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## Original Research

**Country specific associations between social contact and mental health: evidence from civil servant studies across Great Britain, Japan and Finland**N. Cable <sup>a,\*</sup>, T. Chandola <sup>b</sup>, T. Lallukka <sup>c,d</sup>, M. Sekine <sup>e</sup>, E. Lahelma <sup>d</sup>, T. Tatsuse <sup>e</sup>, M.G. Marmot <sup>a</sup><sup>a</sup> Department of Epidemiology and Public Health, University College London, 1-19 Torrington Place, London, WC1E 6BT, United Kingdom<sup>b</sup> Cathie Marsh Institute for Social Research, University of Manchester, Humanities Bridgeford St Building Manchester, M13 9PL, United Kingdom<sup>c</sup> Finnish Institute of Occupational Health, Disability Prevention Research Centre, P.O. Box 40, 00251, Helsinki, Finland<sup>d</sup> Department of Public Health, University of Helsinki, P.O. Box 20 (Tukholmankatu 8B), FIN-00014 University of Helsinki, Finland<sup>e</sup> Department of Epidemiology and Health Policy, University of Toyama, Graduate School of Medicine and Pharmaceutical Sciences, 2630 Sugitani, Toyama 930-0194, Japan

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## ABSTRACT

**Objectives:** Little is known about which component, such as social contact of social networks is associated with mental health or whether such an association can be observed across countries. This study examined whether the association between frequent social contact and mental health differs by composition (relatives or friends) and whether the associations are similar across three occupational cohorts from Great Britain, Japan, and Finland.

**Study design:** Cross-sectional analysis of data from three prospective cohort studies.

**Methods:** Participants were civil servants of a prospective cohort study based in London (Men:  $n = 4519$ ; Women:  $n = 1756$ ), in the West Coast of Japan (Men:  $n = 2571$ ; Women:  $n = 1102$ ), and in Helsinki, Finland (Men:  $n = 1181$ ; Women:  $n = 5633$ ); we included the information on study variables which is complete. Mental health function was the study outcome, indicated by the total score from the Mental Health Component on the Short Form Health Survey36. Participants reported frequencies of contacts with their relatives or friends via a questionnaire. Age, marital status, and occupational position were treated as confounders in this study.

**Results:** Findings from multiple regression showed that the associations between social contact and mental health function were different depending on country of origin and

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gender. Among British or Japanese men, frequent contact with both friends and relatives was positively associated with their mental health function, while only social contact with friends was significantly associated with mental health of Finnish men. In women, the patterns of the associations between social contact and mental health were more distinctive: friends for Great Britain, relatives for Japan, and friends and relatives for Finland. These significant associations were independent of the confounders.

**Conclusions:** Social contact was related to mental health of working people; however, culture and gender are likely to be tapped into.

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## Introduction

In 2004 mental disorders were identified as leading causes of the global burden of disease worldwide, despite the mortality due to these conditions being considerably low.<sup>1</sup> Of these disorders, depression was estimated to have affected over 150 million people worldwide, and was also the third leading cause of moderate to severe disabilities. Individuals experiencing mental disorders are likely to be discriminated against or socially excluded,<sup>2</sup> which the World Health Organisation has sought to address by proposing action plans to prevent mental disorders as well as to provide adequate community-based infrastructure to manage such disorders when they occur. Previous work examining the association between social networks and mental health reported a dose–response relationship between them,<sup>3–6</sup> suggesting that social networks could be used to protect individuals against poor mental health.

Social networks have been used interchangeably with social support,<sup>7,8</sup> contributing to inconsistent findings in the previous studies. Social networks have been thought to promote individual health directly through interaction with the members embedded within the social networks in the forms of social influence or self-validation.<sup>8–10</sup> On the other hand, with the presence of stressors, social support is thought to indirectly affect individual health by mobilising existing resources.<sup>9</sup> This difference in the association with individual health was further shown by an extensive review of the relevant literature by Cohen and Willis.<sup>10</sup>

We noted variations in mental health by country and gender in our previous work, specifically that mental health was poorer among Japanese participants, especially among the female participants.<sup>11–13</sup> We think this gender and country difference in mental health can be associated with frequencies in social contact, a prime characteristic of social networks.<sup>14</sup>

Furthermore, Berkman and Syme<sup>15</sup> developed the Social Network Index, the score derived from a weighted total score on frequencies of social contact with proximal or distal social ties, such as family and friends, which has been adapted by many studies.<sup>16–19</sup> However, a previous study using a British birth cohort study showed that the associations between the size of social networks and psychological well-being were different by composition and were specific to gender.<sup>20</sup> This opens up a debate as to whether or not the effects of social

network composition are similar among people across different cultures.

