



**Omega-3 Supplement Use: A Secondary Analysis of 266,848  
Australians aged 45 Years and Older**

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# TITLE PAGE

## **Omega-3 Supplement Use: A Secondary Analysis of 266,848 Australians aged 45 Years and Older**

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## ABSTRACT

*Objective:* There has been a dramatic increase in the use of dietary supplements in Western industrialized societies over the past few decades and our understanding of the prevalence and pattern of omega-3 consumption is of significance for future nutrition planning, health promotion and health care delivery. However, we know very little about omega-3 consumption or users. This paper, drawing upon the largest dataset with regards to omega-3 use (n=266,848), examines the use and users of omega-3 amongst a large sample of older Australians.

*Design:* Cross-sectional study. A secondary analysis was made of data from the 45 and Up Study that is the largest study of healthy ageing ever undertaken in the Southern Hemisphere.

*Setting:* New South Wales, Australia.

*Participants:* 266,848 participants of the 45 and Up Study.

*Primary and Secondary Outcome Measures:* Participants' use of omega-3, demographics (geographical location, marital status, education level, income and level of healthcare insurance) and health status (quality of life, history of smoking and alcohol consumption, health conditions) were measured.

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3 *Results:* Of the 266,848 participants, 86,939 (32.6%) reported having taken omega-3  
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5 in the 4 weeks prior to the survey. Use of omega-3 was higher among female, non-  
6  
7 smokers, non- to mild (alcoholic) drinkers, residing in a major city, having higher  
8  
9 income and private health insurance. Osteoarthritis, osteoporosis, high cholesterol,  
10  
11 and anxiety and/or depression were positively associated with omega-3 use, while  
12  
13 cancer and high blood pressure were negatively associated with use of omega 3.  
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18 *Conclusions:* This study suggests that a considerable proportion of older Australians  
19  
20 consume omega-3. There is a need for primary healthcare practitioners to enquire  
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22 with patients about omega-3 use and for work to ensure provision of good quality  
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24 information for patients and providers with regards to omega-3 products.  
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# ARTICLE SUMMARY

## Article Focus

- The use of dietary supplements has increased rapidly in Western societies over past decades.
- Our study examines the use of omega-3 amongst older Australians, drawing upon the largest study of healthy ageing undertaken in the Southern Hemisphere (n=266,848).

## Key Messages

- A considerable proportion of older Australians (32.6%) report using omega-3.
- Osteoarthritis, osteoporosis, high cholesterol, and anxiety and/or depression are positively associated with omega-3 use, while cancer and high blood pressure are negatively associated with the use of omega 3.
- There is a need to ensure provision of good quality information for patients and providers with regards to omega-3 products.

## Strengths and Limitations of this Study

- Our study benefits from the use of the largest sample of Australians aged 45 years and older with regards to the consumption of omega-3.
- The interpretation of our findings is limited by the fact that the use of omega-3 was self-reported by the participants and their answers may have been subject to recall bias.

## MAIN TEXT

### **Omega-3 Supplement Use: A Secondary Analysis of 266,848 Australians aged 45 Years and Older**

#### **INTRODUCTION**

There has been a dramatic increase in the use of dietary supplements in Western industrialized societies over the past few decades. The proportion of American adults using at least one dietary supplement has increased from 42% to 53% between 1994 and 2006<sup>1</sup> and research has shown the use of dietary supplements is common in many European countries.<sup>2</sup>

In 2007, a national US survey identified omega-3 – different types of fish oil products such as docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) – as the first (for adults) and second (for children) most commonly used non-vitamin, non-mineral, natural product in America.<sup>3</sup> In Australia, a substantial proportion of GPs (80.3%) and community pharmacists (90.2%) recommend omega-3 to patients<sup>4</sup> and findings from this Australian research also identify omega-3 as among the top five complementary and alternative medicines about which healthcare professionals (71.6% of GP and 71.7% of pharmacists) desire better quality information.

The clinical evidence base for omega-3 is varied depending on the specific condition. There is evidence that omega-3 helps in preventing or benefiting the outcomes of cardiovascular disease<sup>5</sup> with some evidence suggesting a cholesterol lowering effect.

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2  
3 The National Heart Foundation of Australia recommends all Australian adults  
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5 consume about 500 mg (or 1,000 mg for those who have documented coronary heart  
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7 disease) of omega-3 fatty acids per day.<sup>6</sup>  
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11 Beyond cardiovascular disease, existing research has found no evidence of a  
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13 significant association between omega-3 and reducing cancer incidence.<sup>7</sup> However,  
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15 there is some evidence that omega-3 fatty acids may improve clinical, biological and  
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17 quality of life parameters amongst patients with advanced cancer.<sup>8</sup> There is currently  
18  
19 insufficient scientific evidence on the efficacy of omega-3 regarding improvement of  
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21 mental health disorders,<sup>9</sup> <sup>10</sup> asthma,<sup>11</sup> cystic fibrosis,<sup>12</sup> rheumatoid arthritis,  
22  
23 inflammatory bowel disease and osteoporosis<sup>13</sup> and cognitive functions affected by  
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25 aging, dementia, and neurological diseases.<sup>14</sup>  
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32 In recent years the international public health agenda has partly focused on seeking  
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34 cost-effective strategies to improve public health nutrition<sup>15</sup> and in Australia, the  
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36 Federal Government indicated its commitment to the establishment of a  
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38 comprehensive National Food and Nutrition Framework and to the importance of  
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40 providing evidence-based nutrition and dietary guidelines to the public via the  
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42 National Preventive Health Strategy.<sup>16</sup> Furthermore, given the rise of population  
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44 ageing, increasing consumer interest in the value of healthy eating, exercise and  
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46 nutrition,<sup>17</sup> and growth in public awareness of the importance of preventive health,<sup>18</sup>  
47  
48 empirical analysis of the prevalence and pattern of omega-3 consumption is of  
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50 significance for future nutrition planning, health promotion and health care delivery.  
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52 In response, this paper reports the findings of the first study to examine the use and  
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3 users of omega-3 amongst a large sample of older Australians (n=266,848) aged 45  
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5 years and older.  
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## 10 11 **METHOD**

### 12 13 ***Sample***

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15 This research utilised data collected through the 45 and Up Study, which is the  
16  
17 largest study of healthy ageing conducted in the Southern Hemisphere and analyses  
18  
19 data from over 265,000 men and women aged 45 and older who reside in the State of  
20  
21 New South Wales, Australia. The 45 and Up study is described in detail elsewhere,<sup>19</sup>  
22  
23 but briefly participants were randomly selected from the Medicare Australia  
24  
25 database, which provides virtually complete coverage of the general population.  
26  
27 Participants joined the 45 and Up study by completing a postal questionnaire and  
28  
29 providing written consent for follow-up. Recruitment began in February 2006 and  
30  
31 the analyses reported in this paper relate to the 266,848 participants joining the  
32  
33 study at the close of December, 2009. The 45 and Up Study received ethics approval  
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35 from the University of New South Wales Human Research Ethics Committee.  
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### 44 45 ***Use of Omega-3***

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47 Participants were defined as being an omega-3 user if they answered 'yes' to the  
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49 following question: 'In the past 4 weeks have you taken fish oil or Omega-3.'  
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### 52 53 ***Demographic measures***

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55 Area of residence was assigned according to the Accessibility Remoteness Index of  
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57 Australia Plus score for each participant's postcode. Participants were asked about  
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3 their current marital status, highest educational qualification they had completed,  
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5 annual household income, and their level of healthcare insurance.  
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### 8 9 ***Health status measures***

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11 Participants were asked to rate their overall health and overall quality of life on a  
12  
13 five-point Likert scale. They were also asked about their history of smoking and  
14  
15 amount of alcohol consumption. Participants were provided with a list of diseases  
16  
17 (e.g. osteoarthritis, osteoporosis, asthma, cancer) and asked if they had been treated  
18  
19 for any of the disease in the last month. A positive response to this question for a  
20  
21 particular disease was used to determine if a participant had that disease.  
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### 25 26 27 ***Statistical analyses***

28  
29 The demographic and health status characteristics of omega-3 users and non-users  
30  
31 were compared using chi-square tests. Logistic regression modelling, that included  
32  
33 all demographic and health status characteristics variables, was conducted using a  
34  
35 backward stepwise method, to parsimoniously predict use of omega-3. In response to  
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37 the large sample size and multiple comparisons, a p-value <0.005 was adopted for  
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39 statistical significance.  
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## 46 47 **RESULTS**

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49 There were 266,846 participants who answered the question regarding consumption  
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51 of omega-3, of which 86,939 (32.6%) indicated that they had taken omega-3 in the 4  
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53 weeks prior to the survey.  
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3 A comparison between participants who used omega-3 and those who did not use  
4 omega-3 by demographic characteristics is provided in Table 1. Use of omega-3 is  
5 highest among females ( $p < 0.0001$ ) and those aged 60-79 years ( $p < 0.0001$ ). Use of  
6 omega-3 was also higher for those participants: residing in inner regional areas  
7 ( $p < 0.0001$ ); having a trade, certificate of diploma ( $p < 0.0001$ ); having an annual  
8 household income of \$20,000-\$69,999 ( $p < 0.0001$ ); being widowed, divorced or  
9 separated ( $p < 0.0001$ ); and having private health insurance ( $p < 0.0001$ ).

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21 INSERT TABLE 1 HERE  
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25 Table 2 shows a comparison between participants who used omega-3 and those who  
26 did not use omega-3 by health status characteristics. Use of omega-3 was highest  
27 among those participants who never smoked ( $p < 0.0001$ ), drank 0-6 alcoholic drinks  
28 per week ( $p < 0.0001$ ), and whose overall health and quality of life were rated as being  
29 excellent, very good, or good ( $p < 0.0001$ ). Participants who reported being treated for  
30 osteoarthritis ( $p < 0.0001$ ), osteoporosis ( $p < 0.0001$ ), asthma ( $p < 0.0001$ ), high blood  
31 pressure ( $p < 0.0001$ ), high cholesterol ( $p < 0.0001$ ), and thyroid problems ( $p < 0.0001$ )  
32 were all higher users of omega-3. Conversely, participants who reported being  
33 treated for cancer ( $p < 0.0001$ ), or did not report being treated for anxiety or  
34 depression ( $p < 0.0001$ ) were lower users of omega-3.

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53 The result of the multiple logistic regression modelling is presented in Table 3. Of all  
54 the diseases examined osteoarthritis, osteoporosis, high cholesterol, and anxiety  
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3 and/or depression were positively associated with use of omega-3, while cancer and  
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5 high blood pressure were negatively associated with the use of omega-3. That is, the  
6  
7 odds of omega-3 use was 1.65 (95% CI: 1.59, 1.72) times greater for those participants  
8  
9 reporting treatment for osteoarthritis compared to those without osteoarthritis. The  
10  
11 odds of omega-3 use was 1.09 (95% CI: 1.04, 1.15) times greater for those participants  
12  
13 reporting osteoporosis compared to those without osteoporosis. In comparison to  
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15 participants reporting treatment for either anxiety or depression, those participants  
16  
17 with anxiety only or both anxiety and depression were 1.16 (95% CI: 1.07, 1.26) and  
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19 1.19 (95% CI: 1.12, 1.27) times more likely to use omega-3, respectively. Those  
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21 participants reporting treatment for high cholesterol were 1.23 (95% CI: 1.19, 1.27)  
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23 times more likely to use omega-3 compared to those without high cholesterol. The  
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25 odds of omega-3 use was 0.89 (95% CI: 0.84, 0.95) and 0.95 (95% CI: 0.93, 0.98)  
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27 times lower for those participants reporting treatment for cancer and high blood  
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29 pressure, respectively.  
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36 INSERT TABLE 3 HERE  
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40 Table 3 also shows that those participants who rated their overall health to be fair or  
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42 poor were 0.82 (95% CI: 0.79, 0.84) less likely to use omega-3. In comparison to  
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44 current smokers, participants who were former smokers (OR=1.66; 95% CI: 1.58,  
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46 1.74) or never smoked (OR=1.56; 95% CI: 1.49, 1.63) were more likely to use omega-  
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48 3. In comparison to those participants who drank 0-6 alcoholic drinks per week,  
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50 participants who drank 14-20 alcoholic drinks (OR=0.94; 95% CI: 0.91, 0.98) or  $\geq$  21  
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52 alcoholic drinks (OR=0.83; 95% CI: 0.80, 0.87) were less likely to use omega-3.  
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55 Participants with no health insurance were 0.84 (95% CI: 0.82, 0.86) times less  
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3 likely use omega-3 compared to participants with private health insurance. In terms  
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5 of household income, the odds of omega-3 use were 1.14 (95% CI: 1.11, 1.18) and 1.13  
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7 (95% CI: 1.09, 1.18) greater for participants with an income of \$20,000-\$49,999 and  
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9 \$50,000-\$69,999 respectively, compared to those with an income of <\$20,000. In  
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11 comparison to those participants who live in a major city, the odds of omega-3 use  
12  
13 are less for those living in outer regional areas (OR=0.89; 95% CI: 0.86, 0.92) and  
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15 remote or very remote areas (OR=0.86; 95% CI: 0.79, 0.93). In comparison to those  
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17 participants aged 45-49 years, all other age groups have greater odds of omega-3 use,  
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19 with the highest being those aged 60-69 (OR=1.84; 95% CI: 1.77, 1.91) and 70-79  
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21 (OR=1.76; 95% CI: 1.69, 1.85) years. In terms of gender, the odds of omega-3 use was  
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23 1.42 (95% CI: 1.39, 1.46) times greater for female participants.  
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## 31 **DISCUSSION**

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34 Our study, drawing upon the largest database with regards to omega-3 use to date  
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36 and constituting the first analyses of the profile of users and prevalence of use of  
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38 omega-3 in Australia, shows 32.6% of the study participants, aged 45 years and  
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40 older, consume omega-3. This finding identifies omega-3 as one of the most  
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42 commonly used dietary supplements in Australia and is in line with previous  
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44 research showing omega-3 as among the top five complementary and alternative  
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46 medicines recommended by Australian general practitioners and community  
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48 pharmacists.<sup>4</sup> The discovery of such a high level of omega-3 use suggests that further  
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50 research is needed to explore consumer behaviors and decision-making regarding  
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52 omega-3 use alongside assessing the possible health impacts of such consumption.  
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3 Overall, the findings of association between being female, of increased age, having  
4 advanced education *and* higher use of omega-3 are congruent with factors predicting  
5 broader complementary and alternative medicine use.<sup>3 20</sup> The association of omega-3  
6 use with higher annual income and private health insurance highlights the potential  
7 importance of cost of omega-3 products with regards to consumption and this issue  
8 warrants further investigation. It is also important to note that omega-3, like many  
9 complementary and alternative medicine products more generally, is not currently  
10 subsidised by the Australian Pharmaceutical Benefits Scheme (a Federal government  
11 program providing subsidised prescription drugs to residents) and as such attracts  
12 an added 10% goods and services tax. Our finding of a positive association of omega-  
13 3 use with higher annual income may also relate to the suggestion that  
14 socioeconomic status acts as a protective factor in health, with those having better  
15 life chances more likely to adopt self-care measures to maintain their health and  
16 quality of life.<sup>21</sup>

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36 The low use of omega-3 among participants resident in rural and remote areas  
37 compared to those respondents living in metropolitan locations contradicts the  
38 findings of previous research which show higher CAM use in rural areas in  
39 Australia.<sup>22</sup> The low use of omega-3 in these areas may reflect the lack of access to  
40 supplements in geographically isolated regions. Indeed, the urban-rural divide in the  
41 use of complementary and alternative medicine is an issue that has received much  
42 attention in recent years<sup>22-24</sup> and the finding of our study add to the evidence-base  
43 and discussion of this important health service issue and highlight the need for  
44 further investigation into the complexities of rural supplement use.

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3 The variations in the association of omega-3 use with a range of clinical conditions  
4 are noteworthy, especially given the current varied clinical evidence-base of omega-3.  
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7 The finding of low omega-3 use amongst people with cancer is not unexpected as  
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10 research evidence suggests no association between omega-3 and reducing cancer  
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12 incidence.<sup>7</sup> However, it is somewhat surprising that high blood pressure is negatively  
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14 associated with the use of omega-3 as there is evidence that omega-3 has beneficial  
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16 effects in the context of cardiovascular disease and in lowering blood pressure.<sup>5</sup> This  
17  
18 is an area worthy of further empirical investigation.  
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22 The association of higher omega-3 use with diseases such as osteoarthritis,  
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24 osteoporosis, anxiety and/or depression is interesting given there is currently either  
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26 no evidence or insufficient evidence on the efficacy of fish oil supplementation in  
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28 addressing these conditions – this suggests there may currently exist a mismatch  
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30 between clinical evidence and consumers' perceptions of evidence and benefits  
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32 regarding omega-3 use. Together, these study findings highlight the potential need  
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34 for nutrition guidelines for omega-3 intake and consumer awareness of the use of  
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36 omega-3 as well as possible enhanced information and labeling of relevant products  
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38 in Australia. The study findings also add weight to recently identified evidence  
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40 illustrating a desire for good quality information about omega-3 products amongst  
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42 GPs and pharmacists.<sup>4</sup>  
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49 The finding that respondents with better quality of life/health ratings or a healthy  
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51 lifestyle (e.g. non-smoking and/or having less alcoholic drinks) have greater odds of  
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53 omega-3 use may indicate that omega-3 is used for both the treatment of specific  
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55 health conditions and as a preventive therapy. Previous research suggests that this  
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3 distinction between therapeutic and preventive use also exists for complementary  
4 and alternative medicine consumption more broadly.<sup>25</sup> Given these results, it would  
5 be useful for future studies to differentiate between these two approaches to use and  
6 to provide critical, in-depth examination of patients' motivations and understandings  
7 regarding consumption of omega-3 and other dietary supplements.  
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16 The interpretation of our findings is limited by the fact that the disease variable used  
17 from the 45 and Up Study survey was based on individuals reporting that they had  
18 been 'treated in last month' rather than 'ever been diagnosed' and that health and  
19 omega-3 and health care use is self-reported by the participants. As such our study  
20 results may be subject to recall bias. Nevertheless, these limitations are countered by  
21 the insights gained from analysing data from the largest sample of adults aged 45  
22 years and older with regards to their consumption of omega-3.  
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## 36 **CONCLUSION**

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38 Omega-3 is consumed for a wide variety of purposes by a considerable proportion of  
39 Australians aged 45 years and over. In the context of these study findings there is a  
40 need for primary health care practitioners to enquire with their patients about their  
41 use of omega-3 as well as for further work to ensure provision of good quality  
42 information for patients and providers with regards to omega-3 products.  
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Table 1 Demographic characteristic of people aged 45 years and older by Omega-3 use

