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ORIGINAL RESEARCH ARTICLE

Does Attending Work When Ill Vary Across Different Office Concepts? A Bayesian Analysis of Differences in Sickness Presenteeism using Nationally Representative Data

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Abstract

Several studies have examined how sickness absence varies across different office concepts, but the potential role of sickness presenteeism (i.e., attending work when faced with health complaints) is poorly understood. We discuss how different office concepts may influence the decision between attending and not attending work when faced with health complaints, and the implications this may have for how observed differences in sickness absence are interpreted. We then use data from a nationwide probability sample from Norway (N = 3112) to explore (i) differences in presenteeism among employees in different office concepts with and without assigned workstations (i.e., private, conventional shared-room, conventional open-plan, non-territorial) and (ii) whether and how perceived health status moderates these differences. Based on a frequency measure of presenteeism, we infer about likely differences in presenteeism propensity by adjusting for perceived health status and self-certified sickness absence, in addition to important demographic and occupational covariates. Results from Bayesian cumulative probit models indicated similar levels of presenteeism among employees in private and conventional shared-room and open-plan offices and lower levels among employees in non-territorial offices. Differences in presenteeism between private and non-territorial offices increased as perceived health status deteriorated. Our study represents an important step towards a complete picture of attendance patterns across different office concepts. Our findings suggest that whether you have a personalized workstation may be relevant for attending or not attending work when faced with health complaints. Future studies should take this into account when interpreting differences in sickness absence observed across office concepts.

Keywords Attendance behaviour · Non-territorial offices · Open-plan office · Office work · Private office · Shared-room office

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Sickness presenteeism, that is, attending work when ill or experiencing compromised health, represents an important aspect of the overall attendance dynamics in the workplace (Johns, 2008; Lohaus & Habermann, 2021). Although interest from research has increased in recent decades, this widespread phenomenon has received far less attention than its counterpart—sickness absenteeism (e.g., Lohaus & Habermann, 2019; Ruhle et al., 2020). This imbalance is clearly featured in the empirical literature on office concepts and employee outcomes. While several studies have examined differences in sickness absenteeism (Mauss et al., 2023), indicating both higher risk of sickness absence (Bodin Danielsson et al., 2014; Borge et al., 2023; Nielsen & Knardahl, 2020) and more sickness absence days (Pejtersen et al., 2011) in shared and open workspaces than in private offices, few have examined whether and how sickness presenteeism differs between office concepts (for an exemption, see Platts et al., 2020). Thus, the picture of the *overall* attendance pattern across different office concepts is currently incomplete; so is our understanding of the potential role different office concepts may play when employees decide between attending work or not when faced with a health complaint.

This incompleteness has important implications for our understanding of potential mechanisms underlying observed differences in sickness absence across office concepts, as differences in attending work when faced with a health complaint represents a hitherto unexplored alternative explanation. As sickness absence is often taken as evidence for the negative health impact of work exposures (Hansen & Andersen, 2008; Johns, 2008), leaving presenteeism unexplored may lead to inaccurate conclusions about how different office concepts impact employees. For instance, *lower* observed sickness absence in private offices may just reflect a *higher* tendency for employees in private offices to attend work when faced with health complaints, rather than a true difference in health impact. Conversely, if this tendency is higher among employees in shared and open workspaces, this could muffle the extent to which differences in sickness absence reflect differences in health impact. Regardless of the true nature of relationships, studies that aim to unravel whether presenteeism is a relevant factor to consider in relation to office concepts—and if so in what way—seem warranted.

Drawing upon recent conceptual perspectives from the general presenteeism literature (e.g., Gerich, 2016; Karanika-Murray & Biron, 2020; Lohaus & Habermann, 2021), we first discuss how one's office concept may play a part in the decision between attending and not attending work when faced with a health complaint, and why it is important to distinguish this neutral attendance behaviour from the observed prevalence of sickness presenteeism. We then use data from a nationwide probability sample to explore whether and how presenteeism vary across different office concepts (i.e., private office, conventional shared-room office, conventional open-plan office, non-territorial office; see Table 1 for definitions). Since presenteeism arises from an interplay between individual and contextual factors (Karanika-Murray & Biron, 2020), we also explore how employees' perceived health status potentially moderates differences in presenteeism across office concepts.

