

important for public health. The three main interpretations of the mechanisms at stake need further investigation; comparative studies would be valuable but should involve only countries that are comparable.

We thank John Lynch for valuable comments on the interpretation of the results.

Funding: Danish Heart Association and Danish Research Council.

Competing interests: None declared.

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(Accepted 4 June 2001)



The full version of this article appears on bmj.com

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BMJ 2002;324:16-9

Individual income, income distribution, and self rated health in Japan: cross sectional analysis of nationally representative sample

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Abstract

Objective To assess the effects on self rated health of individual income and income distribution in Japan.

Design Cross sectional analysis. Data collected on household income, self rated health, and other sociodemographic characteristics at the individual level from comprehensive survey of the living conditions of people on health and welfare in a nationally representative sample from each prefecture.

Setting Prefectures in Japan.

Participants 80 899 people aged > 15 years with full records in survey.

Main outcome measures Dichotomous variable for self rated health of each respondent (0 if excellent, very good or good; 1 if fair or poor).

Results Inequality in income at the prefecture level measured by the Gini coefficient was comparable with that in other industrialised countries. Unadjusted odds ratios show a 14% increased risk (odds ratio 1.14, 95% confidence interval 1.02 to 1.27) in reporting poor or fair health for individuals living in prefectures with higher inequality in income. After adjustment, individual income was more strongly associated with self rated health than income inequality. Additional inclusion of regional effects showed that median

income at the prefecture level was inversely related to self rated health.

Conclusions Individual income, probably relative to the median prefecture income, has a stronger association with self rated health than income inequality at the prefecture level.

Introduction

A series of international comparative analyses has consistently shown that the health of a population, with indicators such as life expectancy, depends not just on the absolute size of the national income but on how that income is distributed.^{1 2} Studies on income distribution and health have now been extended to analysis within a nation. Large inequalities in income within a society may be an important source of regional variations in health.³⁻⁶

Several possible mechanisms through which income and its distribution may affect health have been proposed.^{4 7-10} Some studies support the idea that income distribution within a region itself influences people's health, while others state that the absolute level of individual income is one of the determinants of individual health.^{5 7} Furthermore, there is a hypothesis that what affects health is individual income relative to average income in a region.¹⁰

As ecological studies are prone to aggregation and confounding bias, individual level studies have been carried out to assess the independent effects of income inequality after adjustment for an individual's income.⁸⁻¹⁰ These studies have exclusively been carried out in the United States, and they have shown mixed results.⁹⁻¹¹⁻¹⁶ It is still not clear whether the relation between income, income distribution, and health at the individual level is a universal phenomenon and whether it can be explained by the proposed mechanisms.

From the early 1960s to the late 1980s Japan achieved the narrowest income differentials in industrialised countries and the highest life expectancy in the world. Several authors have attributed such a rapid improvement in population health to the more egalitarian social system in Japan.¹⁷⁻¹⁸ However, inequality in income in Japan since the late 1980s has increased at a much faster pace than in other industrialised countries.¹⁹

We examined the effects of individual income and its distribution on individuals' self rated health by using a nationally representative sample from the Japanese population.

Methods

Data source—We used data from the 1995 comprehensive survey of the living conditions of people on health and welfare (LCPHW) by the Ministry of Health and Welfare.²⁰ This survey interviewed all household members within 5100 area units, randomly sampled from all prefectures in Japan. After we excluded records with missing values on key variables (4747) and excluded those from people aged ≤ 15 years (17 394), we obtained a total of 80 899 individual observations for analysis.

