Socioeconomic Status Inconsistency and Risk of Stroke Among Japanese Middle-Aged Women

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Background and Purpose—Little research has been conducted to examine the effect of inconsistencies in socioeconomic status on cardiovascular health. In particular, no studies have been reported in Asian countries, including Japan, which is thought to have high socioeconomic status inconsistency among women.

Methods—We examined the effect of status inconsistency between education level and occupation on stroke risk in a prospective 20-year study of 14,742 middle-aged Japanese women included in the prospective Japan Public Health Center-based (JPHC) Study Cohort I in 1990. Status inconsistency between education level and occupation was determined (qualified, overqualified, and underqualified), and the association with risk of stroke was examined. Cox proportional regression analysis was used to determine hazard ratios, which were adjusted for age, marital status, and geographical area.

Results—Adjusted hazard ratio for stroke in overqualified compared with qualified women was 2.06 (95% confidence interval, 1.13–3.78). Adjusted hazard ratios for stroke among highly educated manual workers and workers in service industry were 3.47 (95% confidence interval, 1.54–7.84) and 3.21 (95% confidence interval, 1.49–6.90), respectively, when compared with highly educated professionals/managers.

Conclusions—High academic qualifications without an appropriate job could be a risk factor for stroke among Japanese women. Our result suggests that status inconsistency could be a potential explanation for the increased stroke risk among highly educated women. (Stroke. 2014;45:2592-2598.)

Key Words: education ■ female ■ Japan ■ occupations ■ social class ■ stroke

Socioeconomic gradients in the risk of cardiovascular disease are well documented. Previous studies have consistently reported inverse associations between socioeconomic status measured by education level, occupational class, or income, and incidence and mortality of coronary heart disease and stroke. Several studies in Japanese men and women have also reported that social inequalities affect cardiovascular health, but the results, particularly among women, have not always been consistent with those in Europe and in the United States. One study identified a U-shaped association between education level and total stroke incidence among Japanese women, and another study found no associations between education level and risk of stroke among women. Education level, which reflects human capital (ie, skills, abilities, and knowledge), has been considered as a solid indicator of socioeconomic position because education usually precedes occupation and can indicate the occupations available to an individual and provide a probability of an individual’s future success. However, socioeconomic position, as indicated by education level, may not always be consistent with that indicated by occupation.

Status inconsistency has been defined as inhomogeneity of traditional indicators of socioeconomic status in an individual (eg, a doctor working as a taxi driver). For several decades, social science research has examined the effect of status inconsistency on various outcomes, including social behaviors and psychological symptoms. However, social epidemiological studies examining the health effect of status inconsistency are relatively scarce. In the past few decades, several studies have reported that status inconsistency was associated with declining self-rated health and the risk of ischemic heart disease and cardiovascular disease. As far as we are aware, no studies on the health effects of status inconsistency have been conducted in Asian countries, including Japan.

Education level is not always an adequate predictor of a woman’s future occupational class in Japan. Women’s participation in the labor force, by age group, is represented by an M-shape curve in Japan, which reflects their tendency to have a career break during their 1920s and 1930s for family reasons and then return to the labor force in their 1940s. The Japanese lifetime employment system often does not allow people who reenter the workforce to work in regular employment. Thus,
many women who return to the labor force tend to work as part-time employees in service, sales, and manufacturing industries and as freelancers. Therefore, the mismatch between education level and occupation, termed status inconsistency, is thought to be high among Japanese women.

This study investigated whether status inconsistency between education level and occupation influenced health, and used data from a large nationwide prospective cohort study to determine stroke risk among Japanese women.