We explore these relationships within a Bayesian statistical framework. In contrast to conventional statistical approaches centred around null hypothesis significance testing (i.e., testing the likelihood of the observed data given that the null

Table 1 Overview of office concepts included in the study

Office concept	Main characteristics
Private office	Enclosed room occupied by one employee Assigned desks
Conventional shared-room office	Enclosed room occupied by several employees Assigned desks
Conventional open-plan office	Open space occupied by several employees Assigned desks
Non-territorial office	Enclosed room or open space occupied by several employees Unassigned desks

hypothesis is true; NHST), a Bayesian approach allows us to make intuitive probability statements about the likely size and direction of relationships given prior beliefs and the data at hand (Makowski et al., 2019b). By exploring the practical *equivalence* of presenteeism levels across office concepts (Makowski et al., 2019b), we also infer about the presence versus absence of true differences in presenteeism. In so doing, we aim to determine the evidence for and against office concepts as a potential determinant of presenteeism, and, by extension, the relevance of presenteeism for understanding observed differences in sickness absence across office concepts.

Conceptualising Presenteeism as a Neutral Attendance Behaviour

Research on observed prevalence indicate that presenteeism is widespread in contemporary working life (e.g., Lohaus & Habermann, 2019), and potential consequences are thought to be multifaceted (Patel et al., 2023; Ruhle et al., 2020). While a focus on negative consequences dominates past scholarly work (Lohaus & Habermann, 2019; Miraglia & Johns, 2016), conceptual perspectives and empirical findings telling of positive aspects of presenteeism, or the co-occurrence of positive and negative consequences, are accumulating (e.g., Karanika-Murray & Biron, 2020; Knani et al., 2021; Lohaus et al., 2022; Wang et al., 2023). On one hand, presenteeism may be detrimental to individuals because it hinders or postpones recovery from illness or compromised health (Lohaus & Habermann, 2019; Miraglia & Johns, 2016). It may also have negative consequences for organizations in terms of lower productivity (including long-term sickness absence (e.g., Hansen & Andersen, 2009)), more mistakes (e.g., Niven & Ciborowska, 2015), and spreading of infectious diseases (e.g., Kumar et al., 2013). On the other hand, individual level consequences likely depend on the circumstances in which presenteeism occurs (Ruhle et al., 2020) and presenteeism may also be therapeutic because work fulfils important psychological needs (Karanika-Murray & Biron, 2020). For organisations, lower productivity is arguably better than no productivity at all (Ruhle et al., 2020). This complexity has led scholars to argue in favour of valence-neutral definitions of presenteeism (Patel et al., 2023; Ruhle et al., 2020). Along these lines,

we adhere to an understanding of presenteeism as not inherently or exclusively negative, but as a "goal-directed and purposeful attendance behaviour aimed at facilitating adaptation to work in the face of compromised health" (Karanika-Murray & Biron, 2020, p. 245).

The Decision to Attend Work when Ill Versus the Observed Prevalence of Presenteeism

When studying sickness presenteeism as attendance behaviour, it is important to distinguish between presenteeism *propensity* (i.e., individuals' probability to choose presence over absence when ill or experiencing compromised health) and the *observed prevalence* of presenteeism, which is the product of both presenteeism propensity and the number of health events in a given period (i.e., situations where individuals are faced with health complaints that could justify sick leave; Gerich (2015, 2016)). Reviewing the general empirical literature on presenteeism, Gerich (2015, 2016) found that this distinction between prevalence and propensity has gone largely unnoticed. Research on office concepts and sickness presenteeism is no exception. Based on data from three organizations in Sweden, the single previous study on office concepts and presenteeism (Platts et al., 2020) reported no statistically significant differences between private offices and shared and open workspaces in the *observed prevalence* of presenteeism but did not discuss or attempt to study differences in *propensity*. Yet, distinguishing between the two is fundamental if we want to gain insight into whether and how attending work *when* faced with a health event differs across office concepts (i.e., presenteeism as attendance behaviour; Ruhle et al. (2020)). Since presenteeism prevalence is the product of the individual's presenteeism propensity *and* the number of health events that individual experiences (Fig. 1; Gerich, 2016), any *observed* differences in prevalence between office concepts—or a lack thereof—may be due to differences in either the number of health events or the tendency to attend work when faced with health events, or a combination of both (Gerich, 2015, 2016). It follows from Fig. 1 that a determinant (e.g., office concept) may have opposite effects on the two components. For instance, sharing an office with others may make you more prone to infectious diseases, leading

