Table 2. Age- and multivariate-adjusted odds ratios for suboptimal health† based on the SF-36 scales by alcohol consumption in the HIPOP-OHP Study

Model‡	SF-36 scales	Non-drinker	Ex-drinker	Current drinkers by alcohol consumption, g/d			
				1.0–22.9	23.0–45.9	46.0–68.9	69.0 and over
Model 1	Role-Physical	1.00	1.18 (0.92–1.52)	0.84 (0.72–0.97)*	0.94 (0.79–1.13)	0.94 (0.74–1.19)	0.86 (0.66–1.12)
n=4,521	General Health	1.00	1.69 (1.29–2.20)**	0.83 (0.72–0.96)*	0.94 (0.78–1.12)	1.21 (0.95–1.53)	0.86 (0.66–1.11)
	Vitality	1.00	0.94 (0.73–1.22)	0.82 (0.70–0.94)**	0.79 (0.66–0.95)*	0.69 (0.55–0.88)**	0.70 (0.54–0.91)**
	Role-Emotional	1.00	0.98 (0.76–1.26)	0.97 (0.84–1.12)	1.05 (0.88–1.26)	0.97 (0.77–1.23)	0.89 (0.67–1.17)
	Mental Health	1.00	1.15 (0.90–1.48)	0.87 (0.75–1.01)	1.04 (0.87–1.25)	1.10 (0.87–1.39)	0.89 (0.68–1.16)
Model 2	Role-Physical	1.00	1.15 (0.89–1.49)	0.86 (0.74–1.00)	0.93 (0.77–1.12)	0.92 (0.72–1.17)	0.84 (0.63–1.11)
n=4,415	General Health	1.00	1.76 (1.34–2.33)**	0.90 (0.77–1.04)	0.98 (0.81–1.19)	1.28 (1.00–1.64)	0.83 (0.63–1.10)
	Vitality	1.00	0.96 (0.73–1.25)	0.86 (0.74–1.01)	0.79 (0.65–0.96)*	0.68 (0.53–0.88)**	0.67 (0.50–0.89)**
	Role-Emotional	1.00	0.96 (0.74–1.25)	0.98 (0.84–1.14)	1.04 (0.86–1.25)	0.93 (0.73–1.20)	0.95 (0.71–1.26)
	Mental Health	1.00	1.13 (0.86–1.48)	0.92 (0.79–1.08)	1.04 (0.85–1.26)	1.10 (0.85–1.41)	0.87 (0.65–1.16)
Model 3	Role-Physical	1.00	1.18 (0.91–1.54)	0.85 (0.73–0.997)*	0.93 (0.77–1.12)	0.92 (0.72–1.18)	0.84 (0.64–1.12)
n=4,333	General Health	1.00	1.68 (1.27–2.22)**	0.89 (0.76–1.04)	0.97 (0.80–1.17)	1.23 (0.96–1.59)	0.80 (0.60–1.06)
	Vitality	1.00	0.97 (0.74–1.28)	0.86 (0.73–1.01)	0.77 (0.63–0.94)*	0.69 (0.53–0.90)**	0.67 (0.50–0.90)**
	Role-Emotional	1.00	1.02 (0.78–1.34)	0.99 (0.85–1.16)	1.04 (0.86–1.26)	0.97 (0.76–1.25)	0.97 (0.73–1.29)
	Mental Health	1.00	1.11 (0.84–1.46)	0.91 (0.78–1.07)	1.03 (0.84–1.26)	1.13 (0.87–1.46)	0.88 (0.65–1.18)

*p<0.05, **p<0.01. †Suboptimal health was defined as less than median SF-36 on each scale. ‡Model 1 was adjusted for age. Model 2 was adjusted for age plus marriage status (married, other), working hours (daytime, other), physical activity at work (heavy, other), self-reported job stress (yes, no), smoking status (current smoker, other), and regular exercise (yes, no). Model 3 was adjusted for factors in model 2 plus obesity, hypertension, hyperlipidemia, and diabetes.