Demographic Characteristics	Use of Omega-3		p-value	
	Yes	No		
	(n=86,939)	(n=179,907)		
	%	%		
<b>Sex</b>	Female	60	51	<0.0001
	Male	40	49	
<b>Age (years)</b>	45-49	10	14	<0.0001
	50-59	32	34	
	60-69	32	26	
	70-79	17	15	
	80+	9	11	
<b>Place of Residence</b>	Major city	45	45	<0.0001
	Inner regional	36	35	
	Outer regional	17	18	
	Remote/very remote	2	2	
<b>Education</b>	School Certificate or less	34	34	0.0001
	Higher School Certificate	10	10	
	Trade/certificate/diploma	33	32	
	Tertiary	23	24	
<b>Annual Household Income</b>	< \$20000	25	25	<0.0001
	\$20000-\$49999	33	31	
	\$50000-\$69999	14	13	
	≥ \$70000	28	31	

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<b>Marital Status</b>	Married/defacto	75	75	<0.0001
	Widow/divorce/separ.	20	19	
	Single	5	6	
<b>Health</b>	Private	55	53	<0.0001
<b>Insurance</b>	DVA or HCC	30	29	
	None	15	18	

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For peer review only

Table 2 Health status characteristics of people aged 45 years and older by Omega-3 use

Health Status Characteristics	Use of Omega-3		p-value	
	Yes	No		
	(n=86,939)	(n=179,907)		
	%	%		
<b>Smoking Status</b>	Current smoker	5	8	<0.0001
	Former smoker	36	35	
	Never smoked	59	56	
<b>Alcohol Consumption</b>	0-6 drinks per week	64	62	<0.0001
	7-13 drinks per week	19	19	
	14-20 drinks per week	11	11	
	≥ 21 drinks per week	6	8	
<b>Overall Health</b>	Excellent/very good/good	87	85	<0.0001
	Fair/poor	13	15	
<b>Overall Quality Of Life</b>	Excellent/very good/good	90	89	<0.0001
	Fair/poor	10	11	
<b>Osteoarthritis</b>	Yes	11	7	<0.0001
	No	89	93	
<b>Osteoporosis</b>	Yes	7	5	<0.0001
	No	93	95	

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3	<b>Asthma</b>	Yes	5	4	<0.0001
4		No	95	96	
5					
6					
7					
8	<b>Cancer</b>	Yes	2	3	<0.0001
9		No	98	97	
10					
11					
12					
13					
14	<b>High Blood</b>	Yes	26	24	<0.0001
15	<b>Pressure</b>	No	74	76	
16					
17					
18					
19	<b>High Cholesterol</b>	Yes	17	14	<0.0001
20		No	83	86	
21					
22					
23					
24					
25	<b>Heart Attack or</b>	Yes	3	3	0.2996
26	<b>Angina</b>	No	97	97	
27					
28					
29					
30	<b>Other Heart</b>	Yes	3	3	0.6606
31	<b>Disease</b>	No	97	97	
32					
33					
34					
35					
36	<b>Thyroid</b>	Yes	6	5	<0.0001
37	<b>Problems</b>	No	94	95	
38					
39					
40					
41					
42	<b>Anxiety &amp;</b>	Neither	91	92	<0.0001
43	<b>Depression</b>	Depression only	4	4	
44		Anxiety only	2	1	
45		Both	3	3	
46					
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**Table 3 Multiple logistic regression model for predicting use of Omega-3 in people aged 45 years and older**

Factor		Odds Ratio	95% C.I.
<b>Sex</b>	Male	1.00	—
	Female	1.42	1.39, 1.46
<b>Age</b>	45-49	1.00	—
	50-59	1.43	1.39, 1.49
	60-69	1.84	1.77, 1.91
	70-79	1.76	1.69, 1.85
	80+	1.32	1.25, 1.39
<b>Place of Residence</b>	Major city	1.00	—
	Inner regional	0.98	0.96, 1.01
	Outer regional	0.89	0.86, 0.92
	Remote/very remote	0.86	0.79, 0.93
<b>Annual Household Income</b>	< \$20000	1.00	—
	\$20000-\$49999	1.14	1.11, 1.18
	\$50000-\$69999	1.13	1.09, 1.18
	≥ \$70000	1.03	0.99, 1.07
<b>Insurance</b>	Private	1.00	—
	DVA or HCC	0.93	0.90, 0.95
	None	0.84	0.82, 0.86
<b>Smoking</b>	Current smoker	1.00	—

1				
2				
3	<b>Status</b>	Former smoker	1.66	1.58, 1.74
4		Never smoked	1.56	1.49, 1.63
5				
6				
7				
8	<b>Alcohol</b>	0-6 drinks per week	1.00	—
9				
10	<b>Consumption</b>	7-13 drinks per week	1.02	0.99, 1.05
11		14-20 drinks per week	0.94	0.91, 0.98
12		≥ 21 drinks per week	0.83	0.80, 0.87
13				
14				
15				
16				
17	<b>Overall</b>	Excellent/very good/good	1.00	—
18	<b>Health</b>	Fair/poor	0.82	0.79, 0.84
19				
20				
21				
22	<b>Osteoarthritis</b>	No	1.00	—
23		Yes	1.65	1.59, 1.72
24				
25				
26				
27	<b>Osteoporosis</b>	No	1.00	—
28		Yes	1.09	1.04, 1.15
29				
30				
31				
32				
33	<b>Cancer</b>	No	1.00	—
34		Yes	0.89	0.84, 0.95
35				
36				
37				
38	<b>High Blood</b>	No	1.00	—
39	<b>Pressure</b>	Yes	0.95	0.93, 0.98
40				
41				
42				
43	<b>High</b>	No	1.00	—
44	<b>Cholesterol</b>	Yes	1.23	1.19, 1.27
45				
46				
47				
48	<b>Anxiety &amp;</b>	Neither	1.00	—
49	<b>Depression</b>	Depression only	1.01	0.96, 1.07
50		Anxiety only	1.16	1.07, 1.26
51		Both	1.19	1.12, 1.27
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## COMPETING INTERESTS

None.

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## AUTHORS CONTRIBUTION

All authors devised the study and helped to conceptualize ideas, interpret findings, manuscript writing and reviewing drafts of the article. JA and DS acquired the data from the 45 and Up Study. DS undertook data analysis and JA, DS, CL, AB, JW

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2  
3 contributed to the interpretation of the data. All authors read and approved the final  
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## 11 **DATA SHARING STATEMENT**

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15 There are no additional data available.  
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**Omega-3 Fatty Acid Supplement Use: An Analysis of  
266,848 Australians aged 45 Years and Older**

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# TITLE PAGE

## **Omega-3 Fatty Acid Supplement Use: An Analysis of 266,848 Australians aged 45 Years and Older**

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28 **Keywords**  
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## ABSTRACT

*Objective:* There has been a dramatic increase in the use of dietary supplements in Western societies over the past decades. Our understanding of the prevalence of omega-3 fatty acid supplement consumption is of significance for future nutrition planning, health promotion and care delivery. However, we know little about omega-3 fatty acid supplement consumption or users. This paper, drawing upon the largest dataset with regards to omega-3 fatty acid supplement use (n=266,848), examines the use and users of this supplement amongst a large sample of older Australians living in New South Wales.

*Design:* Cross-sectional study. Data were analysed from the 45 and Up Study, the largest study of healthy ageing ever undertaken in the Southern Hemisphere.

*Setting:* New South Wales, Australia.

*Participants:* 266,848 participants of the 45 and Up Study.

*Primary and Secondary Outcome Measures:* Participants' use of omega-3, demographics (geographical location, marital status, education level, income and level of healthcare insurance) and health status (quality of life, history of smoking and alcohol consumption, health conditions) were measured.



1  
2  
3 *Results:* Of the 266,848 participants, 32.6% reported having taken omega-3 in the 4  
4 weeks prior to the survey. Use of omega-3 fatty acid supplements was higher among  
5 female, non-smokers, non- to mild (alcoholic) drinkers, residing in a major city,  
6  
7 having higher income and private health insurance. Osteoarthritis, osteoporosis,  
8  
9 high cholesterol, and anxiety and/or depression were positively associated with  
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11 omega-3 fatty acid supplement use, while cancer and high blood pressure were  
12  
13 negatively associated with use of omega 3 fatty acid supplements.  
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21 *Conclusions:* This study suggests that a considerable proportion of older Australians  
22  
23 consume omega-3 fatty acid supplements. There is a need for primary healthcare  
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25 practitioners to enquire with patients about this supplement use and for work to  
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27 ensure provision of good quality information for patients and providers with regards  
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29 to omega-3 fatty acid products.  
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# ARTICLE SUMMARY

## Article Focus

- The use of dietary supplements has increased rapidly in Western societies over past decades.
- Our study examines the use of omega-3 fatty acid supplements amongst older Australians, drawing upon the largest study of healthy ageing undertaken in the Southern Hemisphere (n=266,848).

## Key Messages

- A considerable proportion of older Australians living in New South Wales (32.6%) report using omega-3 fatty acid supplements.
- People with osteoarthritis, osteoporosis, high cholesterol, and anxiety and/or depression were more likely to use omega-3 fatty acid supplements, while people with cancer and high blood pressure were less likely to use omega 3 fatty acid supplements.
- There is a need to ensure provision of good quality information for patients and providers with regards to omega-3 fatty acid supplement products.

## Strengths and Limitations of this Study

- Our study benefits from the use of the largest sample of Australians aged 45 years and older with regards to the consumption of omega-3 fatty acid supplement.

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- The interpretation of our findings is limited by the fact that the use of omega-3 fatty acid supplement was self-reported by the participants and their answers may have been subject to recall bias.

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## MAIN TEXT

### **Omega-3 Fatty Acid Supplement Use: An Analysis of 266,848 Australians aged 45 Years and Older**

#### INTRODUCTION

There has been a dramatic increase in the use of dietary supplements in Western industrialized societies over the past few decades. The proportion of American adults using at least one dietary supplement has increased from 42% to 53% between 1994 and 2006.[1] Research also shows the use of dietary supplements is common in European countries such as Denmark (66% of men and 51% of women) and the United Kingdom (48% of women and 36% of men).[2]

In 2007, a national US survey identified omega-3 fatty acid (w3 FA) supplements (products containing docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) products) as the first (for adults) and second (for children) most commonly used natural (non-vitamin, non-mineral) product in America.[3] In Australia, a substantial proportion of GPs (80.3%) and community pharmacists (90.2%) recommend omega-3 to patients[4] and findings from this Australian research also identify w3 FA supplement as among the top five complementary and alternative medicines about which healthcare professionals (71.6% of GP and 71.7% of pharmacists) desire better quality information.

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3 The clinical evidence base for w3 FA supplement use is varied depending on the  
4 specific condition. There is evidence that w3 FA supplements help in preventing or  
5 benefiting the outcomes of cardiovascular disease with some evidence suggesting a  
6 cholesterol lowering effect.[5-7] However, a meta-analysis study released in 2012  
7 found no relation between use of w3 FA supplements and reduced risk of major  
8 cardiovascular diseases.[8] At present, the National Heart Foundation of Australia  
9 recommends all Australian adults consume about 500 mg (or 1,000 mg for those  
10 who have documented coronary heart disease) of w3 FA per day.[9]

11  
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13 Beyond cardiovascular disease, existing research has found no evidence of a  
14 significant association between w3 FA supplement use and reducing cancer  
15 incidence.[10] However, there is some evidence that w3 FA supplements may  
16 improve clinical, biological and quality of life parameters amongst patients with  
17 advanced cancer.[11] There is currently conflicting or insufficient scientific evidence  
18 on the efficacy of w3 FA supplements regarding improvement of mental health  
19 disorders,[12 13] asthma,[14] cystic fibrosis,[15] rheumatoid arthritis, inflammatory  
20 bowel disease and osteoporosis[16] and cognitive functions affected by aging,  
21 dementia, and neurological diseases.[17 18]

22  
23  
24 Given the rise of population ageing and increasing public awareness of the  
25 importance of preventive health,[19] knowledge about consumption of dietary  
26 supplements such as w3 FA is of significance for future health promotion and health  
27 care delivery. In response, this paper describes the findings of the first study to  
28 examine the use of w3 FA supplements in Australia. It aims to provide analysis of the

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3 prevalence and characteristics of omega-3 use amongst a large sample of Australians  
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5 (n=266,848) aged 45 years and older.  
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## 10 11 **METHOD**

### 12 13 ***Sample***

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15 This research utilised data collected through the 45 and Up Study, which is the  
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17 largest study of healthy ageing conducted in the Southern Hemisphere and analyses  
18  
19 data from 266,848 men and women aged 45 and older who reside in the State of New  
20  
21 South Wales, Australia. The 45 and Up study is described in detail elsewhere,[20] but  
22  
23 briefly, individuals aged 45 years and over and resident in New South Wales were  
24  
25 randomly selected from the Medicare Australia database, which provides virtually  
26  
27 complete coverage of the general population. Eligible individuals were mailed an  
28  
29 invitation to take part, an information leaflet, the study questionnaire and consent  
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31 form and a reply paid envelope (available at [www.45andUp.org.au](http://www.45andUp.org.au)). Participants  
32  
33 joined the 45 and Up Study by completing the questionnaire and consent form and  
34  
35 mailing them to the Study coordinating centre. The study over-sampled, by a factor  
36  
37 of two, individuals aged 80 years and over and people resided in rural areas; all  
38  
39 residents of remote areas were sampled. The 45 and Up Study sample included  
40  
41 approximately 10% of the general population in the target age range. Recruitment  
42  
43 began in February 2006 and the analyses reported in this paper relate to the 266,848  
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45 participants joining the study at the close of December, 2009. The overall response  
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47 rate to the mailed invitations to join the study is estimated to be 17.9%, however, the  
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49 exact response rate is difficult to specify as some people may not have received the  
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51 invitation if their address details were incorrect in the Medicare Australia  
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3 database.[20] The 45 and Up study sample has excellent heterogeneity and is  
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5 reasonably representative of the (State of) New South Wales population; has a  
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7 response rate comparable to similar studies internationally and in Australia; and is  
8  
9 among the most representative large scale cohort studies in the world.[21] The 45  
10  
11 and Up Study received ethics approval from the University of New South Wales  
12  
13 Human Research Ethics Committee.  
14

### 15 16 17 18 19 ***Use of Omega-3***

20  
21 Participants were defined as being an w3 FA supplement user if they answered 'yes'  
22  
23 to the following question: 'In the past 4 weeks have you taken fish oil or Omega-3.'  
24  
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### 26 27 28 ***Demographic measures***

29  
30 Area of residence was assigned according to the Accessibility Remoteness Index of  
31  
32 Australia Plus score for each participant's postcode. Participants were asked about  
33  
34 their current marital status, highest educational qualification they had completed,  
35  
36 annual household income, and their level of healthcare insurance.  
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### 39 40 41 ***Health status measures***

42  
43 Participants were asked to rate their overall health and overall quality of life on a  
44  
45 five-point Likert scale. They were also asked about their history of smoking and  
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47 amount of alcohol consumption. Participants were provided with a list of diseases  
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49 (e.g. osteoarthritis, osteoporosis, asthma, cancer) and asked if they had been treated  
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51 for any of the disease in the last month. A positive response to this question for a  
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53 particular disease was used to determine if a participant had that disease.  
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### ***Statistical analyses***

The demographic and health status characteristics of omega-3 users and non-users were compared using chi-square tests. Logistic regression modelling, that included all demographic and health characteristics, was conducted using a backward stepwise method, to parsimoniously predict use of w3 FA supplements. In response to the large sample size and multiple comparisons, a p-value <0.001 was adopted for statistical significance. All analyses were conducted using the statistical software SAS 9.2.

## **RESULTS**

There were 266,846 participants who answered the question regarding consumption of w3 FA supplements, of which 86,939 (32.6%) indicated that they had taken w3 FA supplements in the 4 weeks prior to the survey.

Table 1 reports demographic characteristics of participants by w3 FA supplement use. Use of w3 FA supplements is highest among females compared to males ( $p < 0.0001$ ) and those aged 60-79 years compared to those of other ages ( $p < 0.0001$ ). Use of w3 FA supplements was also higher for those participants: residing in inner regional areas compared to those in outer regional areas ( $p < 0.0001$ ); having a trade, certificate of diploma compared to those with a tertiary education ( $p < 0.0001$ ); having an annual household income of \$20,000-\$69,999 compared to those with higher or lower annual household income ( $p < 0.0001$ ); being widowed, divorced or separated compared to those who are single ( $p < 0.0001$ ); and having private health insurance compared to those with no private health insurance ( $p < 0.0001$ ).



