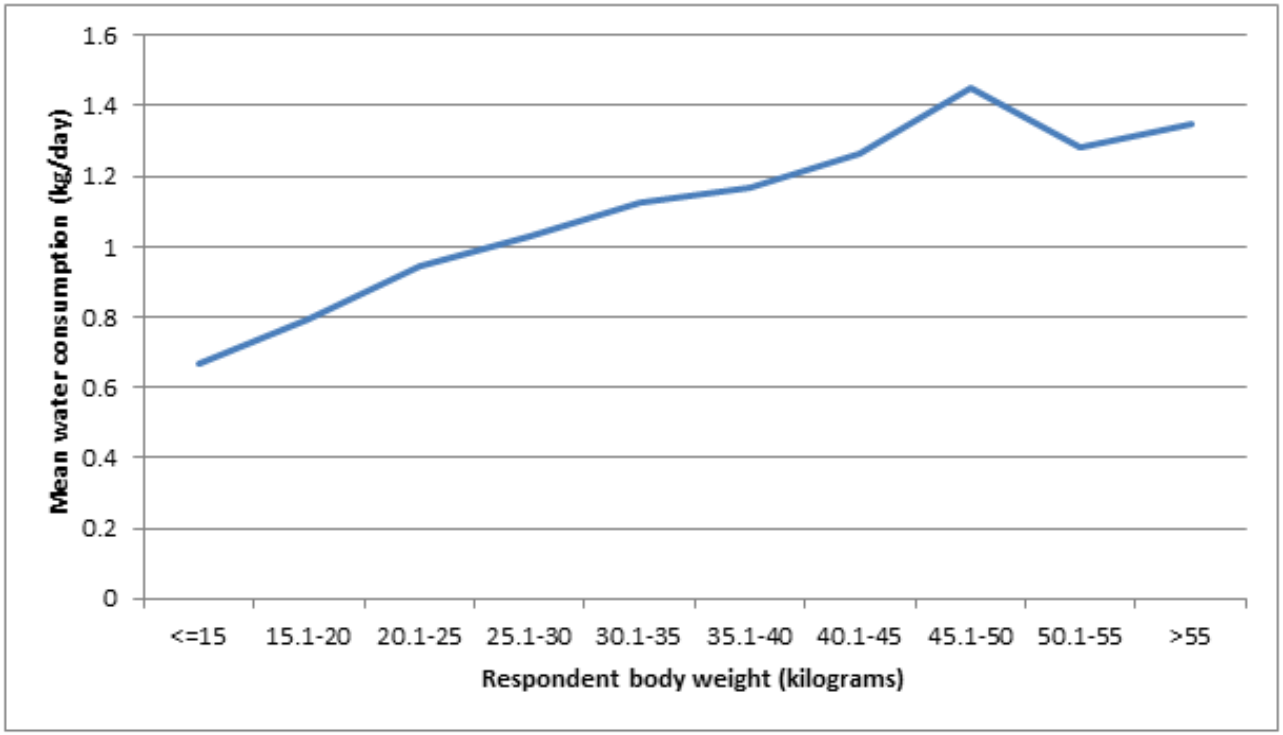
Table 2: Total water consumption for Australian children aged 2–10 years*

Age yrs	Number of respondents	Mean body weight (kg)	*Water consumption^ (g/day)* Mean	*Water consumption^ (g/day)* 90th Percentile	*Water consumption^ (g/day)* 95th Percentile	*Water consumption^ (g/kg bw/day)* Mean	*Water consumption^ (g/kg bw/day)* 90th Percentile	*Water consumption^ (g/kg bw/day)* 95th Percentile
2	258	14	685	1141	1261	48	77	87
3	295	16	751	1207	1412	46	74	83
4	359	19	875	1339	1501	47	72	79
5	267	21	912	1388	1645	43	68	76
6	285	23	961	1379	1664	42	62	78
7	278	27	1029	1626	1862	39	60	69
8	331	31	1070	1624	1825	36	57	63
9	275	34	1138	1726	1858	34	54	61
10	302	40	1243	1913	2082	32	51	56

* Data derived from the 2007 ANCNPAS using weighted Day 1 and Day 2 average consumption.