In addition, closeness with relatives was reported to be different across European countries,<sup>21</sup> while kinship bounded by marriage has been a focal point of social relationships in Japan.<sup>22</sup> In Japan married women are likely to be expected to adopt family members of their husband over their own because they belong to the 'ie' (family in English) of their husband. Those raise the question of whether the association between social networks, especially kinship networks, and mental health is similar among men and women across countries. Our aim is to explain the country differences in mental health in relation to social contact by composition (relatives or friends) across Great Britain, Japan, and Finland through examining this research question: how do the associations between social contact by composition (relatives or friends) and mental health differ between British, Japanese, and Finnish participants?

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## Methods

### Study subjects

Datasets for this study are from the Whitehall II Study (WII), the Japanese Civil Servant Study (JACS), and the Helsinki Health Study (HHS). In 1985, the WII was initiated to examine the detrimental effect of social gradient on health and illness.<sup>23</sup> Civil servants working in London offices were targeted for this cohort study. Since 1985, participants have been followed to assess their social environment, psychosocial exposure, physical and psychological well-being, and health-related behaviours and outcomes. The available cases of 4440 men and 1708 women of the WII participants from the Phase V data, collected during 1997 and 1999 were used for this study.

JACS is a collaborative study along with the WII study.<sup>24</sup> Similarly to the study design for the WII study, the participants in the JACS were all civil servants employed in a west coast prefecture of Japan; they voluntarily responded to a postal questionnaire mailed to them. Phase I data of the JACS, collected during 1998 and 1999, were used for this study to examine cultural differences in the effect of social networks on mental health. The participants were aged 20 to 65 and were non-industrial employees at the time of the survey. Available cases of 2532 men and 1087 women of the JACS participants were used for this study.

The HHS was planned following the WII.<sup>25</sup> The participants were 40- to 60-year-old employees of the City of Helsinki, Finland, at baseline in 2000–2002 ( $n = 8960$ , response rate 67%). The survey questionnaire comprised similar measures on social networks, mental health, and covariates as the WII. Data for a total of 7168 women and 1792 men were available for this study, the gender distribution reflecting that among the employees of the City of Helsinki and the public sector more generally.

Detailed ethical information about the WII, JACS and HHS has been described elsewhere.<sup>12,13</sup> University College London Medical School Committee on the ethics of human research has approved the WII study, while an ad hoc committee of the civil service formed by the ordinary members of the Safety and Health Committee, labour representatives and personnel representatives has approved the content and ethical aspect of the study including data management and publication of any findings from the JACS data. The ethics committees of the health authorities of the City of Helsinki and the Department of Public Health, University of Helsinki, have approved the HHS study.<sup>25</sup>

All of the participants were informed that their participation was voluntary and they were free to refuse or withdraw their participation from the study. Informed consents were obtained from all of the participants. These occupational cohorts are homogeneous in nature: people of working age, working in a stable job. Although this may limit the generalisation of the findings to such a population, it is rather the key strength of this study as we are not comparing heterogeneous populations.

### Exposures

*Social contact with relatives or friends* comprises the main exposures in this study. The words ‘relatives or friends’ in Japanese and Finnish convey the same meaning as the corresponding English words. *Social contact with relatives* is indicated by the response to the questions addressing frequency of face-to-face contact with relatives who live outside of the household as follows: (1) contacted almost daily, (2) once a week, (3) once a month, (4) every few months, (5) almost no contact. Those who identified that they had no relatives outside of the household were treated as the fifth category. In this study, all responses were reversed in order, 1 being ‘almost no contact’, as opposed to 5 being ‘contacted almost daily’.

