# Opposites don't attract: high spouse concordance for dietary supplement use in the EPIC-Norfolk Cohort Study


## ABSTRACT

Objective: Dietary supplements are commonly consumed but may not be beneficial for everyone. It is known that supplement users have healthy behaviour characteristics but until now concordance between spouses living in the same household has not been investigated and concordance may be an important behavioural determinant.

Design: Prospective cohort study, cross-sectional data analysis.

Setting: European Prospective Investigation into Cancer in Norfolk (EPIC-Norfolk, UK), recruitment between 1993 and 1998.

Subjects: Married (or living as married) participants sharing a household, who attended a health examination and completed a 7-day diet diary, were included in the analysis (N= 11 060). The age range was 39-79 years.

Results: Nearly 75% of the households in EPIC-Norfolk were concordant in their supplement use, with 46.7% not using supplements and 27.0% using supplements. Concordance increased with age; the percentage of concordant couples varied less by other socio-demographics. Participants who had a spouse who used a supplement were nearly 9 times more likely to use a supplement (unadjusted). Depending on participant's sex and type of supplement used, odds ratios for 'Supplement use by spouse' in the prediction of participant's supplement use, varied between 6.2-11.7 adjusted for participant's age, smoking status, BMI, social class, education level and physical activity.

Conclusions: 'Supplement use by spouse' is an independent and the strongest predictor of participant's supplement use. This phenomenon can be useful in the design of studies and health interventions; or, when assessing risk of excessive intake from dietary supplements.

## INTRODUCTION

In EPIC-Norfolk, dietary supplements were reported by 44.8% of women and 31.7% of men in their 7 day Diet Diary (7dDD)[1], of which cod liver oil was the most commonly consumed supplement[2]. Studies in the UK have identified the characteristics of supplement users (SU) and found that SU are more likely to have a normal weight, a higher social class and show more health conscious behaviour[3–5]. They have focussed on the SU as an individual; however people sharing a household could influence each other's behaviour, as has been shown for other types of behaviours, such as smoking[6]. Concordance in the choice of using a supplement might partly explain why not all SU consistently show healthy behaviours; their spouse might have influenced them without the SU showing the known characteristics of a SU.

A UK survey among health conscious women aged 33-72 years[4], applied the theory of planned behaviour to analyse why women took dietary supplements[7]. This study found that participants rated family and health experts with the same intensity of normative beliefs regarding supplement use, defined as "perception of whether specific significant others believe you should perform the behaviour or not"[7]. A 'significant other' could be a spouse. A study investigating Complementary Alternative Medicine (CAM) use amongst women with a median of four years since breast cancer diagnosis, reported 15% more use of CAM (of which dietary supplement use is considered one) among their spouses *vs.* women who were not using CAM themselves[8].

There are two reasons why understanding more about spouse concordance is important. Firstly, health interventions encouraging or discouraging supplement use in a specific group could affect the nutritional status or risk of overdosing of people outside the intervention group. Conversely, spouse concordance in supplement use could be useful in health interventions to strengthen a message[6].

In the Norfolk based European Prospective Investigation into Cancer (EPIC-Norfolk), we found stronger associations for women than for men between supplement use and BMI and season, as well as conflicting results between men and women for socio-demographic variables such as age, education and marital status (unpublished results). Therefore, we set out to find what level of concordance exists in SU in a large population of men and women. In this paper we hypothesise that spouses influence each other's choices in using dietary supplements. We studied the existence of concordance and discordance in supplement use and how this relates to other known socio-demographic variables in order to understand the relative importance between spouse concordance, other participants' characteristics and supplement use.

## METHODS

### Study design

EPIC-Norfolk is a prospective cohort study based in East-Anglia (UK) which started recruitment in 1993 (up to 1998) to investigate risk factors for chronic diseases, such as cancer and cardio-vascular diseases[9]. Men and women, recruited from 35 general practitioners' clinics, aged between 39-79 years, completed an informed consent and a health and lifestyle questionnaire. This questionnaire provided information on marital status ('single', 'married or living as married', 'widowed', 'separated', 'divorced'); current or past occupation, from which social class was derived according to the Registrar General's occupation-based classification scheme; highest education level obtained (categorised into: no qualifications, A-level, O-level or Degree/equivalent); smoking status (current, former or never; derived from two questions: "Have you ever smoked as much as one cigarette a day for as long as a year?" and "Do you smoke cigarettes now?") and self-reported physical activity, from which a validated four point score of work-related and leisure time activity was compiled[10]. A health examination was attended by 25639 participants at their general practitioner's clinic. A trained nurse measured height (cm) and weight (kg), with participants wearing light clothing and no shoes.