^ Water consumption includes water consumed as water, bottled water, mineral water etc, and water consumed in mixed foods, for example water in tea/coffee, soft drinks, soups, casseroles etc

Figure 1: Mean water consumption (kg/day) by respondent body weight for Australian children aged 2-10 years



Derived from the 2007 ANCNPAS using unweighted Day 1 and Day 2 average data

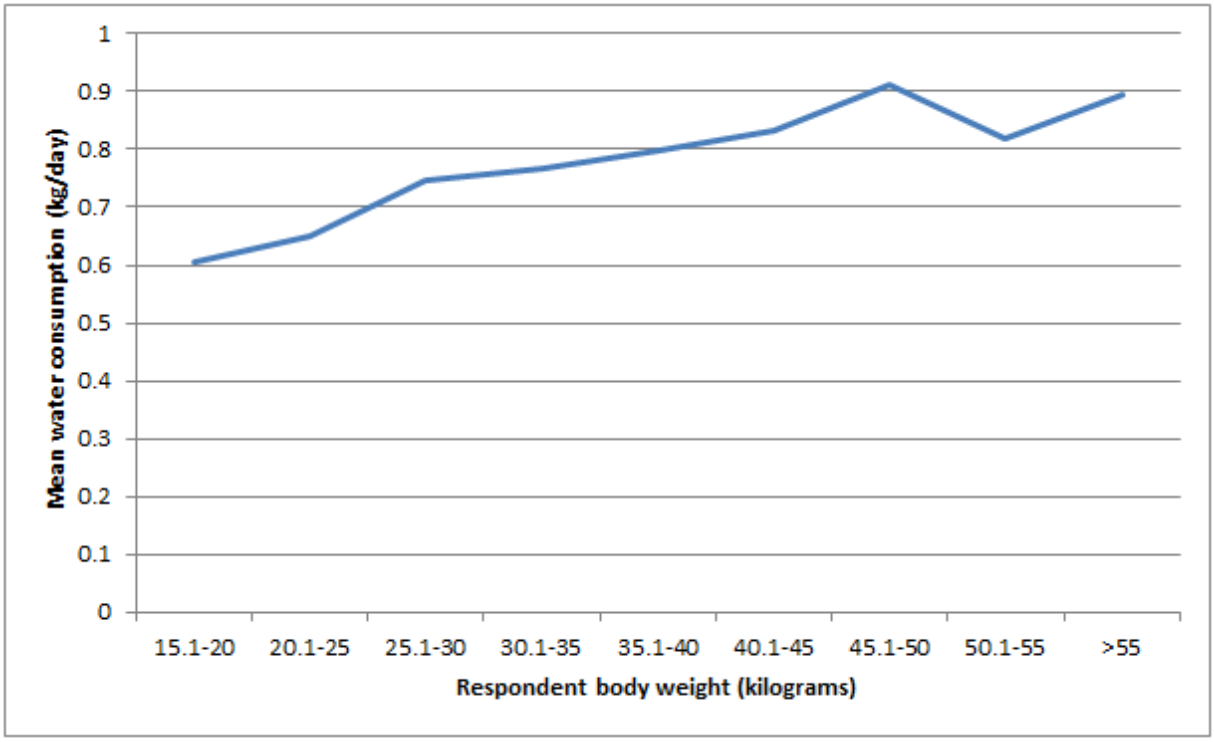
Table 3: Total water consumption for New Zealand children aged 5–10 years *

Age yrs	Number of respondents	Mean body weight (kg)	*Water consumption^ (g/day)* Mean	*Water consumption^ (g/day)* 90th Percentile	*Water consumption^ (g/day)* 95th Percentile	*Water consumption^ (g/kg bw/day)* Mean	*Water consumption^ (g/kg bw/day)* 90th Percentile	*Water consumption^ (g/kg bw/day)* 95th Percentile
5	314	22	618	1055	1346	28	51	61
6	321	24	652	1129	1329	27	50	55
7	320	28	737	1321	1596	27	47	57
8	330	32	746	1272	1421	25	42	47
9	337	36	766	1218	1519	23	37	44
10	346	40	842	1462	1702	22	39	48

* Data derived from the 2002 New Zealand Children's NNS using weighted Day 1 consumption.