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5 INSERT TABLE 1 HERE  
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10 Table 2 shows health status characteristics of participants by w3 FA supplement use.  
11 Use of w3 FA supplements was highest among those participants who never smoked  
12 compared to current smokers ( $p < 0.0001$ ), drank 0-6 alcoholic drinks per week  
13 compared to those who drank  $\leq 21$  alcoholic drinks per week ( $p < 0.0001$ ), and whose  
14 overall health and quality of life were rated as being excellent, very good, or good  
15 compared to those whose overall health and quality of life were rated as fair or poor  
16 ( $p < 0.0001$ ). Participants who reported being treated for osteoarthritis ( $p < 0.0001$ ),  
17 osteoporosis ( $p < 0.0001$ ), asthma ( $p < 0.0001$ ), high blood pressure ( $p < 0.0001$ ), high  
18 cholesterol ( $p < 0.0001$ ), and thyroid problems ( $p < 0.0001$ ) were all higher users of  
19 omega-3 compared to those people who did not have these respective illnesses.  
20 Conversely, participants who reported being treated for cancer ( $p < 0.0001$ ), or did  
21 not report being treated for anxiety or depression ( $p < 0.0001$ ) were lower users of  
22 omega-3 compared to those who had not been treated for these conditions.  
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45 The result of the multiple logistic regression modelling is presented in Table 3. Of all  
46 the diseases examined osteoarthritis, osteoporosis, high cholesterol, and anxiety  
47 and/or depression were positively associated with use of w3 FA supplements, while  
48 cancer and high blood pressure were negatively associated with the use of omega-3.  
49 That is, the odds of w3 FA supplement use was 1.65 (99% CI: 1.55, 1.76) times greater  
50 for those participants reporting treatment for osteoarthritis compared to those  
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3 without osteoarthritis. The odds of omega-3 use was 1.09 (99% CI: 1.01, 1.18) times  
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5 greater for those participants reporting osteoporosis compared to those without  
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7 osteoporosis. In comparison to participants reporting treatment for anxiety or  
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9 depression, those participants with anxiety only or both anxiety and depression were  
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11 1.16 (99% CI: 1.01, 1.34) and 1.19 (99% CI: 1.07, 1.32) times more likely to use w3 FA  
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13 supplements, respectively. Those participants reporting treatment for high  
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15 cholesterol were 1.23 (99% CI: 1.17, 1.29) times more likely to use omega-3 compared  
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17 to those without high cholesterol. The odds of w3 FA supplement use was 0.89 (99%  
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19 CI: 0.80, 0.99) and 0.95 (99% CI: 0.91, 0.99) times lower for those participants  
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21 reporting treatment for cancer and high blood pressure, respectively.  
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27 INSERT TABLE 3 HERE  
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31 Table 3 also shows that those participants who rated their overall health to be fair or  
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33 poor were 0.82 (99% CI: 0.77, 0.86) less likely to use omega-3. In comparison to  
34  
35 current smokers, participants who were former smokers (OR=1.66; 99% CI: 1.53,  
36  
37 1.79) or never smoked (OR=1.56; 99% CI: 1.44, 1.69) were more likely to use w3 FA  
38  
39 supplements. In comparison to those participants who drank 0-6 alcoholic drinks  
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41 per week, participants who drank 14-20 alcoholic drinks (OR=0.94; 99% CI: 0.89,  
42  
43 1.00) or  $\geq 21$  alcoholic drinks (OR=0.83; 99% CI: 0.78, 0.89) were less likely to use  
44  
45 w3 FA supplements. Participants with no health insurance were 0.84 (99% CI: 0.80,  
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47 0.89) times less likely to use w3 FA supplements compared to participants with  
48  
49 private health insurance. In terms of household income, the odds of w3 FA  
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51 supplement use were 1.14 (99% CI: 1.08, 1.20) and 1.13 (99% CI: 1.06, 1.21) greater  
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53 for participants with an income of \$20,000-\$49,999 and \$50,000-\$69,999  
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3 respectively, compared to those with an income of <\$20,000. In comparison to those  
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5 participants who live in a major city, the odds of w3 FA supplement use are less for  
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7 those living in outer regional areas (OR=0.89; 99% CI: 0.85, 0.93) and remote or  
8  
9 very remote areas (OR=0.86; 99% CI: 0.75, 0.98). In comparison to those  
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11 participants aged 45-49 years, all other age groups have greater odds of w3 FA  
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13 supplement use, with the highest being those aged 60-69 (OR=1.84; 99% CI: 1.73,  
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15 1.96) and 70-79 (OR=1.76; 99% CI: 1.64, 1.90) years. In terms of gender, the odds of  
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17 w3 FA supplement use was 1.42 (99% CI: 1.36, 1.52) times greater for female  
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19 participants.  
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## 27 **DISCUSSION**

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29 Our study, drawing upon the largest database with regards to w3 FA supplement use  
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31 to date and constituting the first analyses of the profile of users and prevalence of use  
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33 of w3 FA supplements in Australia, shows 32.6% of the study participants, aged 45  
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35 years and older, consume w3 FA supplements. This finding identifies w3 FA  
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37 supplements as one of the most commonly used dietary supplements amongst older  
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39 Australians and is in line with previous research showing w3 FA supplements as  
40  
41 among the top five complementary and alternative medicines recommended by  
42  
43 Australian general practitioners and community pharmacists.[4] The discovery of  
44  
45 such a high level of w3 FA supplement use amongst older Australians suggests that  
46  
47 further research is needed to explore consumer behaviors and decision-making  
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49 regarding w3 FA supplement use alongside assessing the possible health impacts of  
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51 such consumption.  
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3 Overall, the findings of association between being female, of increased age, having  
4 advanced education *and* higher use of w3 FA supplements are congruent with factors  
5 predicting broader complementary and alternative medicine use.[3 22] The  
6  
7 association of w3 FA supplement use with higher annual income and private health  
8 insurance highlights the potential importance of cost of w3 FA supplement products  
9 with regards to consumption and this issue warrants further investigation. It is also  
10 important to note that w3 FA supplements, like many complementary and  
11 alternative medicine products more generally, is not currently subsidised by the  
12 Australian Pharmaceutical Benefits Scheme (a Federal government program  
13 providing subsidised prescription drugs to residents) and attracts a further 10%  
14 goods and services tax that prescription medicines do not. As such, cost issues  
15 associated with w3 FA supplementation may be more focused in our Australian  
16 population. Our finding of a positive association of w3 FA supplement use with  
17 higher annual income may also relate to the suggestion that socioeconomic status  
18 acts as a protective factor in health, with those having better life chances more likely  
19 to adopt self-care measures to maintain their health and quality of life.[23]  
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40 The low use of w3 FA supplements among participants resident in rural and remote  
41 areas compared to those respondents living in metropolitan locations contradicts the  
42 findings of previous research which show higher CAM use in rural areas in  
43 Australia.[24] However, it does reflect findings from some national and international  
44 studies which suggest lower rates of *commercial* or *pre-packaged* CAM product use  
45 amongst some rural populations, when compared to their urban counterparts, which  
46 may be associated with reduced access to these supplements. [24] Indeed, the urban-  
47 rural divide in the use of complementary and alternative medicine is an issue that  
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3 has received much attention in recent years[24-26] and the results from our study  
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5 help add to the evidence-base and discussion of this important health service issue  
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7 and highlight the need for further investigation into the complexities of regional  
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9 variation in supplement use.  
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14 The variations in the association of w3 FA supplement use with a range of clinical  
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16 conditions are noteworthy, especially given the current varied clinical evidence-base  
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18 of w3 FA supplements. The finding of low w3 FA supplement use amongst people  
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20 with cancer is not unexpected as research evidence suggests no association between  
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22 w3 FA supplements and reducing cancer incidence.[10] Additionally, external factors  
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24 may also result in lower omega-3 supplement use amongst people with cancer:  
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26 patients may relinquish their CAM use when their use of other forms of medical  
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28 treatment increases;[27] or patients may be advised to cease all other medications  
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30 when undergoing cancer treatment.[28] However, it is somewhat surprising that  
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32 high blood pressure is negatively associated with the use of w3 FA supplement as  
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34 there is evidence that omega-3 has beneficial effects in the context of cardiovascular  
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36 disease and in lowering blood pressure.[29] This is an area worthy of further  
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38 empirical investigation.  
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45 The association of higher w3 FA supplement use with diseases such as osteoarthritis,  
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47 osteoporosis, anxiety and/or depression is interesting given there is currently either  
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49 conflicting or insufficient evidence on the efficacy of W3 FA supplements in  
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51 addressing these conditions – this suggests there may currently exist a mismatch  
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53 between clinical evidence and consumers' perceptions of evidence and benefits  
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55 regarding w3 FA supplement use. Together, these study findings highlight the  
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3 potential need for nutrition guidelines for w3 FA supplement intake and consumer  
4 awareness of the use of w3 FA supplements as well as possible enhanced information  
5 and labeling of relevant products in Australia. The study findings also add weight to  
6 recently identified evidence illustrating a desire for good quality information about  
7 w3 FA supplement products amongst GPs and pharmacists.[4]  
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16 The finding that respondents with better quality of life/health ratings or a healthy  
17 lifestyle (e.g. non-smoking and/or having less alcoholic drinks) have greater odds of  
18 w3 FA supplement use may indicate that w3 FA supplements are used for both the  
19 treatment of specific health conditions and as a preventive therapy. Previous  
20 research suggests that this distinction between therapeutic and preventive use also  
21 exists for complementary and alternative medicine consumption more broadly.[30]  
22  
23 Given these results, it would be useful for future studies to differentiate between  
24 these two approaches (therapeutic and preventive use) to use and to provide critical,  
25 in-depth examination of patients' motivations and understandings regarding  
26 consumption of w3 FA supplements and other CAM or dietary supplements.  
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40 The interpretation of our findings is limited by the fact that the association between  
41 w3 FA supplement consumption with particular health conditions does not  
42 necessarily imply that w3 FA supplements have been used specifically for these  
43 conditions. In addition, the disease variable used from the 45 and Up Study survey  
44 was based on individuals reporting that they had been 'treated in last month' rather  
45 than 'ever been diagnosed' and that health, w3 FA supplement use and health care  
46 use is self-reported by the participants. As such our study results may be subject to  
47 recall bias and we may have missed some participants who had a disease but were  
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3 not treated for it in the month prior to being surveyed. Currently this study focuses  
4 solely on the use of W3 FA supplements, and this research may have benefitted by  
5 including an analysis of usual dietary intake (e.g. food frequency questionnaire), in  
6 particular the consumption of omega 3 rich foods such as oily fish that may be also  
7 be consumed for therapeutic benefit. Given the sample of 45 and Up Study was  
8 drawn from the State of New South Wales, generalisation of the findings of this  
9 research to other parts of Australia should be treated with caution. Finally, as the  
10 statistical tests used in our analyses are influenced by sample size, the very large  
11 sample size in this study can make small difference appear to be significant. As such,  
12 readers need to take into account the absolute differences when interpreting the odds  
13 ratios. Nevertheless, these limitations are countered by the insights gained from  
14 analysing data from the largest sample of adults aged 45 years and older with regards  
15 to their consumption of w3 FA supplements.  
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## 36 **CONCLUSION**

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38 W3 FA supplements are consumed for a wide variety of purposes by a considerable  
39 proportion of Australians aged 45 years and over. In the context of these study  
40 findings there is a need for primary health care practitioners to enquire with their  
41 patients about their use of w3 FA supplements as well as for further work to ensure  
42 provision of good quality information for patients and providers with regards to w3  
43 FA products.  
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**Table 1 Demographic characteristic of people aged 45 years and older by w3 FA supplement use**

Demographic Characteristics	Use of w3 FA supplements		p-value
	Yes	No	
	(n=86,939)	(n=179,907)	
	% (SE)	% (SE)	
<b>Sex</b>			
Female	60 (0.2)	51 (0.1)	<0.0001
Male	40 (0.2)	49 (0.1)	
<b>Age (years)</b>			
45-49	10 (0.1)	14 (0.1)	<0.0001
50-59	32 (0.2)	34 (0.1)	
60-69	32 (0.2)	26 (0.1)	
70-79	17 (0.1)	15 (0.1)	
80+	9 (0.1)	11 (0.1)	
<b>Place of Residence</b>			
Major city	45 (0.2)	45 (0.1)	<0.0001
Inner regional	36 (0.2)	35 (0.1)	
Outer regional	17 (0.1)	18 (0.1)	
Remote/very remote	2 (0.1)	2 (0.1)	
<b>Education</b>			
School Certificate or less	34 (0.2)	34 (0.1)	0.0001
Higher School Certificate	10 (0.1)	10 (0.1)	
Trade/certificate/diploma	33 (0.2)	32 (0.1)	
Tertiary	23 (0.1)	24 (0.1)	
<b>Annual Household Income</b>			
< \$20000	25 (0.1)	25 (0.1)	<0.0001
\$20000-\$49999	33 (0.2)	31 (0.1)	
\$50000-\$69999	14 (0.1)	13 (0.1)	



	≥ \$70000	28 (0.2)	31 (0.1)	
<b>Marital Status</b>	Married/defacto	75 (0.1)	75 (0.1)	<0.0001
	Widow/divorce/separ.	20 (0.1)	19 (0.1)	
	Single	5 (0.1)	6 (0.1)	
<b>Health</b>	Private	55 (0.2)	53 (0.1)	<0.0001
<b>Insurance</b>	DVA or HCC	30 (0.2)	29 (0.1)	
	None	15 (0.1)	18 (0.1)	

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\* SE = Standard Error

**Table 2 Health status characteristics of people aged 45 years and older by w3 FA supplement use**

Health Status Characteristics	Use of w3 FA supplements		p-value
	Yes	No	
	(n=86,939)	(n=179,907)	
	% (SE)	% (SE)	
<b>Smoking Status</b>			
Current smoker	5 (0.1)	8 (0.1)	<0.0001
Former smoker	36 (0.2)	35 (0.1)	
Never smoked	59 (0.2)	56 (0.1)	
<b>Alcohol Consumption</b>			
0-6 drinks per week	64 (0.2)	62 (0.1)	<0.0001
7-13 drinks per week	19 (0.1)	19 (0.1)	
14-20 drinks per week	11 (0.1)	11 (0.1)	
≥ 21 drinks per week	6 (0.1)	8 (0.1)	
<b>Overall Health</b>			
Excellent/very good/good	87 (0.1)	85 (0.1)	<0.0001
Fair/poor	13 (0.1)	15 (0.1)	
<b>Overall Quality Of Life</b>			
Excellent/very good/good	90 (0.1)	89 (0.1)	<0.0001
Fair/poor	10 (0.1)	11 (0.1)	
<b>Osteoarthritis</b>			
Yes	11 (0.1)	7 (0.1)	<0.0001
No	89 (0.1)	93 (0.1)	
<b>Osteoporosis</b>			
Yes	7 (0.1)	5 (0.1)	<0.0001
No	93 (0.1)	95 (0.1)	

<b>Asthma</b>	Yes	5 (0.1)	4 (0.1)	<0.0001
	No	95 (0.1)	96 (0.1)	
<b>Cancer</b>	Yes	2 (0.1)	3 (0.1)	<0.0001
	No	98 (0.1)	97 (0.1)	
<b>High Blood Pressure</b>	Yes	26 (0.1)	24 (0.1)	<0.0001
	No	74 (0.1)	76 (0.1)	
<b>High Cholesterol</b>	Yes	17 (0.1)	14 (0.1)	<0.0001
	No	83 (0.1)	86 (0.1)	
<b>Heart Attack or Angina</b>	Yes	3 (0.1)	3 (0.1)	0.2996
	No	97 (0.1)	97 (0.1)	
<b>Other Heart Disease</b>	Yes	3 (0.1)	3 (0.1)	0.6606
	No	97 (0.1)	97 (0.1)	
<b>Thyroid Problems</b>	Yes	6 (0.1)	5 (0.1)	<0.0001
	No	94 (0.1)	95 (0.1)	
<b>Anxiety &amp; Depression</b>	Neither	91 (0.1)	92 (0.1)	<0.0001
	Depression only	4 (0.1)	4 (0.1)	
	Anxiety only	2 (0.1)	1 (0.1)	
	Both	3 (0.1)	3 (0.1)	

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\* SE = Standard Error

**Table 3 Multiple logistic regression model for predicting use of w3 FA supplements in people aged 45 years and older**

<b>Factor</b>		<b>Odds Ratio</b>	<b>99% C.I.</b>
<b>Sex</b>	Male	1.00	—
	Female	1.42	1.37, 1.48
<b>Age</b>	45-49	1.00	—
	50-59	1.43	1.36, 1.52
	60-69	1.84	1.73, 1.96
	70-79	1.76	1.64, 1.90
	80+	1.32	1.21, 1.44
<b>Place of Residence</b>	Major city	1.00	—
	Inner regional	0.98	0.95, 1.02
	Outer regional	0.89	0.85, 0.93
	Remote/very remote	0.86	0.75, 0.98
<b>Annual Household Income</b>	< \$20000	1.00	—
	\$20000-\$49999	1.14	1.08, 1.20
	\$50000-\$69999	1.13	1.06, 1.21
	≥ \$70000	1.03	0.97, 1.10
<b>Insurance</b>	Private	1.00	—
	DVA or HCC	0.93	0.89, 0.98
	None	0.84	0.80, 0.89
<b>Smoking</b>	Current smoker	1.00	—

<b>Status</b>	Former smoker	1.66	1.53, 1.79
	Never smoked	1.56	1.44, 1.69
<b>Alcohol Consumption</b>	0-6 drinks per week	1.00	—
	7-13 drinks per week	1.02	0.97, 1.07
	14-20 drinks per week	0.94	0.89, 1.00
	≥ 21 drinks per week	0.83	0.78, 0.89
<b>Overall Health</b>	Excellent/very good/good	1.00	—
	Fair/poor	0.82	0.77, 0.86
<b>Osteoarthritis</b>	No	1.00	—
	Yes	1.65	1.55, 1.76
<b>Osteoporosis</b>	No	1.00	—
	Yes	1.09	1.01, 1.18
<b>Cancer</b>	No	1.00	—
	Yes	0.89	0.80, 0.99
<b>High Blood Pressure</b>	No	1.00	—
	Yes	0.95	0.91, 0.99
<b>High Cholesterol</b>	No	1.00	—
	Yes	1.23	1.17, 1.29
<b>Anxiety &amp; Depression</b>	Neither	1.00	—
	Depression only	1.01	0.92, 1.11
	Anxiety only	1.16	1.01, 1.34
	Both	1.19	1.07, 1.32

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## Glossary

CAM	Complementary and alternative medicine
DHA	Docosahexaenoic acid
EPA	Eicosapentaenoic acid
GP	General Practitioner
Omega-3 Fatty Acid	w3 FA

For peer review only

## ACKNOWLEDGEMENTS

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## COMPETING INTERESTS

None.

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## AUTHORS CONTRIBUTION

All authors devised the study and helped to conceptualize ideas, interpret findings, manuscript writing and reviewing drafts of the article. JA and DS acquired the data from the 45 and Up Study. DS undertook data analysis and JA, DS, CL, AB, JW

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3 contributed to the interpretation of the data. All authors read and approved the final  
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5 manuscript.  
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## 11 **DATA SHARING STATEMENT**

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# TITLE PAGE

**Omega-3 Fatty Acid Supplement Use: A-SecondaryAn Analysis of 266,848  
Australians aged 45 Years and Older**

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28 **Keywords**

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Omega-3, fish oils, dietary supplements, utilization, adult

**Word Count**

| ~~2,362~~3,020 words

## ABSTRACT

*Objective:* There has been a dramatic increase in the use of dietary supplements in Western ~~industrialized~~ societies over the past ~~few~~ decades ~~and our~~. Our understanding of the prevalence ~~and pattern~~ of omega-3 fatty acid supplement consumption is of significance for future nutrition planning, health promotion and ~~health~~ care delivery. However, we know ~~very~~ little about omega-3 fatty acid supplement consumption or users. This paper, drawing upon the largest dataset with regards to omega-3 fatty acid supplement use (n=266,848), examines the use and users of ~~omega-3~~ this supplement amongst a large sample of older Australians living in New South Wales.

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*Design:* Cross-sectional study. ~~A secondary analysis was made of data~~ Data were analysed from the 45 and Up Study ~~that is~~, the largest study of healthy ageing ever undertaken in the Southern Hemisphere.

*Setting:* New South Wales, Australia.

*Participants:* 266,848 participants of the 45 and Up Study.

*Primary and Secondary Outcome Measures:* Participants' use of omega-3, demographics (geographical location, marital status, education level, income and level of healthcare insurance) and health status (quality of life, history of smoking and alcohol consumption, health conditions) were measured.

