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Transitioning from traditional hospital design to activity-based care: A longitudinal case study of differential occupational health and safety consequences across clinical settings and professional roles

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ABSTRACT

The activity-based care (ABC) model, adapted from activity-based offices, has emerged as a new approach to healthcare facility design. Evidence on its consequences for occupational health and safety-relevant outcomes remains limited. The study examines how transitioning from a traditional hospital design to the ABC model is associated with changes in employee experiences of task–environment alignment and psychosocial work environment, self-reported health, sick leave and turnover over time, and differences in changes across professional roles and clinic types. A repeated-measures survey was conducted in an outpatient hospital unit across 10 specialised clinics. Data were collected 3 months before relocation and at 6 and 18 months post-relocation. Generalised least-squares models examined change over time and tested interactions with professional role and clinic type. Sick leave and turnover were analysed over approximately 1 year before and after relocation using segmented interrupted time-series regression. Ratings of task–environment alignment varied across clinic types and professional roles. Consultation-based clinics and physicians and administrative employees showed persistent declines over time, while surgical/radiology clinics and nursing roles remained stable or improved. Stress and recovery indicators worsened similarly across all groups. Psychosocial conditions were stable, though job satisfaction, perceived quality of work and referral intentions declined. Turnover remained unchanged, while sick leave varied across contexts and roles. The consequences of ABC implementation are not uniform but depend on the alignment of the redesigned workspace and the task demands of different clinical settings and professional groups, a contingency that cannot be easily detected with single time-point post-occupancy evaluation.

1. Introduction

Adapted from the activity-based office concept, activity-based care (ABC) has emerged as a workplace model in hospitals (Appel-Meulenbroek et al., 2011). Instead of assigning consultation rooms to individual professionals, ABC differentiates spaces for patient encounters from those used for documentation, handovers and professional exchange by introducing shared consultation rooms alongside shared administrative workspaces. ABC is intended to accommodate diverse work tasks and enable flexible space use. Underlying this approach is the assumption that different work activities benefit from distinct environmental conditions and that alignment between task requirements and workspace characteristics, often described as 'task–environment alignment', supports social interactions and effective performance (Forooraghi et al., 2025; Hoendervanger et al., 2019; Wohlers & Hertel, 2017). When such alignment is limited, employees may experience difficulties locating suitable workspaces or performing tasks efficiently. Theoretically, a major purpose of ABC is to improve task–environment alignment. However, the implications of ABC for everyday work practices and occupational health and safety conditions in healthcare settings remain insufficiently understood.

Much of the conceptual foundation for ABC originates from research

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on activity-based office environments. Studies in these settings indicate that flexible layouts can support interaction, communication and collaboration among employees (Hoendervanger et al., 2019; Lauterbach & Borge, 2026). At the same time, activity-based offices have been associated with challenges such as reduced privacy, increased noise and visual distractions, and difficulty performing concentration-demanding tasks (Engelen et al., 2019; Lauterbach & Borge, 2026; Marzban et al., 2023; Masoudinejad & Veitch, 2023). These findings highlight the importance of task–environment alignment, suggesting that the effects of activity-based workplaces depend on how well workspace characteristics align with task requirements, with misalignment linked to reduced satisfaction, concentration difficulties and lower perceived productivity (Engelen et al., 2019; Lauterbach & Borge, 2026; Marzban et al., 2023; Masoudinejad & Veitch, 2023). However, whether these findings translate to healthcare environments remains uncertain, as hospital work involves distinct task structures, workflows and spatial constraints that differ from those in office settings.

Research on healthcare facility design has traditionally prioritised patient areas and patient-related outcomes such as safety, recovery and satisfaction, as reflected in the evidence-based design literature and systematic reviews (Brambilla et al., 2019; Elf et al., 2020; Guidolin et al., 2024; Ulrich et al., 2008). Comparatively less attention has been directed towards the consequences of spatial design for occupational health and safety conditions among healthcare employees (Eijkelenboom & Bluyssen, 2019; Jin et al., 2023). Existing evidence nevertheless indicates that characteristics of the physical work environment such as spatial layout, acoustic conditions and workstation configuration are associated with employee stress levels, job satisfaction and perceived support for clinical work (Armbruster et al., 2023; Jonescu et al., 2024; Shetty et al., 2026; Vreman et al., 2023). Within this broader field, empirical studies examining ABC models in healthcare remain scarce. A cross-sectional study in Finnish outpatient healthcare organisations found that well-functioning shared workspaces, particularly those offering quiet zones and places for interaction, were linked to higher work engagement and lower stress (Sirola et al., 2024). Ethnographic observations from another healthcare provider's shift to ABC highlight more problematic consequences, including increased time spent relocating between rooms and searching for equipment, as well as signs of ergonomic strain (Harjunheimo & Peteri, 2024). These studies suggest that ABC may introduce both new opportunities and new constraints in daily work practices. However, most available studies rely on cross-sectional or short-term study designs, offering limited insight into how such environments are experienced over time.

Importantly, healthcare work is highly heterogeneous, making the implications of ABC models unlikely to be uniform across clinical contexts or professional roles. In many consultation-based outpatient settings, healthcare professionals engage in fragmented workflows that involve alternating between patient consultations, documentation, communication and co-ordination, with a substantial proportion of working time devoted to tasks beyond direct patient interactions (Anskär et al., 2018; Ashtari Tafti et al., 2025; Butler et al., 2018; Magnusson et al., 2014). Surgical settings, by contrast, tend to be characterised by more structured and sequential workflows with higher levels of procedural standardisation (Ozkaynak et al., 2022). As workflows reflect the flow of tasks through space and time and are shaped by interactions among people, technologies and the physical environment, such differences imply distinct spatial and organisational requirements (Ozkaynak et al., 2022). From a work system perspective, employee, organisational and safety-relevant outcomes are shaped not by isolated factors but by the interactions within the work system, including the physical environment, tasks, tools and organisational conditions (Carayon et al., 2006). This perspective is formally operationalised in the Systems Engineering Initiative for Patient Safety (SEIPS) model, which provides a structured framework for mapping how interactions among work system components shape processes and outcomes in healthcare settings (Carayon et al., 2006). Professional groups also differ in their task profiles, such as regarding the extent of task switching, diagnostics work, patient interaction or team-based co-ordination (Brown et al., 2024; Maier et al., 2018; Walter et al., 2014). These differences suggest that the spatial configurations introduced through ABC may differentially support healthcare work depending on how well they align with underlying workflow structures and task demands across clinics and professional roles.

Beyond individual experience, spatial transitions in healthcare may also affect the organisation more broadly. Turnover and sick leave are established indicators of workforce strain in healthcare settings and have been linked to work-environment quality (Dewa et al., 2014; Nantsupawat et al., 2017), making them relevant outcomes for evaluating the broader organisational consequences of ABC implementation.

Despite emerging evidence, several important gaps in the literature remain. First, empirical studies examining ABC models in healthcare are scarce and provide limited insight into how effects evolve over time. Second, little is known about how such spatial interventions influence occupational health and safety-relevant outcomes, including task–environment alignment, psychosocial conditions, recovery and organisational indicators such as sick leave and turnover. Third, existing research rarely accounts for heterogeneity across clinical contexts and professional roles, despite substantial differences in workflows and task demands.

To address these gaps, the present study uses a longitudinal design to investigate the consequences of implementing the ABC model in an outpatient hospital. More specifically, this study examines potential changes in employees' experiences of task–environment alignment and the psychosocial work environment, self-reported health, and organisational indicators of occupational health and safety (i.e. sick leave and employee turnover), following the transition to ABC. The study also investigates whether such changes, if any, differ across clinical contexts and professional roles, where task structures and spatial configurations may vary substantially. The following research questions guide our study:

1. How does transitioning from a traditional hospital design to the ABC model affect occupational health and safety-relevant outcomes, including employee experiences of task–environment alignment and psychosocial work environment, self-reported health, and organisational outcomes (i.e. sick leave and employee turnover) over time?
2. How do potential changes in these outcomes vary across different professional roles?
3. How do potential changes in these outcomes vary across different clinics?

2. Method

This study is a part of a larger project with the overall aim of investigating potential changes in professionals' experiences of the healthcare work environment over time following the implementation of ABC.

The design drew on existing research on activity-based working, which supplied the concepts and measures used here but is predominantly cross-sectional and office-based. This motivated a repeated-measures design with a pre-relocation baseline and required items addressing clinical task types (Table 1).

2.1. Case context and study population

The hospital examined in this case is one unit within a broader network of hospitals located in Western Sweden. It operates as an outpatient facility and consists of specialised clinics: surgery, orthopaedics, internal medicine, gynaecology, neurology, ear–nose–throat (ENT), dermatology, ophthalmology, radiology and laboratory services, and occupational therapy and physiotherapy. Its surgical operations

Table 1
Comparison of design characteristics in the traditional and ABC hospital layouts for consultation-based and surgical/radiology clinics.

Design characteristics	Traditional layout	ABC layout
Consultation-based clinics		
Patient and employee flow	Patients and employees moved through the building in the same circulation pattern. Patients registered at decentralised reception desks, then waited in clinic-specific waiting rooms.	Patient and employee flows are separated. On arrival, patients use self-service check-in devices at the main entrance, with host assistance if needed. They are then referred to a waiting area near the consultation rooms.
Spatial distribution	Each floor contained two clinics (except for one floor that accommodated three clinics). Every clinic had its own entrance, breakout room, waiting area, consultation rooms, storage and other dedicated facilities.	Each floor now accommodates three clinics that share resources. There is one common waiting area and breakout room per floor, while each clinic has its own storage. Each clinic has a designated 'home base' near the consultation rooms, but overall resources are pooled.
Consultation rooms	Each clinic had its own consultation rooms, tailored to its specialty.	Consultation rooms are shared across clinics. They have dual access, with one door to the patient area and another to the employee area. To allow flexible use, clinical materials are kept in mobile carts rather than fixed storage.
Administrative work (e.g. phone calls, referrals, dictation, collaboration)	Administrative tasks were carried out in consultation/ examination rooms, expedition rooms and employee rooms (e.g. physicians' and nurses' offices).	These tasks take place in shared workspaces on the employee side of the building. Each clinic has a 'home base' but no assigned desks. Workspaces are shared by multiple clinics and are divided into three zones: **Collaborative:** Workstations in open areas, digital collaboration screens, sofas and meeting rooms; **Semi-quiet:** Workstations with sound-absorbing features in open areas, sofas and breakout rooms; **Quiet:** Small rooms with desks, designed for focused work or digital healthcare meetings.
Surgical and radiology clinics		
Patient and employee flow	Patients and employees used the same circulation routes within the facility. Patients completed registration at decentralised reception desks and subsequently waited in clinic-specific waiting areas.	Patients complete check-in at self-service kiosks located at the main entrance, with host support available when required. They then move to the designated waiting area, from which they are guided either to the pre- or post-operative areas or to radiology services, depending on their scheduled procedures.
Operation theatres and preparation areas	Three adjacent operating theatres were located on the same floor, but none were equipped with dedicated preparation rooms, and the pre- and post-operative departments were positioned on separate floors.	The operating theatres are spaced apart and each is integrated with its own preparation room. The entire floor is now dedicated to the surgical clinic, and the pre- and post-operative areas are situated on the same floor, improving co-ordination and reducing patient transport time.
Administrative work	Administrative tasks were carried out in expedition rooms.	The floor accommodates a range of workspaces, including meeting rooms of various sizes, shared workstations, a lunchroom and breakout spaces for administrative work and collaboration.

include scheduled procedures across several areas: gynaecology, general surgery, orthopaedics, ENT, ophthalmology, plastic surgery and selected dental interventions. The hospital does not provide inpatient care and has no dedicated beds.

Between December 2023 and March 2024, the hospital and its 195 employees relocated to a newly constructed building of approximately 24,500 m^2, designed according to the ABC model. The study population, which comprised the hospital employees, was dynamic, with ongoing turnover and recruitment. Information on staff attrition, recruitment, and workforce size across the three measurement points is described in the Data Collection section.

The new hospital recorded around 100,000 patient visits across its clinics and performed approximately 11,000 surgical interventions in 2024.