^ Water consumption includes water consumed as water, bottled water, mineral water etc, and water consumed in mixed foods, for example water in tea/coffee, soft drinks, soups, casseroles etc

Figure 2: Mean water consumption (kg/day) by respondent bodyweight for New Zealand children aged 5-10 years



Derived from the 2002 New Zealand Children's NNS using unweighted data

Table 4: Summary of total water consumption for Australian children aged 2–3 years and 4–8 years (derived from the 1995 NNS and the 2007 ANCNPAS)

Nutrition Survey	Age group	No. of Respondents	mean body weight (kg)	*Water consumption~* Mean g/day	*Water consumption~* Mean g/kg bw/day	*Water consumption~* 95th Percentile g/day	*Water consumption~* 95th Percentile g/kg bw/day
2007 ANCNPAS*	2–3 years	552	15	720	47	1330	86
2007 ANCNPAS*	4–8 years	1520	24	968	42	1714	74
1995 NNS^	2–3 years	383	16	686	45	1510	96
1995 NNS^	4–8 years	977	24	883	38	1832	81

* Data derived from the 2007 ANCNPAS using weighted Day 1 and Day 2 average consumption.

^ Data derived from the 1995 NNS using unweighted Day 1 consumption.

~ Water consumption includes water consumed as water, bottled water, mineral water etc, and water consumed in mixed foods, for example water in tea/coffee, soft drinks, soups, casseroles etc

Table 5: Water consumption as 'tap water' for Australian children aged 2–3 years and 4–8 years (derived from the 1995 NNS and the 2007 ANCNPAS)

Nutrition Survey	Age group	No. of Respondents	% consumers to respondents	mean body weight (kg)	*Tap water consumption*~ consumers only Mean g/day	*Tap water consumption*~ consumers only Mean g/kg bw/day	*Tap water consumption*~ consumers only 95th Percentile g/day	*Tap water consumption*~ consumers only 95th Percentile g/kg bw/day
2007 ANCNPAS*	2–3 years	552	98	15	540	35	1138	71
2007 ANCNPAS*	4–8 years	1520	98	24	698	30	1405	62
1995 NNS^	2–3 years	383	81	16	559	37	1250	87
1995 NNS^	4–8 years	977	85	24	642	28	1520	72

* Weighted Day 1 and Day 2 average consumption.

^ Unweighted Day 1 consumption.

~ Water consumption includes water consumed as domestic tap water (including bore or rain water). However, due to the way food consumption data were collected in the NNSs this consumption may also include some food items where water was consumed in a mixed foods and the mixed food was dis-aggregated for coding purposes (for example, cordial may have been identified and coded as 50 ml cordial concentrate + 200 ml tap water).

Reported fluoride intake estimates

Fluoride intakes have been reported from several sources for Australian and New Zealand populations; whether intakes were derived from food sources, food and water sources (dietary intakes) or where an estimate of additional fluoride intakes has been noted.

23rd Australian Total Diet Study (FSANZ 2011a): fluoride intakes from food and water

The 23rd Australian Total Diet Study (ATDS) analysed 92 foods and beverages, including tap water, in a 'ready to eat' form, with a total of 570 composite samples analysed for fluoride content (FSANZ 2011a). Foods were purchased by state and territory government representatives and prepared ready to eat prior to analysis in Brisbane using non-fluoridated water, as the ATDS was undertaken prior to the introduction of a water fluoridation program in Brisbane. It was noted in the ATDS report that this may have led to lower fluoride concentrations in some foods than might have been expected in other parts of the country and hence to a potential underestimation of total fluoride intakes. For children, food consumption data were derived from the 2007 Australian National Children's Nutrition and Physical Activity Survey (ANCNPAS), using a mapping process as described above to match analytical values to food consumption amounts. No estimate was made of potential additional fluoride intakes from toothpaste.

A588 Voluntary addition of fluoride to bottled water (FSANZ 2009a): fluoride intakes from food and water, with and without toothpaste

Two fluoride databases were constructed to estimate fluoride intakes for the Australian and New Zealand populations presented in the final assessment report for an application to FSANZ, Application A588 Voluntary addition of fluoride to bottled water. Model diets for 3 month and 9 month old Australian infants were developed, and a 6–12 month old diet for New Zealand infants (FSANZ 2009a). Food consumption data were derived from the 1995 NNS data and 1997 New Zealand adults NNS, using a mapping process to assign fluoride content to foods with no analytical data. At the time of completion of this application, data from the 2002 New Zealand children's NNS and the 2007 Australian National Children's Nutrition and Physical Activity Survey were not available for use in FSANZ's computer modelling program.