Table 3. Age- and multivariate-adjusted odds ratios for suboptimal health† based on the SF-36 scales by frequency of alcohol drinking in the HIPOP-OHP Study

Model‡	SF-36 scales	Non-drinker	Ex-drinker	Current drinkers by frequency of alcohol drinking per week, d/wk			
				1–2	3–4	5–6	Every day
Model 1	Role-Physical	1.00	1.18 (0.92–1.51)	0.88 (0.72–1.09)	0.93 (0.76–1.13)	0.82 (0.69–0.99)*	0.88 (0.75–1.04)
n=4,521	General Health	1.00	1.68 (1.29–2.20)**	0.78 (0.63–0.96)*	1.04 (0.85–1.27)	0.86 (0.72–1.03)	0.93 (0.79–1.09)
	Vitality	1.00	0.95 (0.73–1.22)	0.76 (0.61–0.94)**	0.78 (0.64–0.96)*	0.68 (0.57–0.82)**	0.87 (0.74–1.02)
	Role-Emotional	1.00	0.98 (0.76–1.26)	0.96 (0.78–1.19)	1.09 (0.89–1.34)	0.91 (0.76–1.09)	0.99 (0.84–1.16)
	Mental Health	1.00	1.15 (0.90–1.48)	0.78 (0.63–0.96)*	1.00 (0.82–1.23)	0.89 (0.74–1.07)	1.03 (0.88–1.21)
Model 2	Role-Physical	1.00	1.15 (0.89–1.49)	0.93 (0.75–1.15)	0.96 (0.78–1.18)	0.81 (0.67–0.98)*	0.87 (0.74–1.03)
n=4,415	General Health	1.00	1.76 (1.34–2.32)**	0.83 (0.67–1.03)	1.11 (0.90–1.37)	0.90 (0.74–1.09)	0.97 (0.82–1.15)
	Vitality	1.00	0.96 (0.73–1.26)	0.77 (0.62–0.97)*	0.84 (0.67–1.04)	0.70 (0.57–0.85)**	0.88 (0.74–1.05)
	Role-Emotional	1.00	0.96 (0.74–1.25)	0.95 (0.76–1.18)	1.13 (0.92–1.40)	0.90 (0.74–1.09)	0.99 (0.83–1.17)
	Mental Health	1.00	1.13 (0.86–1.48)	0.78 (0.62–0.97)*	1.08 (0.87–1.34)	0.93 (0.76–1.13)	1.04 (0.88–1.25)
Model 3	Role-Physical	1.00	1.18 (0.91–1.54)	0.93 (0.74–1.15)	0.96 (0.77–1.18)	0.82 (0.68–0.99)*	0.86 (0.73–1.02)
n=4,333	General Health	1.00	1.68 (1.26–2.22)**	0.81 (0.65–1.02)	1.11 (0.90–1.38)	0.87 (0.72–1.06)	0.96 (0.81–1.14)
	Vitality	1.00	0.98 (0.74–1.28)	0.76 (0.61–0.96)*	0.84 (0.67–1.05)	0.69 (0.57–0.85)**	0.87 (0.73–1.04)
	Role-Emotional	1.00	1.02 (0.78–1.33)	0.95 (0.76–1.18)	1.16 (0.94–1.44)	0.93 (0.76–1.13)	1.00 (0.84–1.18)
	Mental Health	1.00	1.11 (0.84–1.46)	0.76 (0.60–0.95)*	1.08 (0.87–1.35)	0.94 (0.77–1.15)	1.03 (0.87–1.24)

*p<0.05, **p<0.01. †Suboptimal health was defined as less than median SF-36 on each scale. ‡Model 1 was adjusted for age. Model 2 was adjusted for age plus marriage status (married, other), working hours (daytime, other), physical activity at work (heavy, other), self-reported job stress (yes, no), smoking status (current smoker, other), and regular exercise (yes, no). Model 3 was adjusted for factors in model 2 plus obesity, hypertension, hyperlipidemia, and diabetes.