Methods

Study Population

The Japan Public Health Center (JPHC) Study Cohort I was a prospective cohort study initiated in 1990. The study recruited registered Japanese residents who were 40 to 59 years in 15 districts of 5 PHC areas. The sampling design and procedures of the study cohort have been described in detail elsewhere. In brief, a self-administered questionnaire was distributed to all 61,595 registered residents in 1990, and they were asked to report on sociodemographic information, personal medical history, smoking and drinking history, and dietary habits. A total of 50,245 participants responded to the questionnaire, and the response rate was 82%. One PHC area in metropolitan Tokyo was excluded from the present analysis (n=7096) because no data on stroke incidence were available. Of the remaining 43,149 participants, 9 were excluded as ineligible (7 were non-Japanese and 2 had moved before the start of the study). Those who reported a history of cancer or cardiovascular diseases at baseline were also excluded (n=1549). Of the remaining 41,591 participants, 21,599 women were eligible for inclusion in this cohort study. Women who did not have information on occupation (n=339) or education level (n=599) and those who did not have an occupation (n=5690) were excluded from the study. We also treated the others option for education level as missing data and excluded these subjects (n=359).

The remaining 14,742 women constituted the study population. The study was approved by the human ethics review committee of the National Cancer Center.

Measurement

Education Level

Educational level was determined by responses given in the self-administered questionnaire at baseline. Participants reported their highest level of education and were categorized into 4 education groups: (1) junior high school; (2) high school; (3) junior college or vocational school; and (4) college graduates and higher. For the education level analysis, we collapsed the latter 2 groups into 1 category because of the small numbers.

Occupation

Subjects were asked to select their occupation from one of the following in the baseline questionnaire: security, farming/forestry/fishery, transportation, labor service, sales, service, office work, professional, management, and unemployed. Those included in the study were categorized into 4 occupational groups: (1) manual (security, farming/forestry/fishery, transportation, and labor services); (2) sales and service; (3) office work, and (4) professional and management.

Status Inconsistency

Status inconsistency was determined according to a previous study. Each category of education level and occupational class was assigned a weight from 1 (lowest) to 4 (highest). Status inconsistency indicated a difference in position in the socioeconomic position scale as determined by subtracting the occupation score from the education score. We considered a difference of 2 points as status inconsistency and categorized participants into 3 groups: qualified (−1, 0, +1), overqualified (+2, +3), and underqualified (−2, −3).

Other Covariates

Information on age, sex, height, weight, marital status, perceived psychological stress (low, moderate, or high), smoking (current, former, or never), alcohol intake (frequency and amount), and frequency of leisure-time physical activity for ≥1 hour (almost none, 1–3× per month, or ≥1× per week) were obtained from responses to the baseline questionnaire. Body mass index was calculated by the reported height and weight (kilogram per square meter). Alcohol intake was categorized into 4 groups (almost none, 1–3× per month, <100 g ethanol/wk, or ≥100 g ethanol/wk) based on calculated ethanol intake and frequency of alcohol drinking. Hypertension status was determined from responses to baseline questions about medical history of hypertension and the use of antihypertensive drugs. Diabetes mellitus status was determined from response to the baseline question about medical history. Hypercholesterolemia was determined from responses to the baseline question about medication use for hypercholesterolemia.

Confirmation of Stroke Incidence

The end point of this study was incidence of any stroke. Subjects were followed up for 20 years, from the time of the baseline survey to January 1, 2010. Residential status, including survival, was confirmed annually through the residential registry of each area. A total of 30 hospitals with a cardiology department and equipped with computer tomographic scanning or MRI apparatus were registered in the 4 PHC areas included in the study. All were major hospitals with admission facilities for acute cardiovascular events, and thus we assumed that most of the acute stroke cases were captured by our registered hospitals. At each hospital, medical records were reviewed annually by registered hospital workers or PHC physicians; all blinded to the lifestyle data of the participants. To complete the surveillance of stroke events, when subjects reported a history of nonfatal stroke on the 5- and 10-year follow-up questionnaires and had not been registered as stroke cases, we enquired by letter or telephone about the onset of stroke and reviewed the medical records.

Occurrence of stroke (ie, subarachnoid hemorrhage, intraparenchymal hemorrhage, or ischemic stroke) was confirmed according to criteria of the National Survey of Stroke, which requires a constellation of neurologic deficits of sudden or rapid onset lasting ≥24 hours or until death. These confirmation methods have been described in detail elsewhere.