Where there were no Australian fluoride concentration data for specific foods, it was assumed that New Zealand data, where available, were representative of these food groups, and vice versa for New Zealand. In addition, a minority of values were imputed from German and US data (Souci et al., 1994; USDA, 2005). Fluoride values for multi-ingredient foods without analysed fluoride values were calculated using commonly used recipes. It was assumed that fluoride from water was not taken up by vegetables when boiled. Information provided by beverage manufacturers indicated that local water supplies (whether fluoridated or non-fluoridated) are used when making products in their processing plants. Therefore, beverages such as soft drinks and fruit juices were assigned the current mean

fluoride content from analytical data for those types of beverages on the market. These values remained the same for all scenarios.

There is considerable uncertainty with the non-water fluoride values of foods for a number of reasons including: limited analysed data for some food groups; considerable uncertainty in fluoride levels in some foods; poor sensitivity of the analysed methods used; and the high proportion of 'non-detected' results, for which assumptions on fluoride levels had to be made.

Where water is used for the preparation or cooking of certain foods in the home, the relevant fluoride concentration in the water for the specific scenario was taken into account when determining the recalculated final fluoride content for these foods in A588 (fluoride content of 0.1 mg F/L, 0.6 mg F/L and 1.0 mg F/L). These foods included tea, coffee, diluted cordial, juices made from concentrate, pasta, rice, noodles, cornmeal, couscous, oats, soup, stock, gravy and in other recipes where water was used, such as jelly.

In A588, a separate estimate was given for potential additional fluoride intakes from toothpaste, but not from the use of supplements containing fluoride or from non-dietary sources (e.g. mouthwashes, dental treatment etc.).

New Zealand fluoride intake estimates (Cressey et al. 2010): fluoride intakes from food and water, with and without toothpaste

New Zealand Total Diet Study (NZTDS) analytical values from 1990/91 were used in the estimated fluoride intakes for children in the New Zealand population reported by Cressey in 2010, using a mapping process. Model diets from the New Zealand Total Diet Study were used for children <5 years of age and the 2002 NNS food consumption data for children aged 5–16 years (Cressey at al. 2010, Hannah et al. 1995). As foods sampled in the NZTDS were prepared ready to eat with distilled water prior to analysis, fluoride values for foods made up with water were recalculated for the two scenarios reported, using fluoride concentrations in drinking water of 0.1 mg F/L for non-fluoridated areas and 1 mg F/L for fluoridated areas. Cressey at al. also reported fluoride intakes for older children using the NZTDS model diets, but these were not used in this review as the results based on the 2002 children's NNS were considered by the EWG to be more accurate. In Cressey et al.2010, a separate estimate was given for potential additional fluoride intakes from toothpaste.

Summary of results

Estimated fluoride intakes from the 2009 FSANZ report and the 23rd ATDS are summarised in Table 6 below for Australian children up to 8 years of age for mean and high consumers of fluoride (90th percentile of intake used in the 2009 FSANZ report to represent a high consumer of fluoride, 95th percentile used in the 23rd ATDS).

Estimated fluoride intakes from the 2009 FSANZ report and 2010 Cressey et al. paper are also summarised in Table 6 for New Zealand children up to 10 years of age for mean and high consumers of fluoride (90th percentile intake of used in the 2009 FSANZ report to represent a high consumer of fluoride, 95th percentile used by Cressey et al).

For the results from the 2009 FSANZ report and Cressey at al., two estimates are given in Table 6: the lower fluoride intake estimate assumed non-fluoridated tap water at 0.1 mg F/L; and the higher fluoride intake estimate assumed fluoridated tap water at 1.0 mg F/L. For the 23rd ATDS results, the lower end of the range of fluoride intakes reflects an estimate of fluoride intake where non-analytical results were assigned a zero value; the upper end of the range an estimate where non-detects were assigned half the limit of reporting (LOR).

Table 6: Reported estimated dietary fluoride intakes for Australia and New Zealand infants and young children (non-fluoridated and fluoridated water scenarios)

