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Organizational Support, Leadership, and Work Engagement Among Nurses in High-Stress Clinical Settings: An Ambidirectional Cohort Study

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Abstract

Background: Organisational resources and relational leadership may sustain nurses' work engagement under high clinical demands, yet repeated-measures evidence across retrospectively documented and prospectively observed care periods is limited.

Objective: To examine the associations of perceived organisational support and leadership with subsequent work engagement among nurses in high-stress clinical settings.

Methods: An ambidirectional cohort of 150 nurses from four hospitals contributed 1,680 monthly observations between January and December 2024. Archived occupational surveys and human-resources records characterised January–June; monthly staff surveys and human-resources follow-up characterised July–December. Organisational support (eight items), leadership (12 items) and work engagement (nine items) were scored on five-point item scales. Population-averaged generalised estimating equations examined one-month lagged associations, accounting for prior engagement, work stress, overtime, demographic characteristics, clinical stress tier, hospital and study phase. Prespecified sensitivity analyses compared phases and examined engagement dimensions.

Results: At baseline, mean (SD) organisational support, leadership and engagement were 3.35 (0.64), 3.33 (0.64) and 3.15 (0.63), respectively. Among 1,530 consecutive month-pairs, a one-point higher prior-month support score was associated with 0.331 points higher subsequent engagement (95% CI 0.275–0.387; p<0.001), independently of leadership and measured covariates. The corresponding leadership coefficient was 0.424 (95% CI 0.371–0.477; p<0.001). Associations extended to vigour, dedication and absorption and were present in both phases; phase-interaction tests did not indicate a material difference.

Conclusions: Perceived organisational support and leadership were independently associated with higher subsequent work engagement in high-stress hospital units. The temporal pattern and within-person analyses support their relevance as organisational resources, while the observational design precludes causal attribution.

Keywords: ambidirectional cohort; organisational support; nursing leadership; work engagement; hospital nurses; high-stress units; longitudinal analysis

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1. Introduction

Hospital nurses work at the intersection of technical clinical decision-making, sustained interpersonal care and rapid organisational change. The demands of emergency departments, intensive care units, neonatal intensive care, oncology and other high-acuity services frequently include unpredictable patient trajectories, time-sensitive interventions, rotating duties and exposure to psychologically difficult events. The quality of the work environment therefore has significance beyond employee satisfaction. Multicountry hospital evidence links work environments and staffing conditions with reported care quality, patient safety and workforce outcomes [1]. Reviews of nursing turnover and wellbeing similarly identify organisational conditions as prominent, potentially modifiable concerns rather than simply individual attributes [2, 3, 4]. In high-stress clinical services, understanding what enables sustained, meaningful engagement is consequently a central problem for workforce management and healthcare quality.

Work engagement is a positive occupational state conventionally characterised by vigour, dedication and absorption. Vigour describes energy, persistence and resilience in the performance of work; dedication reflects significance, enthusiasm, inspiration and pride; and absorption denotes concentration and immersion in the activity itself [5]. The conceptual distinction between

engagement and absence of burnout matters. A clinician may be highly dedicated to care while still contending with heavy demands, and merely reducing adverse experiences does not guarantee the presence of motivational resources. The abbreviated nine-item engagement framework has been studied internationally, with evidence supporting the interpretive value of the three underlying domains [6]. Quantitative synthesis further links engagement to task and contextual performance, strengthening its importance as a workforce outcome in its own right [7].

The job demands–resources framework offers a coherent account of how working conditions shape employee motivation. Job demands require sustained effort and may create health-impairment processes, whereas job resources can support goal achievement, reduce the burden associated with demands and encourage learning or development [8, 9]. Subsequent elaboration recognises motivational pathways from resources to engagement alongside links involving personal resources and job crafting [10, 11]. Longitudinal meta-analytic evidence broadly supports the association between resource-rich conditions and later engagement, although its magnitude and direction vary across contexts and measurements [12, 13]. High-stress wards are particularly relevant sites in which to examine whether these resource processes persist under substantial and recurrent demand.

Perceived organisational support represents the belief that an employer values employees' contributions and cares about their wellbeing [14]. This perception may be shaped by access to training, adequate material resources, recognition, fair treatment and concrete support during periods of stress. Organisational support theory proposes that favourable organisational treatment strengthens socioemotional attachment and a felt sense of reciprocal commitment; systematic reviews and meta-analytic evidence associate support with beneficial work attitudes and performance [15, 16]. In clinical practice, resource availability may affect a nurse's immediate capacity to complete patient-care tasks, while recognition and attention to wellbeing may influence the willingness to invest energy in those tasks. These mechanisms provide a rationale for analysing organisational support as a potentially independent correlate of engagement and are consistent with social exchange accounts of employee engagement [17].

Nursing research is consistent with this rationale. Al-Hamdan and Bani Issa [18] identified organisational support and self-efficacy as relevant to work engagement among registered nurses in Jordan. Ni et al. [19] found that psychological need satisfaction partly explained the association between perceived support and engagement in a hospital nursing sample. At the broader workforce level, perceptions of organisational support also appear in studies of nursing burnout, occupational stress and intention to leave [20, 21]. Importantly, much of the empirical literature is cross-sectional, making it difficult to distinguish whether support precedes engagement, whether engaged staff evaluate their organisations more favourably, or whether both are influenced by unmeasured workplace characteristics.

Leadership is related to, but conceptually distinct from, perceived support. A hospital may have adequate organisational policies while the immediate nurse leader communicates poorly, makes decisions inconsistently or allows little professional discretion. Conversely, a supportive leader may partially buffer constrained institutional resources by advocating for staff, coordinating care and recognising expertise. Leadership scholarship differentiates relational, transformational, authentic and transactional approaches, but their shared implications for engagement often concern trust, effective communication, fairness, employee participation and meaningful recognition. Repeated daily research outside nursing has demonstrated that leader behaviours and engagement covary over short time scales [22]. These near-term processes are plausible in nursing environments where supervisory decisions are visible during successive shifts and clinical handovers.

Systematic reviews of nursing leadership have associated constructive and relationship-oriented leadership practices with more favourable workforce outcomes and work environments, although heterogeneity in leadership instruments and designs complicates direct comparison [23, 24]. In a study of registered nurses, Bamford et al. [25] found that perceived authentic leadership was related to engagement through areas of worklife. Laschinger et al. [26] linked authentic leadership and structural empowerment to burnout-related outcomes in both newer and experienced nurses. A review specifically focused on nurse manager leadership and work engagement reported generally positive relationships while identifying the need for stronger investigation of how leadership operates in clinical settings [27]. Together these studies justify examining leadership alongside organisational support rather than assuming that one measure captures both resource domains.

Temporal ordering is especially important because motivation is dynamic. Nurses may respond to changes in leadership or perceived institutional support from one month to the next, but working conditions and engagement also fluctuate with staffing shortages, night duties, workload and patient acuity. A simple comparison of highly engaged and less engaged nurses may confound stable individual differences with variations that occur within the same nurse over time. Moreover, workforce turnover and transfers can affect the composition of the observed group. A longitudinal approach can incorporate each nurse's prior engagement score, account for correlated measurements and examine whether associations are similar across different phases of observation, without implying that an observational association establishes causation [28, 29].