Since it was possible that our data were biased by heavy or frequent drinkers who had poor health due to alcoholic liver disease, we re-analyzed the data excluding subjects with levels of γ-GTP greater than 100 IU/L. Furthermore, considering effects of common chronic diseases, such as obesity, hypertension, hyperlipidemia, and diabetes, we examined the data among only healthier men without the diseases. Regardless of chronic disease conditions, we found similar associations to those shown in Tables 2 and 3 (data not shown).

Discussion

In the present study, we used the baseline dataset of an intervention trial (HIPOP-OHP study)[23]. The population strategy of the HIPOP-OHP study was conducted in three fields, i.e., nutrition, physical activity, and smoking from 1999 to 2004. Although intervention for alcohol intake was defined as one part of the population strategy for the nutrition field, there was no announcement regarding alcohol intervention, at least in the baseline survey in all companies. Accordingly, our results were not affected by the intervention process.

We found that people who consumed 1.0 to 22.9 g/d of alcohol scored high in HRQOL conditions: Role-Physical, General Health, and Vitality. Also, vitality conditions were better in accordance with increased levels of alcohol intake. The risks for sub-optimal health did not increase even among heavy drinkers (69.0 g/d and over). Ex-drinkers were at increased risk of poorer general health. This association, however, may have been due to former drinkers who had quit because of ill health.

Looking at the frequency of alcohol drinking, men who drank fewer days per week had higher HRQOL levels for General Health, Vitality, and Mental Health. The Vitality score was also good for those who drank 3 to 4 and 5 to 6 d/wk. Although the association of the amount of alcohol consumption and its frequency with the HRQOL scales were slightly different, alcohol drinkers were more likely to rate their health as good in comparison with non-drinkers.

The HIPOP-OHP study demonstrated that alcohol drinking patterns were clearly associated with blood pressure levels[24]. Mean HDL-cholesterol levels were positively associated with alcohol consumption, which can have a protective effect on atherosclerosis[2, 3]. The reliability of the drinking assessment was moderate (kappa=0.76) for subjects who reported drinking status at two separate times in one year. Since it was possible that abstainers from alcohol drinking had a health problem, we analyzed them separately. But when several confounders, including ill health related to obesity, hypertension, hyperlipidemia, and diabetes were considered, the significant association of alcohol drinking with HRQOL was unchanged.

In the present study, we made the definition of sub-optimal HRQOL as less than the median score for each SF-36 sub-scale, similar to a previous study that considered "average," "rather poor," or "very poor" of five subjective health grades to be sub-optimal health[17]. When SF-36 HRQOL scores were divided into quartiles and the lowest category was considered sub-optimal health, the associations of sub-optimal health with alcohol drinking were similarly demonstrated.

Our findings, based on the results of the physical and mental scales of the SF-36, were largely consistent with previous conclusions[17, 18]. That is, light and moderate alcohol drinking might have effects that modify the subjective experience of physical and mental health. Not only levels of alcohol consumption but also the frequency was similarly associated with the SF-36 scales, except for Role-Emotional. In the SF-36 validation study, scales of both Mental Health and Vitality were highly associated with mental conditions[27]. However, the Vitality condition remained at higher levels among men who drank more frequently.

The Japanese SF-36 validation study indicated that Role-Emotional represented physical condition rather than mental condition, as hypothesized, and its association with mental condition was dependent on the levels of psychiatric impairment[27]. Given the difficulty in the interpretation of Role-Emotional, it is unclear why only Role-Emotional sub-scales were not associated with drinking status in our population.

Heavy drinkers were not at increased risk of sub-optimal health in the present study, a finding contrary to the results from a general population study[17]. This may be explained by our population characteristics, in which occupational health was well managed. People with health problems were likely to quit or reduce drinking alcohol under intensive health management. Significant increased odds ratio of sub-optimal General Health for ex-drinkers supported in part this reasoning.