Data source	Mean intake mg/day	High consumer intake mg/day	Comments
Australia (FSANZ 2011a) 23rd ATDS 1995 NNS, 2007 ANCNPAS, 24 hr recall data	*9 months infant* 0.68 *2–3 year child* 1.46–1.56 *4–8 year child* 1.66–1.84	*9 months infant* 1.37 *2–3 year child* 1.99–2.14 *4–8 year child* 2.25–2.58 *whole population aged 2 yrs +* 1.99–5.18 (All above at 95th percentile intake)	Analysed fluoride data, food mapping process used, range depends on value assigned to non-detect results (zero or ½ LOR). No estimate of intake from toothpaste.
Australia (FSANZ 2009a) A588 Voluntary addition of fluoride to bottled water Model diet for infants; based on 1995 NNS, 24 hr recall data	*3 months infant breast fed* 0.002- 0.008 *3 months formula fed infant* 0.2 nonfluoridated water 1.0 fluoridated water *9 months infant* 0.4 nonfluoridated water 1.3 fluoridated water *2–3 year child* 0.5 nonfluoridated water 1.0 fluoridated water *4–8 year child* 0.6 nonfluoridated water 1.2 fluoridated water	*3 months infant breast fed* 0.005–0.016 *3 months formula fed infant* 0.5 nonfluoridated water 1.9 fluoridated water *9 months infant* 0.7 nonfluoridated water 2.7 fluoridated water *2–3 year child* n/a *4–8 year child* n/a (All above at 90th percentile intake)	Fluoride content from NUTTAB database, food mapping process used. For breast fed infants, range of intakes determined by range in fluoride concentrations in breast milk. For other infants and children, fluoride intake estimates were for two scenarios for fluoride in tap water (0.1 nonfluoridated water, 1.0 mg/L fluoridated water). *Additional fluoride intake from toothpaste* Additional fluoride from toothpaste estimated to be 0.1–0.3 mg/day for children <6 years, assuming half or all of it is swallowed; 0.1 mg/day for children aged ≥6, assuming 10% swallowed.

Data source	Mean intake mg/day	High consumer intake mg/day	Comments
New Zealand (Cressey et al. 2010) 2002 NZ Children's NNS (5–15 years), 24 hr recall data Model diets for infants and young children from 2003/04 NZTDS	*6–12 months infant* 0.18 nonfluoridated water 0.71 fluoridated water *1–3 year child* 0.25 nonfluoridated water 0.57 fluoridated water *5–6 year child* 0.38 nonfluoridated water 0.84 fluoridated water *7–10 year child* 0.45 nonfluoridated water 0.99 fluoridated water	n/a n/a *5–6 year child* 0.73 nonfluoridated water 1.74 fluoridated water *7–10 year child* 0.82 nonfluoridated water 1.80 fluoridated water (All above at 90th percentile intake)	Fluoride content from 1987–88 and 1990–91 NZ Total Diet Studies, food mapping process used. For infants and children, fluoride intake estimates were for two scenarios for fluoride in tap water (0.1 nonfluoridated water, 1.0 mg/L fluoridated water). *Additional fluoride intake from toothpaste* Additional fluoride from toothpaste estimated to be 0.12 mg/day (400 mg/kg content) to 0.3 mg/day (1000 mg/kg content) for infants and children < 6 years and 0.3 mg/day for older children.
New Zealand (FSANZ 2009a) A588 Voluntary addition of fluoride to bottled water Model diet for infants	*6–12 months infant* 0.4 nonfluoridated water 0.9 fluoridated water	*6–12 months infant* 0.7 nonfluoridated water 1.7 fluoridated water (All above at 95th percentile intake)	Fluoride content from NZTDS and NUTTAB database. Two scenarios for fluoride in tap water (0.1, 1.0 mg/L). *Additional fluoride intake from toothpaste* Additional fluoride from toothpaste 0.1–0.3 mg/day for <6 years, assuming half or all of it is swallowed; 0.1 mg/day for children aged ≥6, assuming 10% swallowed.

Where non-fluoridated (0.1 mg fluoride/L tap water) and fluoridated (1.0 mg/L tap water) scenarios were used, total fluoride intakes were greater using fluoridated water, as expected.

Estimates for the New Zealand population were in the same order of magnitude as those for similar Australian age groups, though direct comparisons were not possible as the age ranges reported were not the same (FSANZ 2011, FSANZ 2009a, Cressey at al 2010). In general the estimated fluoride intakes for the New Zealand population appear to be lower than those reported for the Australian population of a similar age. This may be due to a more restricted fluoride content database available in New Zealand and/or a lower amount of food in the model diet and hence a more restricted range of foods that could be mapped and assigned a fluoride content value for use in the intake estimates.

Updated fluoride estimates for infants and young children (FSANZ 2014): fluoride intakes from food and water

For the purpose of deriving NRVs for fluoride in the pilot NRV Review, FSANZ reran the A588 calculations for total fluoride intakes from food and beverages for the Australian population based on model diets for infants and the 1995 NNS population aged 2–8 years (FSANZ 2014). Time and resource restrictions on the pilot NRV review did not allow for the development of fluoride content databases for the 2011-13 National Nutrition and Physical Activity Survey component of the Australian Health Survey to allow for use of newer food consumption data, although this would have been desirable for children aged 2–8 years.

