

Diverging trajectories of job demands, job resources, and psychological distress before long-term mental health-related sick leave among teachers

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Objectives This study aimed to (i) examine longitudinal changes in psychosocial work factors and mental health during the three years preceding long-term mental health-related sick leave among teachers and (ii) determine whether within-person changes in job demands and resources were associated with psychological distress.

Methods Annual occupational stress surveys conducted from 2010–2023 were linked to administrative sick-leave records for 505 elementary and junior high school teachers who experienced a first mental health-related sick-leave episode lasting ≥ 180 days. Trajectories from three years before to immediately before leave were estimated using linear mixed-effects models. Within-person associations between psychosocial work factors and psychological distress [measured by the six-item Kessler Psychological Distress Scale (K6)] were examined using person-mean decomposition. The overall teacher population was used as a descriptive standardization reference.

Results Psychological distress and stress responses increased as sick leave approached, whereas quantitative and qualitative job demands remained relatively stable. Job control, coworker support, supervisor support, and work engagement generally became less favorable. Within-person analyses showed that higher-than-usual quantitative and qualitative job demands were associated with higher concurrent K6 scores, whereas higher-than-usual job control, supervisor support, coworker support, and work engagement were associated with lower K6 scores (all $P < 0.001$).

Conclusions The years preceding long-term mental health-related sick leave were characterized by worsening psychological distress and deterioration in perceived job resources rather than a progressive increase in general job demands. Psychosocial work perceptions and distress covaried within individuals, although their temporal and causal direction could not be determined.

Key terms job control; longitudinal study; occupational stress; sickness absence; workplace support.

Teaching is a demanding occupation characterized by heavy workloads, emotional demands, role conflict, and administrative responsibilities (1, 2). Mental health-related sick leave among teachers has important consequences for affected individuals, schools, and educational systems (3, 4), making prevention of prolonged work disability an occupational health priority.

Adverse psychosocial work environments have been linked to poor mental health across occupations (5). High job demands and low job control are associated with common mental disorders and depressive symptoms, while low workplace social support may also contribute to psychological distress (6, 7). The Job

Demands-Resources (JD-R) model proposes that excessive demands contribute to strain, whereas resources such as job control and workplace support may buffer demands and support well-being and engagement (8–10).

Most previous studies, however, have examined psychosocial work factors at a single time point or over relatively broad follow-up periods (1, 11–13). Less is known about how mental health and psychosocial working conditions change within individuals during the years immediately preceding prolonged mental health-related sick leave. In particular, it is unclear whether impending leave is characterized mainly by increasing

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job demands, diminishing job resources, worsening psychological distress, or some combination of these processes.

We therefore examined trajectories of psychosocial work factors and mental health during the three years preceding long-term mental health-related sick leave among teachers, using repeated annual occupational stress surveys linked to administrative sickness-absence records. We also separated within-person changes from stable between-person differences in psychosocial factors and used the overall teacher population during the same calendar period as a descriptive standardization reference.

Methods

Study design and participants

This retrospective longitudinal cohort study used annual occupational stress surveys of full-time elementary and junior high school teachers employed by the Nagoya municipal school system, Japan, from 2010 to 2023. The survey was administered each year for approximately two weeks in late September. Across the study period, 11 561 unique teachers contributed at least one survey. Among full-time elementary and junior high school teachers, annual respondents ranged from 3970 in 2010 to 5715 in 2023 (supplementary material, www.sjweh.fi/article/4337, table S1). Response rates were available for the entire eligible school-system workforce, rather than separately for the elementary and junior high school teacher cohort; the overall response rate was 62.1% in 2010 and generally increased to 88.4% in 2023.

Administrative records identified 505 teachers with a first recorded mental health-related sick-leave episode lasting ≥ 180 days. The 180-day threshold was determined by the available administrative dataset: the Board of Education's long-term sick-leave registry contained only episodes lasting ≥ 180 days, and individual-level records for shorter episodes were not available. Thus, the threshold was not selected as a clinical cut-off by the investigators. The initial diagnosis was the diagnosis recorded on the treating physician's medical certificate submitted at the start of the sick-leave episode. Analyses used survey observations from three years before leave through the survey immediately preceding leave.