The strength of our study is the large population, which consists of mainly manufacturing and related company subjects/employees. This relatively homogeneous population helped us to interpret the effects of alcohol drinking on subjective health, including numerous factors related to working circumstances, carefully standardized in risk assessments. Nonetheless, several limitations should be considered. First, a cross-sectional study design does not prove causality. It can be argued that the data were biased by individuals who did not drink alcohol due to health problems, such as liver dysfunction. So, we separated abstainers from the analysis and presented the risks for sub-optimal health for the rest of the population. Furthermore, when we excluded subjects with levels of γ-GTP greater than 100 IU/L to rule out liver dysfunction, the associations remained. Second, the SF-36 NBS scores of our population were somewhat low in comparison with the national survey for SF-36

standardization in 2002. Because subjective health is affected by socioeconomic status[28], we hypothesize that people with sub-optimal health may be over-represented due to the economic recession in Japan, especially for a workplace population such as in the present study. Third, reporting bias should be considered in the interpretations of the SF-36 sub-scales. For example, if people with favorable HRQOL levels are likely to underestimate their alcohol intake, our findings may have been to some extent affected by the bias. Nevertheless, it is impossible to rule it out from the present study design.

Although light and moderate alcohol consumption has often been reported to be most beneficial for cardiovascular disease and total mortality[1-5], alcohol drinking patterns also may provide benefits for subjective health, explained by the HRQOL sub-scales: Role-Physical, General Health, Vitality, and Mental Health. Nonetheless, a longitudinal study will be needed to clarify the potential causality of association between alcohol consumption and HRQOL conditions.

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Appendix

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働き盛りの農村住民、都市部勤務者の循環器疾患危険因子の比較研究

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【目的】60歳未満の働きざかりの男性を対象として、農村部住民と都市部勤務者を対象として、飲酒、喫煙、塩分摂取量などの生活習慣、循環器疾患の危険因子を比較し、各集団の健康管理上の問題点を明らかにする。
【方法】研究対象とする農村地域は滋賀県X郡とし、東京・大阪近郊の大企業3社の勤務者集団（大都市勤務者）と各種健康指標の比較を実施した。各集団間でデータの相互比較を可能とするために、生活習慣や健康意識把握のための共通問診票を導入し、さらに健診時の検査内容についても精度管理を行った。比較する検査所見としては、血圧、血清脂質、耐糖能異常、喫煙、飲酒、塩分排泄量など主要な循環器疾患の危険因子とその薬物療法、非薬物療法等の実施状況である。X郡住民60歳未満男性 552人（平均年齢 48歳）、大都市（東京、大阪）企業勤務者 60歳未満男性 2,168人（平均年齢 38歳）について健診等の標準化を行なった。両群の年齢構成に大きな差があるため、年齢層がほぼ重複する40～55歳（X郡住民 266人、都市部勤務者 817人、平均年齢は49歳、47歳）を分析対象とした。
【結果】共分散分析で年齢を調整すると、収縮期血圧値はX郡住民で124mmHg、大都市勤務者で128mmHg、拡張期血圧値はそれぞれ82mmHg、78mmHgと有意差を認めた。1日尿中塩分排泄量は13グラムと9グラム、喫煙率は56%と52%でいずれもX郡住民のほうが有意に高かった。また血清総コレステロール値、HDLコレステロール値も、X郡住民、大都市勤務者でそれぞれ、210mg/dlと204mg/dl、54mg/dl、56mg/dlでX郡住民のほうが、脂質プロフィールが悪い傾向を示した。高血圧、高コレステロール血症、糖尿病の服薬率は両群で差を認めなかったが、それぞれの食事療法、運動療法を実施している者の割合は、大都市勤務者のほうが有意に高かった。BMIは両群で差を認めず、随時血糖値（対数変換）は都市部勤務者のほうが高かった。線形重回帰分析の結果、両群の収縮期血圧値の差のうち1.5mmHg（約40%）は塩分排泄量（摂取量）の差に起因することが示された。
【結論】働き盛りの男性において農村と大都市勤務者の危険因子には明らかな差が認められ、今後の農村部の健康管理に課題があることが明らかとなった。引き続き非都市的地域の事業所を加えて更なる比較を実施する予定である。

資　料

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