

Impact of Work-Family Conflict on Perceived Stress – Cross-sectional and Longitudinal Evidence from the Midlife in Japan Study

Mayumi Saiki, PhD, APRN¹, Adrian Loerbroks, PhD², Jian Li, MD, PhD^{1,3}

¹ School of Nursing, University of California Los Angeles, Los Angeles, United States

² Institute of Occupational, Social and Environmental Medicine, Centre for Health and Society, Faculty of Medicine, University of Düsseldorf, Düsseldorf, Germany

³ Departments of Environmental Health Sciences and Epidemiology, Fielding School of Public Health, University of California Los Angeles, Los Angeles, United States

Address correspondence to: Jian Li, MD, PhD, Departments of Environmental Health Sciences and Epidemiology, Fielding School of Public Health, School of Nursing, University of California Los Angeles. 650 Charles E. Young Drive South, Los Angeles, CA 90095, United States; jianli2019@ucla.edu

ORCID

Mayumi Saiki: <https://orcid.org/0000-0002-1648-6872>

Adrian Loerbroks: <https://orcid.org/0000-0003-2795-8684>

Jian Li: <https://orcid.org/0000-0003-2614-4291>

Author Contributions

JL and MS designed this study, MS and JL conducted the statistical analysis, and MS and JL drafted the manuscript. MS created the visual aids. MS, AL, and JL edited, reviewed, and approved the final manuscript.

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Conflict of Interest

None Declared.

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Data Availability Statement

The raw data of the MIDUS Study are publicly available in the ICPSR depository. MIDJA Wave I survey at <https://doi.org/10.3886/ICPSR30822.v3> and Wave II survey at <https://doi.org/10.3886/ICPSR36427.v3>. The statistical SAS syntax supporting the conclusions of this article will be made available by the authors, without undue reservation. Requests to access the statistical SAS syntax should be directed to Dr. Jian Li (jianli2019@ucla.edu).

AI statement

AI was not utilized in any stages of the hypothesis, data collection, data evaluation, and manuscript preparation.

Ethical Considerations and Disclosures

The analytic project was conducted in accordance with the Declaration of Helsinki and approved for exemption by the Institutional Review Board of the University of California, Los Angeles (IRB# 22-000836).

Abstract

Objectives: This study investigated whether exposure to work-family conflict was associated with increased perceived stress (PS) cross-sectionally and longitudinally.

Methods: Using data from the Midlife in Japan Wave I and II surveys over a four-year period, 668 workers in a cross-sectional and 419 workers in a longitudinal study were examined to assess the associations between baseline work-to-family conflict (WFC) and family-to-work conflict (FWC) and changes in baseline and follow-up PS Scale scores.

Results: In the multivariable analysis using linear regression for cross-sectional analysis and Generalized Estimating Equations linear regression for the longitudinal analysis, both binary and continuous WFC/FWC were significantly associated with PS cross-sectionally and longitudinally.

Conclusions: Both WFC and FWC were associated with increased PS cross-sectionally and longitudinally. Screening work-family conflict and developing interventions to mitigate it can be beneficial for enhancing mental health.

Keywords: work-family conflict; perceived stress; workplace psychosocial factors; cross-sectional study; longitudinal study; Japan

SMART Learning Outcomes

- Discuss the effect of short-term and long-term association of work-to-family conflict and family-to-work conflict on increased perceived stress among Japanese workers.
- Recognize other potential factors that may influence the relationship between work-family conflict and perceived stress.
- Evaluate the benefits of work-site screening for work-family conflict to initiate early interventions.

INTRODUCTION

The associations between poor work environment, such as a lack of job control and excessive workload, and mental health have been reported.¹ Mental disorders, such as depression and anxiety, result in a loss of productivity estimated at approximately 1 trillion United States dollars per year.¹ The World Health Organization estimates that 15% of people of productive age suffer from mental disorders.¹ Work-life balance is one of the important factors contributing to workers' mental health.² While work-life balance tends to be better in European countries, the work-life balance in Japan is ranked 37th out of 41 countries by the Organization for Economic Co-operation and Development.³

Workers frequently experience role conflicts arising from multiple responsibilities and demands, including those at home and work. This phenomenon is called work-family conflict. Work-family conflict consists of two components: work roles that interfere with family roles, referred to as work-to-family conflict (WFC), and family roles that interfere with work roles, referred to as family-to-work conflict (FWC). Work-family conflict has been gaining attention in current society due to the increasing number of nuclear families and dual-earner couples. In 2023, the Japanese government reported that 61.4% of the population was in the labor force.⁴ A Japanese study reported that 30.7% of Japanese workers reported high WFC, while 46.2% of them reported high FWC.⁵ A cross-sectional study found that both WFC and FWC were associated with mental health among Japanese workers.⁶ Another Japanese cross-sectional study reported that FWC was associated with psychological distress.⁷ The associations between work-family conflict and other adverse effects on mental health, such as burnout, depression, substance use, and anxiety, have also been reported.²