Data linkage and anonymization

The Nagoya City Board of Education linked annual stress-survey records with administrative sick-leave data using internal identifiers and removed identifying information before providing the dataset to the research

team. The Board had previously used the survey and sick-leave data as internal administrative materials but had not released them publicly; data access for this research project was first approved in 2024.

Measures

Brief Job Stress Questionnaire (BJSQ) (14, 15), which was developed based on the US National Institute for Occupational Safety and Health's General Job Stress Questionnaire (16). Psychosocial work factors and stress response were assessed using the Quantitative job demands, qualitative job demands, job control, supervisor support, and coworker support each comprised three items scored from 1 to 4, giving scale ranges of 3–12; higher scores indicated greater demands, control, or support. Stress response comprised 29 items (range 29–116), with higher scores indicating greater stress. Psychological distress was assessed using the six-item Kessler Psychological Distress Scale (K6) (range 0–24), with higher scores indicating greater distress (17). Work engagement was scored 1–4, with higher values indicating greater engagement. Sex, age, and school type (elementary or junior high school) were obtained from administrative data.

Time relative to sick leave

Survey observations were aligned to the start of long-term sick leave and categorized as three years before, two years before, one year before, or immediately before leave. The immediately preceding observation was defined as an annual survey completed within 365 days before the start of leave. Because the surveys were annual and participation varied across years, not every participant contributed an observation at every time point.

Statistical analysis

For each outcome, linear mixed-effects models estimated trajectories across the four pre-leave time points. Time was treated as categorical. Fixed effects included time, sex, school type, time-by-sex, and time-by-school-type interactions. Age was not included in the primary models. A participant-specific random intercept accounted for repeated measurements, and an autoregressive AR (1) residual covariance structure was used to model correlation between repeated annual observations within individuals. Models were estimated using restricted maximum likelihood. Estimated marginal means (EMM), 95% confidence intervals (CI), and tests of fixed effects were obtained.

Because several trajectories appeared to change more markedly close to sick leave, supplementary piecewise mixed-effects models were fitted using two linear

time terms, representing the period from three to one year before leave and the final year from one year before to immediately before leave. These analyses evaluated whether the final-year slope differed from the preceding trajectory.

To distinguish within-person change from stable between-person differences, supplementary within-between models were fitted with K6 as the outcome. For each psychosocial factor, the participant-specific mean across available observations represented the between-person component, whereas each observation's deviation from that mean represented the within-person component. Both components were entered simultaneously, together with time, sex, and school type, using the same participant-level random-intercept and AR (1) repeated-measures structure. The within-person coefficient therefore indicates whether a teacher reported greater or lower distress when his or her psychosocial factor differed from that individual's own usual level.

For descriptive comparison across measures with different scales, EMM in the sick-leave cohort were standardized using the mean and standard deviation (SD) of the overall elementary and junior high school teacher population during 2010–2023. The overall population served only as a descriptive reference and was not treated as an inferential comparison group; no between-group significance tests were performed. The 11 561 teachers represented unique individuals who contributed at least one survey during the 2010–2023 period, rather than the workforce at a single time point.

School-level clustering was considered because teachers were nested within schools. However, the 505 sick-leave cases were distributed across a large number of schools, with most schools contributing only one or a few cases. This sparse distribution provided limited information for stable estimation of a school-level random effect; therefore, primary models included participant-level random intercepts only.

Mixed-effects models used all available observations under the missing-at-random assumption. Analyses were performed using SPSS Statistics (IBM, Armonk, NY, USA), and two-sided $P < 0.05$ was considered statistically significant.