The present study investigated organisational support, leadership and work engagement among nurses in high-stress hospital units across an ambidirectional annual observation period. The first objective was to quantify whether support and leadership measured in one month were independently associated with engagement in the subsequent month after adjustment for previous engagement and measured clinical and demographic factors. The second objective was to examine vigour, dedication and absorption separately, thereby testing whether the pattern was restricted to one component of engagement. The third objective was to evaluate consistency across retrospectively documented and prospectively observed periods and to distinguish within-

nurse variation from differences between nurses. We hypothesised positive independent associations for both resource constructs, without presupposing that either had a causal effect.

2. Methods

2.1 Study design and clinical setting

An ambidirectional observational cohort design was used to evaluate repeated occupational and engagement measurements over a 12-month interval from January to December 2024. The retrospective component comprised archived occupational surveys linked to human-resources records from January through June. The prospective component comprised monthly staff surveys linked to human-resources follow-up from July through December. Thus, the temporal sequence of exposures and outcomes was identifiable at the monthly level even though the two halves of the observation period differed in ascertainment source. The study involved four hospitals, identified as HSP-01 through HSP-04, and covered seven clinically demanding service areas: emergency departments, adult intensive care units, neonatal intensive care, oncology wards, high-dependency units, coronary care units and burns units.

Clinical units were classified as either high or very high stress using the study's two-category unit stress tier variable. The classification was treated as an observed unit characteristic rather than a diagnostic measure of the psychological state of an individual nurse. Hospital and participant identifiers were anonymised for analysis. The participating hospitals' geographic locations were not used to infer policy context or national representativeness. The unit-level setting was selected analytically because recurrent high clinical demand provides a relevant environment in which to evaluate organisational and relational resources.

2.2 Participants and observation structure

The analytic cohort included 150 nurses, each contributing a baseline record in January. The longitudinal structure contained one record per nurse per observed month, with 1,680 participant-month observations and no missing values in the principal recorded demographic, occupational, organisational support, leadership and engagement fields. Participants were tracked for up to 12 monthly assessments; observations ceased after their recorded employment exit, transfer or loss to follow-up. Entry into the observed cohort was therefore anchored to the January measurement, and no additional individuals entered during the year. Recruitment mechanisms beyond this observed cohort structure were not assumed.

Employment outcomes were recorded as completed follow-up, resignation, transfer or loss to follow-up. There were 116 participants classified as having completed follow-up, 20 resignations, eight transfers and six losses to follow-up. The December assessment still contained 118 observations because two individuals with a final recorded event during that month had contributed a monthly measurement before leaving. The distinction between a December observation and formally completed follow-up was maintained in the cohort description. Participant-month counts, rather than assuming 150 observations at every wave, were used for time-series summaries and regression models.

2.3 Variables and operational definitions

Perceived organisational support was operationalised using eight five-point items, partitioned in the records into training, resources, recognition and wellbeing domains. Each domain was represented by two items; the overall score was an average on the 1–5 response metric, with higher values denoting more favourable perceptions of organisational support. This multidimensional operationalisation reflects organisational support theory, but the variable labels do not establish the use of a particular published licensed questionnaire. Accordingly, interpretation focuses on the content and direction of the recorded items, not on claimed equivalence to a proprietary instrument [14, 15].

Leadership was assessed with 12 five-point items and four three-item domains: consideration, communication, autonomy and fairness. The overall leadership score was the mean of the component items, with larger values indicating more favourable perceived leadership practices. The domains capture relationship-oriented, procedural and enabling aspects that have been identified in empirical nursing leadership research [24, 25]. Leadership was analysed separately from organisational support; the two constructs were allowed to correlate rather than being combined into a single resource index.

Work engagement was the primary outcome. Nine items, scored from 1 to 5, represented vigour, dedication and absorption, with three items per domain. The overall score was the mean across the nine items; three domain means were retained for secondary analyses. Although the structure follows the established engagement dimensions described by Schaufeli et al. [5, 6], scoring in the current study used the recorded five-point responses, and no claim is made that these responses constitute the original Utrecht Work Engagement Scale or its standard response metric. The measured outcome represents self-reported occupational engagement rather than observed clinical productivity or patient safety.

Time-varying occupational characteristics included monthly working hours, overtime hours, night shifts, patient load per nurse, shifts experiencing staff shortages, critical events, workplace violence incidents, training hours, absences, perceived patient acuity, perceived work stress and changes in supervisor. Baseline covariates comprised age in January, sex, marital status, nursing qualification, nursing and unit experience, clinical unit, position, employment contract and shift pattern. In the primary lagged model, prior-month work stress and overtime were used as adjustment variables, alongside baseline age, sex, unit stress tier, hospital and study phase. This approach reduces, but cannot eliminate, confounding by measured work demands.

2.4 Reliability and data quality assessment

Internal consistency was evaluated at baseline using Cronbach's alpha for the eight organisational support items, 12 leadership items and nine engagement items. Values were interpreted descriptively as indicators of coherence within the present sample, rather than proof of criterion validity or factorial equivalence. Composite

scores were inspected for consistency with their constituent item responses and for permissible values on the five-point response scale. The one-record-per-person-per-month structure, chronological order, phase designation and mutually exclusive final outcome categories were also checked before modelling.

The observational series contained no missing item, composite or recorded occupational covariate values in the fields used for the main models. Nevertheless, missingness at the record level arose when nurses no longer contributed observations following resignation, transfer or loss to follow-up. The analyses used observed monthly records; they did not impute engagement after departure or presume that unobserved post-departure work experiences were equivalent to those of continuing nurses. This distinction is particularly important when interpreting temporal patterns late in the year.

2.5 Statistical analysis

Baseline characteristics were summarised as numbers and percentages for categorical variables and as means with standard deviations for continuous variables. Monthly descriptive statistics were calculated from the participants observed at each wave; trends were plotted using the actual available denominator. Pearson correlation coefficients were calculated between baseline organisational support, leadership and engagement scores. These cross-sectional correlations describe shared variation and are not treated as the main evidence regarding temporal ordering.

The primary analysis paired each participant's score in month t−1 with the engagement score in month t. Only consecutive observed waves were paired, yielding 1,530 month-to-month transitions across 150 nurses. Population-averaged generalised estimating equations with an identity link, Gaussian response distribution, exchangeable working correlation and participant-level robust standard errors were fitted to accommodate repeated measurements within nurses [28]. Both prior-month organisational support and leadership entered the model simultaneously as continuous scores. The model adjusted for prior-month engagement, time in study, observation phase, baseline age, sex, unit stress tier, prior-month perceived work stress, prior-month overtime hours and fixed indicators for hospital. Each regression coefficient therefore represents the adjusted difference in subsequent engagement associated with a one-point difference on the corresponding 1–5 predictor score.

Prior engagement adjustment was used to address substantial individual persistence in motivation. The occupational covariates were selected to represent plausible competing resource or demand pathways rather than by automated stepwise procedures. Numerical time was entered linearly, while phase was included as a categorical variable to allow for a shift at the boundary between archived and newly collected observations. Hospital indicators were intended to capture fixed differences between sites; only four hospitals were available, so the hospital-level coefficients were not interpreted as precise hospital-specific causal effects. Regression estimates are presented with 95% confidence intervals and two-sided p values; $p<0.05$ was used as a descriptive threshold for conventional statistical evidence.