The perception of stress exhibits inter-personal variability and thereby elicits differing emotional reactions, which are affected by one's personal resources, such as coping skills and past experiences.⁸ The government of Japan reported that 82.2% of Japanese workers were exposed to stress at work in 2022.⁹ A Japanese study reported that various types of psychosocial working conditions, such as job demands, little control of work, workplace bullying, lack of support from co-workers, and job insecurity, increased perceived stress.¹⁰

The associations between WFC / FWC and perceived stress are one potential mechanism that might underlie the harmful effects on mental health. For instance, a review article indicated that work-family conflict and psychological distress exhibit a reciprocal relationship.² A cross-sectional study examined the associations between perceived stress and depression across 45 low- and middle-income countries, noting that the associations between perceived stress and increased depression were observed in all the examined countries.¹¹ When focusing on a Japanese population, perceived stress was significantly higher among the high levels of depressed group compared to the low levels of depressed group.¹⁰

Six studies have addressed the relationship between work-family conflict and perceived stress.^{12–17} Among these, four studies addressed both components (i.e., WFC and FWC).^{13–15,17} Two of them were longitudinal studies with a short follow-up period, ranging from 3 months¹⁵ to 6 months.¹³ These studies were from the U.S.,¹⁶ Germany,¹³ Poland,¹⁵ Tunisia,¹⁴ China,¹⁷ and Pakistan.¹² The study populations represented healthcare providers,¹⁶ the German workforce,¹³ couples,¹⁵ physical education teachers,¹⁴ full-time female workers,¹⁷ and textile and clothing workers.¹² Four cross-sectional studies reported that WFC was associated with increased perceived

stress.^{12,14,16,17} However, the associations between WFC and perceived stress in longitudinal studies were inconsistent. Although a study in Germany reported that WFC was positively associated with perceived stress during a six-month follow-up among the German workforce,¹³ another study among the Polish couples found no evidence of an association across a three-month follow-up.¹⁵

As the literature demonstrates, research examining whether exposure to work-family conflict leads to changes in perceived stress over time with short follow-up periods is inconsistent. Understanding whether work-family conflict has longitudinal effects with a long follow-up period helps to explore psychological stress mechanisms to prevent the further development of mental illnesses. Moreover, there are no studies examining workers in Japan. In addition, the German study suggested potential longitudinal effects of a short follow-up period on work-family conflict and perceived stress.¹³ Consequently, our study aimed to advance knowledge about whether work-family conflict affects perceived stress in the long term over a four-year period, in Japan. To our knowledge, this is the first study to employ both cross-sectional and longitudinal designs over four years to examine whether work-family conflict is associated with changes in perceived stress among workers in Tokyo, Japan.

This manuscript is a part of the author's doctoral dissertation, "The Impact of Work-Family Conflict on Changes in Lipid Risk Factors, Allostatic Load, and Perceived Stress Among Workers: Four-Year Longitudinal Evidence from the Midlife in Japan Study," deposited in 2025.¹⁸

METHODS

Study Population

This study used the data from the Midlife in Japan (MIDJA) survey Wave I¹⁹ and Wave II.²⁰ The MIDJA study was conducted to understand the health and well-being of Japanese adults who were middle-aged and older at the baseline survey. Participants aged between 30 and 79 were recruited from Tokyo, Japan. Participants were randomly selected from the Basic Resident Register Book for metropolitan areas in Tokyo, using a two-stage stratified random sampling, including age and gender. The baseline survey was conducted from April 2008 to September 2008, and the follow-up survey was conducted from May 2012 to October 2012.

A total of 1,027 participants participated in the MIDJA Wave I survey. Among these, 735 participants had paid jobs, and 727 had complete data on WFC and FWC at baseline. From the 700 participants with complete data on the Perceived Stress Scale 10-item version (PSS-10), 668 participants with full data on covariates were included in a cross-sectional study. Among them, 436 participants were followed up in the MIDJA Wave II survey, and 419 participants with complete PSS-10 at follow-up were included in our longitudinal analysis.

The analytic project was conducted in accordance with the Declaration of Helsinki and approved for exemption by the Institutional Review Board of the University of California, Los Angeles (IRB# 22-000836).

Work-Family Conflict

This study utilized a validated scale to measure work-family conflict²¹. The Japanese

version of the scale has also been tested for reliability and validity.²² The scale captures both WFC and FWC. WFC refers to stress caused by role conflicts, where work roles interfere with family roles. In contrast, FWC reflects stress arising from family roles that interfere with work roles. Additionally, work-family conflict can be categorized into three forms: time-based, strain-based, and behavior-based conflict.²³ Time-based conflict is caused by insufficient time to fulfill roles. Strain-based conflict arises when one role prohibits participation in another role. Behavior-based conflict occurs when one role's behavior is incompatible with behavioral expectations for the other role. Work-family conflict scale in the MIDJA study primarily assesses strain-based conflict, although these questions also imply the other two factors.