### Supplement use

Dietary supplements were defined according to the EU directive 2002/46/EC: "foodstuffs the purpose of which is to supplement the normal diet and which are concentrated sources of nutrients or other substances with a nutritional or physiological effect, alone or in combination, marketed in dose form…" During the health examination, participants were given a 7dDD which measured dietary supplement use by asking "Please name any vitamins, minerals or other food supplements taken on each day of last week"[2]. Participants recording one or more supplements taken on at least one diary day were considered supplement users (SU). Participants who mentioned medication, *e.g.* ferrous sulphate or prescribed calcium, without further use of dietary supplements, were defined as non-supplement users (NSU). Since cod liver oil (CLO) is the most commonly consumed supplement in the UK and nearly 25% in EPIC-Norfolk consumes CLO[2], participants who consumed CLO or fish oil supplements, with or without other types of supplements, were grouped as a separate category of SU (SU+CLO) to partly account for heterogeneity among SU[11,12].

### Household identification

Participants sharing the same address were identified by their surname and postal address at the time of recruitment; the same addresses were given the same household-ID, leaving 15 956 participants eligible (7978 households). Participants who (a) both attended a health examination

(86.7% of 15 956), (b) were living in a household where both EPIC-participants were married (or living as married) (98.3%), and (c) went on to complete their 7dDD including the supplement question (92.3%), were included for this analysis (N=11 060). The age range of this sample was 39-79 years; mean (SD) age among men was 61.1 (8.4) years and among women 58.5 (8.3) years.

**Statistical analysis**

Analyses were sex-stratified for observations to be uncorrelated, unless households rather than participants were the denominator. We use the term 'spouse concordance' to refer to agreement in supplement use, although not all couples were married. The percentages of participants that were concordant in supplement use, *i.e.* where both members took supplements or both did not take supplements, are given for each stratum of the socio-demographic variables for which we wanted to test the associations with supplement use. For equal presentation purposes, continuous variables, such as age, body mass index (BMI, $kg/m^2$) and month of 7dDD completion were grouped. Differences in socio-demographic variables between SU+CLO, SU-CLO and NSU, as well as spouse concordance, were tested using the Chi-squared statistic. Supplement use, as a categorical variable with three categories (NSU, SU+CLO, SU-CLO), was then used as the dependent variable in multinomial logistic regression with 'Supplement use by spouse' as a predictor, including all the socio-demographic variables from Table 1. Participants for whom one or more variables were missing were removed from the regression analysis (2%). Statistical analysis was performed using SPSS v21. P-values below 0.05 were considered statistically significant.

**RESULTS**

Of the 11 060 participants, 4445 (40.2%) were SU; 34.6% among men and 45.7% among women. In the 5530 households, nearly 75% were concordant in their supplement use, with 46.7% not using supplements, *i.e.* both NSU, and 27.0% using supplements, *i.e.* both SU.

Concordance in supplement use was significantly higher among daily SU *vs.* non-daily SU (women only) and for those consuming multiple supplements *vs.* single SU (Table 1). Concordance in supplement use significantly increased with age in both sexes. A higher BMI among women was associated with increased concordance in supplement use, but less concordance among men. The column marked 'sole SU', shows the percentage of men/women who used a supplement, when their spouse did not. For all participants' characteristics, in all strata, this percentage was higher among women. For age and social class the trends for men and women were opposite. For example, where among women sole supplement use increased with increasing social class, for men, this percentage decreased. And where for men physical activity had no association with sole supplement use, for women, more physical activity was associated with more sole supplement use.

The odds of the participant being a SU were higher among women than men, irrespective whether the spouse was a SU or NSU (Figure 1). The odds of using a supplement were higher among participants whose spouses were SU. The OR was 8.86 (95% CI: 7.78-10.09), indicating that participants with a spouse who used supplements were nearly 9 times more likely to be a SU than participants whose spouse was a NSU.

All socio-demographic variables from Table 1 were entered one by one into a multinomial logistic regression model (SU+CLO *vs.* NSU; SU-CLO *vs.* NSU); sex stratified results are presented in Table 2. The OR for 'Supplement use by spouse' attenuated only slightly after inclusion of all other socio-demographic variables. Having a spouse who used supplements was the strongest predictor for both SU+CLO and SU-CLO groups in both sexes, followed at some distance by current smoking. Binary logistic regression, where only SU+CLO and SU-CLO were included, confirmed these differences between the two SU-groups and also found 'supplement use by spouse' to be significantly different.