2.2. The ABC model

The relocation involved both a move to new facilities and the introduction of a new workplace model, with a new spatial configuration and a new way of working. The study therefore evaluates the consequences of a hospital relocation accompanied by implementation of an ABC model. Fig. 1 illustrates the flow and general layout in the traditional and ABC models, respectively. Importantly, the hospital relocation did not produce a uniform transformation; rather, the redesign introduced distinct solutions across different clinical contexts. To capture these variations, Table 1 compares key design characteristics of the traditional layout with those of the ABC layout, presented separately for consultation-based clinics (i.e. surgical outpatient care, orthopaedics, internal medicine, gynaecology, neurology, ENT, dermatology, ophthalmology, and occupational therapy and physiotherapy), where care is primarily consultation-driven, and for surgical and radiology clinics (i.e. surgery and radiology), where operations and imaging services are delivered. The comparison illustrates how patient and employee flows, spatial distribution and administrative functions were reconfigured to promote shared resources, more flexible use of space and increasingly standardised clinical environments.

2.3. Data collection

2.3.1. Survey

Data were collected through a questionnaire designed to evaluate the impact of the transition to the ABC model. The survey was administered at three time points: 3 months before relocation (T1), 6 months after relocation (T2), and 18 months after relocation (T3). All employees were invited to participate through Research Electronic Data Capture (REDCap), a secure web-based data-collection system.

All employees at the outpatient hospital were eligible to participate



Fig. 1. (Left) Schematic illustrations comparing a traditional hospital layout with the ABC design; (right) photographs of the ABC hospital. (Panels A and C: photographs by the organisation; Panels B, D, E: photographs by Ulf Celander; Panel F: photograph by Lisa Arvidsson. All photographs are reproduced with permission of the copyright holder(s).

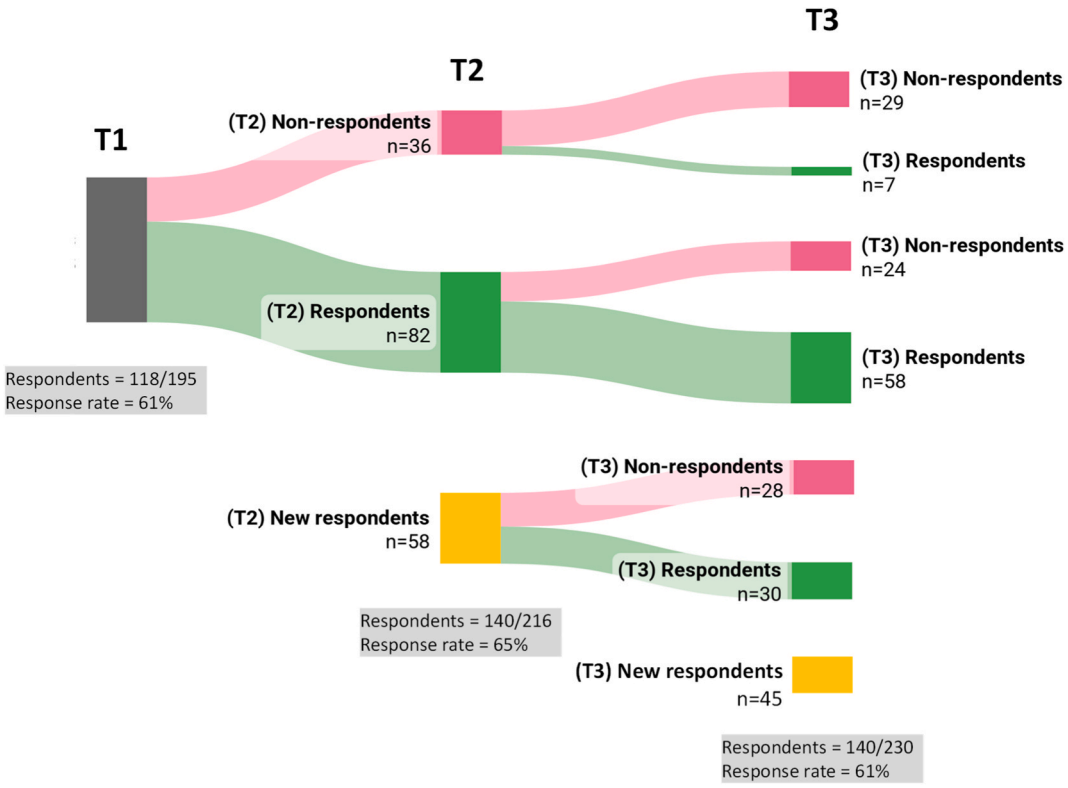


Fig. 2. Sankey diagram illustrating participant flow and response patterns across the study waves (T1–T3), showing transitions between response and non-response, retention between waves and newly responding participants at follow-up. Numbers indicate counts of respondents and non-respondents at each time point, as well as overall response rates.

at each wave. The number of eligible employees was 195 at T1, 216 at T2 and 230 at T3. Between T1 and T2, 42 employees left and 63 were hired; between T2 and T3, 27 employees from the original T1 cohort and 14 newly hired employees left, while 55 additional employees were recruited. Response rates were 61% (n = 118) at T1, 65% (n = 140) at T2 and 61% (n = 140) at T3. Because the workforce changed over the study period, the sample constitutes an open cohort: some respondents were employed only before or only after the relocation. Participant flow across waves, including retention between waves and newly responding participants at follow-up, is presented in Fig. 2.

The questionnaire combined newly developed items with questions drawn from established work environment instruments. The overall aim was to capture employees' experiences of the physical work environment and psychosocial working conditions, as well as aspects of stress and recovery. Items were answered on Likert-type scales with graded response options (e.g. from very good to very bad, agree to disagree, or satisfied to dissatisfied). The full set of survey questions used in this study is presented in Appendix A, Table A1.

Perceptions of task–environment alignment were assessed using five single items, each addressing a distinct aspect of the alignment between work tasks and the physical environment. Three items were developed for this study, following the approach used by Sirola et al. (2023) to assess perceived office support for different task types. Where the instrument addresses work carried out independently as a single category, we distinguished individual routine work from concentration-demanding work and added an item on direct patient work to reflect the clinical setting. A fourth item concerned support for cooperation (Brennan et al., 2002; Sirola et al., 2023), and a fifth overall satisfaction with the workplace design (Pettersson-Strömbäck et al., 2018).

Psychosocial work environment was measured using selected dimensions from the Copenhagen Psychosocial Questionnaire (COPSOQ III) (Berthelsen et al., 2020). Drawing on expertise in both activity-based working and the psychosocial work environment, the research group selected dimensions expected to be affected by the transition, covering the organisation and distribution of work tasks, opportunities for influence and control, role-related conditions, access to information, social relations at work, and employees' perceived ability to perform work of satisfactory quality. The included dimensions covered quantitative demands, influence at work, variation at work, predictability, role clarity, role conflicts, sense of community at work and perceived quality of work, and all items of each dimension were used, following the Swedish standard version of COPSOQ III. Single-item measures of referral intentions (would you recommend other people to apply for a position at your workplace?) and overall job satisfaction (how pleased are you with your job as a whole, everything taken into consideration?), each drawn from a longer COPSOQ subscale, were also included. One question about collaboration with other departments (at my workplace, we have effective collaboration with other departments) was added (SKR, 2023). Perceived stress (Lindström et al., 2000) and recovery were assessed using items derived from the General Nordic Questionnaire for Psychological and Social Factors (QPS) at Work (Ahlborg et al., 2006).

Demographic and occupational information collected at each wave included age, gender, clinic affiliation, professional role, managerial responsibility and extent of direct patient contact.

2.3.2. Turnover and sick leave

Turnover and sick leave data were assessed using administrative records from the study hospital. *Turnover* was defined as the monthly number of employees leaving the outpatient hospital and was stratified by profession and clinic type. Sick leave was measured as total sick-leave hours per month and was stratified by profession and clinic type. While sickness absence is commonly reported in days, occupational health research has argued for rate-based measures derived from payroll data, expressing lost work time relative to expected working time (Hill et al., 2008). Records of contracted working time, comprising monthly employee counts by band, were obtained for the same period and used to express sickness absence as a proportion of scheduled working time.

The data covered the 13 months before and 13 months after the relocation. The four months during which the relocation took place (December 2023 to March 2024) were excluded to ensure stable pre- and post-relocation periods.

2.4. Ethical considerations

The study was reviewed and approved by the Swedish Ethical Review Authority (Ref. no. 2023-03119-01). All participants received written study information and provided informed consent prior to participation. Participation was voluntary, and respondents could discontinue participation at any stage. Given the collection of work environment and health-related data, special attention was paid to data protection. Responses were linked across the three waves using participant identifiers. To protect confidentiality, survey responses were analysed and reported only at group level, to prevent identification of individual participants. Administrative records of sickness absence and turnover were obtained from the study hospital in aggregated form and contained no individually identifiable information. Research data were accessible only to authorised members of the research team. Technical and organisational safeguards were implemented in accordance with the General Data Protection Regulation (GDPR).

2.5. Data analysis

2.5.1. Survey analysis

Descriptive statistics (frequencies and percentages) were calculated to summarise participant characteristics at each measurement point.

Professional roles were classified using the Swedish Standard Classification of Occupations (SSYK) (Statistics Sweden, 2012) as the underlying framework. Based on this structure, we defined four categories: physicians (e.g. specialist physician); registered nurses (e.g. registered nurse, midwife, specialist nurse); assistant nurses and other licensed care occupations (OCs) (e.g. occupational therapist, medical social worker, psychologist/neuropsychologist, physiotherapist); and administrative employees (e.g. office clerk, receptionist, telephone operator, healthcare administrative secretary/medical secretary). Although distinguished within SSYK, the assistant nurses and OC subgroups were combined into a single category for statistical comparisons due to small sample sizes. This approach allowed us to follow the Swedish Standard structure while ensuring that each category included enough respondents for reliable analysis. Clinic type (consultation-based vs. surgical/radiology) was defined a priori according to the design solutions described in Table 1, which correspond to differences in task structure between consultation-based and procedural work.

Task–environment alignment items were analysed individually, and no composite score was computed; Spearman inter-item correlations between the five items at each measurement occasion are reported in Appendix C, Table C1. Psychosocial work environment indices were calculated as the mean of their respective items when at least half of the items were completed and were set to 'missing' otherwise. All outcomes were analysed as continuous variables, with higher scores indicating more positive assessments. Internal consistency was acceptable to good across subscales and measurement occasions ($\alpha = 0.67$ to 0.93), with the lowest value observed for influence at work at T3 (Appendix C, Table C2).

Changes over time were analysed using generalised least-squares (GLS) models for repeated measures. Time (T1, T2, T3) was treated as a categorical variable to allow for non-linear change across measurement occasions. An unstructured covariance matrix was specified to model the within-person correlation across repeated measurements. Estimated marginal means (EMMs) with 95% confidence intervals (CIs) were derived from all models and used for interpretation and graphical presentation. Type III tests of fixed effects were used to assess main and interaction effects.

In the primary analyses, overall changes over time in the full sample were examined. To assess whether trajectories differed between groups, models including professional role (physicians, registered nurses, assistant nurses and OCs, and administrative employees) and clinic type (consultation-based vs. surgical/radiology) were estimated, together with Time × Group interaction terms. Statistically significant interaction effects were followed by pairwise comparisons within groups. Omnibus GLS tests are reported in Appendix B.

Missing data were handled under the assumption of missing at random (MAR), which is accommodated within the GLS framework using maximum likelihood estimation. All respondents were included in the models regardless of how many measurement occasions they contributed; no minimum number of observations was required. In total, 221 individuals responded on at least one occasion, contributing 398 observations. All statistical tests were two-tailed and conducted at a 5% significance level.