The questions assessing frequent contact with friends were addressed to the participants similarly to the questions for face-to-face contact with relatives. We also reversed the order of responses for social contact with friends to be consistent with the responses for social contact with relatives.

### Outcome

Mental health function is our study outcome, indicated by the mental component (MCS) from the Short Form Health Survey36 (SF-36). We applied the US-based weights to derive the MCS score as suggested.<sup>26,27</sup> The weighted total score of the MCS ranges from 0 to 100; the score of 50 is considered as having a good functioning in mental health.<sup>11</sup> The MCS

has been validated and is reported to have a high correlation with the General Health Questionnaire that is another measurement for psychological well-being used in the WII and HHS. In this study we used a continuous value of the MCS, with a higher score indicating having better mental health.

### Confounders

In this study, age, occupational position and partnership are treated as confounders because social networks were found to be associated with age<sup>28,29</sup> and partnerships,<sup>20</sup> while mental health is likely to be determined socially<sup>30</sup> as well as by age.<sup>28</sup> Respondents' age was derived from the duration between the date of respondents' birth and the date for the survey instrumentation. Partnership in this study is indicated by cohabitation status, gathered from participants' marital or cohabitation status. Being partnered is indicated as 1, as opposed to 0 for not being partnered.

Information about respondents' occupational position was based on the three-level civil servant position (1 = executive, 2 = administrative, 3 = clerical) for the WII. For the JACS, it was based on the four-point occupational position obtained from the response to the questionnaire (1: executive, 2: professional, 3: clerical, and 4: non-clerical). In this study, the occupational position of 3 and 4 were combined in order to be comparable with the WII study. In the HHS, the three occupational position were: 1 = professionals and managers, 2 = semi-professionals, 3 = routine non-manual employees. These data were derived from the City of Helsinki personnel register for those who had given an informed consent for such linkage (78%). For others, occupational position was based on self-reported questionnaire survey data.

### Data analyses

We used multiple linear regression to assess the magnitude of the associations between social contact with relatives or friends and mental health across countries. We obtained estimates for each model (1) unadjusted, (2) mutually adjusted between social contact variables, and (3) fully adjusted for age, partnership, and occupational position. In this study, men and women in each country were analysed separately to assess possible gender differences in the patterns of the associations. All analyses were conducted using Stata v 13.1.<sup>31</sup>

## Results

Table 1 shows descriptive findings of social contact and mental health by country and gender. Slightly more Finnish participants (40%) than British participants (30%) reported that they met their relatives at least once a week. In the case of Japanese participants, only 17% of male participants and 27% of female participants responded that they met their relatives at least once a week. Similarly, over 50% of the Finnish participants and around 40% of the British participants responded that they met their friends at least once a week, whereas many Japanese participants saw their friends very

**Table 1 – Descriptive analysis on social contact, mental health and covariates presented separately by country and gender.**