Work-family conflict scale consists of eight items; WFC and FWC each contain four items. The sample questions for WFC are “How often have you experienced your job reducing the effort you can give to activities at home?” and “How often have you experienced stress at work making you irritable at home?”¹⁹ The sample questions for FWC are “How often do responsibilities at home reduce the effort you can devote to your job?” and “How often do personal or family worries and problems distract you when you are at work?” Each WFC and FWC contains four items assessed on a 5-point Likert scale (1: none of the time, 5: most of the time). These scores were summed to create a continuous WFC / FWC score, ranging from 4 to 20. A higher score indicates greater exposure to stress caused by role conflicts. To improve the stability of the explanatory power of continuous variables, the total score of WFC / FWC was converted into a Z-score. Additionally, we created binary WFC and FWC using the median cut-offs, indicating low and high levels of WFC / FWC. We used both continuous and binary WFC / FWC in order to test the robustness of the association. Cronbach's α for WFC and FWC in this study were 0.83 and 0.73,

respectively.

Perceived Stress Scale 10 Items Version (PSS-10)

The PSS-10 is a validated tool that assesses participants' perceptions of threats and demands related to their circumstances when they lack adequate resources to cope with stressors.⁸ It measures emotional reactions to and perceptions of their environments, thereby reducing the likelihood of influences arising from cultural differences, as the PSS-10 evaluates emotional responses and global stress. The PSS-10 consists of ten questions that assess positive and negative emotional responses to stressful events and address emotional experiences from the past month. Of the ten questions, six capture negative emotional experiences, while four inquire about positive emotional experiences. Sample questions include “How often have you been upset because of something that happened unexpectedly?” and “How often have you felt that things were going your way?” Participants responded using a Likert scale ranging from 1 (never) to 5 (very often). This study followed the calculations found in the literature, and the scores for positive experiences were reversed, from 1 (very often) to 5 (never), and summed with both positive and negative subscales to create the total PSS-10 score.⁸ The possible range of scores for the PSS-10 is from 10 to 50. A higher score suggests greater negative emotional responses. Cronbach’s α of PSS-10 for this study at baseline and follow-up was 0.78 and 0.80, respectively.

Covariates

Covariates included in this study are sociodemographic factors, including age (30-45, 46-55, and ≥ 56), sex (men and women), and educational attainment (high school or less, some college, and university or more); work- and family-related factors, including management position (no and

yes), job demands (continuous, ranging from 5-25) as defined by Karasek's Job Demand Control Model,²⁴ marital status (married, never married, and others), and parental status (no and yes); and lifestyle behavioral factors, smoking (never smoker, former smoker, and current smoker), alcohol consumption (drinks per day, which was logarithmically transformed due to its skewed distribution), and physical exercise (no and yes) in line with previous studies.^{25,26}

Statistical Analysis

First, we generated descriptive statistics. For continuous variables, we reported the means and standard deviations (SDs) for each cross-sectional and longitudinal sample. For count variables, we used medians and ranges. For categorical variables, we presented relative frequencies and percentages. As for statistical models, this study employed regular linear regression for the cross-sectional analysis and Generalized Estimating Equations (GEE) linear regression for the longitudinal analysis. GEE is suitable for assessing time dependence in clustered and repeated measures.²⁷ We conducted analyses for each WFC and FWC using a separate regression model.

We employed four adjustment models: Model 0 was unadjusted; Model 1 was adjusted for sociodemographic factors, including age, sex, and educational attainment at baseline; Model 2 was additionally adjusted for management position, job demands, marital status, and parental status at baseline; and Model 3 was additionally adjusted for smoking, alcohol consumption, and physical exercise at baseline. We also conducted sensitivity analysis for a cross-sectional study, including only participants who completed both baseline and follow-up surveys. The results are reported in β coefficients and 95% confidence intervals (CIs). SAS 9.4 statistical software²⁸ was used for this study.

RESULTS

The total number of participants for cross-sectional and longitudinal analyses was 668 and 419, respectively (see Table 1). The age distributions in the cross-sectional and longitudinal samples were relatively similar. The age group of 46-55 years was slightly smaller in both samples. The proportions of female participants were 42.66% of the cross-sectional sample and 47.49% of the longitudinal sample. Most participants had completed educational attainment beyond some college levels and did not hold management positions. The mean and SD of job demands²⁴ in the cross-sectional and longitudinal samples were similar and indicated moderate job demands. Approximately 70 % of participants were married and had children. Most participants were not current smokers and did not engage in physical exercise. The median alcohol consumption was 3 drinks per week in the cross-sectional sample and 2.5 drinks per week in the longitudinal sample. The follow-up rate of this study was 64.77% (410/633). This follow-up rate is comparable to the overall follow-up rate for the MIDJA study, which was 63.97% (657/1027).