The model without 'supplement use by spouse' (data not shown) showed small differences for age among women (OR SU+CLO 1.08, 95% CI 1.04-1.13; OR SU-CLO 0.94, 95% CI 0.90-0.98), a stronger association with social class in men (OR SU-CLO 0.66, 95% CI 0.53-0.81) and a stronger association for education in women (OR SU-CLO 0.76; 95% CI 0.65-0.89) compared to Table 2. This indicates that 'partner supplement use' was not a strong confounder for these variables that are known to be associated with supplement use.

## DISCUSSION

Spouse concordance in supplement use was 73.7%, with increased age being strongly associated with increased concordance. The strongest predictor for dietary supplement use was supplement use of a spouse. This factor was stronger for participants consuming CLO supplements *vs.* non-CLO supplements.

The associations between dietary supplement use and socio-demographics found in studies in the UK[3,4] and other countries[12–14], were also found in this sub-cohort of spouses in the EPIC-Norfolk study. This study was able to include 'supplement use by spouse' and found it to have the strongest association with dietary supplement use compared to known characteristics of SU, while minimally changing the association between the other socio-demographic variables and supplement use.

The positive association found for increased age and spouse concordance has been described by others as concordance due to cohabitation[6]. In our study, being older independently increased supplement use among men (more strongly for CLO than for non-CLO supplements), and decreased

the odds for non-CLO use in women. Assuming that age is correlated with the number of years of marriage, and hence length of cohabitation, we assumed the correlation between age and supplement use to increase after 'supplement use by spouse' was excluded from the model; however, the ORs for age were minimally affected. Positive assortative mating, defined as 'the tendency of individuals to choose a spouse with similar characteristics'[6], could explain the slight attenuation seen for social class and education level with inclusion of 'supplement use by spouse'. Although even in the fully adjusted model 'supplement use by spouse' remained the strongest predictor, we cannot rule out residual confounding.

Strengths of this analysis included the detailed recording of supplement use[2], as well as detailed assessment of socio-demographic characteristics[9]. We were able to identify over 5500 households in this free living UK cohort, which apart from a lower smoking prevalence, represents the UK population between 40-79 years old reasonably well[9]. The analysis described here, was -by design- restricted to a sub-cohort which can be considered a selective group of participants, considering both participants were willing to participate in a long-term prospective study. Compared to the cohort, the mean age among men in this subset increased by 2 years (Supplement Table 1), which might explain the 3% increase in supplement use. The proportion of SU among women was only 1% higher compared to the whole cohort. Smoking was approximately 3% less prevalent in both men and women, and might be indicative of more similar health related behaviours among these spouses overall and hence could have overestimated the spouse concordance for supplement use found in this study. Weaknesses of this analysis include that only 'supplement use by spouse' in EPIC-Norfolk could be assessed; however, other relations/resources (such as magazines, health professionals and friends) exist that can influence beliefs relating to supplement use[7]. Alternatively, other motives for using supplements, such as prevalent illness or health concerns, were not taken into account in this analysis, but are known to influence specific types of supplements[15,16].

The sequence of who in the household started with the use of supplements remains unknown. Future studies would benefit from not only requesting supplement information from the participant, but also establishing whether any of the other household members used supplements; as well as asking who first commenced use, since this additional information will help to identify different motivations and characteristics of SU and could aid the development of health interventions and risk assessment.

## CONCLUSION

‘Supplement use by spouse’ was the strongest predictor of participant’s supplement use and hence can be of importance when developing public health messages to encourage or discourage supplement use since the nutritional status of people beyond the SU could be affected.