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*Results:* Of the 266,848 participants, ~~86,939 (32.6%)~~ reported having taken omega-3 in the 4 weeks prior to the survey. Use of omega-3 fatty acid supplements was higher among female, non-smokers, non- to mild (alcoholic) drinkers, residing in a major city, having higher income and private health insurance. Osteoarthritis, osteoporosis, high cholesterol, and anxiety and/or depression were positively associated with omega-3 fatty acid supplement use, while cancer and high blood pressure were negatively associated with use of omega 3 fatty acid supplements.

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*Conclusions:* This study suggests that a considerable proportion of older Australians consume omega-3 fatty acid supplements. There is a need for primary healthcare practitioners to enquire with patients about ~~omega-3~~this supplement use and for work to ensure provision of good quality information for patients and providers with regards to omega-3 fatty acid products.



## ARTICLE SUMMARY

### Article Focus

- The use of dietary supplements has increased rapidly in Western societies over past decades.
- Our study examines the use of omega-3 [fatty acid supplements](#) amongst older Australians, drawing upon the largest study of healthy ageing undertaken in the Southern Hemisphere (n=266,848).

### Key Messages

- A considerable proportion of older Australians [living in New South Wales](#) (32.6%) report using omega-3 [fatty acid supplements](#).
- ~~Osteoarthritis~~ [People with osteoarthritis](#), osteoporosis, high cholesterol, and anxiety and/or depression ~~are positively associated with~~ [were more likely to use](#) omega-3 ~~use~~ [fatty acid supplements](#), while [people with](#) cancer and high blood pressure ~~are negatively associated with the~~ [were less likely to use](#) ~~of~~ omega 3 [fatty acid supplements](#).
- There is a need to ensure provision of good quality information for patients and providers with regards to omega-3 [fatty acid supplement](#) products.

### Strengths and Limitations of this Study

- Our study benefits from the use of the largest sample of Australians aged 45 years and older with regards to the consumption of omega-3 [fatty acid supplement](#).

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- The interpretation of our findings is limited by the fact that the use of omega-3 fatty acid supplement was self-reported by the participants and their answers may have been subject to recall bias.

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## MAIN TEXT

### Omega-3 Fatty Acid Supplement Use: A Secondary Analysis of 266,848 Australians aged 45 Years and Older

#### INTRODUCTION

There has been a dramatic increase in the use of dietary supplements in Western industrialized societies over the past few decades. The proportion of American adults using at least one dietary supplement has increased from 42% to 53% between 1994 and 2006<sup>1</sup> and research has shown<sup>2006</sup>.<sup>[1]</sup> Research also shows the use of dietary supplements is common in many European countries, such as Denmark (66% of men and 51% of women) and the United Kingdom (48% of women and 36% of men).<sup>[2]</sup>

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In 2007, a national US survey identified omega-3 ~~different types of fish oil fatty acid (w3 FA) supplements~~ (products ~~such as containing~~ docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) ~~products~~) as the first (for adults) and second (for children) most commonly used ~~natural~~ (non-vitamin, non-mineral, ~~natural~~) product in America.<sup>[3]</sup> In Australia, a substantial proportion of GPs (80.3%) and community pharmacists (90.2%) recommend omega-3 to ~~patients+patients~~<sup>[4]</sup> and findings from this Australian research also identify ~~omega-3w3 FA supplement~~ as among the top five complementary and alternative medicines about which healthcare professionals (71.6% of GP and 71.7% of pharmacists) desire better quality information.

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7 The clinical evidence base for omega-3w3 FA supplement use is varied depending on  
8 the specific condition. There is evidence that omega-3 helpsw3 FA supplements help  
9 in preventing or benefiting the outcomes of cardiovascular disease<sup>5</sup>disease with some  
10 evidence suggesting a cholesterol lowering effect.~~The~~.<sup>[5-7]</sup> However, a meta-analysis  
11 study released in 2012 found no relation between use of w3 FA supplements and  
12 reduced risk of major cardiovascular diseases.<sup>[8]</sup> At present, the National Heart  
13 Foundation of Australia recommends all Australian adults consume about 500 mg  
14 (or 1,000 mg for those who have documented coronary heart disease) of omega-3  
15 fatty acidsw3 FA per day.<sup>6</sup>.<sup>[9]</sup>

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26 Beyond cardiovascular disease, existing research has found no evidence of a  
27 significant association between omega-3w3 FA supplement use and reducing cancer  
28 incidence.<sup>7</sup>.<sup>[10]</sup> However, there is some evidence that omega-3 fatty acidsw3 FA  
29 supplements may improve clinical, biological and quality of life parameters amongst  
30 patients with advanced cancer.<sup>8</sup>.<sup>[11]</sup> There is currently conflicting or insufficient  
31 scientific evidence on the efficacy of omega-3w3 FA supplements regarding  
32 improvement of mental health disorders,<sup>9+9</sup>.<sup>[12 13]</sup> asthma,<sup>11</sup>.<sup>[14]</sup> cystic  
33 fibrosis,<sup>12</sup>.<sup>[15]</sup> rheumatoid arthritis, inflammatory bowel disease and  
34 osteoporosis<sup>13</sup>osteoporosis<sup>[16]</sup> and cognitive functions affected by aging, dementia,  
35 and neurological diseases.<sup>14</sup>.<sup>[17 18]</sup>

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46 In recent years the international public health agenda has partly focused on seeking  
47 cost-effective strategies to improve public health nutrition<sup>15</sup> and in Australia, the  
48 Federal Government indicated its commitment to the establishment of a  
49 comprehensive National Food and Nutrition Framework and to the importance of  
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7 providing evidence based nutrition and dietary guidelines to the public via the  
8 National Preventive Health Strategy.<sup>16</sup> Furthermore, ~~given~~ Given the rise of  
9 population ageing, and increasing consumer interest in the value of healthy eating,  
10 exercise and nutrition,<sup>17</sup> and growth in public awareness of the importance of  
11 preventive health,<sup>18</sup> ~~empirical analysis of the prevalence and pattern of omega-3,~~ [19]  
12 knowledge about consumption of dietary supplements such as w3 FA is of  
13 significance for future nutrition planning, health promotion and health care delivery.  
14 In response, this paper ~~reports~~ describes the findings of the first study to examine the  
15 use ~~and users of omega-3 of~~ w3 FA supplements in Australia. It aims to provide  
16 analysis of the prevalence and characteristics of omega-3 use amongst a large sample  
17 of ~~older~~ Australians (n=266,848) aged 45 years and older.

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## METHOD

### Sample

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35 This research utilised data collected through the 45 and Up Study, which is the  
36 largest study of healthy ageing conducted in the Southern Hemisphere and analyses  
37 data from ~~over 265,000~~ 266,848 men and women aged 45 and older who reside in  
38 the State of New South Wales, Australia. The 45 and Up study is described in detail  
39 elsewhere,<sup>19</sup> [20] but briefly ~~participants, individuals aged 45 years and over and~~  
40 resident in New South Wales were randomly selected from the Medicare Australia  
41 database, which provides virtually complete coverage of the general population.  
42  
43 ~~Participants joined the 45 and Up study by completing a postal questionnaire and~~  
44 ~~providing written consent for follow-up.~~ Eligible individuals were mailed an  
45 invitation to take part, an information leaflet, the study questionnaire and consent  
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7 form and a reply paid envelope (available at [www.45andUp.org.au](http://www.45andUp.org.au)). Participants  
8 joined the 45 and Up Study by completing the questionnaire and consent form and  
9 mailing them to the Study coordinating centre. The study over-sampled, by a factor  
10 of two, individuals aged 80 years and over and people resided in rural areas; all  
11 residents of remote areas were sampled. The 45 and Up Study sample included  
12 approximately 10% of the general population in the target age range. Recruitment  
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18 began in February 2006 and the analyses reported in this paper relate to the 266,848  
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20 participants joining the study at the close of December, 2009. The overall response  
21 rate to the mailed invitations to join the study is estimated to be 17.9%, however, the  
22 exact response rate is difficult to specify as some people may not have received the  
23 invitation if their address details were incorrect in the Medicare Australia  
24 database.[20] The 45 and Up study sample has excellent heterogeneity and is  
25 reasonably representative of the (State of) New South Wales population; has a  
26 response rate comparable to similar studies internationally and in Australia; and is  
27 among the most representative large scale cohort studies in the world.[21] The 45  
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29 and Up Study received ethics approval from the University of New South Wales  
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### ***Use of Omega-3***

Participants were defined as being an omega-3w3 FA supplement user if they  
answered 'yes' to the following question: 'In the past 4 weeks have you taken fish oil  
or Omega-3.'

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### ***Demographic measures***

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7 Area of residence was assigned according to the Accessibility Remoteness Index of  
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9 Australia Plus score for each participant's postcode. Participants were asked about  
10 their current marital status, highest educational qualification they had completed,  
11 annual household income, and their level of healthcare insurance.  
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### 14 15 16 ***Health status measures***

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18 Participants were asked to rate their overall health and overall quality of life on a  
19 five-point Likert scale. They were also asked about their history of smoking and  
20 amount of alcohol consumption. Participants were provided with a list of diseases  
21 (e.g. osteoarthritis, osteoporosis, asthma, cancer) and asked if they had been treated  
22 for any of the disease in the last month. A positive response to this question for a  
23 particular disease was used to determine if a participant had that disease.  
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### 30 31 ***Statistical analyses***

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33 The demographic and health status characteristics of omega-3 users and non-users  
34 were compared using chi-square tests. Logistic regression modelling, that included  
35 all demographic and health ~~status~~-characteristics ~~variables~~, was conducted using a  
36 backward stepwise method, to parsimoniously predict use of ~~omega-3-w3 FA~~  
37 supplements. In response to the large sample size and multiple comparisons, a p-  
38 value ~~<0.005001~~ was adopted for statistical significance. All analyses were conducted  
39 using the statistical software SAS 9.2.  
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## 50 **RESULTS**

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7 There were 266,846 participants who answered the question regarding consumption  
8 of ~~omega-3w3 FA supplements~~, of which 86,939 (32.6%) indicated that they had  
9 taken ~~omega-3w3 FA supplements~~ in the 4 weeks prior to the survey.

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14 ~~A comparison between participants who used omega-3 and those who did not use~~  
15 ~~omega-3 by Table 1 reports~~ demographic characteristics ~~is provided in Table 1. Use of~~  
16 ~~omega-3 participants by w3 FA supplement use. Use of w3 FA supplements~~ is highest  
17 among females ~~compared to males~~ ( $p < 0.0001$ ) and those aged 60-79 years ~~compared~~  
18 ~~to those of other ages~~ ( $p < 0.0001$ ). Use of ~~omega-3w3 FA supplements~~ was also  
19 higher for those participants: residing in inner regional areas ~~compared to those in~~  
20 ~~outer regional areas~~ ( $p < 0.0001$ ); having a trade, certificate of diploma ~~compared to~~  
21 ~~those with a tertiary education~~ ( $p < 0.0001$ ); having an annual household income of  
22 \$20,000-\$69,999 ~~compared to those with higher or lower annual household income~~  
23 ( $p < 0.0001$ ); being widowed, divorced or separated ~~compared to those who are single~~  
24 ( $p < 0.0001$ ); and having private health insurance ~~compared to those with no private~~  
25 ~~health insurance~~ ( $p < 0.0001$ ).  
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43 Table 2 shows ~~a comparison between participants who used omega-3 and those who~~  
44 ~~did not use omega-3 by~~ health status characteristics ~~of participants by w3 FA~~  
45 ~~supplement use. Use of omega-3w3 FA supplements~~ was highest among those  
46 participants who never smoked ~~compared to current smokers~~ ( $p < 0.0001$ ), drank 0-6  
47 ~~alcoholic drinks per week compared to those who drank  $\leq 21$~~  alcoholic drinks per  
48 week ( $p < 0.0001$ ), and whose overall health and quality of life were rated as being  
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7 excellent, very good, or good (~~p<0.0001~~), compared to those whose overall health and  
8 quality of life were rated as fair or poor (p<0.0001). Participants who reported being  
9 treated for osteoarthritis (p<0.0001), osteoporosis (p<0.0001), asthma (p<0.0001),  
10 high blood pressure (p<0.0001), high cholesterol (p<0.0001), and thyroid problems  
11 (p<0.0001) were all higher users of omega-3, compared to those people who did not  
12 have these respective illnesses. Conversely, participants who reported being treated  
13 for cancer (p<0.0001), or did not report being treated for anxiety or depression  
14 (p<0.0001) were lower users of omega-3, compared to those who had not been  
15 treated for these conditions.

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29 The result of the multiple logistic regression modelling is presented in Table 3. Of all  
30 the diseases examined osteoarthritis, osteoporosis, high cholesterol, and anxiety  
31 and/or depression were positively associated with use of ~~omega-3w3 FA~~  
32 supplements, while cancer and high blood pressure were negatively associated with  
33 the use of omega-3. That is, the odds of ~~omega-3w3 FA supplement~~ use was 1.65  
34 (~~9599% CI: 1.5955, 1.7276~~) times greater for those participants reporting treatment  
35 for osteoarthritis compared to those without osteoarthritis. The odds of omega-3 use  
36 was 1.09 (~~9599% CI: 1.0401, 1.1518~~) times greater for those participants reporting  
37 osteoporosis compared to those without osteoporosis. In comparison to participants  
38 reporting treatment for ~~either~~ anxiety or depression, those participants with anxiety  
39 only or both anxiety and depression were 1.16 (~~9599% CI: 1.01, 1.34~~) and 1.19 (99%  
40 CI: 1.07, 1.26) and 1.19 (95% CI: 1.12, 1.2732) times more likely to use ~~omega-3w3 FA~~  
41 supplements, respectively. Those participants reporting treatment for high  
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7 cholesterol were 1.23 (9599% CI: 1.1917, 1.2729) times more likely to use omega-3  
8 compared to those without high cholesterol. The odds of ~~omega-3w3 FA supplement~~  
9 use was 0.89 (9599% CI: 0.8480, 0.9599) and 0.95 (9599% CI: 0.9391, 0.9899)  
10 times lower for those participants reporting treatment for cancer and high blood  
11 pressure, respectively.  
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18 INSERT TABLE 3 HERE  
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22 Table 3 also shows that those participants who rated their overall health to be fair or  
23 poor were 0.82 (9599% CI: 0.7977, 0.8486) less likely to use omega-3. In  
24 comparison to current smokers, participants who were former smokers (OR=1.66;  
25 9599% CI: 1.5853, 1.7479) or never smoked (OR=1.56; 9599% CI: 1.4944, 1.6369)  
26 were more likely to use ~~omega-3w3 FA supplements~~. In comparison to those  
27 participants who drank 0-6 alcoholic drinks per week, participants who drank 14-20  
28 alcoholic drinks (OR=0.94; 9599% CI: 0.91, 0.9889, 1.00) or ≥ 21 alcoholic drinks  
29 (OR=0.83; 9599% CI: 0.8078, 0.8789) were less likely to use ~~omega-3-w3 FA~~  
30 ~~supplements~~. Participants with no health insurance were 0.84 (9599% CI: 0.8280,  
31 0.8689) times less likely to use ~~omega-3w3 FA supplements~~ compared to  
32 participants with private health insurance. In terms of household income, the odds of  
33 ~~omega-3w3 FA supplement~~ use were 1.14 (9599% CI: 1.1108, 1.1820) and 1.13  
34 (9599% CI: 1.0906, 1.1821) greater for participants with an income of \$20,000-  
35 \$49,999 and \$50,000-\$69,999 respectively, compared to those with an income of  
36 <\$20,000. In comparison to those participants who live in a major city, the odds of  
37 ~~omega-3w3 FA supplement~~ use are less for those living in outer regional areas  
38 (OR=0.89; 9599% CI: 0.8685, 0.9293) and remote or very remote areas (OR=0.86;  
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7 9599% CI: 0.7975, 0.9398). In comparison to those participants aged 45-49 years, all  
8 other age groups have greater odds of ~~omega-3w3 FA supplement~~ use, with the  
9 highest being those aged 60-69 (OR=1.84; 9599% CI: 1.7773, 1.9496) and 70-79  
10 (OR=1.76; 9599% CI: 1.6964, 1.8590) years. In terms of gender, the odds of ~~omega-~~  
11 ~~3w3 FA supplement~~ use was 1.42 (9599% CI: 1.3936, 1.4652) times greater for female  
12 participants.  
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## 22 DISCUSSION

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24 Our study, drawing upon the largest database with regards to ~~omega-3w3 FA~~  
25 ~~supplement~~ use to date and constituting the first analyses of the profile of users and  
26 prevalence of use of ~~omega-3w3 FA supplements~~ in Australia, shows 32.6% of the  
27 study participants, aged 45 years and older, consume ~~omega-3-w3 FA supplements~~.  
28 This finding identifies ~~omega-3w3 FA supplements~~ as one of the most commonly  
29 used dietary supplements ~~in Australia amongst older Australians~~ and is in line with  
30 previous research showing ~~omega-3w3 FA supplements~~ as among the top five  
31 complementary and alternative medicines recommended by Australian general  
32 practitioners and community pharmacists.<sup>[4]</sup> The discovery of such a high level of  
33 ~~omega-3w3 FA supplement~~ use ~~amongst older Australians~~ suggests that further  
34 research is needed to explore consumer behaviors and decision-making regarding  
35 ~~omega-3w3 FA supplement~~ use alongside assessing the possible health impacts of  
36 such consumption.  
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53 Overall, the findings of association between being female, of increased age, having  
54 advanced education *and* higher use of ~~omega-3w3 FA supplements~~ are congruent  
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with factors predicting broader complementary and alternative medicine use.<sup>[3</sup>

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<sup>22]</sup> The association of ~~omega-3w3 FA supplement~~ use with higher annual income

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and private health insurance highlights the potential importance of cost of ~~omega-~~

~~3w3 FA supplement~~ products with regards to consumption and this issue warrants

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further investigation. It is also important to note that ~~omega-3w3 FA supplements,~~

like many complementary and alternative medicine products more generally, is not

currently subsidised by the Australian Pharmaceutical Benefits Scheme (a Federal

government program providing subsidised prescription drugs to residents) and ~~as~~

~~such~~ attracts ~~an added~~ further 10% goods and services tax-~~that prescription~~

~~medicines do not. As such, cost issues associated with w3 FA supplementation may~~

~~be more focused in our Australian population.~~ Our finding of a positive association of

~~omega-3w3 FA supplement~~ use with higher annual income may also relate to the

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suggestion that socioeconomic status acts as a protective factor in health, with those

having better life chances more likely to adopt self-care measures to maintain their

health and quality of life.<sup>23]</sup>

The low use of ~~omega-3w3 FA supplements~~ among participants resident in rural and

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remote areas compared to those respondents living in metropolitan locations

contradicts the findings of previous research which show higher CAM use in rural

areas in Australia.<sup>22</sup> ~~The low use of omega-3 in these areas may reflect the lack of~~