Men	WII <sup>a</sup> (N = 4519)	JACS <sup>b</sup> (N = 2571)	HHS <sup>c</sup> (N = 1181)
<i>Social contact with relatives (%)</i>			
Almost never	338(7.5)	460(17.9)	25(2.1)
2-3/month	1426(31.6)	884(34.4)	301(25.5)
Monthly	1176(26.0)	780(30.3)	373(31.6)
Weekly	1304(28.9)	415(16.1)	418(35.4)
Daily	275(6.1)	32(1.2)	64(5.4)
<i>Social contact with friends (%)</i>			
Almost never	424(9.4)	723(28.1)	18(1.5)
2-3/month	1103(24.4)	812(31.6)	179(15.2)
Monthly	1176(26.0)	641(24.9)	331(28.0)
Weekly	1490(33.0)	370(14.4)	451(38.2)
Daily	326(7.2)	25(1.0)	202(17.1)
<i>Partnership</i>			
Not partnered (%)	735(16.3)	496(19.3)	232(19.6)
Partnered	3784(83.7)	2075(80.7)	949(80.4)
<i>Occupational position</i>			
1 (High) (%)	2420(53.6)	187 (7.30)	701(59.4)
2	1898(42.0)	1201(46.7)	315(26.7)
3 (Low)	201(4.4)	1183(46.0)	165(14.0)
Mean MCS (SD)	51.53(9.15)	46.49(10.02)	51.16(10.19)
Mean Age (SD)	55.64(6.00)	42.70(10.05)	50.29(6.76)
Women	WII <sup>a</sup> (N = 1756)	JACS <sup>b</sup> (N = 1102)	HHS <sup>c</sup> (N = 5633)
<i>Social contact with relatives (%)</i>			
Almost never	135(7.7)	137(12.4)	61(1.1)
2-3/month	541(30.8)	305(27.7)	1189(21.1)
Monthly	419(23.9)	361(32.8)	1645(29.2)
Weekly	535(30.5)	262(23.8)	2196(39.0)
Daily	126(7.2)	37(3.4)	542(9.6)
<i>Social contact with friends (%)</i>			
Almost never	130(7.4)	216(19.6)	44(0.8)
2-3/month	384(21.9)	357(32.4)	799(14.2)
Monthly	410(23.3)	295(26.8)	1612(28.6)
Weekly	694(39.5)	216 (19.6)	2369(42.1)
Daily	138(7.9)	18 (1.6)	809(14.4)
<i>Partnership status</i>			
Not partnered (%)	672(38.3)	322(29.2)	1771(31.4)
Partnered	1084(61.7)	780(70.8)	3862(68.6)
<i>Occupational position</i>			
1 (High) (%)	372(21.2)	4(0.4)	1731(30.7)
2	857(48.8)	724(65.7)	1199(21.3)
3 (Low)	527(30.0)	374(33.9)	2703(48.0)
Mean MCS (SD)	49.76(10.30)	44.09 (10.21)	51.48(9.84)
Mean Age (SD)	55.97(6.02)	40.23 (10.59)	48.98(6.55)

<sup>a</sup> Whitehall II participants.

<sup>b</sup> Japanese Civil Servant Study participants.

<sup>c</sup> Helsinki Health Study participants.

infrequently. Over 70% of Japanese civil servants met their friends monthly or less, while slightly over 20% of them rarely met with their friends.

Demographic information shows that most of the participants, especially male participants, were partnered. Among the British and Finnish male participants, over 50% were in the high occupational position, while only 7% of the Japanese male participants were in the similar occupational position.

On the other hand, 31% of Finnish female and 21% of British female participants were at the high occupational position, while less than 1% of Japanese female participants were at the similar rank. According to the mean scores on age of the participants, Japanese civil servants appeared to be the youngest of all.

In terms of mental health, Japanese civil servants appeared to have the poorest mental health of all, with British participants having the highest mean score (Table 1). When these scores were assessed via frequencies of social contact (almost never, 2 to 3 times per month, monthly, weekly, and daily), it seems that most frequent social contact with relatives or friends showed the highest mean scores on mental health among most of the participants, apart from Japanese (Table 2).

Unadjusted and adjusted estimates, obtained through analyses using multiple regression to examine the associations between social contact by composition (relatives and friends) and mental health are presented by country and gender in Table 3. Frequent social contact (up to weekly) with

**Table 2 – Distribution of MCS by the composition of social contact (relatives and friends), presented separately by country and gender.**