2.5.2. Turnover and sick leave analysis

Turnover was calculated as the percentage of employees leaving the organisation per month. Effect estimates for turnover are therefore expressed in percentage points. Sick leave was analysed separately for short-term (1–14 days) and long-term (15 or more days) absence, expressed as the percentage of scheduled working time lost. Scheduled working time was calculated for each work unit, profession and month as the number of employees in each band of contracted working time, weighted by the midpoint of that band, multiplied by eight hours and by the number of working days in the month. Employees registered as employed but not in service were excluded from both the numerator and the denominator. Absence hours are registered in proportion to contracted time, such that an employee contracted at 50 percent who is absent for a full day is recorded as four hours rather than eight. Absence hours and scheduled hours were summed separately before the ratio was formed, and profession-months in which no absence was recorded were treated as zero. Effect estimates for sick leave are therefore expressed in percentage points. All outcomes were modelled at the monthly level. In addition to the full-sample analyses, turnover and sick leave were examined separately by professional role (physician, registered nurse, assistant nurses and OCs, administrative employees) and clinic type (consultation-based vs. surgical/radiology). These stratified analyses followed the same modelling structure as the full-sample models.

For all outcomes, segmented interrupted time-series (ITS) regression was used to estimate (1) the pre-relocation trend, (2) the immediate level change at relocation and (3) the post-relocation trend. Data covered the 13 months preceding and the 13 months following relocation. The four months during which the relocation took place (December 2023 to March 2024) were excluded, giving 26 monthly observations. Time was defined as a continuous month index, coded across the two segments so that the excluded months did not enter the series, and separate slope terms were estimated for the pre- and post-relocation periods. Differences between pre- and post-relocation trends were formally assessed using an interaction term representing change in slope after relocation. Post-relocation trends were calculated as the sum of the pre-relocation trend and the estimated change in slope, and the statistical significance of trend differences was assessed using the slope-change term.

Interrupted time-series models were estimated using generalised least squares with a first-order autoregressive [AR(1)] error structure to account for serial dependence among monthly observations. Statistical significance was defined as $p < 0.05$. Given the number of models estimated across outcomes and strata, results are interpreted with an emphasis on consistency of patterns rather than isolated statistically significant findings. Effect estimates are reported as absolute changes in outcome level at the relocation point and as monthly changes in trends, expressed as percentage points for both turnover and sick leave, with corresponding 95% CIs.

All analyses were performed using IBM SPSS Statistics version 28 for Windows (IBM Corp., Armonk, NY, USA).

3. Results

3.1. Participant characteristics

At T1, 118 of 195 eligible employees responded (61%). At T2, 140 of 216 eligible employees participated (65%), including 82 returning respondents from T1 and 58 newcomers. At T3, 140 of 230 eligible employees responded (61%), with 58 individuals completing all three waves. Fig. 2 illustrates the participant flow and response patterns across the study waves (T1–T3).

Participant characteristics at each measurement point are presented in Table 2. Across all time points, most respondents were females (76%–81%); most were registered nurses (50%–57%), followed by physicians (13%–17%) and other professional groups (21%–24%). The age distribution was relatively stable over time, with the largest proportion aged 40–59 years. Approximately 14%–16% reported holding a managerial position. Most participants worked in consultation-based clinics (59%–63%), while 26%–31% worked in surgical or radiology clinics. The distribution of direct patient contact was similar across time points, with the largest proportion reporting more than 6 h per day.

3.2. Changes over time in the full sample

3.2.1. Task–environment alignment

Statistically significant time effects were observed across all items of the task–environment alignment in the full sample (all $p < 0.05$; Fig. 3A), characterised by an initial decline following relocation: ratings of workplace design and support for individual routine work decreased at the first follow-up and remained significantly lower than baseline at T3 (all adjusted $p < 0.05$). In contrast, perceived support for direct patient work and co-operation declined between T1 and T2 (all adjusted $p < 0.05$) but did not differ significantly from baseline at T3. A different

Table 2
Distribution of participant characteristics across the study waves (T1–T3).

Characteristics	T1 ($n = 118$) n (%)	T2 ($n = 140$) n (%)	T3 ($n = 140$) n (%)
Gender			
Female	95 (81%)	106 (76%)	107 (76%)
Male	9 (8%)	11 (8%)	12 (9%)
Prefer not to answer	4 (3%)	7 (5%)	11 (8%)
Age group, years			
18–29	4 (3%)	4 (3%)	1 (1%)
30–39	11 (9%)	10 (7%)	11 (8%)
40–49	31 (26%)	32 (23%)	32 (23%)
50–59	38 (32%)	48 (34%)	48 (34%)
≥60	22 (19%)	24 (17%)	26 (19%)
Prefer not to answer	12 (10%)	22 (16%)	22 (16%)
Managerial position			
Has managerial role	17 (14%)	22 (16%)	20 (14%)
Professional role			
Physician	15 (13%)	21 (15%)	24 (17%)
Registered nurse	46 (39%)	49 (35%)	56 (40%)
Assistant nurses and other licensed care occupations (OCs)	29 (25%)	34 (24%)	26 (19%)
Administrative employee	20 (17%)	19 (14%)	18 (13%)
Direct patient contact per day, hours			
<2	24 (20%)	24 (17%)	31 (22%)
2–6	34 (29%)	47 (34%)	42 (30%)
>6	53 (45%)	54 (39%)	53 (38%)
Clinic type			
Consultation-based clinics	70 (59%)	88 (63%)	82 (59%)
Surgical/radiology clinics	34 (29%)	37 (26%)	44 (31%)

Note. Data were collected in three waves: approximately 3 months before the relocation in 2023 (T1), at 6 months after relocation (T2) and at 18 months after relocation (T3).

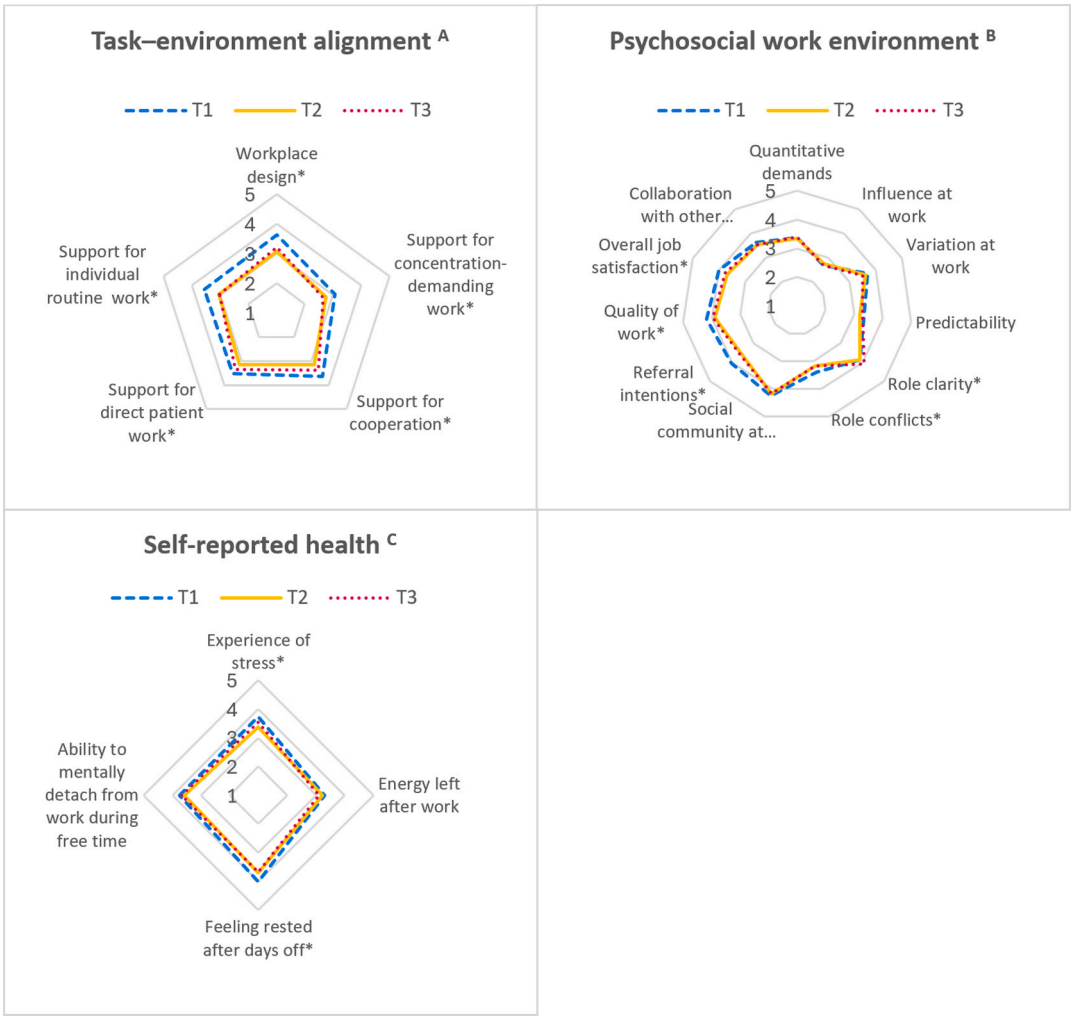


Fig. 3. (A) Task–environment alignment, (B) psychosocial work environment and (C) self-reported health ratings across study waves (T1–T3) in the full sample. Values represent estimated marginal means from GLS models. The dashed blue line indicates T1, solid yellow line T2 and dotted red line T3. Higher values indicate more positive assessments (range 1–5). **Note.** Asterisks indicate at least one statistically significant pairwise difference between time points ($p < 0.05$). Omnibus GLS tests are reported in Appendix B, Tables B1, B2 and B3. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

pattern was observed for support for concentration-demanding work, where the significant decline relative to baseline emerged primarily at T3 (adjusted $p = 0.028$).

3.2.2. Psychosocial work environment

Statistically significant time effects were observed for multiple psychosocial work environment outcomes (all $p < 0.05$; Fig. 3B). Ratings for referral intentions, quality of work and overall job satisfaction followed a consistent pattern characterised by a significant decline from baseline to the first follow-up (adjusted all $p < 0.05$), with ratings remaining significantly lower than baseline at T3 (all adjusted $p < 0.05$) and no statistically significant change between follow-ups. In contrast, ratings of role conflict showed a temporary change, with a significant decline between T1 and T2 (adjusted $p = 0.021$) but no significant differences thereafter. A different trajectory was observed for role clarity ratings, which increased over time, with significant improvements between T2 and T3 (adjusted $p = 0.009$) and T1 and T3 (adjusted $p = 0.015$). No statistically significant time effects were found for quantitative demands, influence at work, variation at work, predictability, social community at work and collaboration with other departments.

3.2.3. Self-reported health

Statistically significant time effects were observed for feeling rested after days off and perceived stress (all $p < 0.05$; Fig. 3C). For feeling rested after days off, ratings decreased from T1 to T2 (adjusted $p = 0.003$) and remained lower than baseline at T3 (adjusted $p < 0.001$), with no significant change between T2 and T3. A similar pattern was found for perceived stress, with ratings worsening from T1 to T2 (adjusted $p = 0.008$) and no subsequent recovery at T3. In contrast, no significant changes over time were observed for ability to mentally detach from work during free time or having energy left after work.