~~access to supplements in geographically isolated regions.~~<sup>[24]</sup> However, it does

~~reflect findings from some national and international studies which suggest lower~~

~~rates of commercial or pre-packaged CAM product use amongst some rural~~

~~populations, when compared to their urban counterparts, which may be associated~~

~~with reduced access to these supplements.~~ <sup>[24]</sup> Indeed, the urban-rural divide in the

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7 use of complementary and alternative medicine is an issue that has received much  
8 attention in recent ~~years<sup>22</sup> years~~[24-26] and the ~~finding of results from~~ our study ~~help~~  
9  
10 add to the evidence-base and discussion of this important health service issue and  
11  
12 highlight the need for further investigation into the complexities of ~~rural~~regional  
13 ~~variation in~~ supplement use.  
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18 The variations in the association of ~~omega-3w3 FA supplement~~ use with a range of  
19 clinical conditions are noteworthy, especially given the current varied clinical  
20 evidence-base of ~~omega-3-w3 FA supplements~~. The finding of low ~~omega-3w3 FA~~  
21 ~~supplement~~ use amongst people with cancer is not unexpected as research evidence  
22 suggests no association between ~~omega-3 and reducing cancer incidence~~.<sup>7</sup>~~w3 FA~~  
23 ~~supplements and reducing cancer incidence~~.<sup>10</sup> Additionally, external factors may  
24 ~~also result in lower omega-3 supplement use amongst people with cancer: patients~~  
25 ~~may relinquish their CAM use when their use of other forms of medical treatment~~  
26 ~~increases~~:<sup>27</sup> or patients may be advised to cease all other medications when  
27 ~~undergoing cancer treatment~~.<sup>28</sup> However, it is somewhat surprising that high  
28  
29 blood pressure is negatively associated with the use of ~~omega-3w3 FA supplement~~ as  
30 there is evidence that omega-3 has beneficial effects in the context of cardiovascular  
31 disease and in lowering blood pressure.<sup>5</sup>~~29~~ This is an area worthy of further  
32 empirical investigation.  
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46 The association of higher ~~omega-3w3 FA supplement~~ use with diseases such as  
47 osteoarthritis, osteoporosis, anxiety and/or depression is interesting given there is  
48 currently either ~~no evidence~~conflicting or insufficient evidence on the efficacy of ~~fish~~  
49 ~~oil supplementation~~~~W3 FA supplements~~ in addressing these conditions – this  
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7 suggests there may currently exist a mismatch between clinical evidence and  
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9 consumers' perceptions of evidence and benefits regarding omega-3w3 FA  
10 supplement use. Together, these study findings highlight the potential need for  
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12 nutrition guidelines for omega-3w3 FA supplement intake and consumer awareness  
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14 of the use of omega-3w3 FA supplements as well as possible enhanced information  
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16 and labeling of relevant products in Australia. The study findings also add weight to  
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18 recently identified evidence illustrating a desire for good quality information about  
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20 omega-3w3 FA supplement products amongst GPs and pharmacists.<sup>[4]</sup>

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24 The finding that respondents with better quality of life/health ratings or a healthy  
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26 lifestyle (e.g. non-smoking and/or having less alcoholic drinks) have greater odds of  
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28 omega-3w3 FA supplement use may indicate that omega-3 isw3 FA supplements are  
29  
30 used for both the treatment of specific health conditions and as a preventive therapy.  
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32 Previous research suggests that this distinction between therapeutic and preventive  
33  
34 use also exists for complementary and alternative medicine consumption more  
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36 broadly.<sup>25</sup> <sup>[30]</sup> Given these results, it would be useful for future studies to  
37  
38 differentiate between these two approaches (therapeutic and preventive use) to use  
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40 and to provide critical, in-depth examination of patients' motivations and  
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42 understandings regarding consumption of omega-3w3 FA supplements and other  
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44 CAM or dietary supplements.

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47 The interpretation of our findings is limited by the fact that the association between  
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49 w3 FA supplement consumption with particular health conditions does not  
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51 necessarily imply that w3 FA supplements have been used specifically for these  
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53 conditions. In addition, the disease variable used from the 45 and Up Study survey

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7 was based on individuals reporting that they had been ‘treated in last month’ rather  
8 than ‘ever been diagnosed’ and that health ~~and omega-3, w3 FA supplement use~~ and  
9 health care use is self-reported by the participants. As such our study results may be  
10 subject to recall bias. ~~and we may have missed some participants who had a disease~~  
11 ~~but were not treated for it in the month prior to being surveyed. Currently this study~~  
12 ~~focuses solely on the use of W3 FA supplements, and this research may have~~  
13 ~~benefitted by including an analysis of usual dietary intake (e.g. food frequency~~  
14 ~~questionnaire), in particular the consumption of omega 3 rich foods such as oily fish~~  
15 ~~that may be also be consumed for therapeutic benefit. Given the sample of 45 and Up~~  
16 ~~Study was drawn from the State of New South Wales, generalisation of the findings~~  
17 ~~of this research to other parts of Australia should be treated with caution. Finally, as~~  
18 ~~the statistical tests used in our analyses are influenced by sample size, the very large~~  
19 ~~sample size in this study can make small difference appear to be significant. As such,~~  
20 ~~readers need to take into account the absolute differences when interpreting the odds~~  
21 ~~ratios.~~ Nevertheless, these limitations are countered by the insights gained from  
22 analysing data from the largest sample of adults aged 45 years and older with regards  
23 to their consumption of ~~omega-3:w3 FA supplements.~~

## 42 CONCLUSION

43 ~~Omega-3 is~~W3 FA supplements are consumed for a wide variety of purposes by a  
44 considerable proportion of Australians aged 45 years and over. In the context of  
45 these study findings there is a need for primary health care practitioners to enquire  
46 with their patients about their use of ~~omega-3w3 FA supplements~~ as well as for  
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further work to ensure provision of good quality information for patients and  
providers with regards to ~~omega-3w3 FA~~ products.

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**Table 1 Demographic characteristic of people aged 45 years and older by Omega-3w3 FA supplement use**

Demographic Characteristics	Use of <u>Omega-3w3 FA supplements</u>		p-value	
	Yes	No		
	(n=86,939)	(n=179,907)		
	% (SE)	% (SE)		
<b>Sex</b>	Female	60 (0.2)	51 (0.1)	<0.0001
	Male	40 (0.2)	49 (0.1)	
<b>Age (years)</b>	45-49	10 (0.1)	14 (0.1)	<0.0001
	50-59	32 (0.2)	34 (0.1)	
	60-69	32 (0.2)	26 (0.1)	
	70-79	17 (0.1)	15 (0.1)	
	80+	9 (0.1)	11 (0.1)	
<b>Place of Residence</b>	Major city	45 (0.2)	45 (0.1)	<0.0001
	Inner regional	36 (0.2)	35 (0.1)	
	Outer regional	17 (0.1)	18 (0.1)	
	Remote/very remote	2 (0.1)	2 (0.1)	
<b>Education</b>	School Certificate or less	34 (0.2)	34 (0.1)	0.0001
	Higher School Certificate	10 (0.1)	10 (0.1)	
	Trade/certificate/diploma	33 (0.2)	32 (0.1)	
	Tertiary	23 (0.1)	24 (0.1)	
<b>Annual Household Income</b>	< \$20000	25 (0.1)	25 (0.1)	<0.0001
	\$20000-\$49999	33 (0.2)	31 (0.1)	
	\$50000-\$69999	14 (0.1)	13 (0.1)	

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	≥ \$70000	28 <u>(0.2)</u>	31 <u>(0.1)</u>	
<b>Marital Status</b>	Married/defacto	75 <u>(0.1)</u>	75 <u>(0.1)</u>	<0.0001
	Widow/divorce/separ.	20 <u>(0.1)</u>	19 <u>(0.1)</u>	
	Single	5 <u>(0.1)</u>	6 <u>(0.1)</u>	
<b>Health Insurance</b>	Private	55 <u>(0.2)</u>	53 <u>(0.1)</u>	<0.0001
	DVA or HCC	30 <u>(0.2)</u>	29 <u>(0.1)</u>	
	None	15 <u>(0.1)</u>	18 <u>(0.1)</u>	

\* SE = Standard Error

Table 2 Health status characteristics of people aged 45 years and older by **Omega-3w3 FA supplement** use

Health Status Characteristics		Use of <b>Omega-3w3 FA supplements</b>		p-value
		Yes (n=86,939)	No (n=179,907)	
		% (SE)	% (SE)	
<b>Smoking Status</b>	Current smoker	5 (0.1)	8 (0.1)	<0.0001
	Former smoker	36 (0.2)	35 (0.1)	
	Never smoked	59 (0.2)	56 (0.1)	
<b>Alcohol Consumption</b>	0-6 drinks per week	64 (0.2)	62 (0.1)	<0.0001
	7-13 drinks per week	19 (0.1)	19 (0.1)	
	14-20 drinks per week	11 (0.1)	11 (0.1)	
	≥ 21 drinks per week	6 (0.1)	8 (0.1)	
<b>Overall Health</b>	Excellent/very good/good	87 (0.1)	85 (0.1)	<0.0001
	Fair/poor	13 (0.1)	15 (0.1)	
<b>Overall Quality Of Life</b>	Excellent/very good/good	90 (0.1)	89 (0.1)	<0.0001
	Fair/poor	10 (0.1)	11 (0.1)	
<b>Osteoarthritis</b>	Yes	11 (0.1)	7 (0.1)	<0.0001
	No	89 (0.1)	93 (0.1)	
<b>Osteoporosis</b>	Yes	7 (0.1)	5 (0.1)	<0.0001
	No	93 (0.1)	95 (0.1)	

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8	<b>Asthma</b>	Yes	5 <u>(0.1)</u>	4 <u>(0.1)</u>	<0.0001
9		No	95 <u>(0.1)</u>	96 <u>(0.1)</u>	
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13	<b>Cancer</b>	Yes	2 <u>(0.1)</u>	3 <u>(0.1)</u>	<0.0001
14		No	98 <u>(0.1)</u>	97 <u>(0.1)</u>	
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18	<b>High Blood</b>	Yes	26 <u>(0.1)</u>	24 <u>(0.1)</u>	<0.0001
19	<b>Pressure</b>	No	74 <u>(0.1)</u>	76 <u>(0.1)</u>	
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23	<b>High Cholesterol</b>	Yes	17 <u>(0.1)</u>	14 <u>(0.1)</u>	<0.0001
24		No	83 <u>(0.1)</u>	86 <u>(0.1)</u>	
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27	<b>Heart Attack or</b>	Yes	3 <u>(0.1)</u>	3 <u>(0.1)</u>	0.2996
28	<b>Angina</b>	No	97 <u>(0.1)</u>	97 <u>(0.1)</u>	
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32	<b>Other Heart</b>	Yes	3 <u>(0.1)</u>	3 <u>(0.1)</u>	0.6606
33	<b>Disease</b>	No	97 <u>(0.1)</u>	97 <u>(0.1)</u>	
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37	<b>Thyroid</b>	Yes	6 <u>(0.1)</u>	5 <u>(0.1)</u>	<0.0001
38	<b>Problems</b>	No	94 <u>(0.1)</u>	95 <u>(0.1)</u>	
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42	<b>Anxiety &amp;</b>	Neither	91 <u>(0.1)</u>	92 <u>(0.1)</u>	<0.0001
43	<b>Depression</b>	Depression only	4 <u>(0.1)</u>	4 <u>(0.1)</u>	
44		Anxiety only	2 <u>(0.1)</u>	1 <u>(0.1)</u>	
45		Both	3 <u>(0.1)</u>	3 <u>(0.1)</u>	
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\* SE = Standard Error

Table 3 Multiple logistic regression model for predicting use of Omega-3w3 FA supplements in people aged 45 years and older

Factor		Odds Ratio	<del>95</del> 99% C.I.
<b>Sex</b>	Male	1.00	—
	Female	1.42	<u>1.3937</u> , <u>1.4648</u>
<b>Age</b>	45-49	1.00	—
	50-59	1.43	<u>1.3936</u> , <u>1.4952</u>
	60-69	1.84	<u>1.7773</u> , <u>1.9196</u>
	70-79	1.76	<u>1.6964</u> , <u>1.8590</u>
	80+	1.32	<u>1.2521</u> , <u>1.3944</u>
<b>Place of Residence</b>	Major city	1.00	—
	Inner regional	0.98	<u>0.9695</u> , <u>1.0402</u>
	Outer regional	0.89	<u>0.8685</u> , <u>0.9293</u>
	Remote/very remote	0.86	<u>0.7975</u> , <u>0.9398</u>
<b>Annual Household Income</b>	< \$20000	1.00	—
	\$20000-\$49999	1.14	<u>1.4408</u> , <u>1.4820</u>
	\$50000-\$69999	1.13	<u>1.0906</u> , <u>1.1821</u>
	≥ \$70000	1.03	<u>0.9997</u> , <u>1.0710</u>
<b>Insurance</b>	Private	1.00	—
	DVA or HCC	0.93	<u>0.9089</u> , <u>0.9598</u>
	None	0.84	<u>0.8280</u> , <u>0.8689</u>
<b>Smoking</b>	Current smoker	1.00	—

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<b>Status</b>	Former smoker	1.66	<u>1.5853</u> , <u>1.7479</u>
	Never smoked	1.56	<u>1.4944</u> , <u>1.6369</u>
<b>Alcohol Consumption</b>	0-6 drinks per week	1.00	—
	7-13 drinks per week	1.02	<u>0.9997</u> , <u>1.0507</u>
	14-20 drinks per week	0.94	<u>0.91</u> , <u>0.9889</u> , <u>1.00</u>
	≥ 21 drinks per week	0.83	<u>0.8078</u> , <u>0.8789</u>
<b>Overall Health</b>	Excellent/very good/good	1.00	—
	Fair/poor	0.82	<u>0.7977</u> , <u>0.8486</u>
<b>Osteoarthritis</b>	No	1.00	—
	Yes	1.65	<u>1.5955</u> , <u>1.7276</u>
<b>Osteoporosis</b>	No	1.00	—
	Yes	1.09	<u>1.0401</u> , <u>1.4518</u>
<b>Cancer</b>	No	1.00	—
	Yes	0.89	<u>0.8480</u> , <u>0.9599</u>
<b>High Blood Pressure</b>	No	1.00	—
	Yes	0.95	<u>0.9391</u> , <u>0.9899</u>
<b>High Cholesterol</b>	No	1.00	—
	Yes	1.23	<u>1.4917</u> , <u>1.2729</u>
<b>Anxiety &amp; Depression</b>	Neither	1.00	—
	Depression only	1.01	<u>0.9692</u> , <u>1.0711</u>
	Anxiety only	1.16	<u>1.0701</u> , <u>1.2634</u>
	Both	1.19	<u>1.4207</u> , <u>1.2732</u>

## Glossary

<u>CAM</u>	<u>Complementary and alternative medicine</u>
<u>DHA</u>	<u>Docosahexaenoic acid</u>
<u>EPA</u>	<u>Eicosapentaenoic acid</u>
<u>GP</u>	<u>General Practitioner</u>
<u>Omega-3 Fatty Acid</u>	<u>w3 FA</u>

## ACKNOWLEDGEMENTS

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## COMPETING INTERESTS

None.

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## AUTHORS CONTRIBUTION

All authors devised the study and helped to conceptualize ideas, interpret findings, manuscript writing and reviewing drafts of the article. JA and DS acquired the data from the 45 and Up Study. DS undertook data analysis and JA, DS, CL, AB, JW



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7 contributed to the interpretation of the data. All authors read and approved the final  
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9 manuscript.

## 10 11 12 13 14 **DATA SHARING STATEMENT**

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## Omega-3 Fatty Acid Supplement Use in the 45 and Up Study Cohort

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# TITLE PAGE

## **Omega-3 Fatty Acid Supplement Use in the 45 and Up Study Cohort**

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## ABSTRACT

*Objective:* There has been a dramatic increase in the use of dietary supplements in Western societies over the past decades. Our understanding of the prevalence of omega-3 fatty acid supplement consumption is of significance for future nutrition planning, health promotion and care delivery. However, we know little about omega-3 fatty acid supplement consumption or users. This paper, drawing upon the largest dataset with regards to omega-3 fatty acid supplement use (n=266,848), examines the use and users of this supplement amongst a large sample of older Australians living in New South Wales.

*Design:* Cross-sectional study. Data were analysed from the 45 and Up Study, the largest study of healthy ageing ever undertaken in the Southern Hemisphere.

*Setting:* New South Wales, Australia.

*Participants:* 266,848 participants of the 45 and Up Study.

*Primary and Secondary Outcome Measures:* Participants' use of omega-3, demographics (geographical location, marital status, education level, income and level of healthcare insurance) and health status (quality of life, history of smoking and alcohol consumption, health conditions) were measured.

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3 *Results:* Of the 266,848 participants, 32.6% reported having taken omega-3 in the 4  
4 weeks prior to the survey. Use of omega-3 fatty acid supplements was higher among  
5 female, non-smokers, non- to mild (alcoholic) drinkers, residing in a major city,  
6  
7 having higher income and private health insurance. Osteoarthritis, osteoporosis,  
8  
9 high cholesterol, and anxiety and/or depression were positively associated with  
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11 omega-3 fatty acid supplement use, while cancer and high blood pressure were  
12  
13 negatively associated with use of omega 3 fatty acid supplements.  
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21 *Conclusions:* This study, analysing data from the 45 and Up Study cohort, suggests  
22  
23 that a considerable proportion of older Australians consume omega-3 fatty acid  
24  
25 supplements. There is a need for primary healthcare practitioners to enquire with  
26  
27 patients about this supplement use and for work to ensure provision of good quality  
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29 information for patients and providers with regards to omega-3 fatty acid products.  
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# ARTICLE SUMMARY

## Article Focus

- The use of dietary supplements has increased rapidly in Western societies over past decades.
- Our study examines the use of omega-3 fatty acid supplements amongst older Australians, drawing upon the largest study of healthy ageing undertaken in the Southern Hemisphere (n=266,848).

## Key Messages

- A considerable proportion of older Australians living in New South Wales (32.6%) report using omega-3 fatty acid supplements.
- People with osteoarthritis, osteoporosis, high cholesterol, and anxiety and/or depression were more likely to use omega-3 fatty acid supplements, while people with cancer and high blood pressure were less likely to use omega 3 fatty acid supplements.
- There is a need to ensure provision of good quality information for patients and providers with regards to omega-3 fatty acid supplement products.

## Strengths and Limitations of this Study

- Our study benefits from the use of the largest sample of Australians aged 45 years and older with regards to the consumption of omega-3 fatty acid supplement.

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- The interpretation of our findings is limited by the fact that the use of omega-3 fatty acid supplement was self-reported by the participants and their answers may have been subject to recall bias.