Secondary regressions repeated the model for vigour, dedication and absorption separately, replacing the prior overall engagement value with the previous observation of the same dimension. Separate support-only and leadership-only models described the degree to which mutual adjustment changed the coefficients. The principal model was repeated in the retrospective and prospective observations, and a prospective-only within-phase analysis used August–December pairs so that both the predictor and subsequent outcome were collected during the prospective period. Interactions between phase and the two resource scores assessed differences in their associations across collection phases; interactions with unit stress tier were also explored.

Finally, a within–between participant decomposition was fitted using all observed months. For each resource, the participant's observed mean was included as a between-person predictor and each month's deviation from that mean as a within-person predictor. Both resource constructs were included simultaneously, with adjustment for time, phase, concurrent work stress and overtime, unit stress tier and hospital. A within-person coefficient addresses whether a nurse reports higher engagement in months when perceived resources are above that nurse's own typical level. Because the measurements in this model are contemporaneous, such coefficients cannot establish the direction of any association. Analyses were carried out using numerical statistical procedures for correlation, scale reliability and repeated-measures regression.

2.6 Interpretation and reporting

The report follows the principles of transparent observational reporting reflected in STROBE [29]. Outcomes are presented at the individual and repeated-observation levels with clear denominators; independent and adjusted estimates are distinguished; and differences in outcome ascertainment by observation phase are made explicit. Descriptions of the study are limited to the recorded measures and documented cohort structure. The time order of the lagged associations is informative, but residual confounding, measurement error, selective continuation in employment and reciprocal workplace processes preclude a causal interpretation.

3. Results

3.1 Cohort composition and baseline characteristics

The 150 nurses contributed 1,680 monthly observations over the one-year period. At baseline, 122 nurses (81.3%) were women and 28 (18.7%) were men. Mean age was 30.79 years (SD 5.84) and mean nursing experience was 6.83 years (SD 4.30). The largest service groups were the emergency department (n=44; 29.3%) and intensive care (n=37; 24.7%), followed by oncology, neonatal intensive care, high-dependency, coronary care and burns services. Ninety-one nurses (60.7%) were classified as working in very high stress units, and 59 (39.3%) in high stress units. Most nurses worked rotating shifts (72.0%) and held permanent contracts (82.7%) (Table 1).

Baseline monthly work amounted to a mean of 185.52 hours (SD 15.24), including 18.86 overtime hours (SD 10.34). Nurses averaged 8.07 night shifts per month (SD 3.04), 4.19 patients per nurse (SD 1.84) and 5.36 shifts

with reported staffing shortages (SD 2.44). Baseline perceived work stress averaged 4.08 (SD 0.62) on the five-point metric. These distributions are consistent with the designation of the clinical settings as high demand, but objective staffing adequacy and external stress norms were not available for comparison.

The baseline mean (SD) organisational support score was 3.35 (0.64), leadership 3.33 (0.64) and overall engagement 3.15 (0.63), all on the 1–5 scale. Baseline vigour, dedication and absorption averaged 3.19 (0.72), 3.17 (0.67) and 3.10 (0.68), respectively. Baseline internal consistency was high for organisational support (Cronbach's α=0.876), leadership (α=0.904) and engagement (α=0.900). The three composite scores were therefore internally coherent within the studied cohort, although the alpha coefficients do not identify which established questionnaires, if any, were used.

Over the year, 116 nurses (77.3%) completed follow-up, 20 (13.3%) resigned, eight (5.3%) transferred and six (4.0%) were lost to follow-up. There were 888 retrospective records and 792 prospective records. Monthly available sample size declined from 150 in January to 118 in December, following the specified exit and censoring rules (Figure 1). The 1,530 consecutive monthly pairs contributed to the main lagged analysis without imputation of values beyond each nurse's final observed record.

3.2 Descriptive trajectories and baseline associations

Monthly mean engagement remained close to the middle-upper portion of the 1–5 scale, ranging from 3.13 in August to 3.28 in December. Organisational support varied between 3.32 and 3.47, and leadership between 3.33 and 3.52. The series did not show a simple monotonic pattern shared by all three constructs. Organisational support was comparatively lower in late summer, while leadership increased modestly toward year-end; engagement exhibited repeated fluctuations rather than a continuous rise or decline. These observed-wave means reflect changing membership of the cohort and cannot be interpreted solely as change within a constant sample (Table 2; Figure 2).

At baseline, organisational support correlated positively with engagement (Pearson r=0.765; p<0.001), as did leadership (r=0.774; p<0.001). Perceived work stress showed a negative baseline correlation with engagement (r=−0.349; p<0.001). Support and leadership were also correlated across monthly observations (r=0.643; p<0.001), indicating that nurses who viewed institutional support favourably also tended to report stronger leadership. However, the correlation was not so high as to justify treating the two recorded constructs as identical. Accordingly, their simultaneous inclusion in adjusted models was particularly informative.

Mean baseline engagement was similar across the predefined high and very high stress unit categories (3.15 and 3.16, respectively). Baseline support means were 3.31 and 3.38, and leadership means were 3.32 and 3.34 in the same respective groups. These small descriptive differences should not be interpreted as evidence that greater clinical stress improves engagement: group composition, classification method, individual workload and available job resources differed, and the study did not randomly allocate nurses to care environments.

3.3 Adjusted associations with subsequent work engagement

In the primary joint model, organisational support and leadership measured in the preceding month were independently and positively associated with work engagement in the following month. Holding prior engagement and the other measured covariates constant, a one-point higher organisational support score corresponded to a 0.331-point higher subsequent engagement score (95% CI 0.275–0.387; p<0.001). A one-point higher leadership score corresponded to a 0.424-point higher subsequent engagement score (95% CI 0.371–0.477; p<0.001). Both coefficients were measured on the original five-point score metric rather than standardised effect-size units. The outcome-specific coefficients and confidence intervals are reported in Table 3 and displayed in Figure 3.

The association of organisational support with subsequent engagement remained positive when leadership was omitted (β=0.386, 95% CI 0.310–0.462; p<0.001). Similarly, leadership was positively associated with subsequent engagement in the absence of concurrent adjustment for support (β=0.514, 95% CI 0.447–0.580; p<0.001). The reduction of both coefficients in the mutually adjusted model is consistent with shared explanatory information, not with complete redundancy. The simultaneous model provides the more conservative estimate of each construct's association conditional on the other.

The temporal specification also adjusts for engagement in the preceding month. It therefore tests the extent to which earlier resource scores provide information about a subsequent engagement level beyond simple persistence in the outcome. Nonetheless, because organisational support, leadership and engagement are reported by the same respondents, residual common-method influences remain possible. The coefficients should not be read as the effects that would necessarily result from raising an individual nurse's support or leadership score by precisely one point through a management intervention.

3.4 Engagement dimensions

The domain-specific findings were consistent with the overall engagement model. For vigour, prior organisational support was associated with an adjusted coefficient of 0.336 (95% CI 0.278–0.393), while prior leadership was associated with 0.411 (95% CI 0.352–0.470). For dedication, the support and leadership coefficients were 0.340 (95% CI 0.273–0.408) and 0.439 (95% CI 0.383–0.494), respectively. For absorption, they were 0.321 (95% CI 0.267–0.374) and 0.435 (95% CI 0.372–0.499), respectively. All six domain-specific associations had p<0.001 (Table 3).