## REFERENCES


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**Table 1: Characteristics of supplement users and spouse concordance among married (or living as married) participants sharing a household in EPIC-Norfolk (N=11 060).**

| Participant's characteristic | Men NSU N (%) | SU+CLO N (%) | SU-CLO N (%) | Sole SU N (%) | Concordant SU/NSU N/N (%) | Women NSU N (%) | SU+CLO N (%) | SU-CLO N (%) | Sole SU N (%) | Concordant SU/NSU N/N (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency supplement** | | | | | | | | | | |
| **Daily** | n/a | 1250 (73.2) | 458 (26.8) | 370 (21.7) | 1338/0 (78.3) | n/a | 1354 (61.4) | 853 (38.6) | 880 (39.9) | 1327/0 (60.1) |
| **Non daily** | n/a | 130 (62.5) | 78 (37.5) | 51 (24.5) | 157/0 (75.5) | n/a | 170 (52.8) | 152 (47.2) | 154 (47.8) | 168/0 (52.2) |
| | | | *P*<0.001[a] | | *P*<0.348[b] | | | *P*<0.003 | | *P*<0.001 |
| **Number of supplements** | | | | | | | | | | |
| **Single (one)** | n/a | 859 (69.4) | 379 (30.6) | 334 (27.0) | 904/0 (73.0) | n/a | 804 (55.4) | 646 (44.6) | 681 (47.0) | 769/0 (53.0) |
| **Multiple** | n/a | 521 (76.8) | 157 (23.2) | 87 (12.8) | 591/0 (87.2) | n/a | 720 (66.7) | 359 (33.3) | 353 (32.7) | 726/0 (67.3) |
| | | | *P*<0.001 | | *P*<0.001 | | | *P*<0.001 | | *P*<0.001 |
| **Age** | | | | | | | | | | |
| **<=50 years** | 561 (75.4) | 105 (14.1) | 78 (10.5) | 44 (5.9) | 139/382 (70.0) | 694 (57.5) | 247 (20.5) | 266 (22.0) | 279 (23.1) | 234/614 (70.3) |
| **>50-60 years** | 1210 (67.9) | 400 (22.4) | 172 (9.7) | 135 (7.6) | 437/808 (69.9) | 1048 (52.9) | 559 (28.2) | 374 (18.9) | 414 (20.9) | 519/892 (71.2) |
| **>60-70 years** | 1335 (61.9) | 614 (28.5) | 208 (9.6) | 162 (7.5) | 660/995 (76.7) | 1024 (53.7) | 583 (30.6) | 300 (15.7) | 282 (14.8) | 601/872 (77.2) |
| **>70 years** | 508 (60.0) | 261 (30.8) | 78 (9.2) | 80 (9.4) | 259/395 (77.2) | 235 (54.0) | 135 (31.0) | 65 (14.9) | 59 (13.6) | 141/202 (78.9) |
| | | | *P*<0.001 | | *P*<0.001 | | | *P*<0.001 | | *P*<0.001 |
| **Social class**[c] | | | | | | | | | | |
| **Professional** | 290 (67.4) | 93 (21.6) | 47 (10.9) | 25 (5.8) | 115/196 (72.3) | 210 (51.9) | 104 (25.7) | 91 (22.5) | 86 (21.2) | 109/186 (72.8) |
| **Managerial** | 1360 (63.7) | 529 (24.8) | 247 (11.6) | 168 (7.9) | 608/973 (74.0) | 1075 (53.9) | 526 (26.4) | 393 (19.7) | 360 (18.1) | 559/933 (74.8) |
| **Skilled non-manual** | 456 (63.3) | 188 (26.1) | 76 (10.6) | 45 (6.3) | 219/306 (72.9) | 465 (50.5) | 294 (31.9) | 162 (17.6) | 179 (19.4) | 277/390 (72.4) |