3.3. Changes over time by professional roles

3.3.1. Task–environment alignment

Statistically significant Time × Professional role interactions were observed for most items of the task–environment alignment (all $p < 0.05$; Fig. 4), except for workplace support for co-operation ($p = 0.107$). Physicians showed consistent declines across most items, with ratings of workplace design, as well as support for concentration-demanding work, routine individual work and direct patient work, significantly decreasing at the first follow-up and not returning to baseline levels (all adjusted $p < 0.05$). A similar pattern was observed among administrative employees, with a significant decline from baseline to the first follow-up and no recovery at T3 for workplace design, concentration-demanding work, and routine individual work (all

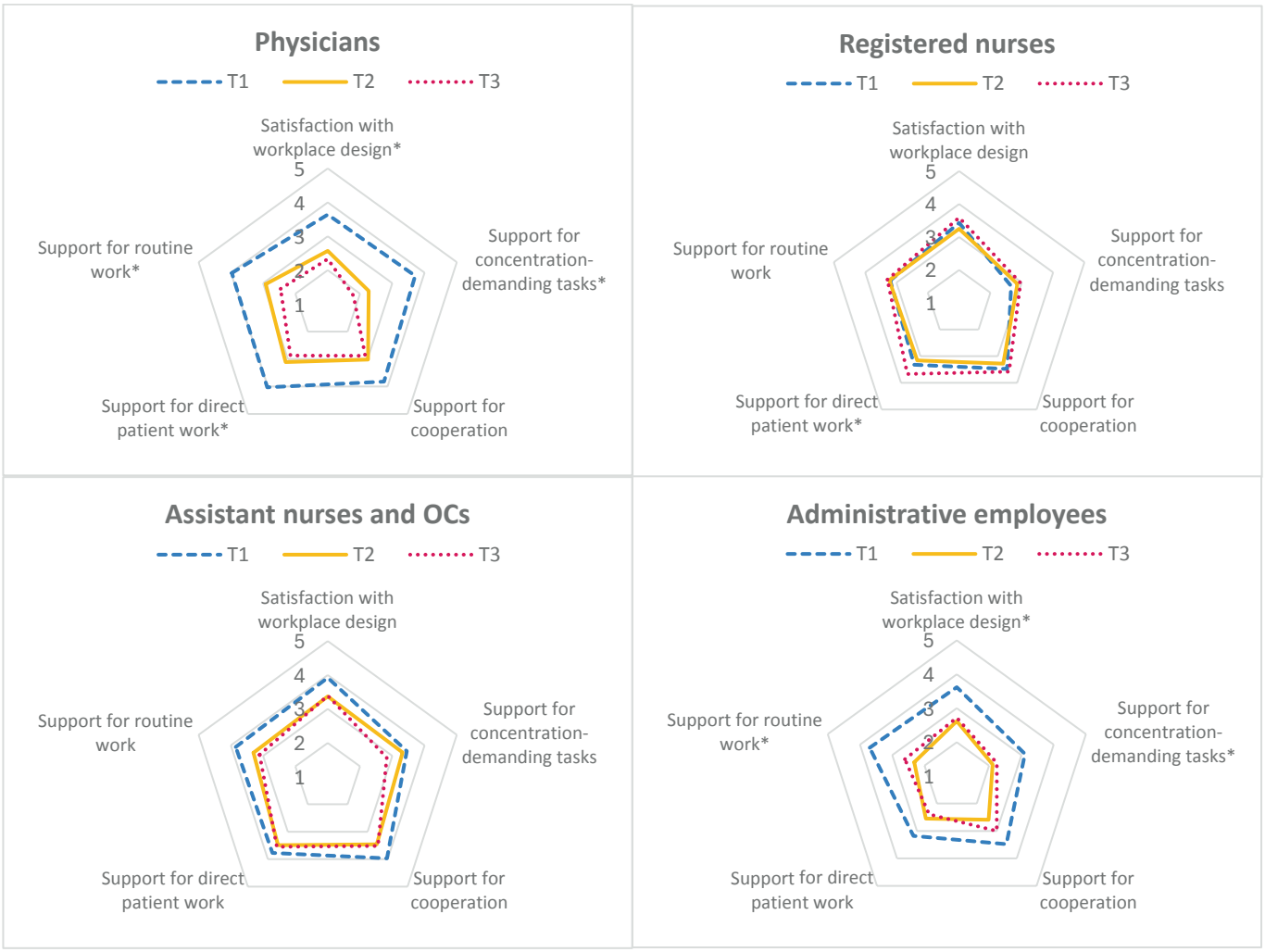


Fig. 4. Task–environment alignment ratings across study waves (T1–T3) for physicians, registered nurses, assistant nurses and OCs, and administrative employees. Values represent estimated marginal means from GLS models. The dashed blue line indicates T1, solid yellow line T2 and dotted red line T3. Higher values indicate more positive assessments (range 1–5). **Note.** OCs = other licensed care occupations. Asterisks indicate at least one statistically significant pairwise difference between time points within professional role ($p < 0.05$). Omnibus GLS are reported in Appendix B, Table B4. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

adjusted $p < 0.05$); however, no statistically significant changes were detected for direct patient work. In contrast, registered nurses showed greater stability over time. Ratings of workplace design, as well as support for concentration-demanding work and routine individual work, did not change significantly, while perceived support for direct patient work increased between T2 and T3 (adjusted $p < 0.05$). Assistant nurses and other OCs also showed stable ratings across all dimensions, with no significant changes over time.

3.3.2. Psychosocial work environment

No statistically significant Time × Professional role interactions were observed for any psychosocial work environment outcome, indicating that the trajectories over time were comparable across physicians, registered nurses, assistant nurses and OCs, and administrative employees (Fig. 5).

3.3.3. Self-reported health

No statistically significant Time × Professional role interactions were found for any of the self-reported health outcomes, suggesting that the patterns over time were similar across physicians, registered nurses, assistant nurses and OCs, and administrative employees (Fig. 6).

3.4. Changes over time by clinic types

3.4.1. Task–environment alignment

Statistically significant Time × Clinic type interactions were observed for all task–environment alignment items (all $p < 0.05$; Fig. 7). Consultation-based clinics showed consistent declines across all items, with ratings of workplace design, as well as support for concentration-demanding work, routine individual work, co-operation and direct patient work, significantly decreasing at the first follow-up and not returning to baseline levels (all adjusted $p < 0.05$). In surgical/radiology clinics, the pattern was generally the opposite: satisfaction with workplace design increased over time (adjusted $p = 0.043$), and perceived support for concentration-demanding work improved at the first follow-up (adjusted $p = 0.025$) and remained stable at T3. For the remaining items, no statistically significant differences were found.

3.4.2. Psychosocial work environment

Across clinic types, most psychosocial work environment dimensions showed no statistically significant Time × Clinic type interaction effects (Fig. 8), except for predictability and influence at work (all $p < 0.05$). For predictability, ratings showed a statistically significant increase from T2 to T3 in surgical/radiology clinics (adjusted $p = 0.002$),

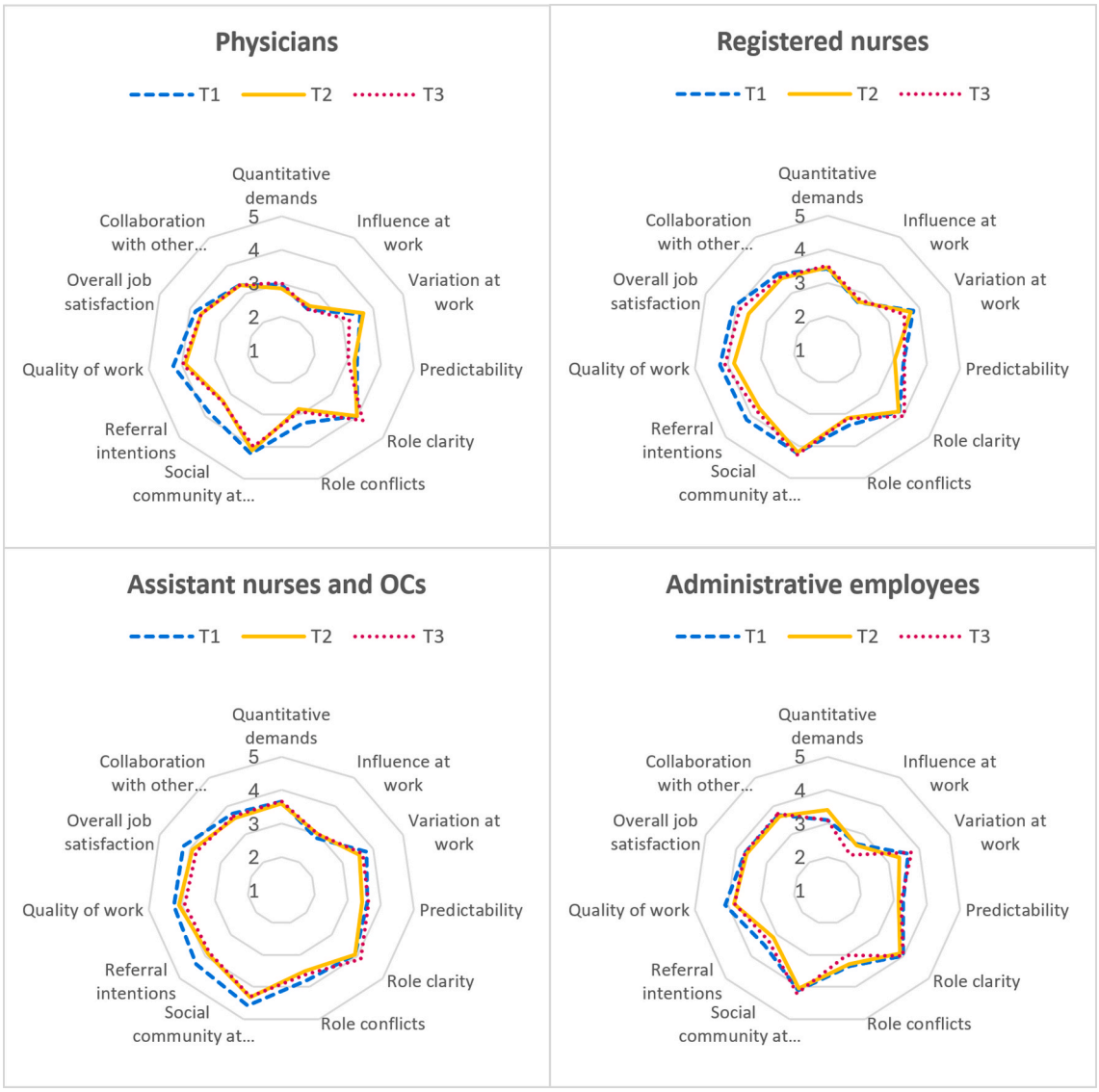


Fig. 5. Psychosocial work environment ratings across study waves (T1–T3) for physicians, registered nurses, assistant nurses and OCs, and administrative employees. Values represent estimated marginal means from GLS models. The dashed blue line indicates T1, solid yellow line T2 and dotted red line T3. Higher values indicate more positive assessments (range 1–5). **Note.** OCs = other licensed care occupations. Asterisks indicate at least one statistically significant pairwise difference between time points within professional role ($p < 0.05$). Omnibus GLS tests are reported in Appendix B, Table B5. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

whereas no significant changes were observed in consultation-based clinics. In contrast, although the overall interaction for influence at work was statistically significant, none of the Bonferroni-adjusted pairwise comparisons reached significance, suggesting that the effect was small and not attributable to a specific time-point contrast.

3.4.3. *Self-reported health*

Statistically significant Time × Clinic type interactions were found only for the ability to mentally detach from work during free time ($p = 0.012$; Fig. 9). Within surgical/radiology clinics, ratings increased significantly from T2 to T3 (adjusted $p = 0.009$). No significant interactions were observed for feeling rested after days off, experience of stress or having energy left after work.

3.5. *Organisational outcomes*

3.5.1. *Turnover*

Across the full sample, turnover showed no statistically significant changes in trends or levels associated with the relocation (Table 3). By professional roles, turnover remained largely stable, except for physicians, who demonstrated a statistically significant declining pre-relocation trend (β = − 0.40 percentage points per month, 95% CI −0.66 to − 0.14) that remained unchanged following the relocation. No statistically significant changes in level or trend were observed for other professional roles (Table 3).

By clinic type, turnover showed no statistically significant changes in trends associated with the relocation. However, consultation-based clinics exhibited a statistically significant immediate decrease in turnover at the time of relocation (β = − 2.92 percentage points, 95% CI−5.19 to −0.64), whereas no such level change was observed in surgical/radiology clinics (Table 3).