Measure of self rated health—Self rated status is strongly correlated with more objective measures of health, such as mortality, independent of medical, behavioural, and psychosocial risk factors.²¹ The 1995 survey elicited the respondent's perceived overall health status by asking, "What is your current health status: excellent, very good, good, fair, or poor?" We created a dichotomous variable for self rated health (0 if excellent, very good, or good; 1 if fair or poor).¹¹⁻¹³⁻¹⁵

Independent variables—We used age, sex, and marital status (never married, married, separated, divorced) as demographic covariates and determined whether the respondent had had a medical check up in the year before the survey. From the 1995 survey we obtained information on annual household income before tax, including benefits and transfer payment. To obtain individual level income we adjusted household income for household size.²²⁻²³ We used the Gini coefficient as a measure of income distribution within a prefecture and divided the sample into quarters.

Statistical analysis—The stratified design of the national survey requires special analysis for unequal sample probabilities and clustered observations and consequent underestimation of errors.²⁴⁻²⁵ Full details of the model building process are in the full version of this paper on the *BMJ's* website.

Results

Median income in the prefecture was slightly lower than the median individual income in our sample (3.13m yen (about £21 096) *v* 3.48m yen (about £23 455), at the average 1995 exchange rate of 1 yen = £0.00674).

Distribution of prefecture level income measured by the Gini coefficient ranged from 0.31 to 0.45 with the median of 0.36. At the prefecture level, the Gini coefficient and median income showed moderate correlation (Pearson's correlation coefficient -0.51). Overall, 9.8% of the sample reported their health as fair (9.0%) or poor (0.8%) (table 1).

Table 2 shows the univariate and multivariate odds ratios for the effects of income distribution at the prefecture level on individual self rated health. The Mantel-Haenszel trend test suggested that higher quarters of the Gini coefficient, lower quarters of median income, and lower categories of individual income were associated with the likelihood of self reported fair or poor health ($P < 0.001$). When we adjusted for prefecture level variables and individual

Table 1 Characteristics (unweighted) of sample of people in Japan

Variable	No (%)	Proportion (%) with fair or poor health
Age (years):		
15-44	40 588 (47.4)	5.8
45-59	22 495 (26.3)	9.8
60-79	19 371 (22.7)	16.7
≥ 80	3 102 (3.6)	25.2
Sex:		
Male	40 801 (47.7)	8.8
Female	44 755 (52.3)	10.8
Marital status:		
Married	56 053 (67.9)	10.3
Never married	20 736 (23.9)	5.4
Separated	6 811 (6.2)	18.8
Divorced	1 956 (2.0)	14.6
Check up:		
In previous year	42 773 (57.4)	10.2
Not in previous year	31 773 (42.6)	10.6
Gini coefficient (inequality):		
1st quarter (lowest)	19 908 (23.3)	9.8
2nd quarter	29 516 (34.5)	9.5
3rd quarter	24 272 (28.3)	9.9
4th quarter	11 860 (13.9)	10.6
Median prefecture income:		
1st quarter (highest)	14 098 (16.5)	10.8
2nd quarter	19 682 (23.0)	10.2
3rd quarter	17 383 (29.3)	9.7
4th quarter	34 393 (40.2)	9.2
Household income (million yen):		
<1.50	10 114 (11.8)	14.4
1.50-1.99	7 038 (8.2)	11.4
2.00-2.49	8 696 (10.2)	10.7
2.50-2.99	8 760 (10.3)	9.9
3.00-3.99	16 527 (19.3)	8.7
4.00-4.99	12 521 (14.6)	8.4
≥ 5.0	21 900 (25.6)	8.5
Self rated health:		
Excellent	25 357 (31.3)	
Very good	14 628 (18.1)	
Good	32 986 (40.8)	
Fair	7 255 (9.0)	
Poor	673 (0.8)	

Table 2 Univariate and adjusted odds ratios (95% confidence intervals) for self rated health (fair or poor=1)