Statistical Analyses

Statistical analyses were based on incidence rates of total stroke during the 20-year follow-up period from 1990 to the end of 2009. For each individual, person-months of follow-up were calculated from January 1, 1990, to the first end point of stroke, death, emigration, or January 1, 2010. The outcome of this study was defined as incidence of first stroke during the study period according to education level, occupation, and status inconsistency.

Differences among education, occupation, and status inconsistency categories in age-adjusted mean values or proportions of demographic factors and cardiovascular risk factors at baseline were calculated using ANOVA or logistic regression models, and their trends were tested using linear regression for continuous variables and logistic regression for dichotomous variables.

Hazard ratios (HRs) with 95% confidence intervals (CIs) for education level and occupation were calculated using the Cox proportional hazard regression analysis after adjusting for age, marital status, PHC area, and education level, which were considered to be potential major confounding variables (model 1). Further reciprocal adjustments were made for education level and occupation (model 2), as well as conventional cardiovascular risk factors (model 3).

We estimated the HR (95% CI) according to status inconsistency using the qualified group as reference, and adjusting for age, marital status, and PHC area, as well as conventional cardiovascular risk factors. Furthermore, we compared stroke risks of categories created by combinations of education level and occupation and setting female professionals/managers with the highest education level as the reference group.
Results

Distributions of education level and occupation in the cohort at baseline are shown in Table 1. The majority of women had a manual job (54%), and junior high-school education as their highest education attainment (53%). Sixty-eight percent of women with a junior high-school education as their highest education level had a manual job. Forty-three percent of women with a junior college or higher education as the highest education level were professionals or managers, whereas 18% had manual jobs.

During the 20-year follow-up period (mean follow-up, 18.5 years), 597 cases of newly diagnosed stroke occurred among the total cohort. Table 2 indicates the age-adjusted distributions of demographic factors and conventional cardiovascular risk factors according to education level, occupation, and status inconsistency. The mean age of participants was 49.0 years and 73% were married. Women with a junior high-school education as their highest education level were more likely to be older, physically inactive, overweight, and have a medical history of hypertension when compared with more highly educated groups. In addition, they were less likely to be married and to perceive that they had high psychological stress. Women with a professional/managerial job were more likely to be married, to be physically active, and to perceive that they had high psychological stress when compared with those with other types of jobs, whereas women with service/sales jobs were more likely to smoke, to have a high alcohol intake, and to be overweight. Overqualified women were more likely to be older, physically active, and overweight, and they were also less likely to smoke and have a high alcohol intake when compared with other groups.

The associations of education level and occupation with stroke risk are shown in Table 3. The association between education level and stroke incidence was not linear; women with education to high-school level had a lower risk of stroke when compared with women in the junior high-school group (HR, 0.69; 95% CI, 0.57–0.84), whereas the risk of stroke in women in the highest education group, which was hypothesized to have the lowest stroke risk among all education groups, was not significantly different from that of the lowest education group (HR, 0.81; 95% CI, 0.59–1.10). However, women who had an office, service/sales, or manual job had a higher risk of developing stroke when compared with those with a professional/managerial job; the adjusted HRs (95% CIs) were 1.53 (0.93–2.53), 1.97 (1.26–3.07), and 1.65 (1.07–2.56), respectively, after adjustment for age, geographical area, and marital status. These associations did not change materially after reciprocal adjustment for education level or occupation, as well as conventional cardiovascular risk factors.

The associations between status inconsistency and stroke risk are shown in Table 4. Women who were overqualified had a higher stroke risk when compared with qualified women; the HR (95% CI), adjusted for age, marital status, area, and education level was 2.06 (1.13–3.78). The association did not materially change after further adjustment for conventional cardiovascular risk factors.

Table 5 shows the results of an analysis by setting professionals or managers in the highest education group as the reference group. The stroke risk of highly educated women with a manual job had the highest stroke risk among all groups (HR, 3.47; 95% CI, 1.54–7.84).