3.5.2. *Sick leave*

Across the full sample, neither short- nor long-term sick leave showed statistically significant changes in trends or levels associated with the relocation (Table 4). For short-term sick leave, the increase in trend following relocation did not reach statistical significance (β = 0.21 percentage points per month, 95% CI −0.06 to 0.48), yielding a post-

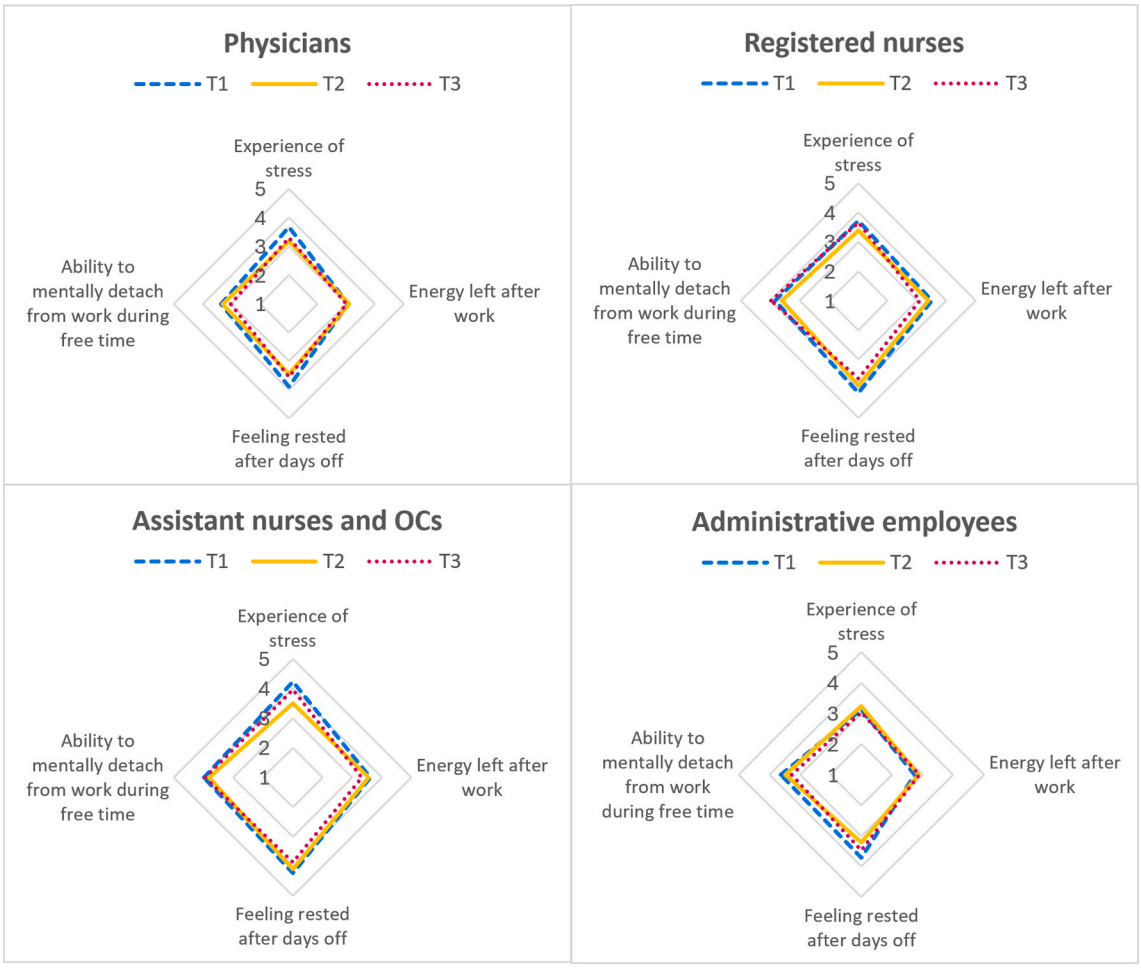


Fig. 6. Self-reported health ratings across study waves (T1–T3) for physicians, registered nurses, assistant nurses and OCs, and administrative employees. Values represent estimated marginal means from GLS models. The dashed blue line indicates T1, solid yellow line T2 and dotted red line T3. Higher values indicate more positive assessments (range 1–5). **Note.** OCs = other licensed care occupations. Asterisks indicate at least one statistically significant pairwise difference between time points within professional roles ($p < 0.05$). Omnibus GLS tests are reported in Appendix B, Table B6. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

relocation trend of 0.15 percentage points per month. For long-term sick leave, the increasing pre-relocation trend and the subsequent decrease in trend were likewise non-significant, resulting in a post-relocation trend of −0.05 percentage points per month.

Across professional roles, short-term sick leave increased significantly in trend for physicians (β = 0.23 percentage points per month, 95% CI 0.06 to 0.40) and registered nurses (β = 0.32 percentage points per month, 95% CI 0.08 to 0.56) relative to their pre-relocation trends, yielding post-relocation trends of 0.14 and 0.16 percentage points per month respectively. Administrative employees showed a statistically significant immediate level increase of 3.28 percentage points (95% CI 1.27 to 5.28) without a corresponding change in trend, and no statistically significant changes were observed for assistant nurses and OCs (Table 4).

For long-term sick leave, assistant nurses and OCs showed a statistically significant increase in trend of 0.60 percentage points per month (95% CI 0.28 to 0.92) relative to a declining pre-relocation trend (β = − 0.22 percentage points per month, 95% CI −0.44 to 0.00, p = 0.050), yielding a post-relocation trend of 0.38 percentage points per month. Administrative employees showed a statistically significant immediate level increase of 5.96 percentage points (95% CI 0.17 to 11.74), although the width of this interval indicates considerable imprecision. Among registered nurses, the decrease in trend approached but did not reach statistical significance (β = − 0.35 percentage points per month, 95% CI −0.71 to 0.00, p = 0.051). No statistically significant changes were observed for physicians.

Across clinic types, short-term sick leave showed no statistically significant changes in trends or levels associated with the relocation in consultation-based settings, whereas surgical and radiology clinics demonstrated a statistically significant decreasing trend prior to relocation (β = − 0.24 percentage points per month, 95% CI −0.43 to −0.06) which increased significantly by 0.40 percentage points per month (95% CI 0.14 to 0.65) following relocation, yielding a post-relocation trend of 0.15 percentage points per month (Table 4). For long-term sick leave, consultation-based clinics demonstrated a statistically significant increasing pre-relocation trend (β = 0.22 percentage points per month, 95% CI 0.02 to 0.41) which did not continue after relocation, resulting in a post-relocation trend of 0.06 percentage points per month, although the change in slope did not reach statistical significance (β = − 0.16, 95% CI −0.45 to 0.13). No statistically significant changes in trends or levels were observed in surgical and radiology clinics.

4. Discussion

To our knowledge, this is among the first longitudinal studies to investigate the consequences of implementing the ABC model in an outpatient hospital in terms of employees' experiences of

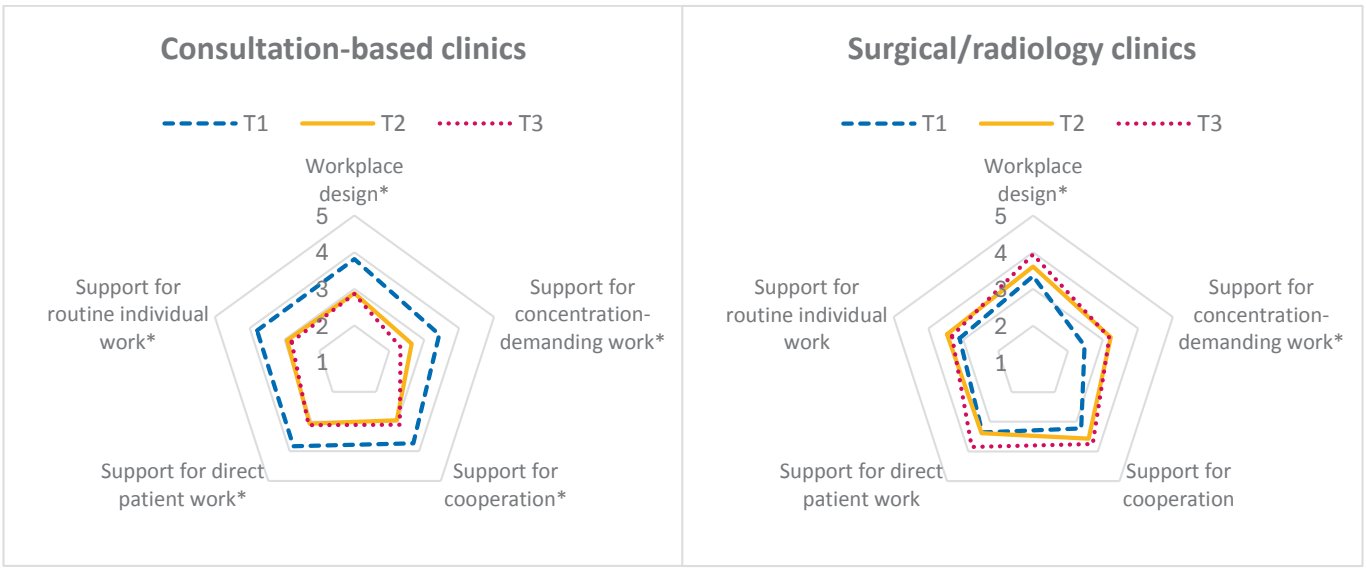


Fig. 7. Task–environment alignment ratings across study waves (T1–T3) for consultation-based and surgical/radiology clinics. Values represent estimated marginal means from GLS models. The dashed blue line indicates T1, solid yellow line T2 and dotted red line T3. Higher values indicate more positive assessments (range 1–5). **Note.** Asterisks indicate at least one statistically significant pairwise difference between time points within clinic type ($p < 0.05$). Omnibus GLS tests are reported in Appendix B, Table B7. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

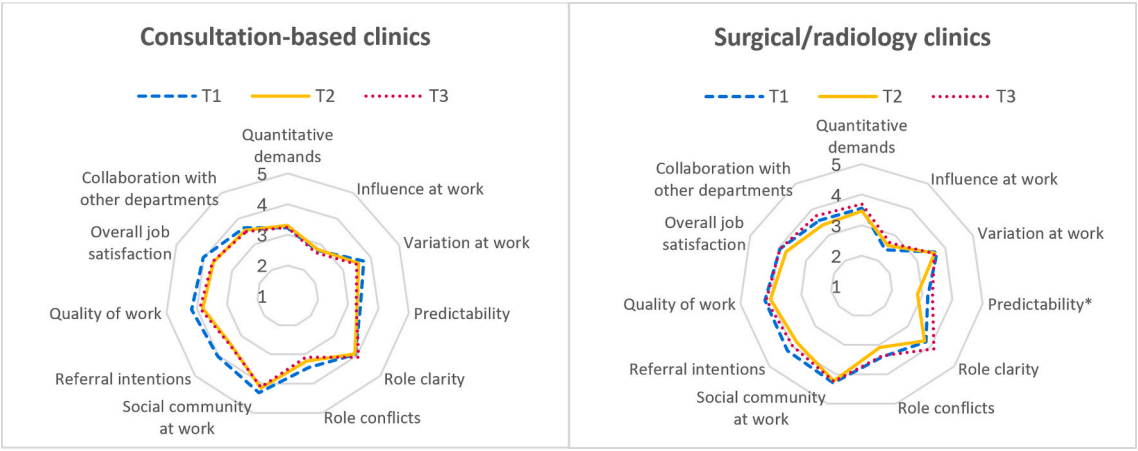


Fig. 8. Psychosocial work environment ratings across study waves (T1–T3) for consultation-based and surgical/radiology clinics. Values represent estimated marginal means from GLS models. The dashed blue line indicates T1, solid yellow line T2 and dotted red line T3. Higher values indicate more positive assessments (range 1–5). **Note.** Asterisks indicate at least one statistically significant pairwise difference between time points within clinic type ($p < 0.05$). Omnibus GLS tests are reported in Appendix B, Table B8. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

task–environment alignment and psychosocial work environment, self-reported health, turnover and sick leave. The consequences of the hospital's transition to ABC were not uniform but varied across clinic types and professional roles – a differential pattern that constitutes the most theoretically consequential finding for understanding system-level occupational health and safety implications. While the full sample showed overall declines in perceived task–environment alignment, these aggregate patterns obscured the marked divergence between clinic type and professional groups, which is discussed more fully in the following sections. Consistent with evidence documenting the negative effects of ABC transitions on employee experience (Harjunheimo & Peteri, 2024; Sirola et al., 2024), the findings extend this evidence base by demonstrating that the consequences of ABC depend on how well the new spatial designs align with the task demands and workflow structures of specific settings and roles, highlighting task–environment alignment as a mechanism linking spatial design to occupational health and safety risks.