Independent variable	Univariate odds ratio	Adjusted odds ratio (model 3)*
Prefecture level variables		
Gini coefficient (inequality):		
1st quarter (lowest)	1.00	1.00
2nd quarter	1.00 (0.92 to 1.10)	0.99 (0.89 to 1.11)
3rd quarter	1.07 (0.98 to 1.18)	1.02 (0.90 to 1.17)
4th quarter	1.14 (1.02 to 1.27)	1.13 (0.96 to 1.34)
Median prefecture income:		
1st quarter (highest)	1.33 (1.20 to 1.47)	0.79 (0.64 to 0.99)
2nd quarter	1.15 (1.07 to 1.24)	0.85 (0.71 to 1.01)
3rd quarter	1.15 (1.05 to 1.25)	0.93 (0.83 to 1.04)
4th quarter	1.00	1.00
Individual level variables		
Household income (million yen)		
<1.50	1.93 (1.72 to 2.15)	1.54 (1.37 to 1.74)
1.50-1.99	1.48 (1.30 to 1.80)	1.30 (1.14 to 1.49)
2.00-2.49	1.38 (1.23 to 1.54)	1.24 (1.11 to 1.40)
2.50-2.99	1.23 (1.09 to 1.38)	1.23 (1.09 to 1.38)
3.00-3.99	1.05 (0.95 to 1.17)	1.08 (0.97 to 1.20)
4.00-4.99	1.01 (0.91 to 1.13)	1.04 (0.93 to 1.17)
≥5.00	1.00	1.00
Age (years):		
15-44	1.00	1.00
45-59	1.69 (1.57 to 1.83)	1.57 (1.43 to 1.72)
60-79	3.15 (2.92 to 3.39)	2.69 (2.45 to 2.95)
≥80	5.10 (4.47 to 5.83)	4.29 (3.65 to 5.05)
Marital status:		
Married	1.00	1.00
Never married	0.53 (0.49 to 0.59)	0.92 (0.83 to 1.02)
Separated	1.99 (1.81 to 2.19)	0.99 (0.88 to 1.11)
Divorced	1.55 (1.31 to 1.84)	1.31 (1.10 to 1.55)
Sex:		
Male	1.00	1.00
Female	1.27 (1.20 to 1.34)	1.18 (1.12 to 1.25)
Health check up in previous year:		
Yes	1.00	1.00
No	1.06 (0.99 to 1.13)	1.01 (0.95 to 1.08)

*Regional block dummies used. Wald χ^2 P<0.001.

characteristics (including household income, age, sex, marital status, and health check up in the previous year, and dummy variables for 12 geopolitical blocks) the graded association of median income remained but the effect of the Gini coefficient became weaker. (The results of adjustment in model 1 and 2 can be found in the full version of this paper on the *BMJ's* website.)

Individual income was significantly associated with self rated health. Compared with those in the highest of the seven income classes (>5.00m yen), adjusted odds ratios for reporting poor health ranged from 1.54 (95% confidence interval 1.36 to 1.73) in the lowest income class (<1.50m yen) to 1.22 (1.08 to 1.38) in the fourth income class (2.50m-2.99m yen). When we further adjusted for 12 geopolitical blocks the effects of explanatory variables other than the prefecture level variables remained stable, but a gradient effect of the Gini coefficient was observed: the odds ratio of the highest quarter of the Gini coefficient was 1.13 (0.96 to 1.34). Median prefecture income, however, showed a reversed gradient against perceived health: individuals in the lowest income quarter were 21% less likely to report poor health (odds ratio 0.79, 95% confidence interval 0.64 to 0.99).

We also examined the effects of income distribution stratified by income, age, and sex to test whether income inequality affects all individuals equally or only subpopulations in a society. In each stratum, however, none of the models suggested differential effects of income inequality on self rated health across strata.

Discussion

In this cross sectional analysis of a nationally representative sample in Japan we have shown that individual income, probably relative to median income at the prefecture level, has a stronger association with an individual's self rated health compared with income inequality at the prefecture level.