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# MAIN TEXT

## Omega-3 Fatty Acid Supplement Use in the 45 and Up Study Cohort

### INTRODUCTION

There has been a dramatic increase in the use of dietary supplements in Western industrialized societies over the past few decades. The proportion of American adults using at least one dietary supplement has increased from 42% to 53% between 1994 and 2006.[1] Research also shows the use of dietary supplements is common in European countries such as Denmark (66% of men and 51% of women) and the United Kingdom (48% of women and 36% of men).[2]

In 2007, a national US survey identified omega-3 fatty acid (w3 FA) supplements (products containing docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) products) as the first (for adults) and second (for children) most commonly used natural (non-vitamin, non-mineral) product in America.[3] In Australia, a substantial proportion of GPs (80.3%) and community pharmacists (90.2%) recommend omega-3 to patients[4] and findings from this Australian research also identify w3 FA supplement as among the top five complementary and alternative medicines about which healthcare professionals (71.6% of GP and 71.7% of pharmacists) desire better quality information.

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3 The clinical evidence base for w3 FA supplement use is varied depending on the  
4 specific condition. There is evidence that w3 FA supplements help in preventing or  
5 benefiting the outcomes of cardiovascular disease with some evidence suggesting a  
6 cholesterol lowering effect.[5-7] However, a meta-analysis study released in 2012  
7 found no relation between use of w3 FA supplements and reduced risk of major  
8 cardiovascular diseases.[8] At present, the National Heart Foundation of Australia  
9 recommends all Australian adults consume about 500 mg (or 1,000 mg for those  
10 who have documented coronary heart disease) of w3 FA per day.[9]

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13 Beyond cardiovascular disease, existing research has found no evidence of a  
14 significant association between w3 FA supplement use and reducing cancer  
15 incidence.[10] However, there is some evidence that w3 FA supplements may  
16 improve clinical, biological and quality of life parameters amongst patients with  
17 advanced cancer.[11] There is currently conflicting or insufficient scientific evidence  
18 on the efficacy of w3 FA supplements regarding improvement of mental health  
19 disorders,[12 13] asthma,[14] cystic fibrosis,[15] rheumatoid arthritis, inflammatory  
20 bowel disease and osteoporosis[16] and cognitive functions affected by aging,  
21 dementia, and neurological diseases.[17 18]

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23  
24 Given the rise of population ageing and increasing public awareness of the  
25 importance of preventive health,[19] knowledge about consumption of dietary  
26 supplements such as w3 FA is of significance for future health promotion and health  
27 care delivery. In response, this paper describes the findings of the first study to  
28 examine the use of w3 FA supplements in Australia. It aims to provide analysis of the

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3 prevalence and characteristics of omega-3 use amongst a large sample of Australians  
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5 (n=266,848) aged 45 years and older.  
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## 10 11 **METHOD**

### 12 13 ***Sample***

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15 This research utilised data collected through the 45 and Up Study, which is the  
16  
17 largest study of healthy ageing conducted in the Southern Hemisphere and analyses  
18  
19 data from 266,848 men and women aged 45 and older who reside in the State of New  
20  
21 South Wales, Australia. The 45 and Up study is described in detail elsewhere,[20] but  
22  
23 briefly, individuals aged 45 years and over and resident in New South Wales were  
24  
25 randomly selected from the Medicare Australia database, which provides virtually  
26  
27 complete coverage of the general population. Eligible individuals were mailed an  
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29 invitation to take part, an information leaflet, the study questionnaire and consent  
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31 form and a reply paid envelope (available at [www.45andUp.org.au](http://www.45andUp.org.au)). Participants  
32  
33 joined the 45 and Up Study by completing the questionnaire and consent form and  
34  
35 mailing them to the Study coordinating centre. The study over-sampled, by a factor  
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37 of two, individuals aged 80 years and over and people resided in rural areas; all  
38  
39 residents of remote areas were sampled. The 45 and Up Study sample included  
40  
41 approximately 10% of the general population in the target age range. Recruitment  
42  
43 began in February 2006 and the analyses reported in this paper relate to the 266,848  
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45 participants joining the study at the close of December, 2009. The overall response  
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47 rate to the mailed invitations to join the study is estimated to be 17.9%, however, the  
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49 exact response rate is difficult to specify as some people may not have received the  
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51 invitation if their address details were incorrect in the Medicare Australia  
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3 database.[20] The 45 and Up study sample has excellent heterogeneity and - in  
4  
5 comparison to the (State of ) New South Wales Population Health Survey - is  
6  
7 reasonably representative of the New South Wales population in terms of gender, age  
8  
9 and education; although there were differences in terms of primary language, health  
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11 insurance, smoking status, psychological distress, and diagnosis of some health  
12  
13 conditions.[21] Further, the study has a response rate comparable to similar studies  
14  
15 internationally and in Australia, and is among the most representative large scale  
16  
17 cohort studies in the world.[21] The 45 and Up Study received ethics approval from  
18  
19 the University of New South Wales Human Research Ethics Committee.  
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### 22 23 24 25 ***Use of Omega-3***

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28 Participants were defined as being an w3 FA supplement user if they answered 'yes'  
29  
30 to the following question: 'In the past 4 weeks have you taken fish oil or Omega-3.'  
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### 33 34 35 ***Demographic measures***

36  
37 Area of residence was assigned according to the Accessibility Remoteness Index of  
38  
39 Australia Plus score for each participant's postcode. Participants were asked about  
40  
41 their current marital status, highest educational qualification they had completed,  
42  
43 annual household income, and their level of healthcare insurance.  
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### 46 47 48 ***Health status measures***

49  
50 Participants were asked to rate their overall health and overall quality of life on a  
51  
52 five-point Likert scale. They were also asked about their history of smoking and  
53  
54 amount of alcohol consumption. Participants were provided with a list of diseases  
55  
56 (e.g. osteoarthritis, osteoporosis, asthma, cancer) and asked if they had been treated  
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3 for any of the disease in the last month. A positive response to this question for a  
4  
5 particular disease was used to determine if a participant had that disease.  
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### 9 10 ***Statistical analyses***

11 The demographic and health status characteristics of omega-3 users and non-users  
12 were compared using chi-square tests. The chi-square tests were used to identify  
13 those variables to be included in the logistic regression model building. Logistic  
14 regression modelling, that commenced with significant demographic and health  
15 characteristics (identified in the chi-square tests), was conducted using a backward  
16 stepwise method, to parsimoniously predict use of w3 FA supplements. In response  
17 to the large sample size and multiple comparisons, a p-value <0.001 was adopted for  
18 statistical significance. All analyses were conducted using the statistical software SAS  
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## 36 **RESULTS**

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38 There were 266,846 participants who answered the question regarding consumption  
39 of w3 FA supplements, of which 86,939 (32.6%) indicated that they had taken w3 FA  
40 supplements in the 4 weeks prior to the survey.  
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47 Table 1 reports demographic characteristics of participants by w3 FA supplement  
48 use. There are statistically significant associations between w3 FA supplement use  
49 and gender, age, place of residence, education, household income, marital status, and  
50 health insurance (all  $p < 0.0001$ ).  
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7 Table 2 shows health status characteristics of participants by w3 FA supplement use.  
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9 There are statistically significant associations between w3 FA supplement use and  
10 smoking status, alcohol consumption, overall health, overall quality of life,  
11 osteoarthritis, asthma, cancer, high blood pressure, high cholesterol, thyroid  
12 problems, anxiety and depression (all  $p < 0.0001$ ).  
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20 INSERT TABLE 2 HERE  
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24  
25 The result of the multiple logistic regression modelling is presented in Table 3. Of all  
26 the diseases examined osteoarthritis, osteoporosis, high cholesterol, and anxiety  
27 and/or depression were positively associated with use of w3 FA supplements, while  
28 cancer and high blood pressure were negatively associated with the use of omega-3.  
29  
30 That is, the odds of w3 FA supplement use was 1.65 (99% CI: 1.55, 1.76) times greater  
31 for those participants reporting treatment for osteoarthritis compared to those  
32 without osteoarthritis. The odds of omega-3 use was 1.09 (99% CI: 1.01, 1.18) times  
33 greater for those participants reporting osteoporosis compared to those without  
34 osteoporosis. In comparison to participants reporting treatment for anxiety or  
35 depression, those participants with anxiety only or both anxiety and depression were  
36 1.16 (99% CI: 1.01, 1.34) and 1.19 (99% CI: 1.07, 1.32) times more likely to use w3 FA  
37 supplements, respectively. Those participants reporting treatment for high  
38 cholesterol were 1.23 (99% CI: 1.17, 1.29) times more likely to use omega-3 compared  
39 to those without high cholesterol. The odds of w3 FA supplement use was 0.89 (99%  
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3 CI: 0.80, 0.99) and 0.95 (99% CI: 0.91, 0.99) times lower for those participants  
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5 reporting treatment for cancer and high blood pressure, respectively.  
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10 INSERT TABLE 3 HERE  
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14 Table 3 also shows that those participants who rated their overall health to be fair or  
15  
16 poor were 0.82 (99% CI: 0.77, 0.86) less likely to use omega-3. In comparison to  
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18 current smokers, participants who were former smokers (OR=1.66; 99% CI: 1.53,  
19  
20 1.79) or never smoked (OR=1.56; 99% CI: 1.44, 1.69) were more likely to use w3 FA  
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22 supplements. In comparison to those participants who drank 0-6 alcoholic drinks  
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24 per week, participants who drank 14-20 alcoholic drinks (OR=0.94; 99% CI: 0.89,  
25  
26 1.00) or  $\geq 21$  alcoholic drinks (OR=0.83; 99% CI: 0.78, 0.89) were less likely to use  
27  
28 w3 FA supplements. Participants with no health insurance were 0.84 (99% CI: 0.80,  
29  
30 0.89) times less likely to use w3 FA supplements compared to participants with  
31  
32 private health insurance. In terms of household income, the odds of w3 FA  
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34 supplement use were 1.14 (99% CI: 1.08, 1.20) and 1.13 (99% CI: 1.06, 1.21) greater  
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36 for participants with an income of \$20,000-\$49,999 and \$50,000-\$69,999  
37  
38 respectively, compared to those with an income of <\$20,000. In comparison to those  
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40 participants who live in a major city, the odds of w3 FA supplement use are less for  
41  
42 those living in outer regional areas (OR=0.89; 99% CI: 0.85, 0.93) and remote or  
43  
44 very remote areas (OR=0.86; 99% CI: 0.75, 0.98). In comparison to those  
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46 participants aged 45-49 years, all other age groups have greater odds of w3 FA  
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48 supplement use, with the highest being those aged 60-69 (OR=1.84; 99% CI: 1.73,  
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50 1.96) and 70-79 (OR=1.76; 99% CI: 1.64, 1.90) years. In terms of gender, the odds of  
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3 w3 FA supplement use was 1.42 (99% CI: 1.36, 1.52) times greater for female  
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5 participants.  
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## 10 11 **DISCUSSION**

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14 Our study, drawing upon the largest database with regards to w3 FA supplement use  
15 to date and constituting the first analyses of the profile of users and prevalence of use  
16 of w3 FA supplements in Australia, shows 32.6% of the study participants, aged 45  
17 years and older, consume w3 FA supplements. This finding identifies w3 FA  
18 supplements as one of the most commonly used dietary supplements amongst older  
19 Australians and is in line with previous research showing w3 FA supplements as  
20 among the top five complementary and alternative medicines recommended by  
21 Australian general practitioners and community pharmacists.[4] The discovery of  
22 such a high level of w3 FA supplement use amongst older Australians suggests that  
23 further research is needed to explore consumer behaviors and decision-making  
24 regarding w3 FA supplement use alongside assessing the possible health impacts of  
25 such consumption.  
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43 Overall, the findings of association between being female, of increased age, having  
44 advanced education *and* higher use of w3 FA supplements are congruent with factors  
45 predicting broader complementary and alternative medicine use.[3 22] The  
46 association of w3 FA supplement use with higher annual income and private health  
47 insurance highlights the potential importance of cost of w3 FA supplement products  
48 with regards to consumption and this issue warrants further investigation. It is also  
49 important to note that w3 FA supplements, like many complementary and  
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3 alternative medicine products more generally, is not currently subsidised by the  
4 Australian Pharmaceutical Benefits Scheme (a Federal government program  
5 providing subsidised prescription drugs to residents) and attracts a further 10%  
6 goods and services tax that prescription medicines do not. As such, cost issues  
7 associated with w3 FA supplementation may be more focused in our Australian  
8 population. Our finding of a positive association of w3 FA supplement use with  
9 higher annual income may also relate to the suggestion that socioeconomic status  
10 acts as a protective factor in health, with those having better life chances more likely  
11 to adopt self-care measures to maintain their health and quality of life.[23]  
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24 The low use of w3 FA supplements among participants resident in rural and remote  
25 areas compared to those respondents living in metropolitan locations contradicts the  
26 findings of previous research which show higher CAM use in rural areas in  
27 Australia.[24] However, it does reflect findings from some national and international  
28 studies which suggest lower rates of *commercial* or *pre-packaged* CAM product use  
29 amongst some rural populations, when compared to their urban counterparts, which  
30 may be associated with reduced access to these supplements. [24] Indeed, the urban-  
31 rural divide in the use of complementary and alternative medicine is an issue that  
32 has received much attention in recent years[24-26] and the results from our study  
33 help add to the evidence-base and discussion of this important health service issue  
34 and highlight the need for further investigation into the complexities of regional  
35 variation in supplement use.  
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53 The variations in the association of w3 FA supplement use with a range of clinical  
54 conditions are noteworthy, especially given the current varied clinical evidence-base  
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3 of w3 FA supplements. The finding of low w3 FA supplement use amongst people  
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5 with cancer is not unexpected as research evidence suggests no association between  
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7 w3 FA supplements and reducing cancer incidence.[10] Additionally, external factors  
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9 may also result in lower omega-3 supplement use amongst people with cancer:  
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11 patients may relinquish their CAM use when their use of other forms of medical  
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13 treatment increases;[27] or patients may be advised to cease all other medications  
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15 when undergoing cancer treatment.[28] However, it is somewhat surprising that  
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17 high blood pressure is negatively associated with the use of w3 FA supplement as  
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19 there is evidence that omega-3 has beneficial effects in the context of cardiovascular  
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21 disease and in lowering blood pressure.[29] This is an area worthy of further  
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23 empirical investigation.  
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29 The association of higher w3 FA supplement use with diseases such as osteoarthritis,  
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31 osteoporosis, anxiety and/or depression is interesting given there is currently either  
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33 conflicting or insufficient evidence on the efficacy of W3 FA supplements in  
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35 addressing these conditions – this suggests there may currently exist a mismatch  
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37 between clinical evidence and consumers' perceptions of evidence and benefits  
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39 regarding w3 FA supplement use. Together, these study findings highlight the  
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41 potential need for nutrition guidelines for w3 FA supplement intake and consumer  
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43 awareness of the use of w3 FA supplements as well as possible enhanced information  
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45 and labeling of relevant products in Australia. The study findings also add weight to  
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47 recently identified evidence illustrating a desire for good quality information about  
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49 w3 FA supplement products amongst GPs and pharmacists.[4]  
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3 The finding that respondents with better quality of life/health ratings or a healthy  
4 lifestyle (e.g. non-smoking and/or having less alcoholic drinks) have greater odds of  
5 w3 FA supplement use may indicate that w3 FA supplements are used for both the  
6 treatment of specific health conditions and as a preventive therapy. Previous  
7 research suggests that this distinction between therapeutic and preventive use also  
8 exists for complementary and alternative medicine consumption more broadly.[30]  
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10 Given these results, it would be useful for future studies to differentiate between  
11 these two approaches (therapeutic and preventive use) to use and to provide critical,  
12 in-depth examination of patients' motivations and understandings regarding  
13 consumption of w3 FA supplements and other CAM or dietary supplements.  
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27 The interpretation of our findings is limited by the fact that the association between  
28 w3 FA supplement consumption with particular health conditions does not  
29 necessarily imply that w3 FA supplements have been used specifically for these  
30 conditions. In addition, the disease variable used from the 45 and Up Study survey  
31 was based on individuals reporting that they had been 'treated in last month' rather  
32 than 'ever been diagnosed' and that health, w3 FA supplement use and health care  
33 use is self-reported by the participants. As such our study results may be subject to  
34 recall bias and we may have missed some participants who had a disease but were  
35 not treated for it in the month prior to being surveyed. Currently this study focuses  
36 solely on the use of W3 FA supplements, and this research may have benefitted by  
37 including an analysis of usual dietary intake (e.g. food frequency questionnaire), in  
38 particular the consumption of omega 3 rich foods such as oily fish that may be also  
39 be consumed for therapeutic benefit. Given the sample of 45 and Up Study was  
40 drawn from the State of New South Wales, generalisation of the findings of this  
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3 research to other parts of Australia should be treated with caution and as the study  
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5 sample has been shown to be not representative of the New South Wales population  
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7 on a number of characteristics, caution should be made in generalising the findings  
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9 to the New South Wales population. Finally, as the statistical tests used in our  
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11 analyses are influenced by sample size, the very large sample size in this study can  
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13 make small difference appear to be significant. As such, readers need to take into  
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15 account the absolute differences when interpreting the odds ratios. Nevertheless,  
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17 these limitations are countered by the insights gained from analysing data from the  
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19 largest sample of adults aged 45 years and older with regards to their consumption of  
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21 w3 FA supplements.  
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## 29 **CONCLUSION**

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32 Our analysis of data from the 45 and Up Study cohort suggests that W3 FA  
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34 supplements are consumed for a wide variety of purposes by a considerable  
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36 proportion of Australians aged 45 years and over. In the context of these study  
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38 findings there is a need for primary health care practitioners to enquire with their  
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40 patients about their use of w3 FA supplements as well as for further work to ensure  
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42 provision of good quality information for patients and providers with regards to w3  
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44 FA products.  
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**Table 1 Demographic characteristic of people aged 45 years and older by w3 FA supplement use**

Demographic Characteristics	Use of w3 FA supplements		p-value	
	Yes	No		
	(n=86,939)	(n=179,907)		
	% (SE)	% (SE)		
<b>Sex</b>	Female	60 (0.2)	51 (0.1)	<0.0001
	Male	40 (0.2)	49 (0.1)	
<b>Age (years)</b>	45-49	10 (0.1)	14 (0.1)	<0.0001
	50-59	32 (0.2)	34 (0.1)	
	60-69	32 (0.2)	26 (0.1)	
	70-79	17 (0.1)	15 (0.1)	
	80+	9 (0.1)	11 (0.1)	
<b>Place of Residence</b>	Major city	45 (0.2)	45 (0.1)	<0.0001
	Inner regional	36 (0.2)	35 (0.1)	
	Outer regional	17 (0.1)	18 (0.1)	
	Remote/very remote	2 (0.1)	2 (0.1)	
<b>Education</b>	School Certificate or less	34 (0.2)	34 (0.1)	0.0001
	Higher School Certificate	10 (0.1)	10 (0.1)	
	Trade/certificate/diploma	33 (0.2)	32 (0.1)	
	Tertiary	23 (0.1)	24 (0.1)	
<b>Annual Household Income</b>	< \$20000	25 (0.1)	25 (0.1)	<0.0001
	\$20000-\$49999	33 (0.2)	31 (0.1)	
	\$50000-\$69999	14 (0.1)	13 (0.1)	