| Participant's characteristic | Men NSU N (%) | SU+CLO N (%) | SU-CLO N (%) | Sole SU N (%) | Concordant SU/NSU N/N (%) | Women NSU N (%) | SU+CLO N (%) | SU-CLO N (%) | Sole SU N (%) | Concordant SU/NSU N/N (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Skilled manual** | 912 (67.3) | 343 (25.3) | 101 (7.4) | 114 (8.4) | 330/668 (73.6) | 719 (56.1) | 356 (27.8) | 207 (16.1) | 242 (18.9) | 321/614 (72.9) |
| **Semi-skilled** | 464 (66.4) | 181 (25.9) | 54 (7.7) | 53 (7.6) | 182/345 (75.4) | 400 (56.7) | 190 (26.9) | 116 (16.4) | 128 (18.1) | 178/343 (73.8) |
| **Non-skilled** | 98 (69.0) | 36 (25.4) | 8 (5.6) | 14 (9.9) | 30/68 (69.0) | 94 (60.6) | 33 (21.3) | 28 (18.1) | 27 (17.4) | 34/80 (73.5) |
| | | | *P*<0.003 | | *P*<0.638 | | | *P*<0.003 | | *P*<0.758 |
| **Level of education** | | | | | | | | | | |
| **Degree** | 539 (66.9) | 181 (22.5) | 86 (10.7) | 59 (7.3) | 208/400 (75.4) | 311 (58.1) | 119 (22.2) | 105 (19.6) | 94 (17.6) | 130/275 (75.7) |
| **A-level** | 1632 (64.2) | 643 (25.3) | 267 (10.5) | 195 (7.7) | 715/1136 (72.8) | 943 (50.0) | 533 (28.3) | 410 (21.7) | 377 (20.0) | 566/805 (72.7) |
| **O-level** | 293 (64.8) | 112 (24.8) | 47 (10.4) | 32 (7.1) | 127/194 (71.0) | 360 (55.2) | 166 (25.5) | 126 (19.3) | 123 (18.9) | 169/307 (73.0) |
| **No qualifications** | 1150 (66.5) | 444 (25.7) | 136 (7.9) | 135 (7.8) | 445/850 (74.6) | 1387 (56.5) | 706 (28.7) | 364 (14.8) | 440 (17.9) | 630/1193 (74.2) |
| | | | *P*<0.054 | | *P*<0.162 | | | *P*<0.001 | | *P*<0.464 |
| **Smoking**[c] | | | | | | | | | | |
| **Never** | 1170 (64.2) | 456 (25.0) | 197 (10.8) | 133 (7.3) | 520/812 (73.1) | 1782 (53.3) | 941 (28.1) | 620 (18.5) | 617 (18.5) | 944/1537 (74.2) |
| **Former** | 2030 (64.1) | 833 (26.3) | 302 (9.5) | 263 (8.3) | 872/1471 (74.0) | 876 (52.4) | 476 (28.5) | 319 (19.1) | 334 (20.0) | 461/743 (72.1) |
| **Current** | 395 (77.8) | 82 (16.1) | 31 (6.1) | 23 (4.5) | 90/281 (73.0) | 319 (68.0) | 91 (19.4) | 59 (12.6) | 71 (15.1) | 79/278 (76.1) |
| | | | *P*<0.001 | | *P*<0.722 | | | *P*<0.001 | | *P*<0.122 |
| **Physical activity** | | | | | | | | | | |
| **Inactive** | 1211 (69.4) | 383 (21.9) | 151 (8.7) | 124 (7.1) | 410/882 (74.0) | 924 (61.2) | 374 (24.8) | 213 (14.1) | 223 (14.8) | 364/791 (76.4) |
| **Moderately inactive** | 853 (62.1) | 381 (27.7) | 140 (10.2) | 108 (7.9) | 413/593 (73.2) | 969 (51.7) | 557 (29.7) | 348 (18.6) | 364 (19.4) | 541/836 (73.5) |
| **Moderately active** | 828 (64.2) | 326 (25.3) | 135 | 98 (7.6) | 363/603 (74.9) | 662 (51.4) | 358 (27.8) | 269 | 257 | 370/567 (72.7) |