Results

Participant characteristics and available observations

Among the 11 561 unique teachers contributing survey data during 2010–2023, 505 experienced a first recorded mental health-related sick-leave episode lasting ≥ 180 days. The sick-leave cohort comprised 189 men (37.4%) and 316 women (62.6%), with a mean age of 38.8 years

(SD 10.7); 341 (67.5%) were elementary and 164 (32.5%) junior high school teachers. Major depressive disorder was the most frequent initial diagnosis ($N=237$, 46.9%), followed by depressive state ($N=137$, 27.1%) and adjustment/stress-related disorder ($N=87$, 17.2%) (table 1). Available observations numbered 186, 210, 266, and 316 at three, two, and one year before, and immediately before leave, respectively (supplementary table S2).

Longitudinal trajectories before sick leave

Mental health. Psychological distress increased as sick leave approached (figure 1A). Model-estimated K6 increased from 6.48 (95% CI 5.61–7.36) three years before leave to 6.70 (95% CI 5.91–7.48), 7.31 (95% CI 6.59–8.02), and 9.17 (95% CI 8.49–9.85) immediately before leave. When standardized against the overall teacher population, this represented an increase from approximately 0.4 SD to approximately 1.0 SD above the population mean. Stress response similarly increased from 61.68 (95% CI 59.22–64.13) three years before leave to 67.25 (95% CI 65.31–69.20) immediately before leave, reaching approximately 0.7 SD above the population reference. Overall time effects were significant for both K6 and stress response (both $P < 0.001$). From one year before leave to immediately before leave, K6 increased by 1.87 points (95% CI 0.86–2.87, $P < 0.001$) and stress response increased by 3.35 points (95% CI 0.62–6.07, $P = 0.007$).

Job demands. In contrast, general job demands did not show a progressive increase (figure 1B). Quantitative job demands were 9.50 (95% CI 9.20–9.80), 9.46 (95% CI 9.19–9.74), 9.39 (95% CI 9.14–9.64), and 9.41 (95% CI 9.18–9.65) from three years before to immediately before leave. Qualitative job demands were 9.08 (95% CI 8.81–9.34), 8.96 (95% CI 8.72–9.20), 8.89 (95% CI 8.67–9.10), and 9.14 (95% CI 8.94–9.35), respectively. Standardized values remained relatively close to those

Table 1. Baseline characteristics of teachers with long-term mental health-related sick leave ($N = 505$). [SD=standard deviation.]

Characteristic	N (%)	Mean (SD)
Age (years)		38.8 (10.7)
Sex		
Male	189 (37.4)	
Female	316 (62.6)	
School type		
Elementary school	341 (67.5)	
Junior high school	164 (32.5)	
Diagnosis		
Adjustment disorder	87 (17.2)	
Depressive state	137 (27.1)	
Major depressive disorder	237 (46.9)	
Bipolar disorder	24 (4.8)	
Anxiety disorder	20 (4.0)	

of the overall teacher population. Overall time effects were not significant for quantitative or qualitative job demands ($P=0.891$ and $P=0.110$, respectively).

Job resources. Several job resources became less favorable as leave approached (figure 1C). Job control declined to 7.23 (95% CI 7.01–7.45) immediately before leave, approximately 0.4 SD below the overall teacher mean. Coworker support declined from 8.66 (95% CI 8.33–8.99) three years before leave to 8.07

(95% CI 7.81–8.33) immediately before leave, also approximately 0.4 SD below the reference. Supervisor support decreased from 8.05 (95% CI 7.72–8.39) to 7.66 (95% CI 7.40–7.92), while work engagement decreased from 3.28 (95% CI 3.17–3.38) to 3.11 (95% CI 3.02–3.19). Overall time effects were significant for job control ($P=0.006$), coworker support ($P=0.002$), and work engagement ($P=0.010$), but not for supervisor support ($P=0.120$). Coworker support was significantly lower immediately before leave than one year earlier