	≥ \$70000	28 (0.2)	31 (0.1)	
<b>Marital Status</b>	Married/defacto	75 (0.1)	75 (0.1)	<0.0001
	Widow/divorce/separ.	20 (0.1)	19 (0.1)	
	Single	5 (0.1)	6 (0.1)	
<b>Health</b>	Private	55 (0.2)	53 (0.1)	<0.0001
<b>Insurance</b>	DVA or HCC	30 (0.2)	29 (0.1)	
	None	15 (0.1)	18 (0.1)	

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\* SE = Standard Error

**Table 2 Health status characteristics of people aged 45 years and older by w3 FA supplement use**

Health Status Characteristics	Use of w3 FA supplements		p-value
	Yes	No	
	(n=86,939)	(n=179,907)	
	% (SE)	% (SE)	
<b>Smoking Status</b>			
Current smoker	5 (0.1)	8 (0.1)	<0.0001
Former smoker	36 (0.2)	35 (0.1)	
Never smoked	59 (0.2)	56 (0.1)	
<b>Alcohol Consumption</b>			
0-6 drinks per week	64 (0.2)	62 (0.1)	<0.0001
7-13 drinks per week	19 (0.1)	19 (0.1)	
14-20 drinks per week	11 (0.1)	11 (0.1)	
≥ 21 drinks per week	6 (0.1)	8 (0.1)	
<b>Overall Health</b>			
Excellent/very good/good	87 (0.1)	85 (0.1)	<0.0001
Fair/poor	13 (0.1)	15 (0.1)	
<b>Overall Quality Of Life</b>			
Excellent/very good/good	90 (0.1)	89 (0.1)	<0.0001
Fair/poor	10 (0.1)	11 (0.1)	
<b>Osteoarthritis</b>			
Yes	11 (0.1)	7 (0.1)	<0.0001
No	89 (0.1)	93 (0.1)	
<b>Osteoporosis</b>			
Yes	7 (0.1)	5 (0.1)	<0.0001
No	93 (0.1)	95 (0.1)	

<b>Asthma</b>	Yes	5 (0.1)	4 (0.1)	<0.0001
	No	95 (0.1)	96 (0.1)	
<b>Cancer</b>	Yes	2 (0.1)	3 (0.1)	<0.0001
	No	98 (0.1)	97 (0.1)	
<b>High Blood Pressure</b>	Yes	26 (0.1)	24 (0.1)	<0.0001
	No	74 (0.1)	76 (0.1)	
<b>High Cholesterol</b>	Yes	17 (0.1)	14 (0.1)	<0.0001
	No	83 (0.1)	86 (0.1)	
<b>Heart Attack or Angina</b>	Yes	3 (0.1)	3 (0.1)	0.2996
	No	97 (0.1)	97 (0.1)	
<b>Other Heart Disease</b>	Yes	3 (0.1)	3 (0.1)	0.6606
	No	97 (0.1)	97 (0.1)	
<b>Thyroid Problems</b>	Yes	6 (0.1)	5 (0.1)	<0.0001
	No	94 (0.1)	95 (0.1)	
<b>Anxiety &amp; Depression</b>	Neither	91 (0.1)	92 (0.1)	<0.0001
	Depression only	4 (0.1)	4 (0.1)	
	Anxiety only	2 (0.1)	1 (0.1)	
	Both	3 (0.1)	3 (0.1)	

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\* SE = Standard Error

**Table 3 Multiple logistic regression model for predicting use of w3 FA supplements in people aged 45 years and older**

<b>Factor</b>		<b>Odds Ratio</b>	<b>99% C.I.</b>
<b>Sex</b>	Male	1.00	—
	Female	1.42	1.37, 1.48
<b>Age</b>	45-49	1.00	—
	50-59	1.43	1.36, 1.52
	60-69	1.84	1.73, 1.96
	70-79	1.76	1.64, 1.90
	80+	1.32	1.21, 1.44
<b>Place of Residence</b>	Major city	1.00	—
	Inner regional	0.98	0.95, 1.02
	Outer regional	0.89	0.85, 0.93
	Remote/very remote	0.86	0.75, 0.98
<b>Annual Household Income</b>	< \$20000	1.00	—
	\$20000-\$49999	1.14	1.08, 1.20
	\$50000-\$69999	1.13	1.06, 1.21
	≥ \$70000	1.03	0.97, 1.10
<b>Insurance</b>	Private	1.00	—
	DVA or HCC	0.93	0.89, 0.98
	None	0.84	0.80, 0.89
<b>Smoking</b>	Current smoker	1.00	—

<b>Status</b>	Former smoker	1.66	1.53, 1.79
	Never smoked	1.56	1.44, 1.69
<b>Alcohol Consumption</b>	0-6 drinks per week	1.00	—
	7-13 drinks per week	1.02	0.97, 1.07
	14-20 drinks per week	0.94	0.89, 1.00
	≥ 21 drinks per week	0.83	0.78, 0.89
<b>Overall Health</b>	Excellent/very good/good	1.00	—
	Fair/poor	0.82	0.77, 0.86
<b>Osteoarthritis</b>	No	1.00	—
	Yes	1.65	1.55, 1.76
<b>Osteoporosis</b>	No	1.00	—
	Yes	1.09	1.01, 1.18
<b>Cancer</b>	No	1.00	—
	Yes	0.89	0.80, 0.99
<b>High Blood Pressure</b>	No	1.00	—
	Yes	0.95	0.91, 0.99
<b>High Cholesterol</b>	No	1.00	—
	Yes	1.23	1.17, 1.29
<b>Anxiety &amp; Depression</b>	Neither	1.00	—
	Depression only	1.01	0.92, 1.11
	Anxiety only	1.16	1.01, 1.34
	Both	1.19	1.07, 1.32

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## Glossary

CAM	Complementary and alternative medicine
DHA	Docosahexaenoic acid
EPA	Eicosapentaenoic acid
GP	General Practitioner
Omega-3 Fatty Acid	w3 FA

For peer review only

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## COMPETING INTERESTS

None.

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## AUTHORS CONTRIBUTION

All authors devised the study and helped to conceptualize ideas, interpret findings, manuscript writing and reviewing drafts of the article. JA and DS acquired the data from the 45 and Up Study. DS undertook data analysis and JA, DS, CL, AB, JW



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contributed to the interpretation of the data. All authors read and approved the final manuscript.

## DATA SHARING STATEMENT

There are no additional data available.

For peer review only

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# TITLE PAGE

**Omega-3 Fatty Acid Supplement Use: ~~An Analysis of 266,848 Australians~~  
aged in the 45 Years and OlderUp Study Cohort**

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## ABSTRACT

*Objective:* There has been a dramatic increase in the use of dietary supplements in Western societies over the past decades. Our understanding of the prevalence of omega-3 fatty acid supplement consumption is of significance for future nutrition planning, health promotion and care delivery. However, we know little about omega-3 fatty acid supplement consumption or users. This paper, drawing upon the largest dataset with regards to omega-3 fatty acid supplement use (n=266,848), examines the use and users of this supplement amongst a large sample of older Australians living in New South Wales.

*Design:* Cross-sectional study. Data were analysed from the 45 and Up Study, the largest study of healthy ageing ever undertaken in the Southern Hemisphere.

*Setting:* New South Wales, Australia.

*Participants:* 266,848 participants of the 45 and Up Study.

*Primary and Secondary Outcome Measures:* Participants' use of omega-3, demographics (geographical location, marital status, education level, income and level of healthcare insurance) and health status (quality of life, history of smoking and alcohol consumption, health conditions) were measured.

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3 *Results:* Of the 266,848 participants, 32.6% reported having taken omega-3 in the 4  
4 weeks prior to the survey. Use of omega-3 fatty acid supplements was higher among  
5 female, non-smokers, non- to mild (alcoholic) drinkers, residing in a major city,  
6  
7 having higher income and private health insurance. Osteoarthritis, osteoporosis,  
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9 high cholesterol, and anxiety and/or depression were positively associated with  
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11 omega-3 fatty acid supplement use, while cancer and high blood pressure were  
12  
13 negatively associated with use of omega 3 fatty acid supplements.  
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21 *Conclusions:* This study, [analysing data from the 45 and Up Study cohort](#), suggests  
22 that a considerable proportion of older Australians consume omega-3 fatty acid  
23 supplements. There is a need for primary healthcare practitioners to enquire with  
24 patients about this supplement use and for work to ensure provision of good quality  
25 information for patients and providers with regards to omega-3 fatty acid products.  
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# ARTICLE SUMMARY

## Article Focus

- The use of dietary supplements has increased rapidly in Western societies over past decades.
- Our study examines the use of omega-3 fatty acid supplements amongst older Australians, drawing upon the largest study of healthy ageing undertaken in the Southern Hemisphere (n=266,848).

## Key Messages

- A considerable proportion of older Australians living in New South Wales (32.6%) report using omega-3 fatty acid supplements.
- People with osteoarthritis, osteoporosis, high cholesterol, and anxiety and/or depression were more likely to use omega-3 fatty acid supplements, while people with cancer and high blood pressure were less likely to use omega 3 fatty acid supplements.
- There is a need to ensure provision of good quality information for patients and providers with regards to omega-3 fatty acid supplement products.

## Strengths and Limitations of this Study

- Our study benefits from the use of the largest sample of Australians aged 45 years and older with regards to the consumption of omega-3 fatty acid supplement.

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- The interpretation of our findings is limited by the fact that the use of omega-3 fatty acid supplement was self-reported by the participants and their answers may have been subject to recall bias.

For peer review only

## MAIN TEXT

### **Omega-3 Fatty Acid Supplement Use: An Analysis of 266,848 Australians aged 45 Years and Older in the 45 and Up Study Cohort**

#### INTRODUCTION

There has been a dramatic increase in the use of dietary supplements in Western industrialized societies over the past few decades. The proportion of American adults using at least one dietary supplement has increased from 42% to 53% between 1994 and 2006.[1] Research also shows the use of dietary supplements is common in European countries such as Denmark (66% of men and 51% of women) and the United Kingdom (48% of women and 36% of men).[2]

In 2007, a national US survey identified omega-3 fatty acid (w3 FA) supplements (products containing docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) products) as the first (for adults) and second (for children) most commonly used natural (non-vitamin, non-mineral) product in America.[3] In Australia, a substantial proportion of GPs (80.3%) and community pharmacists (90.2%) recommend omega-3 to patients[4] and findings from this Australian research also identify w3 FA supplement as among the top five complementary and alternative medicines about which healthcare professionals (71.6% of GP and 71.7% of pharmacists) desire better quality information.

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3 The clinical evidence base for w3 FA supplement use is varied depending on the  
4 specific condition. There is evidence that w3 FA supplements help in preventing or  
5 benefiting the outcomes of cardiovascular disease with some evidence suggesting a  
6 cholesterol lowering effect.[5-7] However, a meta-analysis study released in 2012  
7 found no relation between use of w3 FA supplements and reduced risk of major  
8 cardiovascular diseases.[8] At present, the National Heart Foundation of Australia  
9 recommends all Australian adults consume about 500 mg (or 1,000 mg for those  
10 who have documented coronary heart disease) of w3 FA per day.[9]

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13 Beyond cardiovascular disease, existing research has found no evidence of a  
14 significant association between w3 FA supplement use and reducing cancer  
15 incidence.[10] However, there is some evidence that w3 FA supplements may  
16 improve clinical, biological and quality of life parameters amongst patients with  
17 advanced cancer.[11] There is currently conflicting or insufficient scientific evidence  
18 on the efficacy of w3 FA supplements regarding improvement of mental health  
19 disorders,[12 13] asthma,[14] cystic fibrosis,[15] rheumatoid arthritis, inflammatory  
20 bowel disease and osteoporosis[16] and cognitive functions affected by aging,  
21 dementia, and neurological diseases.[17 18]

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24 Given the rise of population ageing and increasing public awareness of the  
25 importance of preventive health,[19] knowledge about consumption of dietary  
26 supplements such as w3 FA is of significance for future health promotion and health  
27 care delivery. In response, this paper describes the findings of the first study to  
28 examine the use of w3 FA supplements in Australia. It aims to provide analysis of the

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3 prevalence and characteristics of omega-3 use amongst a large sample of Australians  
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5 (n=266,848) aged 45 years and older.  
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## 10 11 **METHOD**

### 12 13 ***Sample***

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15 This research utilised data collected through the 45 and Up Study, which is the  
16  
17 largest study of healthy ageing conducted in the Southern Hemisphere and analyses  
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19 data from 266,848 men and women aged 45 and older who reside in the State of New  
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21 South Wales, Australia. The 45 and Up study is described in detail elsewhere,[20] but  
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23 briefly, individuals aged 45 years and over and resident in New South Wales were  
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25 randomly selected from the Medicare Australia database, which provides virtually  
26  
27 complete coverage of the general population. Eligible individuals were mailed an  
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29 invitation to take part, an information leaflet, the study questionnaire and consent  
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31 form and a reply paid envelope (available at [www.45andUp.org.au](http://www.45andUp.org.au)). Participants  
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33 joined the 45 and Up Study by completing the questionnaire and consent form and  
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35 mailing them to the Study coordinating centre. The study over-sampled, by a factor  
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37 of two, individuals aged 80 years and over and people resided in rural areas; all  
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39 residents of remote areas were sampled. The 45 and Up Study sample included  
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41 approximately 10% of the general population in the target age range. Recruitment  
42  
43 began in February 2006 and the analyses reported in this paper relate to the 266,848  
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45 participants joining the study at the close of December, 2009. The overall response  
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47 rate to the mailed invitations to join the study is estimated to be 17.9%, however, the  
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49 exact response rate is difficult to specify as some people may not have received the  
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51 invitation if their address details were incorrect in the Medicare Australia  
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3 database.[20] The 45 and Up study sample has excellent heterogeneity and - in  
4 comparison to the (State of ) New South Wales Population Health Survey - is  
5 reasonably representative of the (State of)-New South Wales population; in terms of  
6 gender, age and education; although there were differences in terms of primary  
7 language, health insurance, smoking status, psychological distress, and diagnosis of  
8 some health conditions.[21] Further, the study has a response rate comparable to  
9 similar studies internationally and in Australia;<sup>2</sup> and is among the most  
10 representative large scale cohort studies in the world.[21] The 45 and Up Study  
11 received ethics approval from the University of New South Wales Human Research  
12 Ethics Committee.

### ***Use of Omega-3***

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Participants were defined as being an w3 FA supplement user if they answered ‘yes’ to the following question: ‘In the past 4 weeks have you taken fish oil or Omega-3.’

### ***Demographic measures***

Area of residence was assigned according to the Accessibility Remoteness Index of Australia Plus score for each participant’s postcode. Participants were asked about their current marital status, highest educational qualification they had completed, annual household income, and their level of healthcare insurance.

### ***Health status measures***

Participants were asked to rate their overall health and overall quality of life on a five-point Likert scale. They were also asked about their history of smoking and amount of alcohol consumption. Participants were provided with a list of diseases

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3 (e.g. osteoarthritis, osteoporosis, asthma, cancer) and asked if they had been treated  
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5 for any of the disease in the last month. A positive response to this question for a  
6  
7 particular disease was used to determine if a participant had that disease.  
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### 10 11 **Statistical analyses**

12  
13 The demographic and health status characteristics of omega-3 users and non-users  
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15 were compared using chi-square tests. The chi-square tests were used to identify  
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17 those variables to be included in the logistic regression model building. Logistic  
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19 regression modelling, that included all commenced with significant demographic and  
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21 health characteristics, (identified in the chi-square tests), was conducted using a  
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23 backward stepwise method, to parsimoniously predict use of w3 FA supplements. In  
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25 response to the large sample size and multiple comparisons, a p-value <0.001 was  
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27 adopted for statistical significance. All analyses were conducted using the statistical  
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29 software SAS 9.2.  
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## 38 **RESULTS**

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40 There were 266,846 participants who answered the question regarding consumption  
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42 of w3 FA supplements, of which 86,939 (32.6%) indicated that they had taken w3 FA  
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44 supplements in the 4 weeks prior to the survey.  
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49 Table 1 reports demographic characteristics of participants by w3 FA supplement  
50  
51 use. Use of w3 FA supplements is highest among females compared to males  
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53 (p<0.0001) and those aged 60-79 years compared to those of other ages (p<0.0001).  
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55 Use of w3 FA supplements was also higher for those participants: residing in inner  
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3 regional areas compared to those in outer regional areas ( $p < 0.0001$ ); having a trade,  
4 certificate of diploma compared to those with a tertiary education ( $p < 0.0001$ );  
5 having an annual household income of \$20,000–\$69,999 compared to those with  
6 higher or lower annual household income ( $p < 0.0001$ ); being widowed, divorced or  
7 separated compared to those who are single ( $p < 0.0001$ ); and having private health  
8 insurance compared to those with no private health insurance (There are statistically  
9 significant associations between w3 FA supplement use and gender, age, place of  
10 residence, education, household income, marital status, and health insurance (all  
11  $p < 0.0001$ ).

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25 INSERT TABLE 1 HERE  
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29 Table 2 shows health status characteristics of participants by w3 FA supplement use.