The mean and SD of WFC at baseline for the cross-sectional study were 9.38 ± 3.33 , and for the longitudinal study were 9.36 ± 3.21 . The mean and SD of FWC at baseline were 7.65 ± 2.56 for the cross-sectional study and 7.60 ± 2.34 for the longitudinal study. The mean and SD for the PSS-10 at baseline were 26.28 ± 5.81 for the cross-sectional study and 25.98 ± 5.80 for the longitudinal study. The mean and SD for the PSS-10 at follow-up for the longitudinal sample were 26.25 ± 5.69 .

Table 2 shows the cross-sectional associations between WFC / FWC and perceived stress. The associations between binary WFC and continuous WFC were stable across all models. We

also observed robust associations between both binary and continuous WFC across all models. In the fully adjusted model, the β coefficient and 95% CIs for binary and continuous WFC were 2.32 (1.37, 3.26) and 1.91 (1.43, 2.39), respectively.

Both binary and continuous FWC also showed consistent associations from Model 0 to Model 3. The fully adjusted models for binary and continuous FWC of the β coefficients and 95% CIs were 3.12 (2.28, 3.96) and 1.68 (1.25, 2.11), respectively.

We conducted sensitivity analysis to examine cross-sectional associations among participants who completed surveys at both baseline and follow-up ($n = 419$). As shown in Supplementary Table 1 (<http://links.lww.com/JOM/C354>), the association was quite comparable to that reported in the main results in Table 2 ($n = 668$).

Table 3 displays the longitudinal associations of WFC and FWC at baseline and the changes in PSS-10 between baseline and follow-up. This longitudinal study also shows robust associations from Model 0 to Model 3. The associations between baseline WFC and changes in perceived stress from baseline to follow-up for binary and continuous WFC in the fully adjusted model were 2.33 (1.28, 3.37) and 1.53 (0.93, 2.13), respectively. The longitudinal associations between FWC and perceived stress for binary and continuous FWC were 2.29 (1.35, 3.22) and 1.30 (0.80, 1.80), respectively.

[Table 3 here]

Supplementary Table 2 (<http://links.lww.com/JOM/C354>) illustrates retained and dropout

participants. Dropout participants were more likely to be younger, male, never married, consume more alcohol, and have higher perceived stress. However, there were no significant differences in WFC and FWC at baseline between these samples.

DISCUSSION

We examined the cross-sectional and longitudinal associations between WFC / FWC and perceived stress among population-representative Japanese workers in Tokyo. Our results indicated consistent cross-sectional and longitudinal associations between WFC / FWC and increased perceived stress between baseline and follow-up, separated by four years, among Japanese workers.

Regarding WFC, our cross-sectional results were consistent with previous studies that reported WFC as being associated with increased perceived stress.^{12,14,16,17} Our study adds insights from workers in Japan to this sparse evidence base. Moreover, our longitudinal study aligns with the German study, which followed a population-representative sample of workers for six months,¹³ although it contradicts another longitudinal study among Polish couples, which found no association with perceived stress during a three-month period.¹⁵ A possible reason for the discrepancies might be due to the measurement instrument, that the Polish Study used only 2 items of PSS-4, which had relatively limited power to capture the full spectrum of perceived stress, whereas the German Study used 10 items of PSS-10. Our results contributed novel insights specifically related to the long-term effects (i.e., across four years) of WFC on perceived stress.

For FWC, our cross-sectional study showed that FWC was associated with increased perceived stress. Our findings from the cross-sectional studies align with those of previous studies.^{14,17} Additionally, our longitudinal study supports the findings in the German study,¹³ although it contradicts the Polish study that reported no longitudinal associations between FWC and perceived stress.¹⁵ Our study has extended the current body of literature, adding to the developing understanding of the longitudinal effects of FWC, supporting the study in Germany.

Our study suggests that WFC and FWC possibly have long-term effects on increased perceived stress over a four-year period. The German study suggested short-term effects of work-family conflict, and the authors proposed that the effects of work-family conflict last longer than previously believed, i.e., 6 months.¹³ Our study reinforced the notion that work-family conflict influences perceived stress over a four-year period. These studies suggest that WFC and FWC exert short-term and long-term effects that contribute to increased perceived stress.

One potential mechanism underlying the long-term effects of work-family conflict is that it induces anxiety and rumination. Supporting this notion, a U.S. study reported that work-family conflict was associated with increased work-to-family guilt among full-time working parents of toddlers.²⁹ Negative emotions, such as work-family guilt, could lead to rumination. Moreover, a Finnish longitudinal study with a 2-year follow-up period reported that high affective rumination and low detachment from work have negative psychological effects, such as higher job exhaustion and sleep problems.³⁰ Such negative emotions may frequently activate psychophysiological stress responses. Anxiety, rumination, and anticipation of stressful events can activate the autonomic nervous system and the hypothalamic-pituitary-adrenal (HPA) axis, which also depletes energy