A key finding is the divergence between clinic types: while surgical and radiology clinics remained stable or improved following the relocation, consultation–based clinics showed sustained, unrecovered deterioration across all task–environment alignment items. In surgical and radiology settings, the layout consolidated peri-procedural areas and improved spatial sequencing, which may have supported coordination. Conversely, consultation-based clinics replaced specialised assigned rooms with shared generic consultation rooms and mobile carts, potentially disrupting the fit between the physical environment and existing task demands – a misalignment that the SEIPS model identifies as a direct source of performance obstacles in clinical work systems (Carayon et al., 2006). This shift appears to have required healthcare employees to repeatedly reconstruct the conditions for patient encounters, which may create recurrent demands rooted in a lack of spatial consistency. Given that direct patient work is externally scheduled and constrained by clinical requirements, it lacks the flexibility central to ABC principles. The divergent trajectories shown by

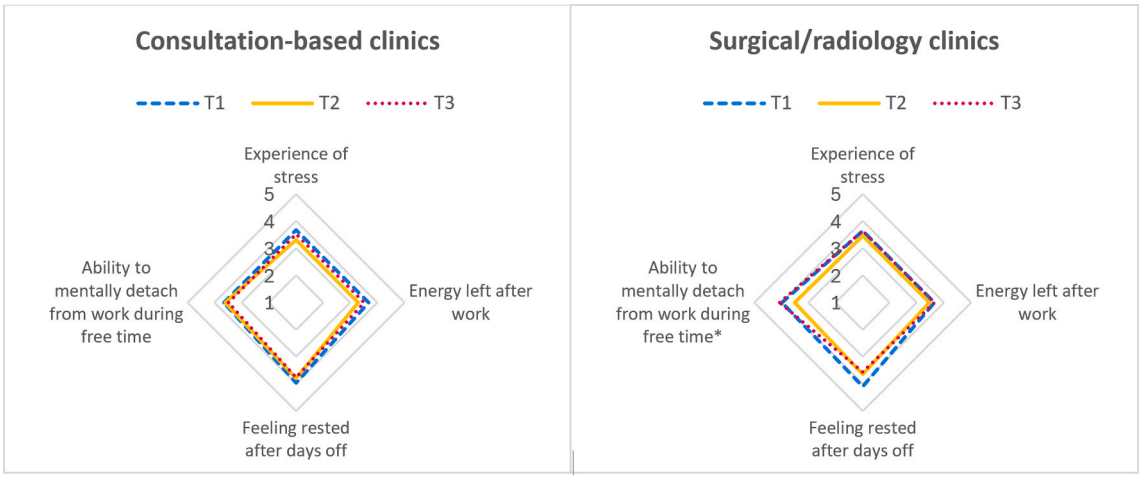


Fig. 9. Self-reported health ratings across study waves (T1–T3) for consultation-based and surgical/radiology clinics. Values represent estimated marginal means from GLS models. The dashed blue line indicates T1, solid yellow line T2 and dotted red line T3. Higher values indicate more positive assessments (range 1–5). **Note.** Asterisks indicate at least one statistically significant pairwise difference between time points within clinic type ($p < 0.05$). Omnibus GLS tests are reported in Appendix B, Table B9. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Table 3
Interrupted time-series estimates with 95% CIs for turnover across the full sample, professional roles and clinic types.

Group	Pre–relocation trend (pp/month; 95% CI)	*p* value	Level change at relocation (pp; 95% CI)	*p* value	Post–relocation trend (pp/month; 95% CI)	*p* value
Full sample	0.05 (−0.07 to 0.17)	0.44	−1.37 (−2.76 to − 0.03)	0.053	0.06 (−0.16 to 0.27)	NA
Professional roles						
Physicians	**−0.40 (−0.66 to − 0.14)***	**0.015**	3.89 (−0.98 to 8.75)	0.152	−0.27 (−0.85 to 0.31)	NA
Registered nurses	0.04 (−0.21 to 0.29)	0.725	0.20 (−2.06 to 2.46)	0.865	−0.09 (−0.48 to 0.30)	NA
Assistant nurses and OCs	0.04 (−0.09 to 0.16)	0.589	−0.83 (−2.29 to 0.63)	0.284	0.06 (−0.17 to 0.28)	NA
Administrative employees	−1.62 (−10.32 to 7.08)	0.733	−26.45 (−120.12 to 67.22) [a]	0.609	1.48 (−16.38 to 19.34)	NA
Clinic types						
Consultation-based	0.10 (−0.11 to 0.31)	0.356	**−2.92 (−5.19 to −0.64)***	**0.022**	0.17 (−0.20 to 0.53)	NA
Surgical/radiology	0.32 (−0.06 to 0.70)	0.121	−3.26 (−7.84 to 1.31)	0.094	−0.08 (−0.67 to 0.52)	NA

Note. OCs = other licensed care occupations. Statistical analyses were conducted using segmented interrupted time–series regression to estimate pre–relocation trends, immediate level changes at relocation and post–relocation trends. Effect estimates are reported as absolute changes in turnover, expressed as percentage points (pp) for level changes at the relocation point and as monthly changes in percentage points for trends, with 95% CIs. Post-relocation trends were calculated as the sum of the pre-relocation trend and the estimated change in slope; statistical significance of trend differences was assessed using the slope-change term. *p < 0.05.

[a] The 95% CI for administrative employees' level change (−120.12 to 67.22 pp) exceeds the mathematically possible range for a percentage-point change, indicating a highly unstable estimate driven by the small subgroup size ($n \approx 18$–20) combined with monthly-level modelling; this estimate should not be interpreted as a precise effect.

Table 4
Interrupted time-series estimates with 95% CIs for short- and long-term sick leave across the full sample, professional roles and clinic types.

Group	Pre-relocation trend (pp/month)		Level change at relocation (pp)		Post-relocation trend (pp/month)	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Full sample	−0.06 (−0.24, 0.12)	0.10 (−0.03, 0.22)	0.55 (−1.12, 2.23)	0.77 (−0.47, 2.01)	0.15	−0.05
Professional roles						
Physicians	−0.09 (−0.22, 0.03)	0.28 (−0.08, 0.64)	0.07 (−1.26, 1.40)	1.82 (−1.88, 5.52)	0.14*	−0.06
Registered nurses	−0.16 (−0.33, 0.02)	0.08 (−0.16, 0.32)	0.57 (−1.29, 2.42)	0.66 (−1.81, 3.12)	0.16*	−0.27
Assistant nurses and OCs	−0.10 (−0.45, 0.25)	−0.22 (−0.44, 0.00)	0.95 (−2.54, 4.44)	−1.18 (−3.49, 1.14)	0.12	0.38***
Administrative employees	0.14 (−0.05, 0.33)	0.35 (−0.31, 1.01)	3.28 (1.27, 5.28)**	5.96 (0.17, 11.74)*	0.01	−0.12
Clinic types						
Consultation-based	−0.02 (−0.21, 0.18)	0.22 (0.02, 0.41)*	1.03 (−0.91, 2.97)	−0.21 (−2.04, 1.63)	0.12	0.06
Surgical/radiology	−0.24 (−0.43, −0.06)**	−0.33 (−0.71, 0.06)	−0.06 (−2.04, 1.91)	3.57 (−0.02, 7.17)	0.15**	−0.22

Note. OCs = other licensed care occupations; pp = percentage points. Sick leave is expressed as the percentage of scheduled working time lost to sickness absence. Scheduled working time was calculated as the number of employees in each band of contracted working time, weighted by band midpoint, multiplied by eight hours and by the number of working days in the month. Segmented interrupted time-series models were estimated using generalised least squares with a first-order autoregressive [AR(1)] error structure; confidence intervals are Wald intervals. Post-relocation trends were calculated as the sum of the pre-relocation trend and the estimated change in slope; statistical significance of trend differences was assessed using the slope-change term, and asterisks on post-relocation trends refer to that term. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

consultation-based clinics and surgical and radiology clinics illustrate how outcomes depend on the alignment between spatial design and

existing task structures. Integrated layouts can support workflow coherence, while an incompatible design creates compounding misalignments (Ozkaynak et al., 2022). This pattern is further reinforced by the reported decline in perceived support for co-operation in consultation-based clinics, suggesting that in cases where the spatial misalignment was most severe, even interpersonally embedded tasks were disrupted.

Professional role was found to moderate task–environment alignment outcomes but not psychosocial or health outcomes. Persistent declines in task–environment alignment measures among physicians and administrative employees contrasted with the relative stability of registered nurses, assistant nurses and OCs – a pattern likely related to differences in workflow structures. Physicians' work tends to be organised around stable consultation rooms as primary workspaces (Sinsky et al., 2016), while nurses' core tasks are more spatially distributed across patient rooms, treatment spaces and shared clinical areas (Hendrich et al., 2008). Hence, the structural disruption introduced by shared activity-based workspaces may have been substantially greater for physicians than for nurses, probably because their pre-existing workflow was more spatially anchored. The absence of role-based moderation in psychosocial and health outcomes suggests that physical environment disruption may not have translated uniformly into differential psychosocial consequences across groups.

Further elaborating the role-specific patterns, among physicians and administrative employees, perceived support for routine individual work declined persistently, with no recovery at T3. These findings are consistent with the concept of *meta*-work: the preparatory and co-ordinative labour associated with shared rooms, mobile storage and unassigned workspaces that enables core clinical work but remains largely invisible to performance metrics (Aroles et al., 2023; Harjunheimo & Peteri, 2024). In ABC, such labour might include locating equipment via mobile carts, verifying room availability and re-establishing spatial configurations prior to clinical tasks. This repeated need to reconfigure work conditions would generate variability that does not diminish over time, if the disruption lies in the structural design of the workspace rather than in individual behaviour or skill deficits. Behavioural adaptation may reduce the effort required for individual episodes of reconfiguration but cannot eliminate the recurring demand itself as long as the spatial conditions remain unchanged. These mechanisms are proposed as plausible explanations for the observed patterns rather than as processes documented in the present study and warrant direct investigation.

In this context, reduced support for concentration-demanding work may reflect the cumulative demands associated with navigating unpredictable environments, suggesting that the burden of spatial reorganisation extends beyond co-ordination and routine work to the attentional conditions required for clinical work. This has implications beyond employee experience, as concentration underpins diagnostic reasoning, medication management and clinical documentation, and environmental conditions that undermine attentional capacity may therefore affect care quality (Jin et al., 2023; Westbrook et al., 2010). While direct comparison is limited, these findings echo patterns reported in activity-based office settings, where shared and non-territorial environments are consistently associated with reduced support for concentration-intensive tasks (Engelen et al., 2019; Lauterbach & Borge, 2026; Marzban et al., 2023; Masoudinejad & Veitch, 2023).

Feeling rested after days off and perceived stress worsened persistently across all professional groups and clinic types, with no corresponding changes in energy after work, mental detachment or quantitative demands. This pattern suggests that impaired recovery capacity may have arisen from sustained compensatory effort rather than from increased workload intensity, with the effects emerging primarily during off-work recovery rather than as immediate in-work exhaustion (Debus et al., 2014; van Hooff et al., 2007). The uniformity of health effects across groups with substantially different physical environment experiences suggests that the relocation and introduction of ABC, as well as the shared administrative infrastructure, generated recovery demands that were not limited to those whose core task environments were most disrupted.

Several psychosocial dimensions remained stable over the observation period, including social community, collaboration with other departments, quantitative demands, influence at work and predictability. One plausible explanation is that established professional relationships buffered the impact of physical environment changes, consistent with evidence that social support resources can offset work-environment demands and sustain engagement during transitions (Bakker & Demerouti, 2007; Sirola et al., 2024). However, an alternative interpretation could be that transitional management attention may have produced contingent rather than durable stability, as leadership support during organisational change may buffer psychosocial outcomes in the short term, while effects persist or emerge over longer time horizons (Flovik et al., 2019). Yet not all psychosocial outcomes followed this stable pattern.

Perceived quality of work in clinical settings reflects whether healthcare employees feel that the conditions of their work adequately support good patient care (Aiken et al., 2012). The sustained decline in perceived quality suggests that the new environment did not meet this standard. This is particularly concerning in healthcare, where poorer work environments have been linked to lower patient safety and lower quality of care, as well as job dissatisfaction among employees (Aiken et al., 2012). The reported declining overall job satisfaction and referral intentions reinforce this picture, signalling that the employees' dissatisfaction extended beyond their daily work experience to their broader identification with the organisation. These outcomes may constitute early indicators of broader psychosocial strain not yet fully manifested at 18 months, underscoring the need for longer follow-up in evaluations of major spatial transitions.