The few studies that have examined the effects of income and its distribution on individual self rated health were exclusively carried out in the United States.^{9 1-16} Although they drew mixed conclusions, their findings were somewhat similar. The negative effect of income inequality on perceived health was attenuated when adjustment was made for individual level income and other explanatory variables. Furthermore, the effect of inequality in individual income was stronger than that of inequality in regional income.¹⁰⁻¹³

The effect of income inequality on health was smaller in our study than in previous studies in the United States.^{12 13} Several explanations can be made for the disparity.

Reasons for disparity with other studies

Firstly, the magnitude of income inequality in Japan may still be small and the significant association between income inequality and health may be observed only at the levels of inequality present in the United States.²⁶ Some researchers report, however, that income inequality in Japan has increased rapidly since the late 1980s.¹⁹ In fact, the mean Gini coefficient in Japan in 1995 was 0.36 and already comparable with those in European countries, although it is still below the level of income inequality in the United States.^{22 27} There may also be a time lag between the prevalence of income inequality and its effects on health.²⁸ Therefore, time series analysis of Japanese data would be needed in a future study.^{5 15}

Secondly, the units of aggregation in our study (that is, prefectures) may be too homogeneous for income distribution to exert an effect independent of individual income. However, the aggregation in a geopolitical level, larger than the prefectures, yielded similar results (data not shown). We decided to use prefecture as the primary unit of aggregation because a prefecture is similar to a state in the United States in terms of its population size and variations in income inequality.

Finally, the relation between income inequality and health may not be universal but instead may depend on social and political characteristics specific to place and cultural norms. Several researchers attribute the significant effect of income inequality in the United States to the degree of economic segregation that may lead to lack of investment in public goods.^{29 30} A recent ecological study in Taiwan also provides limited evidence of changes in association between income inequality and health status, depending on the stage of economic development and social transformation.⁶

What is already known on this topic

Contrary to the common perception of an egalitarian society, in Japan income inequality has increased rapidly since the late 1980s, though life expectancy continues to increase

Individual level studies, exclusively carried out in the United States to assess the independent effects of income inequality on health, have had mixed results

What this study adds

Individual income levels, probably relative to regional median income, may have more influence on an individual's perceived health than regional income inequality in Japan

Conclusions

Individual income, probably relative to median income at the prefecture level, has a stronger association with an individual's self rated health compared with income inequality at the prefecture level in Japan. Our results, however, do not mean that we should not be concerned with reducing income inequality. Inequality in income at state level in the previous studies may reflect various social conditions, including the effects of local policies that cannot easily be observed but vary across states.^{10 26 30}

Funding: This study was in part supported by a grant from the Japan Ministry of Health, Labour and Welfare (No 100-50101).
Competing interests: None declared.

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(Accepted 29 August 2001)

A conversation that changed my letters

"It's disgusting, treating her like that," she said, starting a short but heated discussion. The educated, articulate daughter of someone else's patient showed me the source of her dismay—the first sentence of a letter from a consultant to her mother's general practitioner:

"Thank you for referring this 70 year old woman, whom I saw in clinic..."

It had never occurred to me that our habit of starting referral letters, clinic replies, and, indeed, most other forms of medical correspondence in this way might be a source of offence. Aided by another medical colleague, I argued that no offence was intended, that the letter was between professionals, and that she was misinterpreting a technical style. Her response was simple—that our habitual style was not patient centred.

I found myself in agreement. It is a small thing, but patients and their relations have ever easier access to their records and have a

right to feel that they are viewed as individuals. So I am trying her suggestion and urge others to do the same.

"Thank you for seeing Mrs Smith, who is concerned about..."

David Tooth *general practitioner, Kiveton, nr Sheffield*

We welcome articles of up to 600 words on topics such as *A memorable patient, A paper that changed my practice, My most unfortunate mistake*, or any other piece conveying instruction, pathos, or humour. If possible the article should be supplied on a disk. Permission is needed from the patient or a relative if an identifiable patient is referred to. We also welcome contributions for "Endpieces," consisting of quotations of up to 80 words (but most are considerably shorter) from any source, ancient or modern, which have appealed to the reader.