Men	WII <sup>a</sup> (N = 4519)	JACS <sup>b</sup> (N = 2571)	HHS <sup>c</sup> (N = 1181)
<i>Mean (SD)</i>			
<i>Social contact with relatives</i>			
Almost never	48.74(11.07)	43.53(10.93)	47.01(14.63)
2-3/month	51.05(9.22)	46.37(10.17)	49.33(11.13)
Monthly	51.74(8.87)	47.52(9.39)	50.60(10.13)
Weekly	52.24(8.74)	48.12(9.11)	52.82(9.01)
Daily	53.10(8.44)	46.39(9.63)	53.85(9.03)
<i>Social contact with friends</i>			
Almost never	48.51(11.06)	44.67(11.11)	40.47(16.31)
2-3/month	51.07(9.11)	46.90(9.28)	50.12(10.64)
Monthly	51.57(8.83)	47.70(9.19)	51.15(9.75)
Weekly	52.38(8.76)	46.91(10.36)	50.10(10.10)
Daily	52.95(8.49)	49.04(8.90)	53.20(17.1)
Women	WII <sup>a</sup> (N = 1756)	JACS <sup>b</sup> (N = 1102)	HHS <sup>c</sup> (N = 5633)
<i>Mean (SD)</i>			
<i>Social contact with relatives</i>			
Almost never	47.18(11.71)	41.63(10.90)	46.21(12.82)
2-3/month	48.94(11.13)	44.49(9.60)	49.67(10.70)
Monthly	50.25(9.78)	44.23(10.38)	51.19(9.88)
Weekly	50.55(9.70)	44.55(10.44)	52.41(9.09)
Daily	51.08(8.42)	45.40(8.28)	53.14(9.41)
<i>Social contact with friends</i>			
Almost never	44.82(11.70)	43.90(10.16)	43.83(15.05)
2-3/month	49.13(9.87)	44.35(10.20)	48.48(11.47)
Monthly	50.24(9.70)	44.83(10.49)	51.23(9.70)
Weekly	50.35(10.45)	44.27(9.91)	52.24(9.24)
Daily	51.73(9.64)	43.47(10.94)	53.13(8.81)

<sup>a</sup> Whitehall II participants.

<sup>b</sup> Japanese Civil Servant Study participants.

<sup>c</sup> Helsinki Health Study participants.

**Table 3 – Country specific associations (unadjusted, mutually and fully adjusted) between social contact by composition and mental health, tested by using multiple regression analysis in men and women.**

Men	WII <sup>a</sup> (N = 4519)			JACS <sup>b</sup> (N = 2571)			HHS <sup>c</sup> (N = 1181)		
	Unadjusted	Mutually adjusted <sup>d</sup>	Fully adjusted <sup>e</sup>	Unadjusted	Mutually adjusted <sup>d</sup>	Fully adjusted <sup>e</sup>	Unadjusted	Mutually adjusted <sup>d</sup>	Fully adjusted <sup>e</sup>
<b>Relatives</b>									
Almost never	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
2-3/month	2.32***	1.91**	1.63**	2.83***	2.54***	2.10***	2.32	0.65	0.61
Monthly	3.01***	2.49***	1.71**	3.99***	3.50***	2.74***	3.58	1.64	1.45
Weekly	3.50***	2.87***	1.94***	4.59***	4.05***	3.44***	5.80**	3.83	3.39
Daily	4.36***	3.66***	2.15**	2.86	2.22	1.81	6.83**	4.41	3.52
<b>Friends</b>									
Almost never	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
2-3/month	2.56***	2.34***	1.78**	2.23***	1.70**	1.85***	9.65***	9.17***	8.60**
Monthly	3.06***	2.69***	2.12**	3.03***	2.32***	2.61***	10.68***	9.62***	9.51***
Weekly	3.87***	3.41***	2.73***	2.24***	1.56*	2.28***	10.63***	9.45***	9.58***
Daily	4.44***	3.97***	3.43***	4.37*	4.01*	4.51*	12.74***	11.39***	11.79***
<b>Women</b>									
<b>Relatives</b>									
Almost never	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
2-3/month	1.76	1.32	0.95	2.86**	2.88**	3.09**	3.47**	2.45	1.96
Monthly	3.07**	2.56*	2.22*	2.60*	2.64*	2.86**	4.98***	3.57**	3.00*
Weekly	3.37**	2.75**	2.10*	2.92**	2.93**	3.34**	6.21***	4.55***	3.93**
Daily	3.90**	3.12*	2.18	3.77*	3.87*	4.55*	6.94***	5.10***	4.52**
<b>Friends</b>									
Almost never	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
2-3/month	4.31***	4.14***	4.17***	0.45	0.16	0.21	4.65**	4.04**	3.98**
Monthly	5.41***	5.04***	5.07***	-0.07	-0.32	-0.35	7.41***	6.34***	6.45***
Weekly	5.52***	5.25***	5.06***	0.36	0.33	0.14	8.41***	7.21***	7.53***
Daily	6.91***	6.45***	6.08***	-0.43	-0.53	-0.86	9.30***	8.06***	8.48***