and leads to allostatic load, which refers to the wear and tear on the body. Even though they are not directly exposed to the actual stressors, this mechanism is similar to that of actual stressful events.^{31,32} Furthermore, one possible explanation for the psychophysiological connection between perceived stress and mental health is that stress perception may alter neural connectivity. The U.S. study reported that perceived stress was significantly positively associated with amygdala activity, as measured by 18F-fluorodeoxyglucose positron emission tomography-computed tomography.³³ This study supports the notion that perceived stress influences amygdala activity, which activates the HPA axis. Hyperactivity of the HPA axis is observed in patients with major depressive disorder.³⁴ This groundbreaking study linked perceived stress and neural activity, revealing potential underlying mechanisms linking perceived stress to mental illness. Additionally, a Spanish study reported that elevated perceived stress was positively correlated with functional connectivity, as measured by functional magnetic resonance imaging between the right anterior insula and the right putamen.³⁵ The putamen is associated with learning, motor control, cognitive functions, reward, and addiction,³⁶ while the insula is associated with cognition, emotions, motivation, and human behavior. These studies suggest possible alterations in brain circuits related to perceived stress and provide a potential explanation for the pathway from exposure to work-family conflict, resulting in long-term effects on elevated perceived stress through alterations in the motivations and reward pathways.

Other physiological changes reported in our previous studies suggested that only WFC was associated with increased allostatic load,³⁷ low-density lipoprotein cholesterol, and the ratio of total cholesterol to high-density lipoprotein cholesterol,³⁸ while FWC was not. However, our current study shows that both WFC and FWC were significantly associated with psychological

changes among Japanese workers, indicating the different effects of WFC and FWC on mental and physical health outcomes. Work-family conflict, especially WFC, is a significant issue in Japan, as illustrated by the implementation of the Work Style Reform Act in 2019.³⁹ Work schedules, supervisor support,² and strain⁴⁰ can be sources of work-family conflict. One unique underlying factor for work-family conflict in Japan is its collectivist culture. A symbolic phenomenon representing collective workplace culture is “Tsukiai zangyo,” meaning collective overtime, in which workers are discouraged from leaving while their co-workers or supervisors are still working.⁴² Collective overtime is deeply built on the Japanese social norm, i.e., working overtime is seen as working hard.⁴² This traditional collective culture, which prioritizes the group’s interests over individual interests,⁴³ creates a unique problem of role conflict in Japan compared with Western individualistic countries, that WFC may induce more severe physical health consequences than FWC.

Since work-family conflict has long-term effects, it is crucial to disrupt its pathways to reduce its chronic consequences. Benefits of individual- and organizational-level interventions that target work-family conflict have been documented. At the individual level, occupational health providers can utilize work-family conflict scale to screen workers and initiate early interventions. For instance, a meta-analysis suggested interventions designed to improve personal resources, such as parenting skills, stress management, and mindfulness, to mitigate work-family conflict.⁴⁴ A study in China proposed that utilizing an employee assistance program is also effective in reducing both WFC and FWC.⁴⁵ At the organizational level, a workplace intervention that provided training to supervisors to increase their understanding of work-family conflict, as well as training to employees in redesigning their work, including control over their schedules, improved work-

family conflict.⁴⁶ Another systematic review also suggested that flexible work schedules consistently improved work-family well-being.⁴⁷

Strengths and Limitations

The strengths of this study should be highlighted. This study is the first to examine both cross-sectional and longitudinal associations across four years between work-family conflict and perceived stress in Japan. Our findings indicate that work-family conflict affects perceived stress not only in the short term but also in the long term. This study contributes new insights by demonstrating that work-family conflict has a prolonged effect on increasing perceived stress even after four years.

We also need to consider the limitations of this study. Work-family conflict has three additional forms of conflict, including time-based, strain-based, and behavior-based.²³ However, our work-family conflict scale was strain-based, although these questions included nuances of time- and behavior-based work-family conflict. For instance, “How often do responsibilities at home reduce the effort you can devote to your job?” is a strain-based WFC question, but this question also implies time-based WFC. Due to this reason, the applicability of time- and behavior-based work-family conflict is limited.

Second, the exposure information in this study was based on baseline measurement. Thus, this study did not consider any potential changes in work-family conflict or in participants’ environmental factors, such as working conditions and family structure. Moreover, other potential factors not included in the covariates but influencing perceived stress, such as role clarity, support

at work,¹² and job dissatisfaction¹⁴.

Third, the MIDJA data are relatively old, as the baseline survey was conducted in 2008 and the follow-up survey was conducted in 2012. Following the MIDJA studies, the working environment has undergone changes related to the implementation of the Work-Style Reform Act in 2019.³⁹ However, the number of compensated workers' compensation claims related to psychiatric conditions has increased from 497 in 2014 to 888 in 2023.⁴⁸ Thus, the effect of old data is considered to be minimal. Furthermore, MIDJA data was collected in Tokyo, which is a metropolitan area in Japan. Therefore, the generalization of our findings may not apply to other areas in Japan.