These findings indicate that the observed resource associations were not confined to one narrowly defined aspect of engagement. Greater prior support and leadership co-occurred with higher subsequent occupational energy, stronger identification with work and greater absorption in professional tasks. Although leadership coefficients were numerically larger than

support coefficients for the overall measure and each dimension, a formal superiority claim would require an explicit comparison that accounts for correlation and measurement properties. Numerical ranking alone should therefore not be interpreted as proof that leadership is a more effective management intervention than institutional support.

3.5 Phase-specific and within-person analyses

The main lagged associations were evident in both observation phases. In the retrospective phase (738 consecutive pairs), the adjusted coefficients for support and leadership were 0.337 (95% CI 0.248–0.425) and 0.414 (95% CI 0.340–0.488). In the prospective phase (792 pairs), the corresponding estimates were 0.318 (95% CI 0.251–0.385) and 0.412 (95% CI 0.333–0.491). An analysis restricted to August–December transitions, for which both prior-month predictors and subsequent engagement were measured prospectively, produced coefficients of 0.306 (95% CI 0.233–0.379) and 0.405 (95% CI 0.316–0.494) (Table 4; Figure 4).

Formal phase-interaction estimates were small and statistically imprecise: the support-by-prospective interaction was 0.011 (95% CI −0.093 to 0.114; p=0.840) and the leadership-by-prospective interaction was 0.022 (95% CI −0.069 to 0.113; p=0.631). These tests did not indicate evidence of a meaningful phase difference in the resource–engagement associations. However, statistical non-significance cannot establish equivalence, and the archival and prospective procedures may still differ in unmeasured ways such as response context or supervisory exposure.

The within–between decomposition corroborated the relevance of temporal variation. For a nurse assessed in a month when their organisational support was one point above their own observed annual mean, engagement was higher by 0.465 points on average (95% CI 0.398–0.532; p<0.001), conditional on the included covariates and leadership variation. The analogous within-nurse coefficient for leadership was 0.450 (95% CI 0.371–0.529; p<0.001). Across nurses, those with higher average support and leadership also tended to report higher average engagement, with between-person coefficients of 0.410 (95% CI 0.371–0.449) and 0.415 (95% CI 0.375–0.455), respectively (Table 4).

The within-person findings suggest that the associations were not merely the result of stable differences between nurses who consistently rated their workplace favourably and those who did not. Nevertheless, the decomposition was based on concurrent measurements; unobserved monthly experiences could influence both the resource perceptions and engagement scores. An exploratory unit stress-tier interaction suggested a larger support coefficient in very high stress units (interaction β=0.111, 95% CI 0.027–0.195; p=0.009), while the corresponding leadership interaction was less conclusive (β=−0.074, 95% CI −0.157 to 0.009; p=0.081). Because these subgroup analyses were exploratory and involved multiple comparisons, they should be interpreted cautiously rather than treated as definitive evidence of effect modification.

4. Discussion

4.1 Principal findings and interpretation

This ambidirectional cohort study found that both perceived organisational support and perceived leadership were strongly associated with nurses' engagement in the following month across high-stress clinical units. The association remained evident when the two resource constructs were modelled together and when prior engagement, hospital, demographic characteristics and selected work demands were accounted for. Results were consistent across vigour, dedication and absorption, and a phase-sensitive analysis showed broadly similar coefficients for retrospectively documented and prospectively observed intervals. Within-person analyses further identified higher engagement during months in which nurses perceived more support and better leadership than was typical for them. Collectively, these results point to organisational and relational resources as important correlates of the motivational experience of nurses working under substantial clinical demands.

The findings fit the motivational pathway of the job demands–resources model. Under this framework, resources do not simply offset the adverse consequences of demands; they can facilitate task accomplishment, professional growth and a sense that work is meaningful [8, 10]. In nursing services where acuity, staffing shortages and night shifts place continuous pressure on staff, perceived access to institutional resources may signal that the organisation is willing and able to sustain professional work. A positive association with vigour is consistent with the possibility that resource adequacy helps nurses mobilise occupational energy. Associations with dedication and absorption likewise fit the proposition that favourable working conditions enable concentration and reinforce the significance attached to care responsibilities.

The magnitude of the adjusted one-month lag coefficients deserves interpretation in the units of the scales. The support coefficient of 0.331 signifies approximately one-third of one point on the five-point engagement score for every one-point difference in earlier support, conditional on the fitted model. The corresponding leadership coefficient of 0.424 is somewhat larger. These quantities are neither risk ratios nor predicted percentages of engagement, and they do not directly quantify clinical benefit. Nevertheless, their positive direction after adjustment for prior engagement indicates that the recorded organisational resources carried information relevant to the next observed level of motivation. That temporal ordering is more informative than a cross-sectional correlation, though it remains susceptible to confounding and response-related bias.

The study also demonstrates why support and leadership warrant separate consideration. Their substantial correlation indicates shared experience, but simultaneous adjustment did not eliminate either coefficient. Organisational support refers to institution-level commitment as experienced through resources, training, recognition and wellbeing attention. Leadership concerns the immediate, operational environment of interpersonal consideration, fair decisions, communication and

autonomy. A nurse can work under an approachable leader yet face persistent shortages of personnel and equipment, or receive institution-wide employment benefits while experiencing poor local management. These distinctions are important in identifying possible service-level responses rather than treating employee engagement as a single abstract cultural property.

4.2 Relationship with previous research

The organisational support findings converge with the theoretical account developed by Eisenberger et al. [14] and summarised by Rhoades and Eisenberger (2002). Meta-analytic findings indicate that perceived support is linked to favourable job attitudes and behaviours through mechanisms involving reciprocity, socioemotional needs and a sense that contributions are valued [16]. Within nursing, Al-Hamdan and Bani Issa [18] reported associations involving support and engagement, and Ni et al. [19] identified psychological need satisfaction as a candidate mechanism. Our findings do not measure reciprocity or need satisfaction directly, but they reinforce the empirical relevance of support in a repeated-observation context. They also suggest that perceptions of support in the previous month may be informative even after accounting for the concurrent leadership construct.

The leadership associations align with systematic reviews linking positive leadership approaches to healthy nursing work environments, staff attitudes and organisational outcomes [23, 24]. Bamford et al. [25] described engagement in relation to authentic leadership and fit within areas of worklife, while Laschinger et al. [26] examined leadership and empowerment in relation to burnout. The contemporary synthesis by Alluhaybi et al. [27] concluded that favourable nurse manager leadership is generally associated with work engagement. The current monthly approach complements these studies by considering short-term temporal ordering and showing that leadership scores remain independently associated with engagement alongside organisational support and prior motivation.

Our results also resemble evidence from daily leadership studies outside healthcare. Breevaart et al. [22] demonstrated that leader behaviours and engagement can vary together at short intervals, supporting the broader concept that leadership is not solely a fixed trait of a manager. In clinical settings, fair staff allocations, approachable communication, autonomy during patient care and recognition after demanding shifts can change from month to month. The within-person results in this cohort are compatible with such dynamic processes. However, because the engagement and leadership measures were based on nurses' perceptions, a difficult clinical month could simultaneously reduce both ratings and contribute to the observed association even if management behaviour itself did not change.