| Participant's characteristic | Men NSU N (%) | SU+CLO N (%) | SU-CLO N (%) | Sole SU N (%) | Concordant SU/NSU N/N (%) | Women NSU N (%) | SU+CLO N (%) | SU-CLO N (%) | Sole SU N (%) | Concordant SU/NSU N/N (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | (10.5) | | | | | (20.9) | (19.9) | |
| **Active** | 722 (64.3) | 290 (25.8) | 110 (9.8) | 91 (8.1) | 309/502 (72.2) | 446 (52.1) | 235 (27.5) | 175 (20.4) | 190 (22.2) | 220/386 (70.8) |
| | | | *P*<0.002 | | *P*<0.483 | | | *P*<0.001 | | *P*<0.016 |
| **Start 7dDD** | | | | | | | | | | |
| **Spring (Mar-May)** | 930 (65.7) | 355 (25.1) | 130 (9.2) | 96 (6.8) | 389/692 (76.4) | 778 (54.8) | 415 (29.2) | 228 (16.0) | 252 (17.7) | 391/671 (74.7) |
| **Summer (Jun-Aug)** | 904 (65.4) | 345 (25.0) | 133 (9.6) | 105 (7.6) | 373/648 (73.9) | 793 (56.0) | 365 (25.8) | 257 (18.2) | 240 (17.0) | 382/684 (75.3) |
| **Autumn (Sep-Nov)** | 940 (66.9) | 329 (23.4) | 136 (9.7) | 105 (7.5) | 360/657 (72.4) | 742 (53.0) | 382 (27.3) | 277 (19.8) | 289 (20.6) | 370/641 (72.2) |
| **Winter (Dec-Feb)** | 840 (63.6) | 351 (26.4) | 137 (10.3) | 115 (8.7) | 373/583 (72.0) | 688 (53.2) | 362 (28.0) | 243 (18.8) | 253 (19.6) | 352/584 (72.4) |
| | | | *P*<0.562 | | *P*<0.035 | | | *P*<0.105 | | *P*<0.133 |
| **BMI**[c] | | | | | | | | | | |
| **<=20 kg/m$^2$** | 34 (73.9) | 6 (13.0) | 6 (13.0) | 2 (4.3) | 10/26 (78.3) | 81 (51.6) | 41 (26.1) | 35 (22.3) | 34 (21.7) | 42/67 (69.4) |
| **>20-25 kg/m$^2$** | 1100 (63.0) | 457 (26.2) | 189 (10.8) | 129 (7.4) | 517/782 (74.4) | 1137 (51.0) | 628 (28.2) | 464 (20.8) | 461 (20.7) | 631/978 (72.2) |
| **>25-30 kg/m$^2$** | 1954 (64.4) | 788 (26.0) | 294 (9.7) | 243 (8.0) | 839/1387 (73.3) | 1225 (54.6) | 644 (28.7) | 375 (16.7) | 401 (17.9) | 618/1053 (74.5) |
| **>30 kg/m$^2$** | 520 (74.8) | 129 (18.6) | 46 (6.6) | 47 (6.8) | 128/381 (73.2) | 553 (62.0) | 209 (23.4) | 130 (14.6) | 136 (15.2) | 203/477 (76.2) |
| | | | *P*<0.001 | | *P*<0.744 | | | *P*<0.001 | | *P*<0.052 |

SU, supplement user; sole SU, participant is the only SU in the household; NSU, non-supplement user; SU+CLO, cod liver oil supplement user; SU-CLO, supplement user who does not consume cod liver oil.

[a] Chi-squared test: testing the hypothesis that there is no difference between SU+CLO, SU-CLO and NSU regarding the socio-demographic variables.

[b] Chi-squared test: testing the hypothesis that there is no difference between concordant and discordant spouses regarding the socio-demographic variables.

[c] Because of missing values, the numbers do not add up to 11,060.

**Table 2: Adjusted OR of using CLO or non-CLO supplements compared to not using a supplement at all in 10 855[a] married (or living as married) participants sharing a household in the EPIC-Norfolk cohort study.**