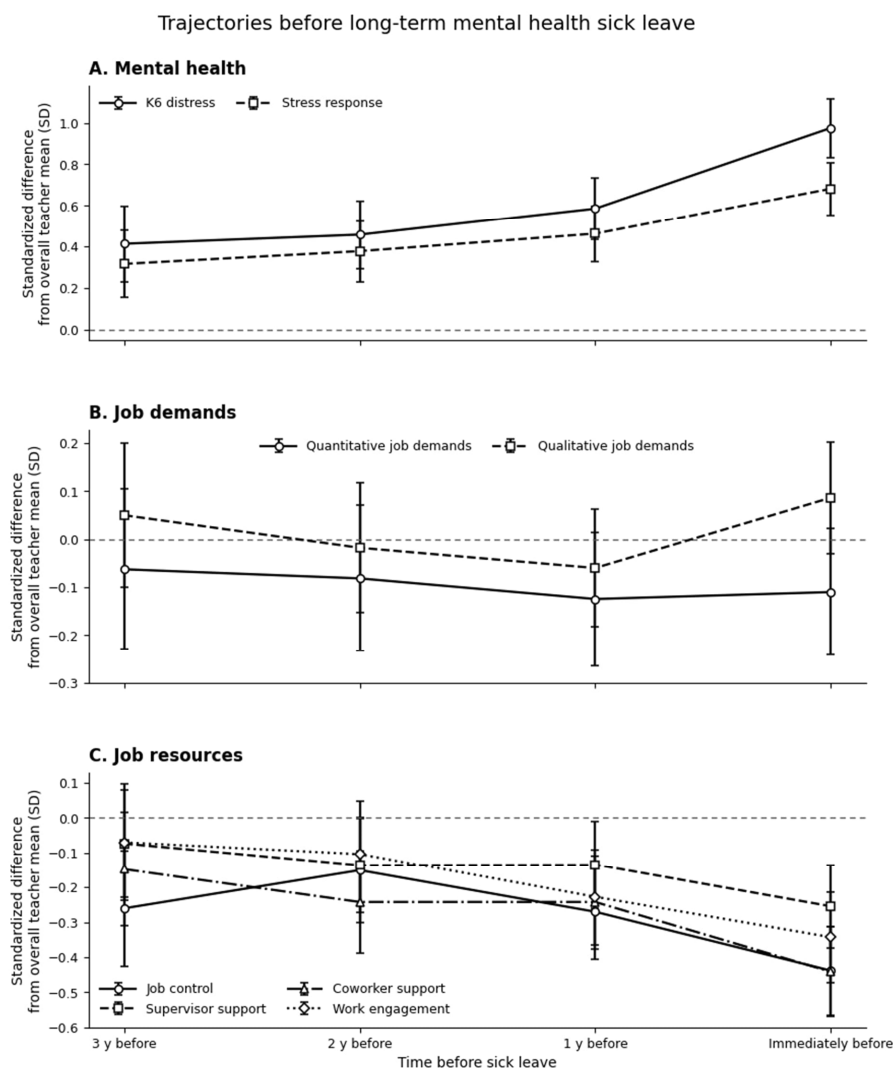


Figure 1. Trajectories of mental health and psychosocial work factors during the three years preceding long-term mental health-related sick leave. Estimated marginal means from the linear mixed-effects models are expressed as standardized differences from the mean of the overall elementary and junior high school teacher population during 2010–2023. Standardized differences were calculated by subtracting the overall teacher mean from each estimated marginal mean and dividing by the standard deviation of the overall teacher population for the corresponding measure. Error bars indicate 95% confidence intervals of the estimated marginal means after standardization. The horizontal dashed line at zero represents the mean of the overall teacher population. The overall teacher population was used solely as a descriptive reference and was not included as a comparison group in the mixed-effects models. Panel A shows mental health indicators (K6 psychological distress and stress response), Panel B job demands (quantitative and qualitative job demands), and Panel C job resources (job control, supervisor support, coworker support, and work engagement). For K6, stress response, and job demands, higher scores indicate greater distress or demands; for job control, social support, and work engagement, higher scores indicate more favorable psychosocial conditions.