The following changes were made in the updated estimates:

- A new value for fluoride content of infant formula was used in the infant diet models to reflect the lower fluoride content of infant formula products available in the food supply in 2014. Clifford et al. in 2009 reported analysis results of 0.07 mg F/kg for infant formula, a paper that was not available at the time FSANZ prepared the A588 Report in 2008. It replaced the value of 0.24 mg F/kg used for infant formula made up with distilled water used in models in the FSANZ A588 report, as reported by Silva et al. (Silva et al. 1996, Clifford et al. 2009, FSANZ 2009a).
- A new approach to deriving high percentile fluoride intakes for infants was taken, using the 95th percentile body weight for boys at 3 months and 9 months of age from the 2007 WHO Growth charts as the starting point for the model diets for high consumers, as the model is based on energy requirements for infants of a certain bodyweight. The median body weight for boys from the WHO charts was used to estimate mean fluoride intakes. Previous estimates by FSANZ presented in A588 applied a simple multiplication factor of 2 to the median bodyweight derive a 90th percentile intake, a factor which has generally applied to the intake estimates for the whole population, not infants per se (FSANZ 2009a). This adjustment was also applied to the 6–12 month old infant diet for New Zealand populations.
- Additional theoretical total fluoride intake estimates, assuming tap water was fluoridated at 1.9 mg F/L and 2.1 mg F/L, were made to allow for comparison with the earlier US studies on which the IOM based the current NRVs for fluoride for children (IOM 1997, Dean 1942).

Application A588 did not report fluoride intakes for New Zealand children aged 2–15 years as food consumption data for this age group were not available to FSANZ at the time. Resources were not available during the NRV pilot review to construct a new fluoride database to apply to the foods reported as consumed in the 2002 New Zealand Children's NNS, so theoretical total fluoride intake estimates assuming 1.9 mg/L and 2.1 mg/L are not available for New Zealand children aged 5–8 years.

In all other respects, the same assumptions were made as for the original A588 models described above in terms of allowing for tap water use in a number of foods (tea, coffee, diluted cordial, juices made from concentrate, pasta, rice, noodles, cornmeal, couscous, oats, soup, stock, gravy and in other recipes where water was used, such as jelly), with the same limitations to the modelling process applying.

Updated fluoride intake estimates are presented in Tables 7, 8 and 9 below.

Table 7 : Updated estimated dietary fluoride intake (from food and water) for infants from model diets (derived from Australian food consumption data from the 1995 NNS by FSANZ in 2014)

Age group	*Fluoride 0.1 mg/L water* Mean intake mg/day	*Fluoride 0.1 mg/L water* 95th percentile intake mg/d**	*Fluoride 1.0 mg/L water* Mean intake mg/day	*Fluoride 1.0 mg/L water* 95th percentile intake mg/d**	*Fluoride 1.9 mg/L water* Mean intake mg/day	*Fluoride 1.9 mg/L water* 95th percentile intake mg/d**	*Fluoride 2.1 mg/L water* Mean intake mg/day	*Fluoride 2.1 mg/L water* 95th percentile intake mg/d**	*Bodyweight (kg)* Median	*Bodyweight (kg)* 95th percentile
Australia 3 mth infant*	0.16	0.19	0.80	0.96	1.44	1.73	1.66	1.92	6.4	7.7
Australia 9 mth infant^	0.31	0.36	1.23	1.47	2.16	2.57	2.37	2.83	8.9	10.6
New Zealand 3 mth infant*	0.16	0.19	0.80	0.96	1.44	1.73	1.66	1.92	6.4	7.7
New Zealand 6–12 mth infant$	0.33	0.39	0.79	0.93	1.27	1.49	1.38	1.63	9.0#	10.6

*Mean intake calculation assumes 800 g or 784 mL infant formula/day required to meet energy requirements for a boy of median body weight of 6.4 kg (WHO growth curves, WHO 2007) and energy requirement of 343 kJ/kg bw /day (FAO 2004); from manufacturer's instructions approx. 130g infant formula powder used with 900 mL water to make up 1 Litre infant formula with baseline level of average fluoride content of 0.07 mg/kg infant formula made up with distilled water (as reported by Clifford et al. 2009)

^For 9 mth old infants mean intake calculation assumes infant boy of median body weight (WHO growth curves, WHO 2007), with a diet where 544 g infant formula per day (533 ml/day) provides half the energy needs and solid food the other half, based on an energy requirement of 343 kJ/kg bw /day (FAO 2004).