| | MEN | | | | | | WOMEN | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | % | SU+CLO vs. NSU | 95% CI | SU-CLO vs. NSU | 95% CI | | % | SU+CLO vs. NSU | 95% CI | SU-CLO vs. NSU | 95% CI |
| | 5446 | | 1362 (25.0%) | | 526 (9.7%) | | 5409 | | 1486 (27.5%) | | 989 (18.3%) | |
| **Concordance** | | | | | | | | | | | | |
| **Spouse is NSU** | 2956 | 54.3 | Ref | | Ref | | 3528 | 65.2 | Ref | | Ref | |
| **Spouse is SU** | 2490 | 45.7 | 9.85 | 8.45-11.48 | 7.31 | 5.92-9.03 | 1881 | 34.8 | 11.70 | 10.06-13.60 | 6.15 | 5.21-7.26 |
| **Age (per 5 years)** | 5446 | | 1.26 | 1.21-1.32 | 1.07 | 1.01-1.14 | 5409 | | 1.00 | 0.96-1.05 | 0.89 | 0.84-0.93 |
| **BMI (per 4 units)** | 5446 | | 0.85 | 0.77-0.93 | 0.80 | 0.71-0.91 | 5409 | | 0.89 | 0.83-0.95 | 0.85 | 0.78-0.91 |
| **Social class** [b] | | | | | | | | | | | | |
| **Non-Manual** | 3263 | 59.9 | Ref | | Ref | | 3290 | 60.8 | Ref | | Ref | |
| **Manual** | 2183 | 40.1 | 1.14 | 0.97-1.33 | 0.71 | 0.57-0.88 | 2119 | 39.2 | 0.95 | 0.82-1.11 | 0.88 | 0.75-1.04 |
| **Education level** | | | | | | | | | | | | |
| **Some qualification** [c] | 3752 | 68.9 | Ref | | Ref | | 3031 | 56.0 | Ref | | Ref | |
| **No qualification** | 1694 | 31.1 | 0.97 | 0.82-1.14 | 0.88 | 0.69-1.11 | 2378 | 44.0 | 1.08 | 0.93-1.26 | 0.80 | 0.68-0.94 |
| **Smoking** | | | | | | | | | | | | |
| **Never** | 1810 | 33.2 | Ref | | Ref | | 3290 | 60.8 | Ref | | Ref | |
| **Former** | 3134 | 57.5 | 1.04 | 0.89-1.21 | 0.99 | 0.80-1.22 | 1660 | 30.7 | 1.06 | 0.91-1.24 | 1.13 | 0.96-1.34 |
| **Current** | 502 | 9.2 | 0.52 | 0.39-0.70 | 0.51 | 0.34-0.78 | 459 | 8.5 | 0.61 | 0.46-0.80 | 0.59 | 0.44-0.81 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Physical activity** [d] | | | | | | | | | | | | |
| **Active** | 2379 | 43.7 | Ref | | Ref | | 2113 | 39.1 | Ref | | Ref | |
| **Inactive** | 3067 | 56.3 | 0.84 | 0.72-0.97 | 0.83 | 0.68-1.01 | 3296 | 60.9 | 0.91 | 0.78-1.06 | 0.81 | 0.69-0.95 |
| **Season** | | | | | | | | | | | | |
| **Summer (Apr-Sep)** | 2702 | 49.6 | Ref | | Ref | | 2721 | 50.3 | Ref | | Ref | |
| **Winter (Oct-Mar)** | 2744 | 50.4 | 1.04 | 0.90-1.19 | 1.15 | 0.94-1.39 | 2688 | 49.7 | 1.11 | 0.96-1.28 | 1.17 | 1.01-1.37 |

OR, odds ratio; CI, confidence interval; SU+CLO, cod liver oil supplement user; SU-CLO, supplement user who does not consume cod liver oil

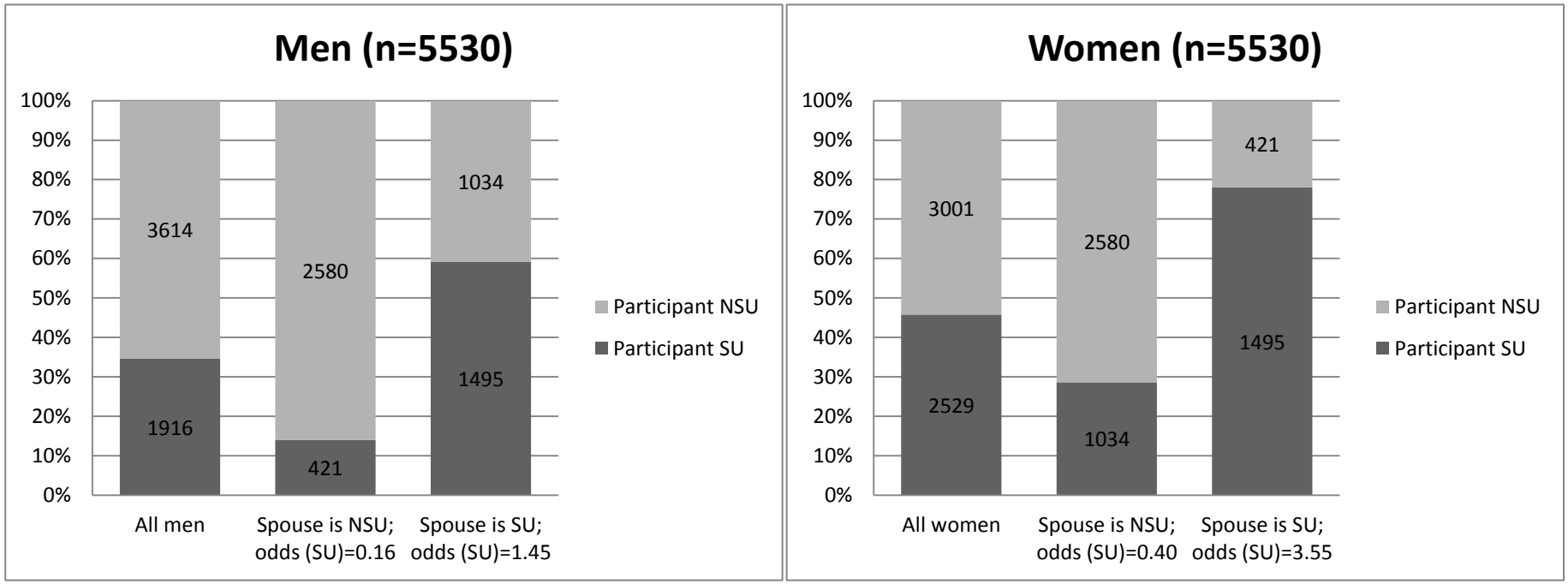
[a] Participants with complete variable data (listwise) were included in the analysis (98%).