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31 ~~Use of~~There are statistically significant associations between w3 FA supplements was  
32 highest among those participants who never smoked compared to current smokers  
33 ( $p < 0.0001$ ), drank 0–6 alcoholic drinks per week compared to those who drank  $\leq 21$   
34 alcoholic drinks per week ( $p < 0.0001$ ), supplement use and whosesmoking status,  
35 alcohol consumption, overall health and, overall quality of life were rated as being  
36 excellent, very good, or good compared to those whose overall health and quality of  
37 life were rated as fair or poor ( $p < 0.0001$ ). Participants who reported being treated  
38 for, osteoarthritis ( $p < 0.0001$ ), osteoporosis ( $p < 0.0001$ ), asthma ( $p < 0.0001$ ),  
39 cancer, high blood pressure ( $p < 0.0001$ ), high cholesterol ( $p < 0.0001$ ), and, thyroid  
40 problems ( $p < 0.0001$ ) were all higher users of omega-3 compared to those people  
41 who did not have these respective illnesses. Conversely, participants who reported  
42 being treated for cancer ( $p < 0.0001$ ), or did not report being treated for, anxiety  
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~~and depression ( $p < 0.0001$ ) were lower users of omega-3 compared to those who had not been treated for these conditions: all  $p < 0.0001$ ).~~

INSERT TABLE 2 HERE

The result of the multiple logistic regression modelling is presented in Table 3. Of all the diseases examined osteoarthritis, osteoporosis, high cholesterol, and anxiety and/or depression were positively associated with use of w3 FA supplements, while cancer and high blood pressure were negatively associated with the use of omega-3. That is, the odds of w3 FA supplement use was 1.65 (99% CI: 1.55, 1.76) times greater for those participants reporting treatment for osteoarthritis compared to those without osteoarthritis. The odds of omega-3 use was 1.09 (99% CI: 1.01, 1.18) times greater for those participants reporting osteoporosis compared to those without osteoporosis. In comparison to participants reporting treatment for anxiety or depression, those participants with anxiety only or both anxiety and depression were 1.16 (99% CI: 1.01, 1.34) and 1.19 (99% CI: 1.07, 1.32) times more likely to use w3 FA supplements, respectively. Those participants reporting treatment for high cholesterol were 1.23 (99% CI: 1.17, 1.29) times more likely to use omega-3 compared to those without high cholesterol. The odds of w3 FA supplement use was 0.89 (99% CI: 0.80, 0.99) and 0.95 (99% CI: 0.91, 0.99) times lower for those participants reporting treatment for cancer and high blood pressure, respectively.

INSERT TABLE 3 HERE

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3 Table 3 also shows that those participants who rated their overall health to be fair or  
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5 poor were 0.82 (99% CI: 0.77, 0.86) less likely to use omega-3. In comparison to  
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7 current smokers, participants who were former smokers (OR=1.66; 99% CI: 1.53,  
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9 1.79) or never smoked (OR=1.56; 99% CI: 1.44, 1.69) were more likely to use w3 FA  
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11 supplements. In comparison to those participants who drank 0-6 alcoholic drinks  
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13 per week, participants who drank 14-20 alcoholic drinks (OR=0.94; 99% CI: 0.89,  
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15 1.00) or  $\geq 21$  alcoholic drinks (OR=0.83; 99% CI: 0.78, 0.89) were less likely to use  
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17 w3 FA supplements. Participants with no health insurance were 0.84 (99% CI: 0.80,  
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19 0.89) times less likely to use w3 FA supplements compared to participants with  
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21 private health insurance. In terms of household income, the odds of w3 FA  
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23 supplement use were 1.14 (99% CI: 1.08, 1.20) and 1.13 (99% CI: 1.06, 1.21) greater  
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25 for participants with an income of \$20,000-\$49,999 and \$50,000-\$69,999  
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27 respectively, compared to those with an income of <\$20,000. In comparison to those  
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29 participants who live in a major city, the odds of w3 FA supplement use are less for  
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31 those living in outer regional areas (OR=0.89; 99% CI: 0.85, 0.93) and remote or  
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33 very remote areas (OR=0.86; 99% CI: 0.75, 0.98). In comparison to those  
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35 participants aged 45-49 years, all other age groups have greater odds of w3 FA  
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37 supplement use, with the highest being those aged 60-69 (OR=1.84; 99% CI: 1.73,  
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39 1.96) and 70-79 (OR=1.76; 99% CI: 1.64, 1.90) years. In terms of gender, the odds of  
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41 w3 FA supplement use was 1.42 (99% CI: 1.36, 1.52) times greater for female  
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47 participants.

## 53 DISCUSSION

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3 Our study, drawing upon the largest database with regards to w3 FA supplement use  
4 to date and constituting the first analyses of the profile of users and prevalence of use  
5 of w3 FA supplements in Australia, shows 32.6% of the study participants, aged 45  
6 years and older, consume w3 FA supplements. This finding identifies w3 FA  
7 supplements as one of the most commonly used dietary supplements amongst older  
8 Australians and is in line with previous research showing w3 FA supplements as  
9 among the top five complementary and alternative medicines recommended by  
10 Australian general practitioners and community pharmacists.[4] The discovery of  
11 such a high level of w3 FA supplement use amongst older Australians suggests that  
12 further research is needed to explore consumer behaviors and decision-making  
13 regarding w3 FA supplement use alongside assessing the possible health impacts of  
14 such consumption.  
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31 Overall, the findings of association between being female, of increased age, having  
32 advanced education *and* higher use of w3 FA supplements are congruent with factors  
33 predicting broader complementary and alternative medicine use.[3 22] The  
34 association of w3 FA supplement use with higher annual income and private health  
35 insurance highlights the potential importance of cost of w3 FA supplement products  
36 with regards to consumption and this issue warrants further investigation. It is also  
37 important to note that w3 FA supplements, like many complementary and  
38 alternative medicine products more generally, is not currently subsidised by the  
39 Australian Pharmaceutical Benefits Scheme (a Federal government program  
40 providing subsidised prescription drugs to residents) and attracts a further 10%  
41 goods and services tax that prescription medicines do not. As such, cost issues  
42 associated with w3 FA supplementation may be more focused in our Australian  
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3 population. Our finding of a positive association of w3 FA supplement use with  
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5 higher annual income may also relate to the suggestion that socioeconomic status  
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7 acts as a protective factor in health, with those having better life chances more likely  
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9 to adopt self-care measures to maintain their health and quality of life.[23]  
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13 The low use of w3 FA supplements among participants resident in rural and remote  
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15 areas compared to those respondents living in metropolitan locations contradicts the  
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17 findings of previous research which show higher CAM use in rural areas in  
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19 Australia.[24] However, it does reflect findings from some national and international  
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21 studies which suggest lower rates of *commercial* or *pre-packaged* CAM product use  
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23 amongst some rural populations, when compared to their urban counterparts, which  
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25 may be associated with reduced access to these supplements. [24] Indeed, the urban-  
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27 rural divide in the use of complementary and alternative medicine is an issue that  
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29 has received much attention in recent years[24-26] and the results from our study  
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31 help add to the evidence-base and discussion of this important health service issue  
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33 and highlight the need for further investigation into the complexities of regional  
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35 variation in supplement use.  
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42 The variations in the association of w3 FA supplement use with a range of clinical  
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44 conditions are noteworthy, especially given the current varied clinical evidence-base  
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46 of w3 FA supplements. The finding of low w3 FA supplement use amongst people  
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48 with cancer is not unexpected as research evidence suggests no association between  
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50 w3 FA supplements and reducing cancer incidence.[10] Additionally, external factors  
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52 may also result in lower omega-3 supplement use amongst people with cancer:  
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54 patients may relinquish their CAM use when their use of other forms of medical  
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3 treatment increases;<sup>[27]</sup> or patients may be advised to cease all other medications  
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5 when undergoing cancer treatment.<sup>[28]</sup> However, it is somewhat surprising that  
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7 high blood pressure is negatively associated with the use of w3 FA supplement as  
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9 there is evidence that omega-3 has beneficial effects in the context of cardiovascular  
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11 disease and in lowering blood pressure.<sup>[29]</sup> This is an area worthy of further  
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13 empirical investigation.  
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18 The association of higher w3 FA supplement use with diseases such as osteoarthritis,  
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20 osteoporosis, anxiety and/or depression is interesting given there is currently either  
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22 conflicting or insufficient evidence on the efficacy of W3 FA supplements in  
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24 addressing these conditions – this suggests there may currently exist a mismatch  
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26 between clinical evidence and consumers' perceptions of evidence and benefits  
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28 regarding w3 FA supplement use. Together, these study findings highlight the  
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30 potential need for nutrition guidelines for w3 FA supplement intake and consumer  
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32 awareness of the use of w3 FA supplements as well as possible enhanced information  
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34 and labeling of relevant products in Australia. The study findings also add weight to  
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36 recently identified evidence illustrating a desire for good quality information about  
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38 w3 FA supplement products amongst GPs and pharmacists.<sup>[4]</sup>  
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45 The finding that respondents with better quality of life/health ratings or a healthy  
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47 lifestyle (e.g. non-smoking and/or having less alcoholic drinks) have greater odds of  
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49 w3 FA supplement use may indicate that w3 FA supplements are used for both the  
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51 treatment of specific health conditions and as a preventive therapy. Previous  
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53 research suggests that this distinction between therapeutic and preventive use also  
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55 exists for complementary and alternative medicine consumption more broadly.<sup>[30]</sup>  
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3 Given these results, it would be useful for future studies to differentiate between  
4 these two approaches (therapeutic and preventive use) to use and to provide critical,  
5 in-depth examination of patients' motivations and understandings regarding  
6 consumption of w3 FA supplements and other CAM or dietary supplements.  
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14 The interpretation of our findings is limited by the fact that the association between  
15 w3 FA supplement consumption with particular health conditions does not  
16 necessarily imply that w3 FA supplements have been used specifically for these  
17 conditions. In addition, the disease variable used from the 45 and Up Study survey  
18 was based on individuals reporting that they had been 'treated in last month' rather  
19 than 'ever been diagnosed' and that health, w3 FA supplement use and health care  
20 use is self-reported by the participants. As such our study results may be subject to  
21 recall bias and we may have missed some participants who had a disease but were  
22 not treated for it in the month prior to being surveyed. Currently this study focuses  
23 solely on the use of W3 FA supplements, and this research may have benefitted by  
24 including an analysis of usual dietary intake (e.g. food frequency questionnaire), in  
25 particular the consumption of omega 3 rich foods such as oily fish that may be also  
26 be consumed for therapeutic benefit. Given the sample of 45 and Up Study was  
27 drawn from the State of New South Wales, generalisation of the findings of this  
28 research to other parts of Australia should be treated with caution and as the study  
29 sample has been shown to be not representative of the New South Wales population  
30 on a number of characteristics, caution should be made in generalising the findings  
31 to the New South Wales population. Finally, as the statistical tests used in our  
32 analyses are influenced by sample size, the very large sample size in this study can  
33 make small difference appear to be significant. As such, readers need to take into  
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3 account the absolute differences when interpreting the odds ratios. Nevertheless,  
4 these limitations are countered by the insights gained from analysing data from the  
5 largest sample of adults aged 45 years and older with regards to their consumption of  
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10 w3 FA supplements.

## 11 12 13 14 15 16 **CONCLUSION**

17  
18 Our analysis of data from the 45 and Up Study cohort suggests that W3 FA  
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20 supplements are consumed for a wide variety of purposes by a considerable  
21  
22 proportion of Australians aged 45 years and over. In the context of these study  
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24 findings there is a need for primary health care practitioners to enquire with their  
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26 patients about their use of w3 FA supplements as well as for further work to ensure  
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28 provision of good quality information for patients and providers with regards to w3  
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32 FA products.  
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**Table 1 Demographic characteristic of people aged 45 years and older by w3 FA supplement use**

Demographic Characteristics	Use of w3 FA supplements		p-value	
	Yes	No		
	(n=86,939)	(n=179,907)		
	% (SE)	% (SE)		
<b>Sex</b>	Female	60 (0.2)	51 (0.1)	<0.0001
	Male	40 (0.2)	49 (0.1)	
<b>Age (years)</b>	45-49	10 (0.1)	14 (0.1)	<0.0001
	50-59	32 (0.2)	34 (0.1)	
	60-69	32 (0.2)	26 (0.1)	
	70-79	17 (0.1)	15 (0.1)	
	80+	9 (0.1)	11 (0.1)	
<b>Place of Residence</b>	Major city	45 (0.2)	45 (0.1)	<0.0001
	Inner regional	36 (0.2)	35 (0.1)	
	Outer regional	17 (0.1)	18 (0.1)	
	Remote/very remote	2 (0.1)	2 (0.1)	
<b>Education</b>	School Certificate or less	34 (0.2)	34 (0.1)	0.0001
	Higher School Certificate	10 (0.1)	10 (0.1)	
	Trade/certificate/diploma	33 (0.2)	32 (0.1)	
	Tertiary	23 (0.1)	24 (0.1)	
<b>Annual Household Income</b>	< \$20000	25 (0.1)	25 (0.1)	<0.0001
	\$20000-\$49999	33 (0.2)	31 (0.1)	
	\$50000-\$69999	14 (0.1)	13 (0.1)	



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	≥ \$70000	28 (0.2)	31 (0.1)	
<b>Marital Status</b>	Married/defacto	75 (0.1)	75 (0.1)	<0.0001
	Widow/divorce/separ.	20 (0.1)	19 (0.1)	
	Single	5 (0.1)	6 (0.1)	
<b>Health</b>	Private	55 (0.2)	53 (0.1)	<0.0001
<b>Insurance</b>	DVA or HCC	30 (0.2)	29 (0.1)	
	None	15 (0.1)	18 (0.1)	

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\* SE = Standard Error

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**Table 2 Health status characteristics of people aged 45 years and older by w3 FA supplement use**

Health Status Characteristics	Use of w3 FA supplements		p-value	
	Yes	No		
	(n=86,939)	(n=179,907)		
	% (SE)	% (SE)		
<b>Smoking Status</b>	Current smoker	5 (0.1)	8 (0.1)	<0.0001
	Former smoker	36 (0.2)	35 (0.1)	
	Never smoked	59 (0.2)	56 (0.1)	
<b>Alcohol Consumption</b>	0-6 drinks per week	64 (0.2)	62 (0.1)	<0.0001
	7-13 drinks per week	19 (0.1)	19 (0.1)	
	14-20 drinks per week	11 (0.1)	11 (0.1)	
	≥ 21 drinks per week	6 (0.1)	8 (0.1)	
<b>Overall Health</b>	Excellent/very good/good	87 (0.1)	85 (0.1)	<0.0001
	Fair/poor	13 (0.1)	15 (0.1)	
<b>Overall Quality Of Life</b>	Excellent/very good/good	90 (0.1)	89 (0.1)	<0.0001
	Fair/poor	10 (0.1)	11 (0.1)	
<b>Osteoarthritis</b>	Yes	11 (0.1)	7 (0.1)	<0.0001
	No	89 (0.1)	93 (0.1)	
<b>Osteoporosis</b>	Yes	7 (0.1)	5 (0.1)	<0.0001
	No	93 (0.1)	95 (0.1)	

<b>Asthma</b>	Yes	5 (0.1)	4 (0.1)	<0.0001
	No	95 (0.1)	96 (0.1)	
<b>Cancer</b>	Yes	2 (0.1)	3 (0.1)	<0.0001
	No	98 (0.1)	97 (0.1)	
<b>High Blood Pressure</b>	Yes	26 (0.1)	24 (0.1)	<0.0001
	No	74 (0.1)	76 (0.1)	
<b>High Cholesterol</b>	Yes	17 (0.1)	14 (0.1)	<0.0001
	No	83 (0.1)	86 (0.1)	
<b>Heart Attack or Angina</b>	Yes	3 (0.1)	3 (0.1)	0.2996
	No	97 (0.1)	97 (0.1)	
<b>Other Heart Disease</b>	Yes	3 (0.1)	3 (0.1)	0.6606
	No	97 (0.1)	97 (0.1)	
<b>Thyroid Problems</b>	Yes	6 (0.1)	5 (0.1)	<0.0001
	No	94 (0.1)	95 (0.1)	
<b>Anxiety &amp; Depression</b>	Neither	91 (0.1)	92 (0.1)	<0.0001
	Depression only	4 (0.1)	4 (0.1)	
	Anxiety only	2 (0.1)	1 (0.1)	
	Both	3 (0.1)	3 (0.1)	

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\* SE = Standard Error

**Table 3 Multiple logistic regression model for predicting use of w3 FA supplements in people aged 45 years and older**

<b>Factor</b>		<b>Odds Ratio</b>	<b>99% C.I.</b>
<b>Sex</b>	Male	1.00	—
	Female	1.42	1.37, 1.48
<b>Age</b>	45-49	1.00	—
	50-59	1.43	1.36, 1.52
	60-69	1.84	1.73, 1.96
	70-79	1.76	1.64, 1.90
	80+	1.32	1.21, 1.44
<b>Place of Residence</b>	Major city	1.00	—
	Inner regional	0.98	0.95, 1.02
	Outer regional	0.89	0.85, 0.93
	Remote/very remote	0.86	0.75, 0.98
<b>Annual Household Income</b>	< \$20000	1.00	—
	\$20000-\$49999	1.14	1.08, 1.20
	\$50000-\$69999	1.13	1.06, 1.21
	≥ \$70000	1.03	0.97, 1.10
<b>Insurance</b>	Private	1.00	—
	DVA or HCC	0.93	0.89, 0.98
	None	0.84	0.80, 0.89
<b>Smoking</b>	Current smoker	1.00	—

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3	<b>Status</b>	Former smoker	1.66	1.53, 1.79
4		Never smoked	1.56	1.44, 1.69
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7				
8	<b>Alcohol</b>	0-6 drinks per week	1.00	—
9				
10	<b>Consumption</b>	7-13 drinks per week	1.02	0.97, 1.07
11		14-20 drinks per week	0.94	0.89, 1.00
12		≥ 21 drinks per week	0.83	0.78, 0.89
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17	<b>Overall</b>	Excellent/very good/good	1.00	—
18	<b>Health</b>	Fair/poor	0.82	0.77, 0.86
19				
20				
21				
22	<b>Osteoarthritis</b>	No	1.00	—
23		Yes	1.65	1.55, 1.76
24				
25				
26				
27	<b>Osteoporosis</b>	No	1.00	—
28		Yes	1.09	1.01, 1.18
29				
30				
31				
32	<b>Cancer</b>	No	1.00	—
33		Yes	0.89	0.80, 0.99
34				
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38	<b>High Blood</b>	No	1.00	—
39	<b>Pressure</b>	Yes	0.95	0.91, 0.99
40				
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42				
43	<b>High</b>	No	1.00	—
44	<b>Cholesterol</b>	Yes	1.23	1.17, 1.29
45				
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47				
48	<b>Anxiety &amp;</b>	Neither	1.00	—
49	<b>Depression</b>	Depression only	1.01	0.92, 1.11
50		Anxiety only	1.16	1.01, 1.34
51		Both	1.19	1.07, 1.32
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## Glossary

CAM	Complementary and alternative medicine
DHA	Docosahexaenoic acid
EPA	Eicosapentaenoic acid
GP	General Practitioner
Omega-3 Fatty Acid	w3 FA

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## COMPETING INTERESTS

None.

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## AUTHORS CONTRIBUTION

All authors devised the study and helped to conceptualize ideas, interpret findings, manuscript writing and reviewing drafts of the article. JA and DS acquired the data from the 45 and Up Study. DS undertook data analysis and JA, DS, CL, AB, JW

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3 contributed to the interpretation of the data. All authors read and approved the final  
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## 11 **DATA SHARING STATEMENT**

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