Lastly, the follow-up rate for this study was 64.77%. Our additional analysis indicated that the participants who dropped out were generally younger, male, never married, consumed more alcohol, and had higher perceived stress, leading to a retention bias that could not be eliminated. However, there were no differences in baseline WFC and FWC scores between retained participants and those who dropped out (please see details in Supplementary Table 2, <http://links.lww.com/JOM/C354>). Therefore, the effect of retention bias is minimal.

CONCLUSIONS

We examined the cross-sectional and longitudinal effects of work-family conflict on perceived stress. This study found that both WFC and FWC have long-term effects spanning four years on increased perceived stress among Japanese workers. Due to the long-term effects on WFC and FWC, it is crucial for occupational health clinicians and organizations to screen for work-

family conflict in order to initiate early interventions, including individual and organizational interventions. Future studies finding strategies to mitigate work-family conflict are warranted.

ACCEPTED

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LEGEND

FIGURE 1: Flowchart illustrating participant selection for this study. Participants were identified from the Midlife in Japan (MIDJA) Study, who were currently employed with full data on work-family conflict, covariates, perceived stress, and follow-up in MIDJA II. Participants were excluded if they were not currently working, had missing data of interest in MIDJA I, were lost to follow-up, or had missing data in MIDJA II. The final sample for cross-sectional analyses was 668, and the final sample for longitudinal analyses was 419. PSS-10, Perceived Stress Scale 10-item version; WFC, work-to-family conflict; FWC, family-to-work conflict.

TABLE 1: Table 1 illustrates baseline characteristics of the cross-sectional and longitudinal study sample. A total of 668 workers in the cross-sectional study and 419 workers in the longitudinal study were included in this study. These numbers reflect the observed frequency, sorted by category, with the percentage in each category. WFC, work-to-family conflict; FWC, family-to-work conflict; PSS-10, Perceived Stress Scale 10-item version.

TABLE 2: The results of the cross-sectional association of work-family conflict, including work-to-family conflict and family-to-work conflict. Linear regression was used for this cross-sectional analysis. These results are reported as β -coefficients and 95% confidence intervals (CIs). Significant level, *** $p < 0.001$. Continuous work-to-family conflict and family-to-work conflict are increased by standard deviation (SD).

Model 0: no adjustment;

Model 1: adjustment for age, sex, and education at baseline;

Model 2: Model 1 + additional adjustment for management position, job demands, marital status, and parental status at baseline;

Model 3: Model 2 + additional adjustment for smoking, alcohol consumption, and physical exercise at baseline.

TABLE 3: The results of the longitudinal association of work-family conflict, including work-to-family conflict and family-to-work conflict. Generalized estimating equations with linear regression were used for this longitudinal analysis. These results are reported as β -coefficients and 95% confidence intervals (CIs). Significant level, *** $p < 0.001$. Continuous work-to-family conflict and family-to-work conflict are increased by standard deviation (SD).

Model 0: no adjustment;

Model 1: adjustment for age, sex, and education at baseline;

Model 2: Model 1 + additional adjustment for management position, job demands, marital status, and parental status at baseline;

Model 3: Model 2 + additional adjustment for smoking, alcohol consumption, and physical exercise at baseline.

FIGURE 1. Sample Selection.