(mean difference -0.40, 95% CI -0.77– -0.04, $P=0.022$); the corresponding one-year contrasts for job control and work engagement were not statistically significant.

Changes during the final year before sick leave

Although several trajectories appeared visually steeper during the final year, supplementary piecewise models did not show statistically significant evidence that the final-year slope differed from the preceding three-to-one-year trajectory. The findings therefore support worsening mental health and deterioration in several perceived job resources as leave approached, but not a statistically distinct acceleration confined to the final year.

Within-person associations between psychosocial work factors and psychological distress

Within-between analyses showed significant within-person associations between each psychosocial work factor and K6 (all $P<0.001$; supplementary table S3). When a teacher reported higher-than-usual quantitative job demands ($b=0.534$) or qualitative job demands ($b=0.653$), K6 was higher. Conversely, higher-than-usual job control ($b=-0.814$), supervisor support ($b=-0.489$), coworker support ($b=-0.531$), and work engagement ($b=-2.017$) were associated with lower concurrent K6. Significant between-person components were also observed. These results indicate that the associations were not explained solely by stable differences between individuals. Because psychosocial factors and K6 were measured concurrently, however, temporal direction cannot be determined.

Descriptive comparison with the overall teacher population

Standardized descriptive comparisons showed that mental health indicators were already less favorable several years before leave and diverged further as leave approached, whereas general job demands remained near the overall teacher reference. Job resources were generally lower, particularly immediately before leave. Figure 2 summarizes the joint trajectory of standardized job demands and job resources: movement occurred predominantly along the job-resources dimension, with the largest resource deficit immediately before leave. These population comparisons were descriptive only and were not used for inferential testing.

Sex and school-type interactions

Time-by-sex and time-by-school-type interactions were not statistically significant for most outcomes, providing little evidence that the overall pre-leave trajectories differed systematically by sex or between elementary and junior high school teachers.

Discussion

Main findings

In this longitudinal cohort of teachers who subsequently experienced long-term mental health-related sick leave, psychological distress increased during the three years preceding leave, whereas quantitative and qualitative job

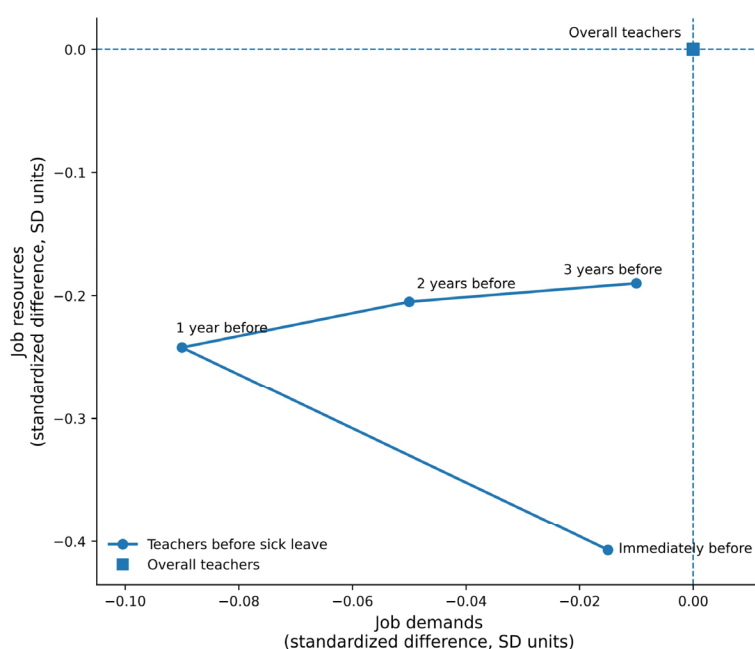


Figure 2. Trajectory of job demands and job resources during the three years preceding long-term mental health sick leave. Standardized differences from the overall teacher population are shown in SD units. The overall teacher population serves as a descriptive reference and is represented by the origin (0, 0). Job demands represent the standardized composite of quantitative and qualitative job demands, and job resources represent the standardized composite of job control, supervisor support, coworker support, and work engagement. Negative values indicate lower levels than those in the overall teacher population. The trajectory shows relatively small differences in job demands throughout the pre-leave period, whereas job resources were consistently lower and declined markedly immediately before sick leave.