\*P < 0.05, \*\*P < 0.01, \*\*\*P < 0.0001.  
<sup>a</sup> Whitehall II participants.  
<sup>b</sup> Japanese Civil Servant Study participants.  
<sup>c</sup> Helsinki Health Study participants.  
<sup>d</sup> Social contact variables are mutually adjusted with each other.  
<sup>e</sup> All estimates were fully adjusted for age, partnership status, and occupational position.

relatives was positively associated with mental health in British and Japanese male participants even after having accounted for the effects from confounders that are marital status, occupational position and age. In Finnish male participants, weekly or more contact with relatives was significantly and positively associated with mental health in the unadjusted model; however, these became attenuated after having accounted for the effects from confounders. In contrast, frequent contact with friends appeared to be more strongly associated with mental health among all male participants, especially among Finnish participants, compared with the association between contact with relatives and mental health.

In women social contact with relatives was strongly associated with mental health in Japanese and Finnish participants, while it was marginal among British participants. On the other hand, social contact with friends and mental health were positively associated in the group of British and Finnish female participants, while the association was almost non-existent in the group of Japanese female participants.

Frequent social contact with friends appeared to be associated with mental health function of the British and Finnish female civil servants only.

## Discussion

Our findings showed that social contact with relatives or friends contributed differently to mental health function according to country of origin and gender. It appeared that the mental health of British or Japanese men may benefit from contact with both friends and relatives, while social contact with friends may weigh more on the mental health of Finnish men. In women, the patterns of the associations between social contact and mental health were more distinctive: friends for Great Britain, relatives for Japan, and friends and relatives for Finland. Contact with friends did not bear any significance in Japanese women's mental health. Our study updates the existing evidence between social relationship and health across countries,<sup>21,32</sup> adding presence of country- and

gender-specific patterns of the association between social contact and mental health.

### Contact with relatives within the context of country

Cable et al.<sup>20</sup> reported that kinship networks were the independent source of psychological well-being among middle-aged British men born in 1958, but not among women, which was consistent with our finding. Nakane<sup>22</sup> defined 'ie' ('family' in English) as the centre of social relationships in Japan, where traditional family ties are strong and patriarchal in nature. It was not surprising to see the strong associations between weekly interaction with relatives and mental health among Japanese male civil servants; however, we did not expect to find the association became non-significant in the case of daily contact with relatives (most frequent in the category). We anticipated weak associations between contact with relatives and Japanese women's mental health because of the likelihood of their marrying into their spouse's kinship network.<sup>22</sup> These women may have seen their own relatives as well as those of their spouse, but detailed information about the contact points was not available to us in our study.

Sweester<sup>33</sup> found that married couples in Helsinki interacted predominantly with relatives of the female partner's side rather than with those of the male partner's side. This is the opposite practice to that of Japanese traditional culture, described by Nakane's 'ie'. Moreover, these (Finnish) male partners were more likely to have requested domestic or even practical assistance from their in-laws than from their own parents or siblings.<sup>33</sup> Extending these findings to our study, it is possible that female civil servants in Helsinki were likely to be in frequent contact with their blood relatives, whereas contacts with relatives for Finnish male civil servants were likely to be with relatives from their female partner's side if they were partnered. Again, detailed information about contact points is not available to us; we are unable to ascertain whether the association between social contact with relatives and mental health would be different depending on who these relatives are.

### Contact with friends within the context of country

In the study by Cable et al.,<sup>20</sup> friendship networks were reported as the independent source of psychological well-being among middle-aged British men and women. We found consistent positive associations between frequent social contact with friends and mental health function of civil servants from three countries, with the exception of Japanese female civil servants. Furthermore, friendship appears to be more important for the mental health of Finnish men, while it seems not to bear significance for Japanese women's mental health.

In our study, having contact with relatives was not statistically significant for the mental health function of Finnish men after having accounted for social contact with friends and confounders. It is possible that Finnish men in our study may be more mentally reliant on friendship than on kinship than is the case with British or Japanese men if they were indeed meeting with their spouse's relatives over their own as indicated by Sweester.<sup>33</sup> Although we need to be cautious in interpretation because of the lack of available information on contact points, further studies will be able to show the

mechanisms of country differences in the associations between kinship and mental health.