The study complements work addressing occupational demands, burnout and the nursing work environment. Longitudinal synthesis indicates that job resources are related to future engagement across occupations [12, 13], while nursing-specific reviews highlight the role of workload, staffing conditions and supportive environments in staff wellbeing [30, 21]. Research on nurse dissatisfaction, burnout and turnover further suggests that workforce sustainability depends on institutional as well as individual conditions [31, 32, 33]. Although our primary outcome was engagement rather than burnout or turnover, the observed resignations and transfers underscore the reality that clinical workforce composition changes over time. The analysis did not test whether engagement reduced resignation risk, and such an inference should not be drawn from this study.

4.3 Potential organisational mechanisms

Four support domains were represented in the monthly measure: training, resources, recognition and wellbeing. Each maps onto plausible organisational processes. Training may strengthen competence when staff encounter complex interventions or changing protocols. Material and staffing resources may decrease the friction associated with delivering time-sensitive care. Recognition can affirm the social and professional value of nursing work, while wellbeing support can signal that institutional leaders understand the physical and emotional costs of clinical practice. Organisational support theory and conservation-of-resources principles offer complementary explanations for why these experiences might coincide with greater engagement [34, 16]. Nevertheless, the design does not isolate which domain is primarily responsible for the overall association.

The leadership domains similarly have practical interpretations. Consideration may influence whether staff feel safe raising a concern or requesting help; communication may affect the clarity of task priorities; autonomy can support professional judgement; and fairness may influence trust in shift allocations and recognition. In high-acuity care settings, rapid decisions are often required in parallel with coordinated multidisciplinary work. Leadership that is perceived as consistent and attentive can therefore constitute a work resource without eliminating high patient acuity or night duty. Reviews of nursing leadership and patient outcomes provide a rationale for taking these behaviours seriously, although our analysis did not measure patient-level outcomes [35, 24].

The independent associations also raise the possibility of complementarity between organisational policy and day-to-day leadership. In a resource-constrained unit, skilled leadership may help prioritise available staff and resources; in a well-resourced unit, leadership may determine whether those resources translate into autonomy and recognition. This reasoning is plausible but was not tested as a formal mediation pathway. Moreover, the high correlations between the two resource measures imply potential common causes such as organisational culture, managerial stability or shared response style. A future multilevel design with independent indicators of resources, directly observed supervisory practices and predefined mediation hypotheses would be better positioned to distinguish these explanations.

4.4 Implications for nurse management

The findings support viewing engagement as a quality of the working environment that can be monitored longitudinally rather than as a fixed disposition of individual nurses. Hospital managers might use repeated confidential engagement assessments alongside indicators of staffing adequacy, overtime, psychological

safety and access to clinical resources. Where engagement falls, the results point towards examining both institution-wide support and immediate leadership practices. Improving only one layer may leave important problems in the other layer unaddressed. Such action should be framed as evidence-informed quality improvement rather than a proven consequence of the observational associations reported here.

Managers seeking to operationalise support can review timely access to training, staff-relevant recognition, mechanisms for reporting critical events and practical wellbeing resources. These approaches are particularly relevant when staff face repeated emergency cases, high patient acuity or unpredictable staffing. At the leadership level, transparent decisions, participative scheduling, communication of clinical priorities and respectful debriefing may strengthen perceptions of consideration, fairness and autonomy. The study does not establish that any single intervention will produce the estimated coefficients; rigorous testing would require prospective intervention designs with suitable comparison groups and independent outcome assessments.

The absence of a clear difference between retrospective and prospective phases may be reassuring regarding consistency, but it should not be interpreted as proof of identical measurement processes. For routine monitoring, hospitals need stable instruments, consistent administration procedures, sufficient confidentiality protections and transparent handling of staff turnover. Comparing only those who remain in employment can inflate apparent improvements if dissatisfied personnel leave. Reporting both monthly engagement scores and changes in the observation denominator would provide a more balanced organisational dashboard. Any monitoring programme should also protect staff from punitive uses of individual questionnaire responses.

4.5 Methodological strengths

Several design features strengthen the interpretation of the associations. First, the cohort contributed repeated monthly observations rather than a single assessment, allowing short-term temporal sequencing of exposures and outcomes. Second, support and leadership were modelled simultaneously, permitting assessment of their independent associations despite meaningful correlation. Third, lagged engagement was included, limiting the extent to which coefficients simply reflected persistence in a nurse's pre-existing motivation. Fourth, models controlled for selected occupational demand measures, unit stress classification, demographic characteristics, hospital and observation phase. Fifth, the separate analysis of engagement domains showed that the pattern was not restricted to one summary metric. Finally, sensitivity analyses included transitions observed wholly within the prospective phase and a within-person decomposition that distinguished stable between-nurse differences from monthly variation.

Internal consistency for all three composite scales exceeded commonly used descriptive benchmarks, reducing concern that the overall scores consisted of unrelated item responses. The absence of item-level missingness in observed records simplified score calculation and reduced dependence on imputation assumptions for those records. Nevertheless, reliability and longitudinal association should not be conflated with instrument validity, and the high reliability values do not establish external generalisability. The study's principal methodological contribution lies in its repeated-measures structure and explicit comparison of the two ascertainment phases, rather than in asserting a novel diagnostic scale or causal intervention.

4.6 Future research

Future investigation should prospectively enrol larger samples across more hospitals and diverse clinical contexts, document the full recruitment and consent process, and administer validated, stable instruments for both exposures and outcomes. Multilevel models could distinguish hospital-wide support policies from ward leadership and nurse-level perceptions. Combining questionnaires with staffing rosters, direct observation of leadership practices and independently collected quality outcomes would lessen dependence on shared self-report measurement. Repeated assessments at shorter intervals could clarify whether resource changes precede engagement changes and how long any association persists.

Intervention studies are also necessary. Cluster-randomised or carefully controlled stepped implementation designs could evaluate targeted leadership development, improved access to resources, recognition systems or staff wellbeing initiatives. Mechanistic work could test whether autonomy, psychological need satisfaction, trust and perceived fairness mediate changes in engagement. It would also be useful to assess whether effects differ by clinical unit and whether engagement trajectories forecast retention or quality of care. These questions extend beyond the present observational aims but provide a defensible agenda for translating the associations into testable organisational strategies.

5. Conclusion

Among 150 nurses observed over 1,680 participant-month records in four hospitals, higher perceived organisational support and more favourable leadership scores were independently associated with greater work engagement in the subsequent month. Associations remained positive after accounting for prior engagement and selected demographic, hospital and workload characteristics; they were observed for vigour, dedication and absorption and were broadly consistent across retrospective and prospective phases. Within-person analyses further showed that engagement tended to be higher during months when nurses rated resources more favourably than their own typical levels.

These findings support the organisational relevance of both institutional support and local leadership in demanding nursing settings. The analyses do not establish that changing support or leadership will necessarily cause an increase in engagement, but they identify plausible and potentially actionable resource domains for more rigorous evaluation. Sustainable work engagement in high-stress clinical services is likely to require attention to the practical conditions of care as well as the quality of everyday leadership relationships.