Discussion

This study sought to examine how status inconsistency affects stroke risk among Japanese women using data from a large prospective cohort. The study supported previous reports that status inconsistency influences cardiovascular health. Status inconsistency was associated with increased risk of stroke among women in Japan, and overqualified women were more likely to develop stroke when compared with qualified women. Furthermore, our results suggest that status inconsistency may influence the association between education level and stroke risk. Status inconsistency seems to be a factor in the unexpected nonlinear association between education level and stroke risk; our results showed that stroke risk was highest for manual workers with college or higher education of all groups categorized by education level and occupation. To the best of our knowledge, this study is one of a limited number of studies investigating the effect of status inconsistency on cardiovascular risk, and the first study conducted in an Asian country.

Although studies on the relationship between status inconsistency and cardiovascular diseases are limited, their results have shown the harmful effect of status inconsistency on cardiovascular health. Peter et al identified that overqualified men and women aged 25 to 65 years had ≥3× the risk of developing ischemic heart disease when compared with suitably qualified subjects in a German health insurance company. However, another study of men and women aged 45 to 65 years from the EPIC-Heidelberg cohort found a higher risk of developing cardiovascular diseases (ie, myocardial infarction and stroke) among underqualified men when compared with suitably qualified men, but no association was identified among women. As far as we know, no studies have been conducted on stroke risk. Our study found that status inconsistency, especially overqualification, was associated with increased risk of stroke among Japanese women. Furthermore, we identified the highest stroke risk among highly educated women with manual jobs, suggesting that the identified nonlinear association between education level and stroke risk could result, at least in part, from the influence of status inconsistency.

One of the possible mechanisms by which status inconsistency influences stroke risk is increased psychological distress resulting from status inconsistency. It was postulated that status inconsistency produced psychological stress, as

Table 1. Distributions of Occupation and Education Levels in a Cohort of 14742 Japanese Women Aged 40–59 Years at Baseline

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Manual Job</th>
<th>Service/ Sales</th>
<th>Office Work</th>
<th>Professional/ Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>n (%)</td>
<td>8031 (54)</td>
<td>3949 (27)</td>
<td>1638 (11)</td>
<td>1124 (8)</td>
</tr>
<tr>
<td>Junior high school</td>
<td>7867 (53)</td>
<td>5385 (68)</td>
<td>2024 (26)</td>
<td>138 (2)</td>
</tr>
<tr>
<td>High school</td>
<td>5219 (35)</td>
<td>2356 (45)</td>
<td>1521 (29)</td>
<td>262 (5)</td>
</tr>
<tr>
<td>Junior college or vocational school</td>
<td>1311 (9)</td>
<td>272 (21)</td>
<td>378 (29)</td>
<td>47 (14)</td>
</tr>
<tr>
<td>College and higher</td>
<td>345 (2)</td>
<td>26 (8)</td>
<td>47 (14)</td>
<td>254 (74)</td>
</tr>
</tbody>
</table>
individuals could be frustrated because they had invested in educational attainment but did not feel that they were adequately rewarded, or their occupational aspirations were not consistent with their educational achievements. Role conflicts between inconsistencies in different status indicators could lead to stressful conditions and uncertainty in self-identity. Indeed, our results indicated that women who had status inconsistency were more likely to perceive that they had high psychological stress when compared with other groups. Increased psychological distress has been reported to be an independent risk factor for stroke, and the increased risk may be mediated partly through increased blood pressure levels.

We examined whether conventional cardiovascular risk factors could explain the identified association between status inconsistency and stroke risk by adjusting for these factors in the model. We identified a higher proportion of overweight among

<table>
<thead>
<tr>
<th>Table 3. Hazard Ratios (95% Confidence Intervals) for Stroke Incidence According to Education Level and Occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Education</strong></td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Junior high school</td>
</tr>
<tr>
<td>High school</td>
</tr>
<tr>
<td>Junior college, vocational school, or college</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Occupation</strong></th>
<th>Person-Years</th>
<th>No. of Cases</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional/manager</td>
<td>20239</td>
<td>22</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Office work</td>
<td>30186</td>
<td>49</td>
<td>1.53 (0.93–2.53)</td>
<td>1.73 (1.02–2.94)</td>
<td>1.63 (0.96–2.78)</td>
</tr>
<tr>
<td>Service/sales</td>
<td>71973</td>
<td>184</td>
<td>1.97 (1.26–3.07)</td>
<td>2.02 (1.25–3.26)</td>
<td>1.78 (1.10–2.88)</td>
</tr>
<tr>
<td>Manual job</td>
<td>150861</td>
<td>342</td>
<td>1.65 (1.07–2.56)</td>
<td>1.64 (1.01–2.65)</td>
<td>1.60 (0.99–2.60)</td>
</tr>
</tbody>
</table>