The findings indicate a divergence between organisational outcomes, with turnover remaining largely unchanged while sick leave reflects more context-dependent responses within particular professional groups and clinical settings following the relocation. This aligns with the distinction between turnover as a distal withdrawal behaviour and sick leave as a more proximal strain indicator. The stable turnover patterns suggest that the relocation did not meaningfully alter the longer-term processes underlying behavioural exit, which are primarily shaped by core psychosocial working conditions that showed limited change in the present study (Berthelsen et al., 2026). In contrast, the variation in sick leave – particularly the increased absence among specific professional groups and in particular clinical settings – points to more immediate and context-dependent strain responses related to changes in workflows and task demands, in line with prior research linking work-environment characteristics to sickness absence (Nielsen & Knardahl, 2020; Pejtersen et al., 2011).

At the same time, these patterns are best understood as reflecting different stages and dimensions of response to spatial change rather than inconsistent findings. Proximal indicators such as sick leave may capture strain emerging during early phases of adjustment, while turnover reflects more distal processes that unfold over longer time frames. The partial decoupling between subjective assessments and behavioural outcomes further suggests that different outcome measures respond to system changes on distinct temporal trajectories (Platts et al., 2020). Taken together, these findings highlight the multi-layered and temporally differentiated nature of occupational health and safety responses to spatial redesign, where different indicators capture different thresholds and phases of strain across roles and clinical contexts.

Taken together, the findings suggest that the consequences of spatial redesign may extend beyond immediate changes in work experience to encompass cognitive functioning, recovery processes and organisational outcomes, operating across different time frames and levels of the work system. Rather than yielding uniform effects, the ABC transition was accompanied by context- and role-dependent misalignments, with distinct but interrelated responses, ranging from disruption of everyday

work practices to accumulated strain and selective behavioural outcomes. These results underscore the importance of understanding workplace design as a system-level intervention, where impacts on occupational health and safety emerge through interacting mechanisms and unfold over time.

4.1. Strengths and limitations

This study has several strengths. First, it was conducted in a real-world hospital relocation context, enabling an examination of workplace design change as experienced within everyday clinical practice rather than under controlled experimental conditions. The detailed documentation of architectural design and workflow changes provides important contextual information that supports the interpretation of the findings and contributes to post-occupancy knowledge about the ABC model. Second, the longitudinal design, including measurement before and up to 18 months after relocation, offers insight into temporal adaptation processes that are rarely captured in evaluations of ABC. Third, the study integrated employees' experiences of the work environment with organisational outcomes, enabling a triangulation of experiential data with sick leave and turnover data as objective indicators of workplace strain following the transition to ABC. Finally, this study contributes empirical evidence on ABC in outpatient healthcare settings and incorporates multiple professional groups and clinic types, allowing an exploration of variation in responses to spatial change across organisational and clinical contexts.

The findings should also be interpreted in light of several limitations. First, because the relocation to new facilities and the implementation of the ABC model occurred simultaneously, the observed changes reflect the combined effect, and the contribution of the model as such cannot be isolated.

Second, the absence of a comparison hospital means that temporal confounding cannot be excluded. All participants were exposed to the same external healthcare environment, and part of the observed deterioration in well-being may reflect broader developments in the healthcare sector rather than relocation-related effects. During the study period, Swedish healthcare was characterised by workforce shortages, high service demands associated with post-pandemic care backlogs, economic pressures, and ongoing organisational restructuring related to the transition towards more integrated models of care (Janlov et al., 2023). Such factors may have contributed to the widespread increases in stress and decreases in recovery observed across the sample.

The design nonetheless allows some distinction to be drawn. Developments affecting all employees equally would be expected to produce uniform rather than differential change, and the analyses of Time × Group interactions therefore help separate broad temporal developments from changes specific to particular occupational groups or clinical settings. Applied to our own findings, perceived stress and recovery deteriorated uniformly across all groups and a systemic explanation is hardest to rule out for these outcomes. The divergent trajectories across clinic types are less readily explained in this way, since both sector-wide conditions and the experience of relocation itself were common to all groups, whereas the design solutions differed between parts of the building. This reasoning does not extend to organisational changes affecting particular groups or clinics. No systematic review of concurrent organisational developments at the study hospital was undertaken, and we cannot exclude the possibility that changes such as staffing policy revisions, leadership changes or budget adjustments coincided with the relocation. The sick-leave findings should also be interpreted with caution, as sickness absence is influenced by many factors beyond the work environment and the administrative records do not include reasons for absence.

A further limitation concerns the composition of the workforce. While turnover rates remained stable, the ongoing staff replacement meant that the workforce composition changed over time, and some observed effects may reflect differences in who was employed rather than changes in behaviour. Although the responses across the time points were sufficient for longitudinal analysis, the number of participants with repeated measurements was modest, which may have reduced the statistical power, particularly in subgroup analyses.

Most outcomes were based on self-reported measures, which capture experiential aspects of workplace design but do not reflect objective performance, behavioural measures or patient outcomes. Importantly, the study measured designed environments and how employees experienced them but not how the spaces were actually used in practice, whether quiet zones were reliably accessible, whether employees appropriated spaces for unintended purposes or whether workarounds were developed that partially compensated for design inadequacies. This gap between designed and actual space use is well documented in qualitative research on ABC healthcare settings (Harjunheimo & Peteri, 2024) and represents an unmeasured source of variance that may have influenced the outcome patterns observed. In addition, this study reflects a single hospital relocation involving a specific implementation of ABC, and transferability to other healthcare settings or design solutions should therefore be considered with caution. Future research would benefit from multi-site designs and an integration of observational methods and experience sampling alongside survey measurement to capture actual space use patterns, and social network analysis would allow the collaboration structures that spatial redesign reshapes to be examined directly rather than through self-reported perceptions of co-operation.

4.2. Implications for practice

The divergent outcomes across clinic types challenge the assumption that flexible workspace principles can be applied uniformly across clinical settings. In consultation-based outpatient care, replacing specialty-configured rooms with shared generic spaces generated persistent deterioration that remained unresolved across 18 months – a pattern that standard ABC implementation frameworks do not anticipate. Preserving semi-dedicated consultation rooms alongside flexible administrative areas would be a more differentiated approach that warrants prospective evaluation.

This study's findings indicate that pre-implementation assessment is needed before applying ABC to clinical settings and that such assessment should be role specific. Frameworks such as SEIPS provide a structured basis for identifying where proposed spatial changes are likely to generate work-system incoherence – and for which professional groups – before such incoherence manifests.

For organisations already operating ABC in clinical settings, sustained declines in job satisfaction and perceived work quality, regardless of professions, should be treated as signals of structural misalignment requiring intervention. Occupational health monitoring frameworks should include role-specific indicators of spatial disruption. In healthcare settings already encountering workforce shortages, acting on these signals early is a practical necessity.

5. Conclusion

The transition to ABC in the studied outpatient hospital was followed by markedly different consequences depending on clinical setting and professional role, with consultation-based clinics and spatially anchored professional groups bearing the greatest and most persistent burden. These differential patterns reflect the degree to which the redesigned spatial system aligned with existing task demands and workflow structures – a finding that challenges the assumption that ABC operates uniformly across a healthcare organisation. Sustained declines in perceived quality of work, job satisfaction and recovery-related health indicators, alongside context-dependent sick leave patterns, suggest that spatial transitions accompanied by persistent task–environment misalignment may be associated with occupational health and safety concerns that extend beyond the immediate transition period and across

multiple dimensions of employee and organisational functioning. While longer follow-up and multi-site designs will be necessary to establish the generalisability of these effects, this study provides longitudinal evidence – with a pre-transition baseline rarely available in post-occupancy research – that workplace design in healthcare operates as a system-level intervention whose occupational health and safety implications appear closely related to the coherence between spatial design and the task demands of the clinical settings it serves.

CRediT authorship contribution statement

Melina Forooraghi: Writing – original draft, Visualization, Methodology, Formal analysis, Data curation, Conceptualization. **Linda Corin:** Writing – review & editing, Methodology, Investigation, Conceptualization. **Lisa Björk:** Writing – review & editing, Methodology, Investigation, Conceptualization. **Ingibjörg H. Jonsdottir:** Writing – review & editing, Methodology, Conceptualization. **Maral Babapour Chafi:** Writing – review & editing, Project administration, Methodology, Investigation, Conceptualization.

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During the preparation of this work, the author(s) used Copilot/Microsoft to edit the text. After using this tool/service, the author(s) reviewed and edited the content as needed and take full responsibility for the content of the published article.

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Data availability

Data will be made available on request.

References

Ahlborg, G., Ljung, T., Swan, G., Glise, K., Jonsdottir, I.B.H., Währborg, E.P., 2006. *Stressrelaterad ohälsa bland anställda vid Västra Götalandsregionen och Försäkringskassan i Västra Götalands län* (ISM-rapport, Issue. https://mellanarkiv-offentlig.vgregion.se/alfresco/s/archive/stream/public/v1/source/available/sofia/hos1697-550018648-18934/native/ISM-rapport%202-KART%20.pdf.

Aiken, L.H., Sermeus, W., Van den Heede, K., Sloane, D.M., Busse, R., McKee, M., Bruyneel, L., Rafferty, A.M., Griffiths, P., Moreno-Casbas, M.T., Tishelman, C., Scott, A., Brzostek, T., Kinnunen, J., Schwendimann, R., Heinen, M., Zikos, D., Sjetne, I.S., Smith, H.L., Kutney-Lee, A., 2012. Patient safety, satisfaction, and quality of hospital care: cross sectional surveys of nurses and patients in 12 countries in Europe and the United States. BMJ 344, e1717. https://doi.org/10.1136/bmj.e1717.

Anskär, E., Lindberg, M., Falk, M., Andersson, A., 2018. Time utilization and perceived psychosocial work environment among staff in Swedish primary care settings. BMC Health Serv. Res. 18. https://doi.org/10.1186/s12913-018-2948-6.

Appel-Meulenbroek, R., Groenen, P., Janssen, I., 2011. An end-user's perspective on activity-based office concepts. J. Corporate Real Estate 13 (2), 122–135. https://doi.org/10.1108/14630011111136830.

Armbruster, C., Walzer, S., Witek, S., Ziegler, S., Farin-Glattacker, E., 2023. Noise exposure among staff in intensive care units and the effects of unit-based noise management: a monocentric prospective longitudinal study. BMC Nurs. 22 (1), 460. https://doi.org/10.1186/s12912-023-01611-3.

Aroles, J., Bonneau, C., Bhankaraully, S., 2023. Conceptualising 'meta-work' in the context of continuous, global mobility: the case of digital nomadism. Work Employ. Soc. 37 (5), 1261–1278. https://doi.org/10.1177/09500170211069797.

Ashtari Tafti, E., Cannaby, A.M., Carter, V., Strobel, S., 2025. The relationship between nurse contact time and patient outcomes: a retrospective observational study using real-time location data. BMC Health Serv. Res. 25 (1). https://doi.org/10.1186/s12913-025-12822-6.

Bakker, A.B., Demerouti, E., 2007. The job demands-resources model: state of the art. J. Manag. Psychol. 22 (3), 309–328. https://doi.org/10.1108/02683940710733115.

Berthelsen, H., Corin, L., Leineweber, C., Stjernlof, S., Muhonen, T., Westerlund, H., 2026. Healthcare workforce mobility and organisational turnover in Sweden, 2014-2024: a multi-method analysis across occupations and sectors. BMC Health Serv. Res. 26 (1). https://doi.org/10.1186/s12913-026-15120-x.

Berthelsen, H., Westerlund, H., Bergstrom, G., Burr, H., 2020. Validation of the Copenhagen psychosocial questionnaire version III and establishment of benchmarks for psychosocial risk management in Sweden. Int. J. Environ. Res. Public Health 17 (9). https://doi.org/10.3390/ijerph17093179.

Brambilla, A., Rebecchi, A., Capolongo, S., 2019. Evidence based Hospital Design. A literature review of the recent publications about the EBD impact of built environment on hospital occupants' and organizational outcomes. Ann Ig 31 (2), 165–180. https://doi.org/10.7416/ai.2019.2269.