**For 3 mth old infants the high percentile intake is based on an infant boy of 95th percentile body weight (WHO growth curves, WHO 2007), 800 g formula per day (784 ml/day); for 9 mth infants the high percentile intake is based on an infant boy of 95th percentile body weight (WHO growth curves, WHO 2007) with a diet where 648 g infant formula per day (635 ml/day) provides half the energy needs and solid food the other half, based on an energy requirement of 343 kJ/kg bw /day (FAO 2004).

$ For 6–12 mth old infants assumed 9 kg body weight as reported in 2003/04 NZ Total Diet study (Vanoort et al. 2006) and the infant diet used in that report with 700 g infant formula per day (686 ml); for a 95th percentile intake this has been adjusted to account for a 95th percentile body weight of 10.6 kg, with 824 g infant formula per day (808ml).

#Data source did not specify if this figure represented the median or mean bodyweight for this age group.

The lower estimated fluoride intakes for 6–12 month old NZ infants compared to Australian 9 month old infants of a similar average body weight is likely to largely be due to the lower amount of infant formula included in the New Zealand model diet (350 ml/day for NZ infants aged 6–12 months, 533 ml/day for Australian infants aged 9 months). Infant formula is a major contributor to fluoride intakes, particularly at higher levels of fluoridation of tap water.

Table 8: Updated estimated dietary fluoride intakes from food and water (mg/day) from all foods for Australian children aged 2–3 years for four water fluoride concentration scenarios, 1995 NNS

	Fluoride concentration for tap water 0.1 mg/L (baseline)	*Fluoride concentration for tap water* 1.0 mg/L	*Fluoride concentration for tap water* 1.9 mg/L	*Fluoride concentration for tap water* 2.1 mg/L
Mean	0.5	1.0	1.6	1.7
Median	0.5	1.0	1.5	1.6
90th Percentile	0.7	1.6	2.6	2.8
95th Percentile	0.7	1.8	3.0	3.3

Intakes derived from the 1995 National Nutrition Survey, using a second day adjusted nutrient intake methodology
Mean body weight for Australian children aged 2–3 years = 15.5 kg, n = 383
Fluoride concentration used in tap water and where tap water is used in recipes (eg tea, coffee, cordials, cooked rice/pasta, soups etc)

Table 9: Updated estimated dietary fluoride intakes from food and water (mg/day) from all foods for Australian children aged 4–8 years for four water fluoride concentration scenarios, 1995 NNS

	Fluoride concentration for tap water 0.1 mg/L (baseline)	*Fluoride concentration for tap water* 1.0 mg/L	*Fluoride concentration for tap water* 1.9 mg/L	*Fluoride concentration for tap water* 2.1 mg/L
Mean	0.6	1.2	1.9	2.0
Median	0.6	1.1	1.7	1.9
90th Percentile	0.8	1.9	3.0	3.2
95th Percentile	0.8	2.1	3.5	3.7

Intakes derived from the 1995 National Nutrition Survey, using a second day adjusted nutrient intake methodology
Mean body weight for Australian children aged 4–8 years = 24 kg, n = 977
Fluoride concentration used in tap water and where tap water is used in recipes (eg tea, coffee, cordials, cooked rice/pasta, soups etc)

Major contributors to dietary fluoride intakes

Major food and water contributors to dietary fluoride intake for different age/sex population groups were also reported for the studies presented in Tables 10 and 11, for both unfluoridated and fluoridated water scenarios. The percentage contribution of different food groups to total fluoride intakes varies with the level of fluoridation assumed, the food consumption patterns at different ages and the contribution of water to the total fluoride intake.

