Japan Healthy Aging Study (J-HAS): Continuous digital markers and biological data in healthy seniors

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The Japan Healthy Aging Study (J-HAS) is a prospective cohort designed to explore, through the latest technological and methodological advancements, the common biological and digital signatures of healthy longevity among the oldest-old. Between October and December 2022, 150 community-dwelling Japanese adults aged 80+ were enrolled and began participation. Data collection was structured to integrate genomic, metabolomic, proteomic, clinical, and digital biomarkers, with the goal of characterizing resilience and functional maintenance in “super-seniors.” The study design of including dual wearables, minute-level data, continuous daily questionnaires, and multi-omics profiling in individuals aged 80+ is novel and provides an important opportunity to study healthy aging in real-world conditions. Participants were monitored continuously for two years using both a Fitbit and an Oura Ring, yielding approximately 103 million minute-by-minute observations of activity, and 91,000 person-days of wearable data. In addition, participants completed daily lifestyle questionnaires for two years and monthly surveys. Clinical examinations were conducted at three points: baseline (V1, October–December 2022), one-year follow-up (V2), and two-year follow-up (V3). Each visit included comprehensive clinical assessments and laboratory testing. This presentation aims to introduce the J-HAS cohort, describe methodological considerations, and summarize initial findings related to demographic characteristics and compliance over the study period.

Association between environmental factors and restricted life-space among independent older adults.

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Background : Life-space among older adults is a predictor of falls and death; therefore, preventing its restriction is an important public health issue.

Purpose : This study aimed to clarify the association between life-space and built and natural environments.

Methods : This cross-sectional study used data from the Japan Gerontological Evaluation Study 2022. The outcome variable was life-space assessment (LSA). Exposure variables were natural and built environments. Natural environments included the amount of snowfall, the presence of beautiful scenery, and the presence of slopes. Built environments included the presence of parks and fresh food stores, and the number of hospitals and libraries. Covariates included age, sex, smoking and alcohol history, socioeconomic status, physical and psychological function, and use of car. We employed generalized linear mixed models, with all exposures trichotomized at the tertile and treated as fixed effects, while municipal variance was set as random effects.

Results : A total of 21,002 participants (mean age, 74.8 years; 52.2 % female) from 70 municipalities were included in the analysis. In the built environment model, a fewer hospitals were negatively associated with LSA, with a proportional change of variance to the null model (PCV) of 37.3. In the natural environment model, high presence of slopes and high snowfall were negatively associated with LSA, with a PCV of 51.9. In the fully adjusted model, a high presence of slopes, high snowfall, and a fewer libraries were negatively associated with LSA, and a high presence of hospitals was positively associated, with a PCV of 67.6.

Conclusions : In addition to individual factors, built environments and natural environments were associated with LSA, with natural environments explaining a large proportion of the municipal variance.

Implications : To prevent restricted life-space, strategies utilizing built environments and addressing natural environments are required.

Late-Pregnancy Exposure to Non-Optimal Temperature and Preterm Birth: A 45-Year Study in Japan

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Background : Evidence linking extreme heat with increased preterm birth (PTB) risk in the last weeks of pregnancy is a growing concern amid climate change. However, evidence remains limited across the full temperature spectrum, especially for cold exposure, and in Japan. No studies have examined long-term temporal trends in these associations.

Objective: To assess temporal variation in the short-term association between daily mean temperature and PTB in Japan from 1979 to 2023.

Methods : We applied a time-stratified case-crossover design using a conditional Poisson model and a distributed lag non-linear model with 28 days of lag to estimate prefecture-specific temperature-PTB associations, pooled nationally via random-effects meta-analysis. To assess temporal variation, data were split into two 20-year periods. Linear mixed-effects meta-regression examined the role of prefecture-level variables in explaining temporal differences in heat- and cold-related PTB risks.