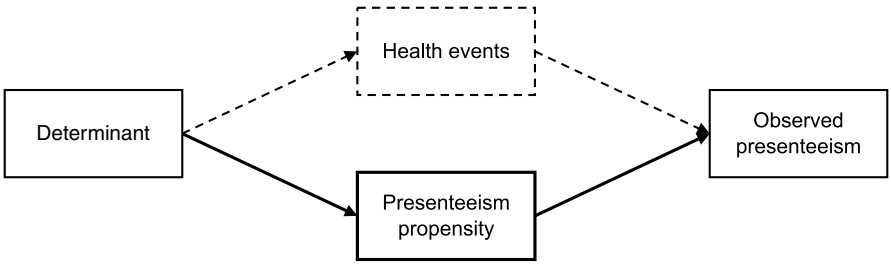

Fig. 1 A determinant may result in observed presenteeism both by triggering health events and by shifting the propensity to attend work in case of health events. The path via propensity is of primary conceptual interest in this paper (indicated by bold lines)

to more health events, but less inclined to attend work when infected to avoid infecting others, implying lower presenteeism propensity. This implies that if we examine only presenteeism prevalence, potential differences in presenteeism propensity may go undetected.

One important reason for the lack of empirical studies distinguishing between prevalence and propensity may be the methodological difficulty in doing so (Ruhle et al., 2020). Most studies on sickness presenteeism, including the current study, use so-called frequency measures of presenteeism (i.e., asking respondents to report the number of incidents of sickness presenteeism in a given period). While this captures the observed prevalence of presenteeism, additional data modifications or statistical techniques is necessary to attempt to isolate observed differences due to propensity from differences due to number of health events triggered. Current recommendations include utilising sickness absence data or general health information if available (Gerich, 2015; Hansen & Andersen, 2008; Ruhle et al., 2020). Ruhle and colleagues (2020), for instance, recommend adjusting for sickness absence incidents from the same reporting period to account for differences in health events, arguing that this would allow investigators "to identify factors associated with more presenteeism of individuals that could be expected from their volume of sickness absenteeism" (p. 350). Thus, when only frequency data on presenteeism is available, this technique could be used to get an *indication* of differences in presenteeism propensity between groups or conditions of interest, for instance across office concepts.

Office Concepts and the Decision to Attend Work when Faced with Health Complaints

Previous research has identified multiple determinants of presenteeism (e.g., Lohaus & Habermann, 2019; Miraglia & Johns, 2016), commonly classified into person-related, work-related, organizational, and environmental factors (Lohaus & Habermann, 2019). These determinants may contribute to the observed prevalence of presenteeism either by triggering health events, by shifting an individual's propensity to attend work when faced with health events, or through both paths simultaneously (see Fig. 1). Since we focus on differences in attending work *when* faced with a health event (i.e., the second pathway), it is beyond our scope to detail how office concepts potentially differ in the number of health events triggered. Yet, based on systematic literature reviews (e.g., James et al., 2021; Masoudinejad & Veitch, 2023; Richardson et al., 2017) it seems more likely that shared and open workspaces would trigger more health events than private offices rather than the opposite.

Delving into the propensity pathway from office concepts to presenteeism, a brief description of the individual decision-making process leading up to either attending or not attending work when faced with a health event is necessary to understand how this behaviour may differ across office concepts. Decision models of presenteeism assume that when faced with a health event, the individual must choose between going to work or calling in sick, and that different factors, such as one's office concept, drive employees towards choosing one over the other (Gerich, 2016). As one of the few comprehensive frameworks of the decision-making process of presenteeism

and absenteeism, Lohaus and Haberman (2019) draw on Vroom's (1964) expectancy theory and posit that employees will choose either presenteeism or absenteeism depending on which has the greatest motivational force, which is determined by the valence, instrumentality, and expectancy of the two alternatives. They elaborate:

> …when employees who are scheduled for work realizes that they are in a medical condition that justifies calling in sick, they will make a conscious decision. They will think about relevant goals in this situation and how highly they value these goals (valences). They will speculate on which outcome is instrumental or detrimental for reaching these goals (instrumentality). Finally, they will reflect on how presenteeism and absenteeism might affect these outcomes (expectancy). They will choose that attendance behavior that – in sum – seems the best trade-off for attaining their goals (motivational force). (Lohaus & Habermann, 2021, p. 4)

While one's office concept may influence all three aspects of attending work when faced with a health event, the potential influence on expectancy (e.g., perceived probability that presenteeism will lead to adequate job performance) is particularly relevant. Expectancy is determined by several factors, such as self-efficacy, perceived control over performance, and goal difficulty (Pinder, 2008). Assuming employees aim to balance health and performance aspects when ill or experiencing compromised health (Karanika-Murray & Biron, 2020), work environment factors that *increase* self-efficacy (i.e., can I sustain performance without further compromising my health?) and perceived control (i.e., how much control do I have over whether attending work leads to adequate performance without compromising health?) and *decrease* difficulty (i.e., how difficult is it to sustain performance without compromising health?) will shift the preference towards presenteeism.