Table 10: Major contributors (>5%) to dietary fluoride intake (From food and water) for infants and young children (Australia)

Data source	Major contributors Non-fluoridated water (0.1 mg F/L)	Major contributors Fluoridated water (1.0 mg F/L)
23rd ATDS Using 2007 ANCNPAS, 24 hr recall data Model diet for 9 mth old infant Fluoride content analysed, food mapping process used	na	Fluoride content of water as analysed (0.8 mg/L) For 9 mth infants major contributors were: water (37%) infant formula (20%) For children 2–8 years main contributors were: water (33–34%), pome fruits (6%), non-alcoholic beverages (5% excl waters and milk)
A588 Voluntary addition of fluoride to bottled water 2007 ANCNPAS, 24 hr recall data Fluoride content from NUTTAB database (included results from 23rd ATDS), food mapping process used Model diets for 3 mth, 9mth old infants	For 3 mth infants either breast milk or formula only For 9 mth infants major contributors based on non-fluoridated water were: infant & follow on formula (45%), non-alcoholic beverages (30%), water (15%), cereal & cereal products (7%), dairy products (6%) For 2–3 yr child, major contributors based on non-fluoridated water were: non-alcoholic beverages (27%), dairy products (22%), cereal & cereal products (12%), water (10%), meat & meat dishes (7%), vegetables & vegetable dishes (7%) For 4–8 yr child, major contributors based on non-fluoridated water were: non-alcoholic beverages (28%), dairy products (20%), cereal & cereal products (11%), water (10%), meat & meat dishes (8%), vegetables & vegetable dishes (7%)	For 3 mth infants either breast milk or formula only For 9 mth infants major contributors based on fluoridated water were: infant & follow on formula (49%), water (39%), non-alcoholic beverages (4%) For 2–3 yr child, major contributors based on fluoridated water were: water (46%) non-alcoholic beverages (20%), dairy products (10%), cereal & cereal products (8%) For 4–8 yr child, major contributors based on fluoridated water were: water (45%) non-alcoholic beverages (22%), dairy products (9%), cereal & cereal products (8%)
Updated infant diets FSANZ 2014 (using lower fluoride content for infant formula)	For 9 mth infants major contributors based on non-fluoridated water were: infant formula & follow on formula (36%), non-alcoholic beverages (18%), water (17%), dairy products (5%)	For 9 mth infants major contributors based on fluoridated water were: infant formula & follow on formula (44%), water (43%), non-alcoholic beverages (5%)

Table 11: Major contributors (>5%) to dietary fluoride intake (from food and water) for infants and young children (New Zealand)

Data source	Major contributors Non-fluoridated water (0.1 mg F/L)	Major contributors Fluoridated water (1.0 mg F/L)
A588 Voluntary addition of fluoride to bottled water Model diet used for 6–12 mth old infant Fluoride content from NUTTAB database (included results from 23rd ATDS), food mapping process used	For 6–12 mths infants major contributors based on non-fluoridated water were: infant & follow on formula (29%), cereal & cereal products (17%), dairy products (16%), infant foods (9%), non-alcoholic beverages and waters (9%).	For 6–12 mths infants major contributors based on fluoridated water were: infant & follow on formula (44-49%), non-alcoholic beverages (19-22%), water (14-17%), cereal & cereal products (8-10%), dairy products (7-10%), infant foods (6%).
Cressey et al. 2010 2002 Children's NNS Fluoride content as analysed from 1987–88 and 1990–91 NZ Total Diet Studies, food mapping process used Model diets for children <5 yrs from NZ Total Diet Study	For 6–12 mth infants major contributors based on non-fluoridated water were: infant formula & follow on formula (25%), infant foods (11%), yoghurt (8%), bread (7%), water (7%) For 1–3 yr child major contributors based on non-fluoridated water were: water (10%), bread (10%), yoghurt (7%), biscuits (6%), fruit drink (5%) For 5–6 yr child major contributors based on non-fluoridated water were: bread (20%), water (10%), potatoes (5%), fruit drink (5%) For 7–10 yr child major contributors based on non-fluoridated water were: bread (15%), water (9%), carbonated beverages (9%), tea (6%)	For 6–12 mth infants major contributors based on fluoridated water were: infant formula & follow on formula (50%), water (22%), infant foods (5%) For 1–3 yr child major contributors based on fluoridated water were: water (44%), fruit drink (11%), bread (5%) For 5–6 yr child major contributors based on fluoridated water were: water (43%), fruit drink (10%), bread (8%), chocolate bev (7%) For 7–10 yr child major contributors based on fluoridated water were: water (41%), carbonated beverages & fruit drink (8%), bread (7%),
Updated infant diets FSANZ 2014 (using lower fluoride content for infant formula	For 6–12 mth infants major contributors based on non-fluoridated water were: infant formula & follow on formula (21%), infant foods (7%), yoghurt (15%), bread (5%), water (5%), fish and products (5%)	For 6–12 mth infants major contributors based on fluoridated water were: infant formula & follow on formula (44%), water (19%), infant foods (6%), yoghurt (6%)

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