demands remained relatively stable. Several perceived job resources, particularly job control and workplace support, became less favorable. Although some changes appeared larger close to leave, piecewise analyses did not demonstrate a statistically distinct final-year acceleration. Within-person analyses further showed that fluctuations in psychosocial work perceptions covaried with fluctuations in psychological distress within the same teachers. Taken together, the findings suggest that the period preceding prolonged mental health-related sick leave is characterized more clearly by worsening mental health and deterioration in perceived job resources than by a progressive rise in broad job-demand scores.

Psychological distress before long-term sick leave

Psychological distress was already elevated relative to the overall teacher population three years before sick leave and increased further as leave approached. This pattern is compatible with a gradual process of deteriorating mental health preceding prolonged work disability rather than an abrupt onset immediately before absence. Previous research has linked changes in psychosocial work characteristics to sickness absence (19). The graphical trajectories suggested particularly marked deterioration near leave, but the lack of statistically significant slope changes in the piecewise models cautions against defining the final year as a discrete critical transition period. Annual measurement may also be too coarse to detect shorter-term changes occurring in the months immediately before absence.

Contrasting trajectories of job demands and job resources

The contrast between relatively stable job demands and declining job resources is central to the present findings and is summarized in figure 2. Within the JD-R framework, occupational strain may arise not only from increasing demands but also from insufficient or diminishing resources available to manage continuing demands. Job control may be especially relevant for teachers because the ability to organize work, prioritize competing tasks, and adapt classroom or administrative responsibilities can influence how demands are experienced. Similarly, supervisor and coworker support may provide practical and emotional resources during periods of increasing psychological difficulty.

Nevertheless, stable scores for quantitative and qualitative job demands should not be interpreted as evidence that workload or work stressors were unimportant. The BJSQ measures broad perceived demands rather than objective workload and does not fully capture teacher-specific stressors such as difficult interactions with students or parents, classroom management problems, or acute workplace events. In addition, duties may

have been adjusted for some teachers whose health was deteriorating, potentially attenuating observed demand levels. Thus, a stable mean trajectory could coexist with important changes in the type, context, or individual impact of work demands. This pattern may also be compatible with sickness presenteeism, whereby employees continue working despite impaired health (18), although presenteeism was not directly measured in this study.

Self-reported work environment and reciprocal relationships

An important interpretive issue is that psychosocial work factors were self-reported. These measures represent teachers' perceptions of their working conditions rather than objective characteristics of the workplace. Deteriorating mental health may lead individuals to experience or report lower control and support more negatively; conversely, actual or perceived deterioration in job resources may contribute to worsening mental health. These mechanisms are not mutually exclusive and may operate reciprocally over time.

The within-person analyses help address, but do not eliminate, this issue. By separating each teacher's deviation from his or her own average psychosocial score from stable between-person differences, these models showed that less favorable-than-usual work perceptions were accompanied by greater concurrent psychological distress within the same individual. This makes it less likely that the associations simply reflect fixed characteristics of teachers who generally report both poorer work environments and worse mental health. However, because psychosocial factors and K6 were measured at the same annual survey, the analysis cannot establish which changed first. The results should therefore be interpreted as evidence of co-evolution of psychological distress and perceived psychosocial working conditions rather than a unidirectional causal pathway.