Results : We analyzed 2,195,768 PTBs (4.23% of 51,855,047 live singleton births). The pooled exposure-response curve was U-shaped, with a minimum morbidity temperature (MMT) at the 56th percentile (17.7° C). Compared to the MMT, the relative risk (RR) of heat-related PTB (99th percentile) was 1.13 [95% CI: 1.10–1.15], and 1.11 [95% CI: 1.09–1.14] for cold-related PTB (1st percentile). Heat-related RR declined from 1.15 [95% CI: 1.11–1.18] in 1979–2000 to 1.09 [95% CI: 1.05–1.12] in 2001–2023 (p= 0.02); cold-related RR remained stable. Improvements in health system capacity, economic conditions, and air conditioning (A/C) prevalence were associated with reduced heat-related risk. A/C was also positively associated with MMT shifts.

Discussion : Heat-related PTB risk declined significantly, while cold-related risk remained consistent. These changes may reflect enhanced infrastructure and increased A/C access, highlighting the built environment's role in modulating heat vulnerability during pregnancy.

Prenatal per-/polyfluoroalkyl substances and development: The Japan Environment and Children's study

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Background and aim : Per- and polyfluoroalkyl substances (PFAS) have raised global concern due to their adverse effects on children's development. However, the association between prenatal exposure to PFAS and the achievement of developmental milestones in children remains unclear. This study aimed to examine the individual and cumulative associations between prenatal PFAS and developmental delay in 4-year-old children.

Methods : We used data collected in the Japan Environment and Children's Study (JECS), an ongoing prospective birth cohort. The participants were registered between January 2011 and March 2014. Among 28 PFAS measured in maternal plasma, eight with detection frequencies ≥ 60 % were analyzed. Developmental delays were assessed using the Japanese version of the Ages and Stages Questionnaires third edition (JASQ-3), a self-administered screening tool. Suspected developmental delay was defined as a total score falling below the Japanese version cutoffs for the five JASQ-3 domains (communication, gross motor, fine motor, problem solving, and personal-social). Univariate and multivariable logistic regression analysis and quantile g-computation were applied.

Results : We analyzed data from 15,131 mothers (15,175 children) in JECS. Findings revealed that these eight PFAS were not significantly associated with higher odds of developmental delay across any JASQ-3 domain, nor did their combined effects. However, the effects of PFAS substances not measured in this study and the impact of continued postnatal exposure to PFAS on developmental delays remain a concern.

Conclusions : The eight PFASs examined in this study were not associated with increased odds of developmental delay in any domain of the JASQ-3, nor was their combined effect found. Continuous investigation of the effects of PFAS on development throughout the lifespan is necessary.

Association between Fine Particulate Matter (PM2.5) and Mortality: Aichi Workers' Cohort Study

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Background : Fine particulate matter (PM2.5), with a diameter of 2.5 μm or less, can penetrate deep into the lungs and has been linked to adverse health outcomes. Previous studies have shown associations between residential PM2.5 levels and mortality, but socioeconomic status may have confounded these findings. This study focused on a relatively homogeneous occupational cohort in terms of socioeconomic status to examine the association between PM2.5 exposure and mortality.

Methods : The subjects were 4,573 local government employees residing in Aichi Prefecture who responded to self-administered questionnaire in August 2013, provided their annual health check-up data and valid home address. Participants were followed until March 2022. PM2.5 exposure was defined as the average annual concentration in 2013, measured at the nearest of 120 monitoring station to each participant's residential postal code. Participants were divided into two groups at the third quartile cut-point ($<16.65\,\mu g/m^3$, $\geq 16.65\,\mu g/m^3$). The association between PM2.5 exposure and mortality were estimated using Cox proportional hazards models, adjusting for sex, age, physical activity level, smoking history, drinking history, obesity, hypertension, dyslipidemia, diabetes, and cardiovascular disease.

Results : Compared to the group below $16.65\,\mu g/m^3$, the group exposed to $16.65\,\mu g/m^3$ or higher had a lower proportion of males (67.5%vs.70.9%) and a lower mean age (42.5vs.43.5). Smoking history in the higher group (31.7%) was not significantly different from that of the lower group (33.0%). The cumulative mortality rate over 8.7 years in the group exposed to PM2.5 at or above $16.65\,\mu g/m^3$ was 0.8%, higher than the 0.3% in the group below this level. The multivariable-adjusted hazard ratio (95%CI) was 2.52 (1.07-5.97,p = 0.035).

Conclusion : In the present prospective cohort study of local government employees residing in Aichi Prefecture, PM2.5 exposure was associated with an increased risk of mortality.