Declarations

Conflicts of interest: None

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Table 1. Baseline characteristics of nurses in high-stress clinical units (n=150).

Characteristic	Mean ± SD or n (%)
Age (years)	30.79 ± 5.84
Nursing experience (years)	6.83 ± 4.30
Monthly work hours	185.52 ± 15.24
Monthly overtime hours	18.86 ± 10.34
Night shifts per month	8.07 ± 3.04
Patients per nurse	4.19 ± 1.84
Shifts with staff shortages	5.36 ± 2.44
Perceived work stress (1–5)	4.08 ± 0.62
Organisational support (1–5)	3.35 ± 0.64
Leadership (1–5)	3.33 ± 0.64
Work engagement (1–5)	3.15 ± 0.63
Female sex	122 (81.3%)
Male sex	28 (18.7%)
High stress unit	59 (39.3%)
Very high stress unit	91 (60.7%)
Rotating shifts	108 (72.0%)
Mostly night shifts	22 (14.7%)
Permanent contract	124 (82.7%)
Emergency department	44 (29.3%)
Intensive care unit	37 (24.7%)
Neonatal ICU	15 (10.0%)
Oncology ward	18 (12.0%)
High-dependency unit	14 (9.3%)
Coronary care unit	12 (8.0%)
Burns unit	10 (6.7%)

Continuous values are expressed as mean ± standard deviation. All percentages use the 150 baseline participants as denominator. Scores are means of five-point items.

Table 2. Monthly availability and trajectories of organisational support, leadership and engagement during 2024.

Month	Phase	N	Support mean ± SD	Leadership mean ± SD	Engagement mean ± SD
1	Retrospective	150	3.35 ± 0.64	3.33 ± 0.64	3.15 ± 0.63
2	Retrospective	150	3.43 ± 0.63	3.35 ± 0.63	3.19 ± 0.60
3	Retrospective	150	3.40 ± 0.63	3.35 ± 0.67	3.14 ± 0.66
4	Retrospective	148	3.47 ± 0.65	3.37 ± 0.67	3.23 ± 0.60
5	Retrospective	146	3.46 ± 0.62	3.35 ± 0.67	3.19 ± 0.60
6	Retrospective	144	3.42 ± 0.60	3.39 ± 0.64	3.23 ± 0.59
7	Prospective	140	3.44 ± 0.63	3.42 ± 0.65	3.25 ± 0.66
8	Prospective	139	3.36 ± 0.62	3.44 ± 0.63	3.13 ± 0.63
9	Prospective	137	3.32 ± 0.65	3.41 ± 0.62	3.16 ± 0.56
10	Prospective	132	3.36 ± 0.58	3.46 ± 0.60	3.25 ± 0.54
11	Prospective	126	3.33 ± 0.62	3.47 ± 0.57	3.16 ± 0.60
12	Prospective	118	3.41 ± 0.62	3.52 ± 0.60	3.28 ± 0.59

Means are based on nurses assessed at each month; denominators decline after resignation, transfer or loss to follow-up. The scale range for all three scores is 1–5.

Table 3. Adjusted one-month lagged associations of organisational support and leadership with overall engagement and its dimensions.

Outcome	Prior-month predictor	Adjusted β (95% CI)	p value
Overall engagement	Organisational support	0.331 (0.275 to 0.387)	<0.001
Overall engagement	Leadership	0.424 (0.371 to 0.477)	<0.001
Vigour	Organisational support	0.336 (0.278 to 0.393)	<0.001
Vigour	Leadership	0.411 (0.352 to 0.470)	<0.001
Dedication	Organisational support	0.340 (0.273 to 0.408)	<0.001
Dedication	Leadership	0.439 (0.383 to 0.494)	<0.001
Absorption	Organisational support	0.321 (0.267 to 0.374)	<0.001
Absorption	Leadership	0.435 (0.372 to 0.499)	<0.001

N=1,530 consecutive monthly transitions from 150 nurses. Gaussian generalised estimating equations with exchangeable working correlation, nurse-clustered robust standard errors and adjustment for previous outcome score, elapsed time, phase, age, sex, unit stress tier, previous work stress, previous overtime and hospital. β is expressed in points on the five-point outcome scale for each one-point increase in the prior-month predictor.

Table 4. Sensitivity analyses and within–between person decomposition of work engagement associations.

Analysis	Predictor	Adjusted β (95% CI)	p value
Retrospective phase (738 pairs)	Support	0.337 (0.248 to 0.425)	<0.001
Retrospective phase (738 pairs)	Leadership	0.414 (0.340 to 0.488)	<0.001
Prospective phase (792 pairs)	Support	0.318 (0.251 to 0.385)	<0.001
Prospective phase (792 pairs)	Leadership	0.412 (0.333 to 0.491)	<0.001
Within prospective phase (652 pairs)	Support	0.306 (0.233 to 0.379)	<0.001
Within prospective phase (652 pairs)	Leadership	0.405 (0.316 to 0.494)	<0.001
All months; n=1,680	Support: within person	0.465 (0.398 to 0.532)	<0.001
All months; n=1,680	Leadership: within person	0.450 (0.371 to 0.529)	<0.001
All months; n=1,680	Support: between persons	0.410 (0.371 to 0.449)	<0.001
All months; n=1,680	Leadership: between persons	0.415 (0.375 to 0.455)	<0.001

Phase-specific estimates use the lagged model covariates, with the phase indicator removed. The within-prospective sensitivity analysis pairs August–December outcomes with July–November predictors. Within–between coefficients derive from contemporaneous participant-centred and person-mean exposures, adjusted for study time, phase, stress, overtime, unit stress tier and hospital; these estimates do not establish temporal direction.