Model 1: adjusted for age, marital status, and geographical area.
Model 2: model 1 + adjustment for education level/occupation.
Model 3: model 2 + adjustment for cardiovascular risk factors (body mass index, smoking status, alcohol intake, physical activity, perceived psychological stress, medical history of hypertension, medical history of diabetes mellitus, medical history of hypercholesterolemia).

Heavy drinker: consumed ethanol ≥100 g/wk.
Physically active: during leisure time, physical activity more than once a week.
Overweight: body mass index ≥27 kg/m².
E indicates education score; and 0, occupation score.
overqualified women when compared with qualified women, but no excess rates of hypertension, diabetes mellitus, and heavy drinking were observed. Adjustment for cardiovascular risk factors did not markedly change the association between social status inconsistency and risk of stroke. However, all data were collected at baseline and were self-reported, and thus our adjustment could be incomplete. Additional studies are needed to explore the associations in more detail.

Our findings support the view that there is no straight-forward association between different education levels and different occupation types. Although education level influences the choice of future occupation, education level and occupational class are not necessarily in harmony, as seems to be the case, in particular, among women in Japan. As stated previously, Japanese women are more likely to take a career break for family reasons, such as raising children and caring for parents compared with Japanese men. Consequently, their attained education level often is not translated into occupational class, which may be a reason for the effect of status inconsistency on cardiovascular health among Japanese women. The proportion of Japanese women attending college or participating in the labor force has increased rapidly in recent decades. However, there remain major sex differences in employment in present Japanese society; for example, the labor participation rate among women is still lower than that among men, and female workers were more likely to have irregular employment (54.5%) when compared with men (19.8%) in 2012. Considering this situation, the social status inconsistency may be large among Japanese women.

These findings, however, should be interpreted with some caution. First, the generalizability of our results may be limited. The data included 4 public health districts in a nonmetropolitan setting in Japan so we should be cautious in the generalizability of our results. Second, there may be some measurement error in occupational categorization. In this study, we used 4 occupational categories as an indicator of socioeconomic position. Rather than creating white-collar and blue-collar job categories, we separated white-collar workers into professionals/managers, office workers, and workers in sales and service industries in reference to previous studies. Our analysis indicated hypothesized associations with stroke risk, but there is room for refining the occupational classification. Third, there

### Table 4. Hazard Ratios for Stroke Incidence According to Status Inconsistency

<table>
<thead>
<tr>
<th>Status Inconsistency</th>
<th>No. at Risk</th>
<th>Person-Years</th>
<th>No. of Cases</th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underqualified (E&lt;0)</td>
<td>720</td>
<td>13,423</td>
<td>28</td>
<td>1.01 (0.69–1.48)</td>
<td>1.04 (0.71–1.53)</td>
</tr>
<tr>
<td>Qualified (E=0)</td>
<td>13,707</td>
<td>254,118</td>
<td>553</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Overqualified (E&gt;0)</td>
<td>316</td>
<td>5772</td>
<td>16</td>
<td>2.06 (1.13–3.78)</td>
<td>2.23 (1.22–4.09)</td>
</tr>
</tbody>
</table>

Model 1: age, marital status, area, and education level were adjusted. Model 2: model 2+cardiovascular disease risk factors (body mass index, smoking status, alcohol intake, physical activity, perceived psychological stress, medical history of hypertension, medical history of diabetes mellitus, and medical history of hypercholesterolemia).

E indicates education score; and O, occupation score.