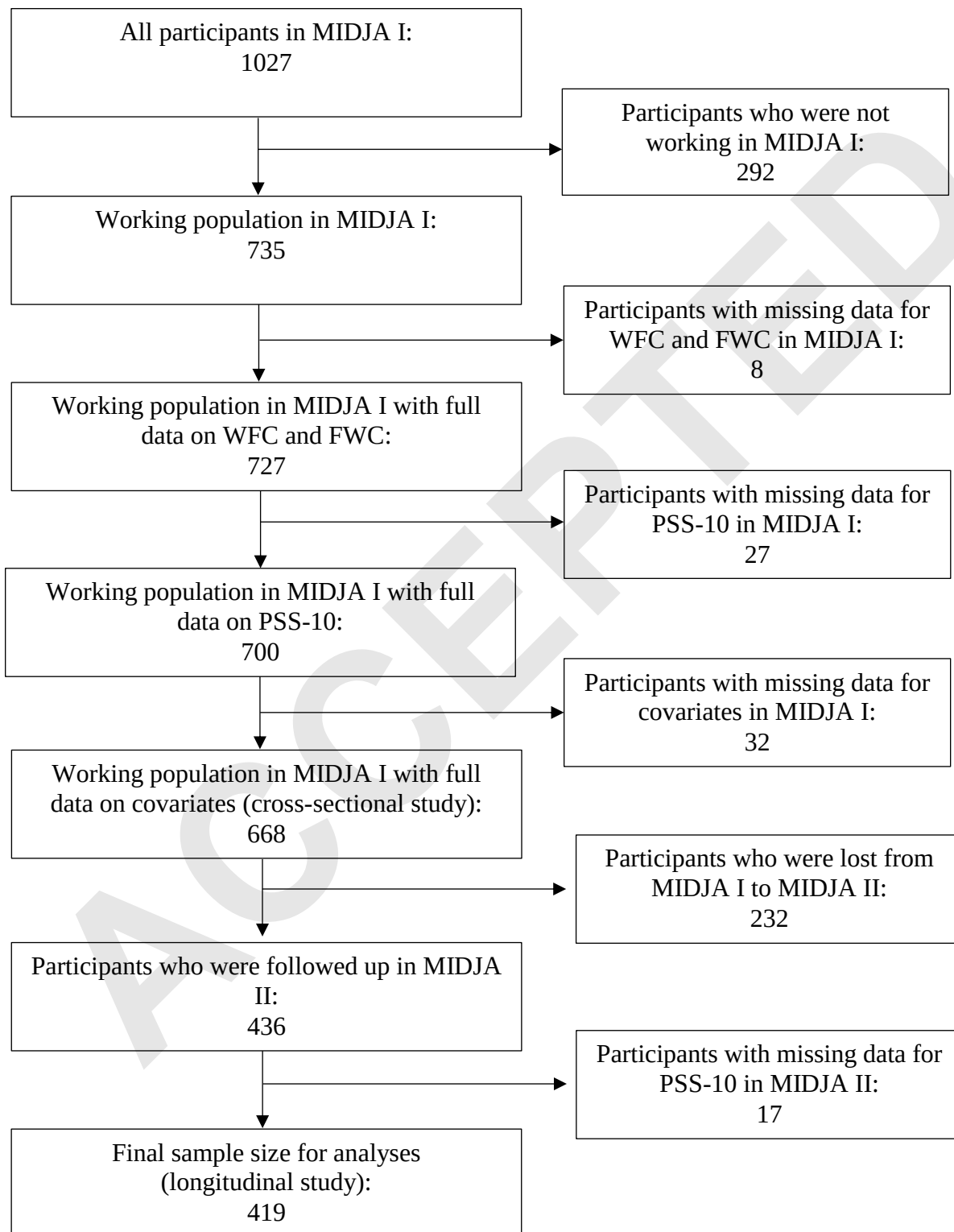


TABLE 1. Characteristics of the study sample at baseline for cross-sectional and longitudinal samples.

Variables		Cross-sectional sample <i>n</i> = 668	Longitudinal sample <i>n</i> = 419
Age at baseline	30- 45 years	258 (38.62%)	151 (36.04%)
	46-55 years	170 (25.45%)	118 (28.16%)
	≥ 56 years	240 (35.93%)	150 (35.80%)
Sex at baseline	Male	383 (57.34%)	220 (52.51%)
	Female	285 (42.66%)	199 (47.49%)
Education at baseline	High school or less	240 (35.93%)	146 (34.84%)
	Some college	173 (25.90%)	105 (25.06 %)
	University or more	255 (38.17%)	168 (40.10 %)
Management position at baseline	No	442 (66.17%)	279 (66.59 %)
	Yes	226 (33.83%)	140 (33.41%)
Job demands	Mean ± SD	13.43 ± 3.70	13.22 ± 3.64
Marital status at baseline	Married	459 (68.71%)	301 (71.84%)
	Never married	132 (19.76%)	71 (16.95%)
	Others	77 (11.53%)	47 (11.22%)
Parental Status	No	220 (32.93%)	127 (30.31%)
	Yes	448 (67.07%)	292 (69.69%)
Smoking at baseline	Never smoker	222 (33.23%)	144 (34.37 %)
	Former smoker	248 (37.13%)	160 (38.19%)
	Current smoker	198 (29.64%)	115 (27.45 %)
Alcohol consumption (drinks per week) at baseline	Median (range)	3 (0 – 140)	2.5 (0 – 140)
Physical exercise at baseline	No	396 (59.28%)	239 (57.04 %)
	Yes	272 (40.72%)	180 (42.96%)
Continuous WFC at baseline	Mean ± SD	9.38 ± 3.33	9.36 ± 3.21
Binary WFC at baseline	Low	274 (41.02%)	207 (49.40%)

	High	394 (58.98%)	212 (50.60%)
Continuous FWC at baseline	Mean $\pm$ SD	7.65 $\pm$ 2.56	7.60 $\pm$ 2.34
Binary FWC at baseline	Low	306 (45.81%)	187 (44.63%)
	High	362 (54.19%)	232 (55.37%)
PSS-10 at baseline	Mean $\pm$ SD	26.28 $\pm$ 5.81	25.98 $\pm$ 5.80
PSS-10 at follow-up	Mean $\pm$ SD	NA	26.25 $\pm$ 5.69

TABLE 2. Cross-sectional associations of work-family conflict and Perceived Stress Scale-10 at baseline (β coefficient and 95% CIs) (n = 668).