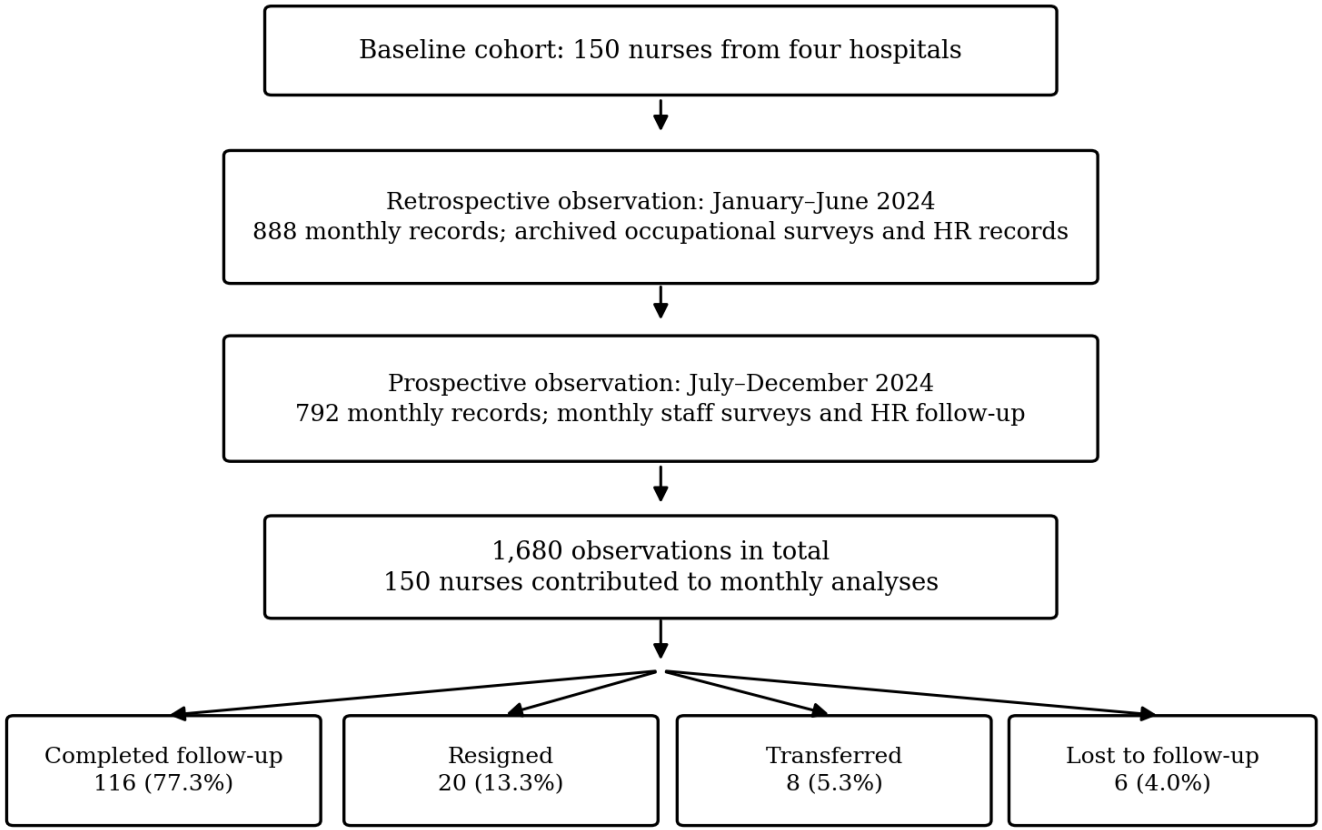


Figure 1. Cohort and observation structure over the retrospective and prospective phases, with final participant outcomes.

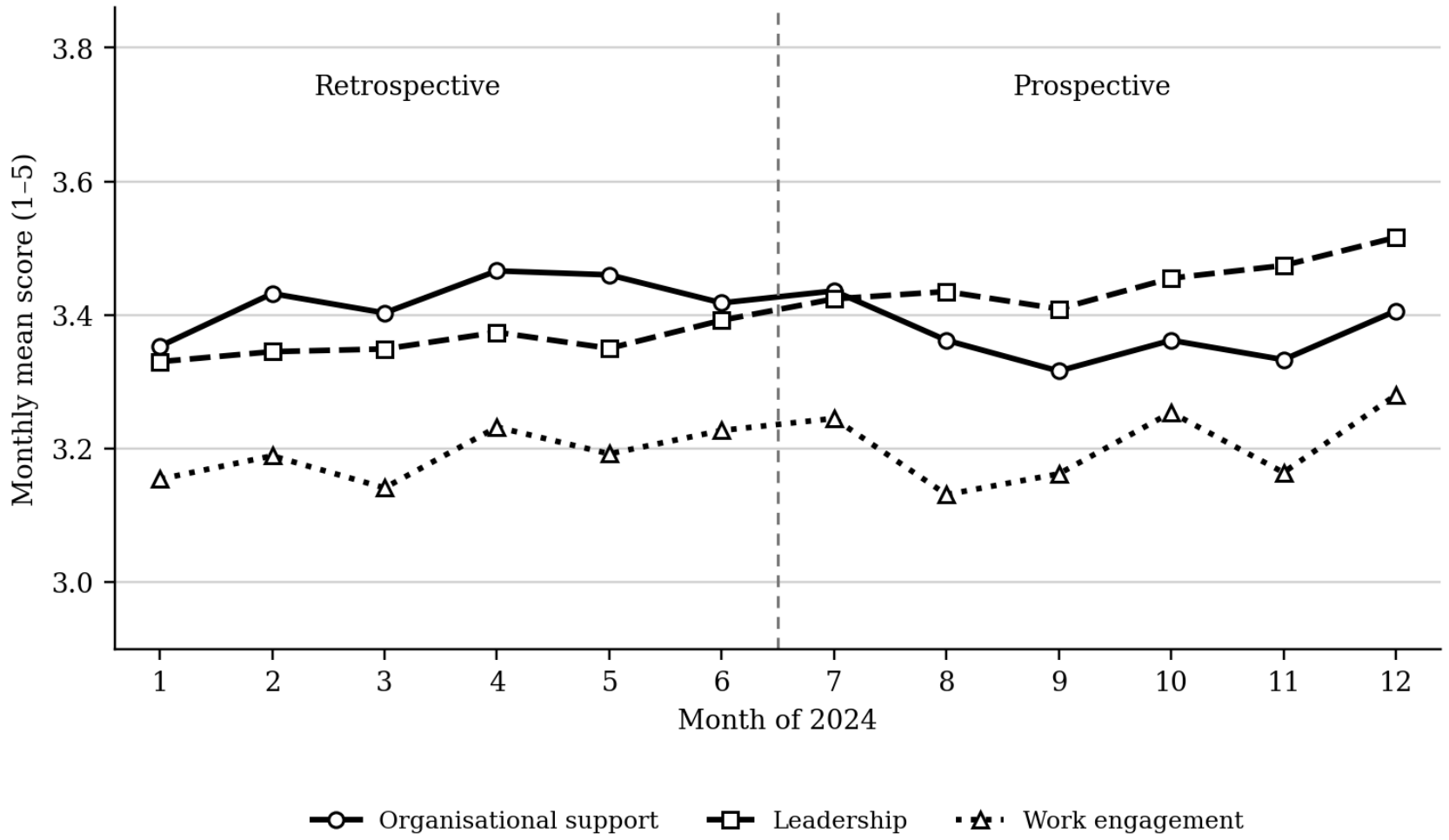


Figure 2. Monthly observed means for organisational support, leadership and work engagement. The vertical dashed line marks the beginning of prospective observation. Participants contributing to each monthly mean vary over time.