Interpretation in relation to the overall teacher population

The overall teacher population was included to provide a descriptive frame of reference for measures expressed on different scales. It was not an inferential comparison group. Individual teachers in the sick-leave cohort were not matched with controls on calendar year, age, sex, school type, or other characteristics, and no statistical tests comparing the two populations were performed. Accordingly, conclusions regarding change are based primarily on longitudinal trajectories within the sick-leave cohort. The standardized population reference is useful for showing that distress was already elevated several years before leave, that the largest deviations emerged for mental health and job resources, and that general job-demand scores remained comparatively close to population levels.

Sex and school-type differences

The absence of consistent time-by-sex or time-by-school-type interactions suggests that the broad pattern of increasing distress and declining resources was not restricted to a particular sex or school type. These analyses were not designed to exclude more specific subgroup differences, particularly for individual stressors not measured by the BJSQ, and statistical power for interaction effects was more limited than for the overall trajectories.

Strengths

Major strengths of this study are the linkage of repeated annual occupational stress surveys with administrative sick-leave records, the ability to reconstruct trajectories for several years before prolonged absence, and the simultaneous examination of mental health, job demands, and job resources. Mixed-effects models allowed participants with incomplete repeated observations to contribute available data. The within-person decomposition additionally distinguished time-varying associations within teachers from stable differences between teachers.

Limitations

Several limitations should be considered. First, psychosocial work factors and mental health were self-reported, creating potential common-method and mood-congruent reporting effects; concurrent measurement also prevents determination of temporal direction. Second, the administrative registry contained only sick-leave episodes lasting ≥ 180 days. The findings therefore apply to prolonged episodes and cannot be generalized directly to shorter mental health-related absences; alternative duration thresholds could not be examined. Third, fewer observations were available at earlier pre-leave time points. Mixed-effects models used all available observations under a missing-at-random assumption, but this assumption cannot be verified and selective non-response may have influenced estimates.

Fourth, although teachers were nested within schools, the 505 cases were dispersed across many schools and most schools contributed only one or a few cases, limiting stable estimation of school-level random effects. Unmeasured school-level factors may therefore remain. Fifth, the BJSQ captures general psychosocial working conditions but not all teacher-specific stressors or objective indicators such as working hours, class size, or administrative workload. Finally, the overall teacher population was used only as an unadjusted descriptive standardization reference; differences from that reference should not be interpreted as causal or adjusted between-group effects.

Implications

The findings suggest potential value in monitoring changes in psychological distress together with perceived job resources, rather than focusing only on whether general job-demand scores increase. Declining perceptions of control or workplace support alongside increasing distress may indicate deteriorating occupational functioning even when broad workload measures remain stable. However, the present observational findings do not demonstrate that interventions targeting job resources alone will prevent long-term sick leave. Studies using more frequent assessments, objective workplace indicators, and temporally lagged analyses are needed to clarify directionality and identify actionable intervention points.

Concluding remarks

Among teachers who subsequently experienced long-term mental health-related sick leave, psychological distress increased as leave approached, whereas general job demands remained relatively stable and several perceived job resources became less favorable. Within-person changes in psychosocial work factors covaried with psychological distress, although causal direction could not be determined. These findings are consistent with potentially reciprocal deterioration in mental health and perceived psychosocial job resources before prolonged sickness absence.

Ethics approval and consent to participate

The study protocol was approved by the Ethics Committee of Aichi Medical University (No. 2024-177). The occupational stress survey was conducted as part of the occupational health program of the Nagoya municipal school system, and participation in the survey was voluntary. Survey data were linked to administrative sick-leave records by the Nagoya City Board of Education, and only anonymized linked data were provided to the research team for analysis. The requirement for individual informed consent for the present study was waived by the Ethics Committee because the study used anonymized existing data.

Availability of data and materials

The data used in this study were obtained from the Nagoya municipal teacher stress survey and include sensitive information related to individual respondents. The data are not publicly available due to institutional and ethical restrictions. Access to anonymized data may be granted upon reasonable request to the corresponding

author and with permission from the Nagoya municipal authorities.

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The authors declare no competing interests.

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