In the case of Japanese female civil servants, they appeared to be in less contact with their friends as compared with British or Finnish female civil servants. Indeed, 20% of Japanese female civil servants responded that they rarely had contact with their friends. In this study, Japanese participants were younger than the civil servants from Great Britain or Finland. Family role responsibility (i.e. caring) were found to be negatively affected the mental health of women<sup>34</sup>; one can speculate this might be the case for Japanese women in addition to a lack of opportunities to meet up with friends by attending to their family role responsibility. However, we accounted for the effects from age, partnership and occupational position; all estimates of social contact are statistically independent. Further investigation examining what aspect of social contact with friends may have a negative impact on Japanese women's mental health would be useful.

### Limitations

As stated previously, information about social contact is also a limitation in our study. Selfhout et al.<sup>35</sup> reported that adolescents with a higher score on extraverted or agreeable personality trait were likely to have more friends than those who had a lower score on either trait and they were more likely to choose others with similar personality traits as their friends. In our study, information about personality traits was not available at the time of survey. Future studies measuring multiple aspects of social contact, similar to the study by Michie et al.<sup>36</sup> could be useful in providing further knowledge to underpin the contextual factors associated with social relationships and mental health.

As stated in the method section, we applied US weights to derive the MCS score. SF-36 was also validated in the Finnish population<sup>37</sup> as well as in the other European countries.<sup>38</sup> Using the Japanese population, Suzukamo et al.<sup>39</sup> reported that a three component model (mental, physical, and role) fitted the data better than the traditional two component model (mental and physical). Fukuhara et al.<sup>40</sup> demonstrated the construct validity of the MCS among the Japanese population by showing a strong association with depression, which was also reported in the work by Suzukamo et al.<sup>39</sup>

In our study, we analysed the data separately to assess associations between social contact and mental health across countries to address the research questions. Further studies using SF-36 among the Japanese population will be useful when researchers are to test the magnitude of associations between social contacts and mental health across countries by pooling the data.

One can also argue that the cross-sectional nature of this study is a limitation; however, establishing a causal inference is not within our scope. Our findings suggest cultural and gender contexts are important to consider when examining the association between social relationships and health.

### Strengths

The use of civil servants from Great Britain, Japan and Finland is likely to have limited generalisation in respect of our

findings; however, this homogenous nature of occupational cohorts (people of working age, working in a stable job) allowed us to closely understand the association between social contact and mental health, separately by gender and country. Previous studies that examined the association between social ties<sup>41</sup> or social capital<sup>42</sup> and mental health treated gender as a covariate. By examining men and women separately, our study was able to show that country differences in the associations between social ties and mental health are gender-specific, thus adding new knowledge to the research areas of social relationships and health.

Indices to quantify the degree of social networks often apply weights according to the proximity of social ties (i.e. Social Network Index). Our findings showed that the associations between social contact and mental health are different by composition and are specific to country and gender. We suggest similar investigation to validate the association between social relationships and mental health by paying close attention to each component of social networks, gender and country.

In summary, our study showed that social contact were positively associated with mental health. However, the magnitude of such association is likely to be different by composition (relatives or friends) that is specific to country and gender.

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## Author statements

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### Ethical standards

University College London Medical School Committee on the ethics of human research has approved the Whitehall II study, while an ad hoc committee of the civil service formed by the ordinary members of the Safety and Health Committee, labour representatives and personnel representatives has approved the content and ethical aspect of the study including data management and publication of any findings from the JACS data. The ethics committees of the health authorities of the City of Helsinki and the Department of Public Health, University of Helsinki, have approved the HHS study. All of the participants were informed that their participation was voluntary and they were free to refuse or withdraw their participation from the study. Informed consents were obtained from all of the participants. The manuscript does not contain clinical or patient information.

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## Competing interests

Noriko Cable, Tarani Chandola, Tea Lallukka, Michikazu Sekine, Eero Lahelma, Takashi Tatsuse, Michael G Marmot declare that they have no conflicts of interests.

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