In favour of expecting higher presenteeism propensity among employees in private offices, having your own office provides more control over psychological privacy at work (James et al., 2021; Masoudinejad & Veitch, 2023), which may make it easier for employees to modify work tasks, reduce effort without interference from others, or take more or longer breaks when needed (Nielsen et al., 2023). They may also feel more in control over work outcomes knowing they can adjust the level of environmental distraction and social interaction (Borge et al., 2024), rendering the workday more predictable than for employees in shared and open workspaces (Vischer, 2007). For employees without assigned workstations, the contrast to private offices in terms of predictability may be even more pronounced (Radun & Hongisto, 2023), also due to lower psychological ownership at work (e.g., Halldorsson, 2021). Yet, opportunities to switch between different types of workstations in non-territorial offices might facilitate a better fit to personal preferences and daily needs compared to shared and open workspaces with assigned workstations (Engelen et al., 2019). In case of infectious diseases, employees may perceive a higher risk of infecting others in shared and open workspaces compared to private offices, which may also weigh in on the decision to attend work or not.

There are also reasons to expect higher presenteeism propensity among employees in shared and open workspaces. For instance, past empirical work links unpredictable and stressful working conditions to higher presenteeism (e.g., Lohaus &

Habermann, 2019; Miraglia & Johns, 2016). With regards to office concepts, this would suggest that employees in shared and open workspaces may choose to attend work more often when faced with a health event to compensate for productivity decrements or resource depletion due to working in a distracting work environment (Miraglia & Johns, 2016). In other words, they may hold a belief that working through illness will help them cope with lower productivity (i.e., expectancy). Attendance behaviour may also be more visible in shared and open workspaces, and absence from work may therefore go less unnoticed. This may increase the instrumentality of presenteeism, or employees' beliefs that attending work may be rewarded (or at least less damaging) compared to not attending.

> Research question 1: Does presenteeism differ between private offices and shared and open workspace categories (i.e., conventional shared-room, conventional open-plan, non-territorial offices)?

The above arguments assume that employees' perceptions of their own health do not in itself influence the tendency to choose presence over absence when faced with a specific health event. This belief may be ill-advised (Gerich, 2015), particularly considering recent perspectives depicting presenteeism as resulting from the *interplay* between individual and contextual factors (Biron et al., 2022; Karanika-Murray & Biron, 2020). In the spirit of expectancy theory, perceptions of your overall health may influence the extent to which you feel *capable* of attending work when faced with a health event (i.e., the self-efficacy aspect of expectancy). It may also increase the salience of certain work environment factors in the decision-making process. Job control, for instance, may be particularly relevant for attendance decisions among employees with chronic health conditions, as higher job control provides more leeway in self-managing daily work demands and symptom fluctuations (Shaw et al., 2023, 2024). This would suggest that for work features that impact employees' perceptions of control, such as one's office concept (e.g., Borge et al., 2024; Hootegem & Witte, 2017; Nielsen et al., 2023), differences in presenteeism may increase as perceived health status deteriorates. This expectation is supported by findings in Gerich (2019), indicating that high job control facilitated presenteeism particularly for vulnerable employees.

> Research question 2: Does perceived health status moderate differences in presenteeism between private offices and shared and open workspace categories (i.e., conventional shared-room, conventional open-plan, non-territorial offices)?

Methods

Sample and Procedure

Data came from a nationally representative survey of employees in Norway conducted by personal telephone interviews between September 2016 and April 2017 (Statistics Norway, 2022). A gross sample of 20,272 individuals randomly drawn

from the Norwegian population between 17 and 67 years of age received written information by mail before telephone contact. Of these, 10,665 participated in the survey (response rate = 53%). Participation was based on informed consent. Eligible participants in the current study were employees in paid work who spent half or more of their working time on office work, excluding self-employed participants. Since the survey asked about presenteeism during the last 12 months, we excluded participants who had changed employer—and likely also office concept—in 2016 or 2017. We also excluded participants who, when asked about presenteeism, reported not having been ill during the study period. After also excluding three participants with missing data on office concept, the final sample consisted of 3112 participants.

Exposure Variable

Office concept was a categorical variable with four categories indicating whether the participant worked alone in an enclosed room (i.e., private office), an enclosed room with assigned workstations with one or several others (i.e., conventional shared-room office), an open workspace with assigned workstations with several others (i.e., conventional open-plan office), or a shared or open office environment with unassigned workstations (i.e., non-territorial office). The variable was a combination of the following three questions: (i) "do you work in your own office, shared room office, or office landscape?", (ii) "how many people do you normally share an office with?", and (iii) "do you have a fixed workstation?". The two last questions were only asked to participants in shared-room or open-plan offices. To retain the substantial meaning of the final office categories, participants in shared-room offices who reported sharing with more than ten people were placed in the open-plan category, and participants in open-plan offices who reported sharing with only one or two people were placed in the shared-room category.