	Model 0	Model 1	Model 2	Model 3
Work-to-family conflict				
Low	0.00	0.00	0.00	0.00
High	3.54 (2.68, 4.40)***	3.19 (2.30, 4.09)***	2.43 (1.48, 3.38)***	2.32 (1.37, 3.26)***
Continuous (Increase per SD)	2.35 (1.95, 2.75)***	2.25 (1.82, 2.68)***	1.94 (1.46, 2.43)***	1.91 (1.43, 2.39)***
Family-to-work conflict				
Low	0.00	0.00	0.00	0.00
High	4.01 (3.17, 4.84)***	3.72 (2.87, 4.56)***	3.17 (2.33, 4.01)***	3.12 (2.28, 3.96)***
Continuous (Increase per SD)	2.18 (1.77, 2.59)***	2.04 (1.62, 2.47)***	1.70 (1.27, 2.13)***	1.68 (1.25, 2.11)***

TABLE 3. Longitudinal associations of work-family conflict at baseline and changes of Perceived Stress Scale-10 at baseline and follow-up (β coefficient and 95% CIs) (n = 419).

	Model 0	Model 1	Model 2	Model 3
Work-to-family conflict				
Low	0.00	0.00	0.00	0.00
High	3.37 (2.45, 4.30)***	3.13 (2.18, 4.09)***	2.39 (1.33, 3.45)***	2.33 (1.28, 3.37)***
Continuous (increase per SD)	1.99 (1.46, 2.51)***	1.91 (1.35, 2.46)***	1.57 (0.96, 2.19)***	1.53 (0.93, 2.13)***
Family-to-work conflict				
Low	0.00	0.00	0.00	0.00
High	3.22 (2.30, 4.15)***	2.88 (1.96, 3.80)***	2.27 (1.34, 3.21)***	2.29 (1.35, 3.22)***
Continuous (increase per SD)	1.80 (1.33, 2.27)***	1.65 (1.17, 2.13)***	1.31 (0.80, 1.82)***	1.30 (0.80, 1.80)***

Supplementary Tables

TABLE 1: Sensitivity analysis of the cross-sectional association of work-to-family conflict and family-to-work conflict on perceived stress, including participants who completed both baseline and follow-up surveys (n = 419).

All Participants (n = 419)	Model 0	Fully adjusted
Work-to-family conflict		
Low	0.00	0.00
High	4.16 (3.12, 5.20)***	2.91 (1.74, 4.07)***
Continuous (Increase per SD)	2.44 (1.93, 2.95)***	1.91 (1.30, 2.53)***
Family-to-work conflict		
Low	0.00	0.00
High	4.09 (3.04, 5.14)***	3.08 (2.00, 4.16)***
Continuous (Increase per SD)	2.23 (1.72, 2.75)***	1.68 (1.14, 2.23)***

Linear regression was used for this cross-sectional analysis. These results are reported as b-coefficients and 95% confidence intervals (CIs). Significant level, *** $p < 0.001$. Continuous work-to-family conflict and family-to-work conflict are increased by standard deviation (SD).

Model 0: no adjustment;

Fully Adjusted Model: adjustment for age, sex, education, management position, job demands, marital status, parental status, smoking, alcohol consumption, and physical exercise at baseline.

TABLE 2. Characteristics of the study sample at baseline between retained and dropout participants.

Variables		Retained participants <i>n</i> = 436	Dropout participants <i>n</i> = 232	<i>P</i>
Age	30- 45 years	151 (34.63%)	107 (46.12%)	0.012
	46-55 years	121 (27.75%)	49 (21.12%)	
	≥ 56 years	164 (37.61%)	76 (32.76%)	
Sex	Male	231 (52.98%)	152 (65.52%)	0.002
	Female	205 (47.02%)	80 (34.48%)	
Marital status	Married	315 (72.25%)	144 (62.07%)	0.007
	Never married	71 (16.28%)	61 (26.29%)	
	Others	50 (11.47%)	27 (11.64%)	
Education	High school or less	155 (35.55%)	85 (36.64%)	0.494
	Some college	108 (24.77%)	65 (28.02%)	
	University or more	173 (39.68%)	82 (35.34%)	
Management position	No	290 (66.51%)	152 (65.52%)	0.796
	Yes	146 (33.49%)	80 (34.48%)	
Smoking	Never smoker	152 (34.86%)	70 (30.17%)	0.128
	Former smoker	166 (38.07%)	82 (35.34%)	
	Current smoker	118 (27.06%)	80 (34.48%)	
Alcohol consumption (drinks per week)	Median (range)	2.50 (0.00-140.00)	4.50 (0.00 – 70.00)	0.020
Physical exercise	No	252 (57.80%)	144 (62.07%)	0.285
	Yes	184 (42.20%)	88 (37.93%)	
WFC	Mean ± SD	9.27 ± 3.21	9.57 ± 3.55	0.264
FWC	Mean ± SD	7.62 ± 2.36	7.70 ± 2.92	0.724
PSS-10	Mean ± SD	25.90 ± 5.80	26.99 ± 5.78	0.020

Chi-square test for categorical variables and t-test for continuous variables were used to assess differences between retained and dropout participants. WFC, work-to-family conflict; FWC, family-to-work conflict; PSS-10, Perceived Stress Scale 10-item version.