Brennan, A., Chugh, J.S., Kline, T., 2002. Traditional versus open office design - a longitudinal field study. Environ. Behav. 34 (3), 279–299. https://doi.org/10.1177/0013916502034003001.

Brown, A., El-Achkar, E., Fragnito, F., Gosnell, S., Kelly, J., Kucharski, D., Priestly, A., Kumar, S., 2024. Clinical care ratios for, and tasks undertaken by, allied health professionals: a scoping review of the literature. PLoS One 19 (11). https://doi.org/10.1371/journal.pone.0312435.

Butler, R., Monsalve, M., Thomas, G.W., Herman, T., Segre, A.M., Polgreen, P.M., Suneja, M., 2018. Estimating time physicians and other health care workers spend with patients in an intensive care unit using a sensor network. Am. J. Med. 131 (8). https://doi.org/10.1016/j.amjmed.2018.03.015.

Carayon, P., Schoofs Hundt, A., Karsh, B.T., Gurses, A.P., Alvarado, C.J., Smith, M., Flatley Brennan, P., 2006. Work system design for patient safety: the SEIPS model. Qual. Saf. Health Care 15 Suppl 1 (Suppl 1), i50–i58. https://doi.org/10.1136/qshc.2005.015842.

Debus, M.E., Sonnentag, S., Deutsch, W., Nussbeck, F.W., 2014. Making flow happen: the effects of being recovered on work-related flow between and within days. J. Appl. Psychol. 99 (4), 713–722. https://doi.org/10.1037/a0035881.

Dewa, C.S., Loong, D., Bonato, S., Xuan Thanh, N., Jacobs, P., 2014. How does burnout affect physician productivity? A systematic literature review. BMC Health Serv. Res. 14 (35). https://doi.org/10.1186/1472-6963-14-325.

Eijkelenboom, A., Bluyssen, P.M., 2019. Comfort and health of patients and staff, related to the physical environment of different departments in hospitals: a literature review. Intell. Build. Int. 14 (1), 95–113. https://doi.org/10.1080/17508975.2019.1613218.

Elf, M., Anåker, A., Marcheschi, E., Sigurjónsson, A., Ulrich, R.S., 2020. The built environment and its impact on health outcomes and experiences of patients, significant others and staff-a protocol for a systematic review. Nurs. Open 7 (3), 895–899. https://doi.org/10.1002/nop2.452.

Engelen, L., Chau, J., Young, S., Mackey, M., Jeyapalan, D., Bauman, A., 2019. Is activity-based working impacting health, work performance and perceptions? A systematic review. Build. Res. Inf. 47 (4), 468–479. https://doi.org/10.1080/09613218.2018.1440958.

Flovik, L., Knardahl, S., Christensen, J.O., 2019. Organizational change and employee mental health: a prospective multilevel study of the associations between organizational changes and clinically relevant mental distress. Scand. J. Work Environ. Health 45 (2), 134–145. https://doi.org/10.5271/sjweh.3777.

Forooraghi, M., Hultberg, A., Jonsdottir, I.H., Chafi, M.B., 2025. Exploring alignments between design principles and work unit needs in activity-based flexible offices: a case study. Ergonomics 68 (9), 1472–1490. https://doi.org/10.1080/00140139.2025.2475350.

Guidolin, K., Jung, F., Hunter, S., Yan, H., Englesakis, M., Verderber, S., Chadi, S., Quereshy, F., 2024. The influence of exposure to nature on inpatient hospital stays: a scoping review. HERD 17 (2), 360–375. https://doi.org/10.1177/19375867231221559.

Harjunheimo, F., Peteri, V., 2024. Organisational dressage: conflicting embodied rhythms of a health station. Health Place 87. https://doi.org/10.1016/j.healthplace.2024.103247.

Hendrich, A., Chow, M., Skierczynski, B., Lu, Z., 2008. A 36-hospital time and motion study: how do medical-surgical nurses spend their time? Perm. J. 12 (3), 25–34. https://doi.org/10.7812/tpp/08-021.

Hill, J.J.I., Slade, M.D., Cantley, L., Vegso, S., Fiellin, M., Cullen, M.R., 2008. The relationships between lost work time and duration of absence spells: proposal for a payroll driven measure of absenteeism. J. Occup. Environ. Med. 50 (7), 840–851. https://doi.org/10.1097/JOM.0b013e31816b44dd.

Hoendervanger, J.G., Van Yperen, N.W., Mobach, M.P., Albers, C.J., 2019. Perceived fit in activity-based work environments and its impact on satisfaction and performance. J. Environ. Psychol. 65. https://doi.org/10.1016/j.jenvp.2019.101339.

Janlov, N., Blume, S., Glenngard, A.H., Hanspers, K., Anell, A., Merkur, S., 2023. Sweden: health system review. Health Syst. Transit. 25 (4), 1–236. https://www.ncbi.nlm.nih.gov/pubmed/38230685.

Jin, H.Y., Gold, C., Cho, J., Marzban, F., Lim, L., 2023. The role of healthcare facility design on the mental health of healthcare professionals: a literature review. HERD 16 (1), 270–286. https://doi.org/10.1177/19375867221118685.

Jonescu, E.E., Farrel, B., Ramanayaka, C.E., White, C., Costanzo, G., Delaney, L., Hahn, R., Ferrier, J., Litton, E., 2024. Mitigating intensive care unit noise: design-led modeling solutions, calculated acoustic outcomes, and cost implications. HERD 17 (3), 220–238. https://doi.org/10.1177/19375867241237501.

Lauterbach, A.S., Borge, R.H., 2026. How is your new office? A meta-analytic review of activity-based offices' theoretical foundations and empirical outcomes. J. Occup. Organ. Psychol. 99 (1), e70099. https://doi.org/10.1111/joop.70099.

Lindström, K., Elo, A., Skogstad, A., Dallner, M., Gamberale, F., Hottinen, V., Knardahl, S., Orhede, E., 2000. *User's guide for the QPSNordic. General Nordic questionnaire for the psychological and social factors at work.* Nordic Council of Ministers.

Magnusson, C., Ekebergh, M., Jutengren, G., Knutsson, S., 2014. Patientfocused care: an observational study of registered nurses' time for direct patient care. Vård i Norden 34 (4), 4–9. https://doi.org/10.1177/010740831403400402.

Maier, C.B., Köppen, J., Busse, R., Team, M., 2018. Task shifting between physicians and nurses in acute care hospitals: cross-sectional study in nine countries. Hum. Resour. Health 16. https://doi.org/10.1186/s12960-018-0285-9.

Marzban, S., Candido, C., Mackey, M., Engelen, L., Zhang, F., Tjondronegoro, D., 2023. A review of research in activity-based working over the last ten years: lessons for the post-COVID workplace. J. Facil. Manag. 21 (3), 313–333. https://doi.org/10.1108/Jfm-08-2021-0081.

Masoudinejad, S., Veitch, J.A., 2023. The effects of activity-based workplaces on contributors to organizational productivity: a systematic review. J. Environ. Psychol. 86. https://doi.org/10.1016/j.jenvp.2022.101920.

Nantsupawat, A., Kunaviktikul, W., Nantsupawat, R., Wichaikhum, O.A., Thienthong, H., Poghosyan, L., 2017. Effects of nurse work environment on job dissatisfaction, burnout, intention to leave. Int. Nurs. Rev. 64 (1), 91–98. https://doi.org/10.1111/inr.12342.

Nielsen, M.B., Knardahl, S., 2020. The impact of office design on medically certified sickness absence. Scand. J. Work Environ. Health 46 (3), 330–334. https://doi.org/10.5271/sjweh.3859.

Ozkaynak, M., Unertl, K., Johnson, S., Brixey, J., Haque, S.N., 2022. Clinical workflow analysis, process redesign, and quality improvement. In: Finnell, J.T., Dixon, B.E. (Eds.), Clinical Informatics Study Guide: Text and Review. Springer International Publishing, pp. 103–118. https://doi.org/10.1007/978-3-030-93765-2_8.

Pejtersen, J.H., Feveile, H., Christensen, K.B., Burr, H., 2011. Sickness absence associated with shared and open-plan offices – a national cross sectional questionnaire survey. Scand. J. Work Environ. Health 37 (5), 376–382. https://doi.org/10.5271/sjweh.3167.

Pettersson-Strömbäck, A., Bodin Danielsson, C., Nordin, M., Öhrn, M., Harder, M., Olsson, T., Wahlström, V., Slunga-Järvholm, L., 2018. *Slutrapport från AKTIKON-PROJEKTET i Örnsköldsviks kommun: Arbetsmiljö, fysisk aktivitet, hälsa och produktivitet i aktivitetsbaserad kontorsmiljö – en kontrollerad studie i Örnsköldsviks kommun.* U. universitet.

Platts, L.G., Seddigh, A., Berntson, E., Westerlund, H., 2020. Sickness absence and sickness presence in relation to office type: an observational study of employer-recorded and self-reported data from Sweden. PLoS One 15 (4). https://doi.org/10.1371/journal.pone.0231934.

Shetty, R.S., Kamath, G.B., Shetty, S.R., Kv, S., Rao, A., Prabhu, V., Nayak, S., 2026. Exploring healthcare staff perceptions and satisfaction with the physical work environment: a qualitative study. Healthcare (Basel) 14 (5). https://doi.org/10.3390/healthcare14050642.

Sinsky, C., Colligan, L., Li, L., Prgomet, M., Reynolds, S., Goeders, L., Westbrook, J., Tutty, M., Blike, G., 2016. Allocation of physician time in ambulatory practice: a time and motion study in 4 specialties. Ann. Intern. Med. 165 (11), 753–760. https://doi.org/10.7326/M16-0961.

Sirola, P., Haapakangas, A., Ruohomaeki, V., 2023. Perception of work environment and well-being in activity-based office - three-wave longitudinal study. Nord. J. Work. Life Stud. 13 (2), 23–38. https://doi.org/10.18291/njwls.135181.

Sirola, P., Hirvonen, S., Malve-Ahlroth, S., Haapakangas, A., Reijula, K., 2024. Associations of shared workspaces with healthcare professionals' work engagement and perceived stress. Stud. Health Technol. Inform. 319, 250–265. https://doi.org/10.3233/SHTI240948.

SKR, 2023. *Hållbart SäkerhetsEngagemang: HSE-anvandaranvisning.*

Statistics Sweden, E. S. D. (2012). SSYK 2012 Swedish Standard Classification of Occupations 2012. In: Statistics Sweden MIS 2012.

Ulrich, R.S., Zimring, C., Zhu, X., DuBose, J., Seo, H.B., Choi, Y.S., Quan, X., Joseph, A., 2008. A review of the research literature on evidence-based healthcare design. HERD 1 (3), 61–125. https://doi.org/10.1177/193758670800100306.

van Hooff, M.L.M., Geurts, S.A.E., Kompier, M.A.J., Taris, T.W., 2007. Workdays, in-between workdays and the weekend: a diary study on effort and recovery. Int. Arch. Occup. Environ. Health 80 (7), 599–613. https://doi.org/10.1007/s00420-007-0172-5.

Vreman, J., Lemson, J., Lanting, C., van der Hoeven, J., van den Boogaard, M., 2023. The effectiveness of the interventions to reduce sound levels in the ICU: a systematic review. Crit. Care Explor. 5 (4), e0885. https://doi.org/10.1097/CCE.0000000000000885.

Walter, S.R., Li, L., Dunsmuir, W.T.M., Westbrook, J.I., 2014. Managing competing demands through task-switching and multitasking: a multi-setting observational study of 200 clinicians over 1000 hours. BMJ Quality Safety 23 (3), 231–241. https://doi.org/10.1136/bmjqs-2013-002097.

Westbrook, J.I., Woods, A., Rob, M.I., Dunsmuir, W.T., Day, R.O., 2010. Association of interruptions with an increased risk and severity of medication administration errors. Arch. Intern. Med. 170 (8), 683–690. https://doi.org/10.1001/archinternmed.2010.65.

Wohlers, C., Hertel, G., 2017. Choosing where to work at work - towards a theoretical model of benefits and risks of activity-based flexible offices. Ergonomics 60 (4), 467–486. https://doi.org/10.1080/00140139.2016.1188220.