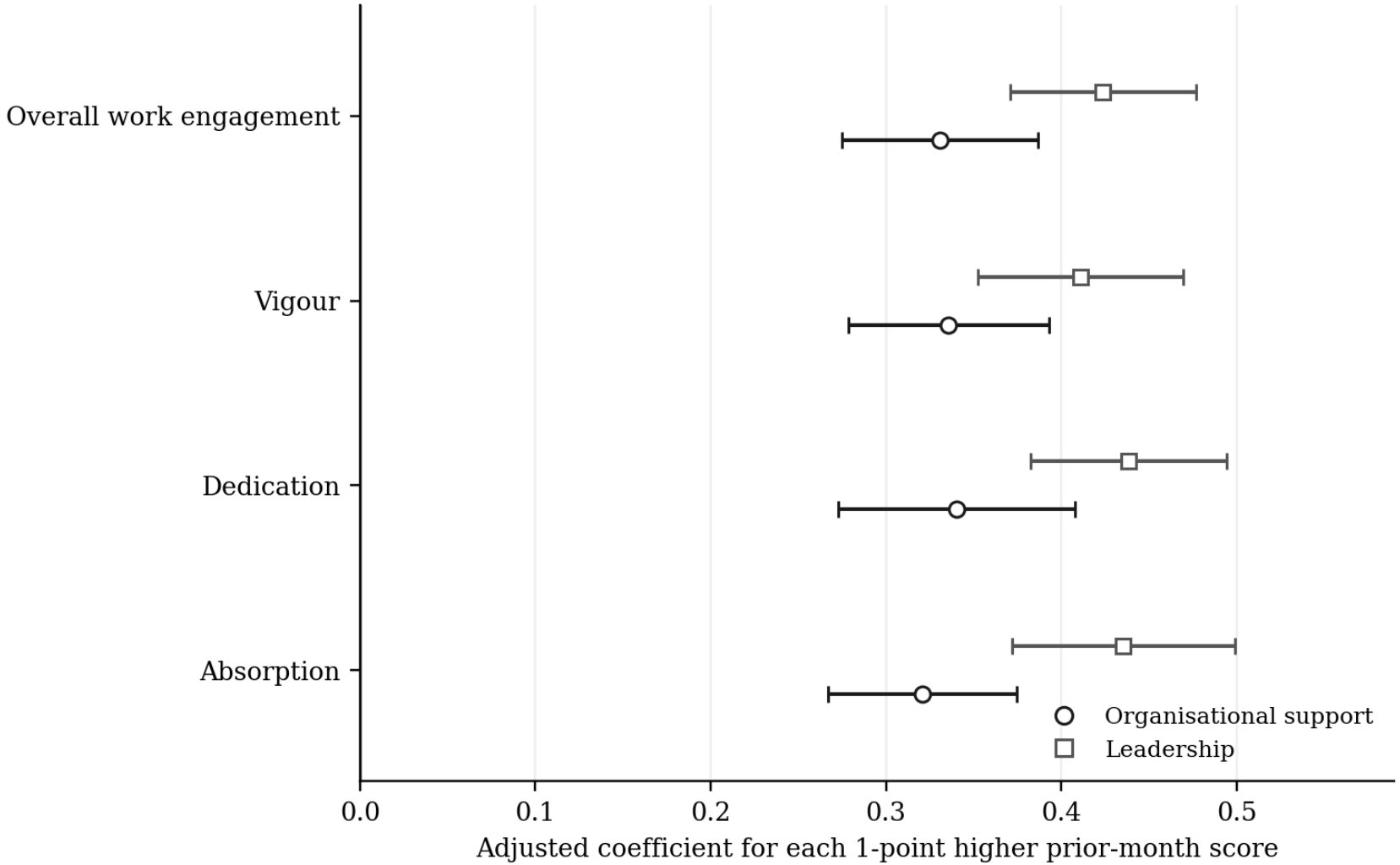


Figure 3. Adjusted associations of support and leadership in the preceding month with subsequent overall engagement and the vigour, dedication and absorption domains. Markers represent regression coefficients and whiskers represent 95% confidence intervals.

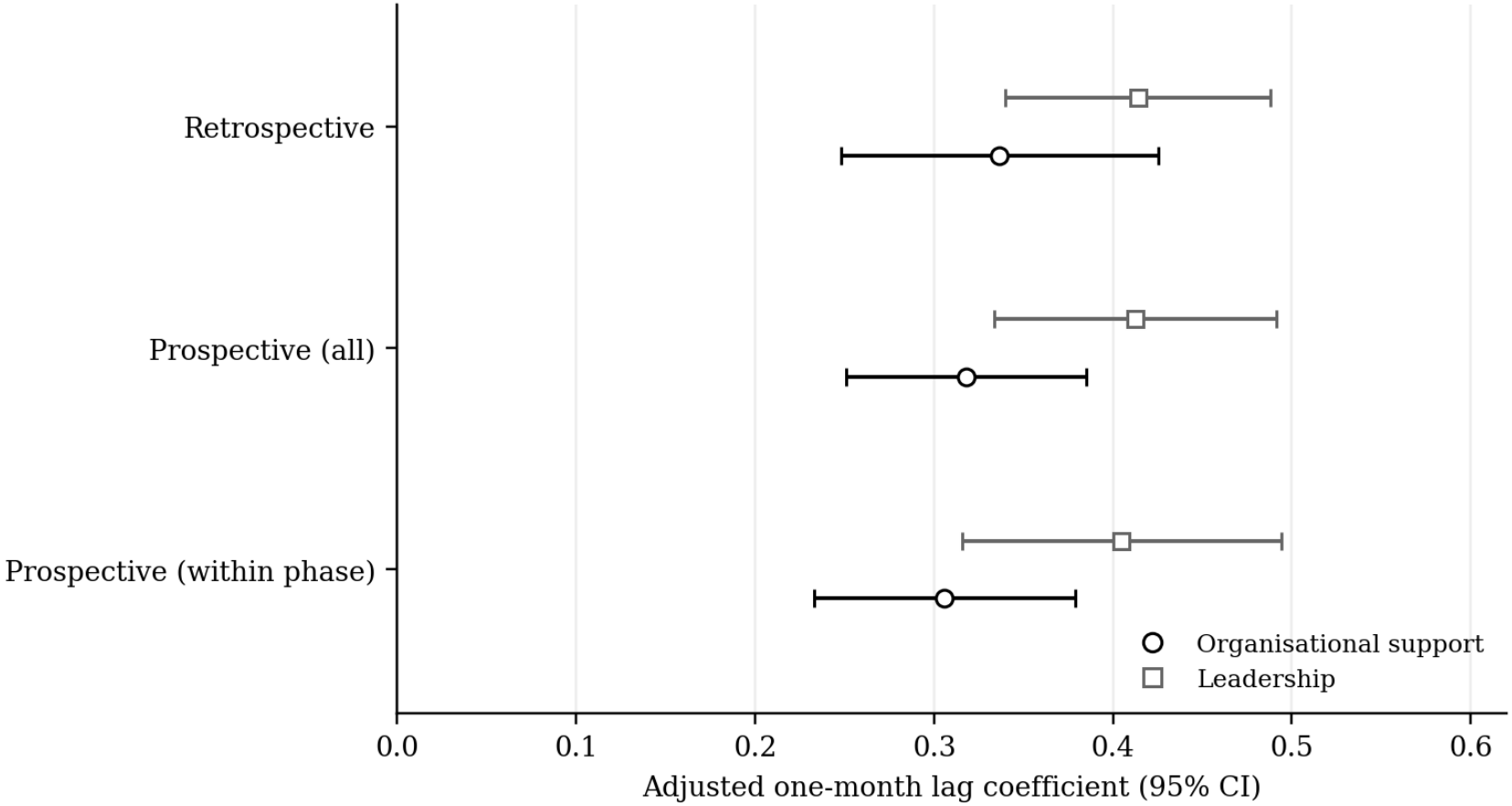


Figure 4. Sensitivity of the adjusted one-month lag associations to observation phase. "Prospective (within phase)" excludes the June–July boundary transition; whiskers denote 95% confidence intervals.