

A Gerontological Cohort Study of Aged Twins: The Osaka University Aged Twin Registry

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We describe subject recruitment and research results from the Osaka University Aged Twin Registry (OUATR). The research focus of OUATR is the genetic and environmental contributions to physical-cognitive-mental aging which we examined in Japanese twins in later adulthood. Within this large-scale registry (12,000 pairs) of oriental twins born between 1900 and 1935, approximately 10% of participants are MZ twins reared apart from early childhood. Two hundred and fifty pairs have had comprehensive medical examinations, including various blood chemical panels, lymphocyte subtests, WAIS (Wechsler Adult Intelligence Scale), and urine analysis. The future foci of this study are primarily on longevity, decline of cognitive functions with aging, bio-physiological functions, lifestyle and behavior genetics, and psycho-spiritual functions.

It is often difficult to collect a large number of twins in late adulthood. The Osaka University Aged Twin Registry (OUATR) is one of only a few registries in oriental countries that contain a large number of aged twins. OUATR consists of approximately 12,000 pairs of twins born between 1900 and 1935 in Japan. It is not rare in traditional Japanese society for twin pairs to be separated soon after birth and consequently, approximately 10% of the OUATR twins were reared apart. This aids the study of aging and environmental contributions to psycho-physiological development. Moreover, since there are many diseases which have differing genetic mechanisms across ethnic populations, this study is of interest in that it is constituted largely of oriental twin subjects. This report describes the OUATR and current research results.

Methods

Recruitment of Twins

OUATR was previously called the Kinki University Adult Twin Registry (Hayakawa & Shimizu, 1987). Twin pairs in this registry were recruited by newspaper advertisements, posters in hospitals, referrals from nurse-midwives, and follow-up studies of previous twin research (Hayakawa & Shimizu, 1982). Questionnaires were mailed to 3000 pairs each year. Zygosity was established using methods previously reported (Hayakawa et al., 1987).

Current Major Research Foci

One of the research foci is on lifestyle factors related to the decline of cognitive functions with aging. Another focus of

this research is on the relationship between serum concentrations of Apolipoprotein E and alcohol drinking, cigarette smoking, dietary habits, physical activity and occupational workload. We are also studying longevity from the aspects of social, familial, psychological and spiritual factors. Since the heritability of obesity appeared to differ between Caucasian and Japanese twins in our study (Allison et al., 1996), the mechanisms of these discrepancies are also under investigation. Moreover, we have studied food preference and dietary habits and their relation to imprinting of tastes. Twin pairs reared apart present a powerful research method for this type of question since Japanese society currently consists of both people eating traditional vegetable-based Japanese meals, and people eating Western-style meals (Kato & Hayakawa, 2002). See Table 1 for a summary of the OUATR.

Results

Major Achievements

Response rates among the recipients of questionnaires varied from 73% to 87%. Single-respondent twin pairs accounted for approximately 15% of all respondents. Two hundred and fifty twin pairs living apart in the community volunteered to visit the university hospitals for comprehensive medical examinations (Hayakawa & Shimizu, 1987). Among the original 12,000 twin pairs 67% were MZ and among the 250 pairs reared apart, 74% were MZ.

We have assessed heritability estimates of 100 health indices, such as serum lipids concentrations and physical measurements (Hayakawa & Sogi, 2000; Shirakawa et al., 1996). We estimated that the heritability of serum concentration levels of HDL cholesterol, LDL cholesterol, Apolipoprotein A-I and B are around 0.5 (Hayakawa, 1988). Longevity and the decline of cognitive functions with aging have been analyzed from both genetic and environmental aspects WAIS scores show a relatively strong environmental influence on cognitive aging. Intra-pair

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Table 1

Outlines of Osaka University Aged Twin Registry in Japan

Name of register	Osaka University Aged Twin Registry
Country	Japan
Kind of ascertainment	Volunteers (identified by newspaper advertisements, posters in hospitals, referrals from nurse-midwives)
Opposite sex twins (yes or no)	Yes
Number of pairs (separated by birth range and sex)	12,000 pairs (born in 1900–1935) (mean age: 70 years)
Primary interest	Aging, dementia, physical diseases, serum lipids, cognitive functions, lifestyle, quality of life, life satisfaction
Variables measured (+number of pairs in total)	Mailed questionnaires: Once a year Comprehensive medical examinations: 250 pairs
DNA / blood samples (+ number pairs)	Blood (250 pairs)
Contact	Prof. K. Hayakawa, or K. Kato
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Major publications	Hayakawa et al. "Lifestyle... <i>Atherosclerosis</i> , 66(1987), pp. 1–9. Hayakawa et al. "Risk...". <i>Acta Geneticae Medicae et Gemellologiae</i> , 41(1992), pp. 187–189. Kato, Hayakawa, et al. "Intrapair...". <i>J.J.P.H.</i> 49(2002), in press.
Major sources of funding	Government
Comments	10 % of the twin pairs were reared apart

analysis of identical twins reared apart showed a strong influence of family environment on the formation of health-related behaviors, food preference, and other lifestyle factors in later adulthood. Concordances of causes of death were generally very low even within the MZ pairs, except death by breast cancer (Hayakawa et al., 1992).

Discussion

Future Plans

We plan to investigate the genetic backgrounds of life satisfaction, psycho-spiritual function, and higher cognitive function. We plan crosscultural research among the identical twin pairs in which one twin lives in Japan and the other emigrated to the United States before the age of 20. Collaborations are welcomed, and all requests for collaboration should be directed to the first author, and will be assessed by the study's Steering Committee.

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