[b] Some qualification takes the summed categories of A-level, O-level and Degree.

[c] Manual takes the summed categories of: skilled manual, semi-skilled and non-skilled. Non-manual takes the summed categories of: professional, managerial and skilled non-manual.

[d] Active takes the summed categories of active and moderately active. Inactive contains the categories inactive and moderately inactive.

**Figure 1: Dietary supplement use in the EPIC-Norfolk cohort study, by spouse's supplement use (N=11 060).**




SU, supplement user, NSU, non-supplement user.

**Supplement Table 1: Comparison of household sample to all men and women in EPIC-Norfolk who attended the first health examination.**

| Participant's characteristic | MEN Attended health examination N (%) | Sample N (%) | WOMEN Attended health examination N (%) | Sample N (%) |
|---|---|---|---|---|
| **Dietary supplement use** | 10,241 | 5530 | 12,779 | 5530 |
| **NSU** | 6991 (68.3) | 3614 (65.4) | 7048 (55.2) | 3001 (54.3) |
| **SU** | 3250 (31.7) | 1916 (34.6) | 5731 (44.8) | 2529 (45.7) |
| | | | | |
| **Age** | 11,607 | 5530 | 14,032 | 5530 |
| **<=50 years** | 2707 (23.3) | 744 (13.5) | 3652 (26.0) | 1207 (21.8) |
| **>50-60 years** | 3596 (31.0) | 1782 (32.2) | 4430 (31.6) | 1981 (35.8) |
| **>60-70 years** | 3635 (31.3) | 2157 (39.0) | 4163 (29.7) | 1907 (34.5) |
| **>70 years** | 1669 (14.4) | 847 (15.3) | 1787 (12.7) | 435 (7.9) |
| | | | | |
| **Mean (SD) Age** | 59.1 (9.3) | 61.1 (8.4) | 58.4 (9.3) | 58.5 (8.3) |
| **Mean (SD) BMI** | 26.5 (3.3) | 26.5 (3.2) | 26.2 (4.4) | 26.2 (4.2) |
| | | | | |
| **Social class** [a] | 11,400 | 5483 | 13,667 | 5463 |
| **Manual** | 4743 (41.6) | 2197 (40.1) | 5274 (38.6) | 2143 (39.2) |
| **Non-manual** | 6657 (58.4) | 3286 (59.9) | 8393 (61.4) | 3320 (60.8) |
| | | | | |
| **Level of education** [b] | 11,598 | 5530 | 14,023 | 5530 |
| **Some qualifications** | 8064 (69.5) | 3800 (68.7) | 8103 (57.8) | 3073 (55.6) |
| **No qualifications** | 3534 (30.5) | 1730 (31.3) | 5920 (42.2) | 2457 (44.4) |
| | | | | |
| **Smoking** | 11,526 | 5496 | 13,893 | 5483 |
| **Never** | 3837 (33.3) | 1823 (33.2) | 7837 (56.4) | 3343 (61.0) |
| **Former** | 6284 (54.5) | 3165 (57.6) | 4477 (32.2) | 1671 (30.5) |
| **Current** | 1405 (12.2) | 508 (9.2) | 1579 (11.4) | 469 (8.6) |
| | | | | |
| **Physical activity** | 11,597 | 5530 | 14,023 | 5530 |
| **(Moderately) inactive** | 6435 (55.5) | 3119 (56.4) | 8761 (62.5) | 3385 (61.2) |
| **(Moderately) active** | 5162 (44.5) | 2411 (43.6) | 5262 (37.5) | 2145 (38.8) |

SU, supplement user, NSU, non-supplement user.

[a] Manual takes the summed categories of: skilled manual, semi-skilled and non-skilled. Non-manual takes the summed categories of: professional, managerial and skilled non-manual.

[b] Some qualification takes the summed categories of A-level, O-level and Degree.