### Table 5. Hazard Ratios for Risk of Total Stroke According to Categories of Occupation and Education Level

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Occupation</th>
<th>No. at Risk</th>
<th>Person-Years</th>
<th>No. of cases</th>
<th>Hazard ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Junior college, vocational school, or college (n=1657)</td>
<td>Professional/Manager (n=1124)</td>
<td>724</td>
<td>238</td>
<td>405</td>
<td>1.00 (0.56–4.80)</td>
</tr>
<tr>
<td></td>
<td>Office Work (n=1638)</td>
<td>4866</td>
<td>4286</td>
<td>7393</td>
<td>3.21 (1.49–6.90)</td>
</tr>
<tr>
<td></td>
<td>Service/Sales (n=3949)</td>
<td>10</td>
<td>5</td>
<td>19</td>
<td>3.47 (1.54–7.84)</td>
</tr>
<tr>
<td></td>
<td>Manual Job (n=8031)</td>
<td>262</td>
<td>1080</td>
<td>1521</td>
<td>2.34 (0.56–4.80)</td>
</tr>
<tr>
<td>High school (n=5219)</td>
<td>Professional/Manager (n=1124)</td>
<td>4845</td>
<td>19,903</td>
<td>27,816</td>
<td>2.02 (1.02–3.98)</td>
</tr>
<tr>
<td></td>
<td>Office Work (n=1638)</td>
<td>7</td>
<td>28</td>
<td>49</td>
<td>1.62 (0.83–3.17)</td>
</tr>
<tr>
<td></td>
<td>Service/Sales (n=3949)</td>
<td>138</td>
<td>320</td>
<td>2024</td>
<td>2.44 (1.29–4.62)</td>
</tr>
<tr>
<td></td>
<td>Manual Job (n=8031)</td>
<td>2581</td>
<td>5996</td>
<td>36,816</td>
<td>100,780</td>
</tr>
<tr>
<td>Junior high school (n=7867)</td>
<td>Professional/Manager (n=1124)</td>
<td>138</td>
<td>320</td>
<td>2024</td>
<td>1.98 (0.68–5.79)</td>
</tr>
<tr>
<td></td>
<td>Office Work (n=1638)</td>
<td>2581</td>
<td>5996</td>
<td>36,816</td>
<td>100,780</td>
</tr>
<tr>
<td></td>
<td>Service/Sales (n=3949)</td>
<td>138</td>
<td>320</td>
<td>2024</td>
<td>1.98 (0.68–5.79)</td>
</tr>
<tr>
<td></td>
<td>Manual Job (n=8031)</td>
<td>138</td>
<td>320</td>
<td>2024</td>
<td>1.98 (0.68–5.79)</td>
</tr>
</tbody>
</table>

Hazard ratios adjusted for age, marital status, and geographical area. CI indicates confidence interval.
may be some selection bias resulting from exclusion of subjects because of missing values of indicator variables of socioeconomic position. These subjects in this study (6%) were more likely to be older, overweight, and unmarried but the direction of the bias is unknown. Forth, no information on income was available to estimate participants’ socioeconomic status. Fifth, another limitation perhaps is that the various parameters were determined only at baseline.

Conclusions
Despite these limitations, the present study indicated a significant association between overqualification and increased risk of stroke among women in Japan. It also suggested that status inconsistency may explain the association between indicators of socioeconomic position and stroke risk, which could be a possible reason for the previously identified U-shaped association between education level and stroke risk among Japanese women. The mechanisms for the effect of status consistency on cardiovascular health remain to be elucidated in future studies.

Appendix

Acknowledgments
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Disclosures
None.

References
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An erratum has been published regarding this article. Please see the attached page for:
/content/45/12/e310.full.pdf
The version of the article, “Socioeconomic Status Inconsistency and Risk of Stroke Among Japanese Middle-Aged Women” by Honjo et al that published online ahead-of-print on July 15, 2014, and appears in the September issue (Stroke. 2014;45:2592–2598) contained an error in the tables. The total number of service/sales should be 3949 in Table 1, 2, 3, and 5. The authors regret the error.

This correction has been made to the online version of the article, which is available at http://stroke.ahajournals.org/content/45/9/2592.