Outcome Variable

Presenteeism was an ordinal variable with four levels (i.e., "never", "once", "two to three times", "four times or more") based on the following question: "how many times during the past 12 months have you gone to work even if you were so ill that you really should have stayed home?". Miraglia and Johns (2016) noted in their meta-analysis that 12 months is the most common reporting period in measures of presenteeism. While a long period might introduce more recall bias compared to shorter periods, a long period may be needed for presenteeism to have occurred (Demerouti et al., 2009; Gerich, 2019).

As previously discussed, one way to approximate differences in presenteeism *propensity* based on frequency measures is by including variables to account for potential differences in the number of health events (Gerich, 2015; Hansen & Andersen, 2008; Ruhle et al., 2020). Here we build on this strategy by including perceived health status and the number of self-certified sickness absence episodes to account for potential differences in health events beyond baseline confounders.

In other words, while our outcome variable is a frequency measure of presenteeism, additional adjustment facilitates inferences about presenteeism propensity based on the differences we observe after adjusting for perceived health status and sickness absence.

Moderator and Adjustment Variables

Perceived health status was an ordinal variable with four levels (i.e., "very good", "good", "neither good nor bad", "bad or very bad") based on the following question: "how would you evaluate your own health in general?". The question originally had five response categories, but only seven participants reported the level "very bad", and it was therefore merged with the adjacent level (i.e., "bad").

The number of self-certified sickness absence episodes was self-reported and based on two questions: (i) "have you had self-certified sickness absence in the last 12 months?", and (ii) "how many times/episodes with self-certified sickness absence have you had in the last 12 months?".

Since we use non-experimental survey data to estimate differences in presenteeism across office concepts, we included several variables to adjust for baseline confounders that influence both the allocation of employees to different office concepts and the occurrence of presenteeism (either by triggering health events or in the decision-making process). A review of methodological considerations in office concepts research (Bennis et al., 2022) suggests that employees in different office concepts differ on key demographic (e.g., age, sex, education level) and occupational characteristics (e.g., type of work, seniority). Many of the same variables are also known determinants of presenteeism (e.g., Gerich, 2016). *Demographic* adjustment variables therefore included age (in years), sex (i.e., male or female), and highest achieved education level (i.e., primary/lower secondary school, upper secondary school, one to four years of university/college education, and five or more years of university/college education). *Occupational* adjustment variables were main occupation group (based on the International Standard Classification of Occupations (ISCO)) and a dichotomous variable for leadership/executive responsibility ("does your position include leadership responsibility, so that other people work under your supervision, or is it otherwise an executive position?"). Leadership/executive responsibility was self-reported, the rest came from national registries.

Statistical Analysis

We prepared and analysed data in R version 4.3.2 (R Core Team, 2023). We estimated Bayesian cumulative probit models (i.e., ordinal probit regression; Bürkner & Vuorre, 2019) with the brms package (Bürkner, 2017) and used the bayestestR (Makowski et al., 2019a) and marginaleffects (Arel-Bundock, 2024) packages to describe posterior distributions, calculate predictions, and perform comparisons. All models were fitted using four MCMC chains with 2000 iterations each, resulting in 4000 posterior samples, as the first 1000 iterations in each chain are warmup to calibrate the sampler (Bürkner, 2017). Chain convergence and resolution were ensured

by checking the potential scale reduction factor (i.e., R-hat) and effective sample size (ESS) for each parameter. We also performed posterior predictive checks to ensure that the model provided good representation of the observed data. Computer code for all models, evidence of chain convergence and resolution, and posterior predictive checks for the final model can be found in the supplementary material.

A cumulative probit model assumes participants' responses to the question about presenteeism originate from a latent (unobserved) continuous variable (Bürkner & Vuorre, 2019). This latent variable is normally distributed with a standard deviation of 1. This modelling approach serves several purposes. First, the idea of a latent construct manifesting in different survey responses aligns well with how presenteeism is conceptualized in the general literature and in the current study. Further, for categorical predictors such as office concepts, the effect parameter of each dummy variable can be interpreted on a standardized mean difference scale (i.e., Cohen's d). Thus, differences between office concepts may be readily interpreted in terms of effect size.

The model further assumes K thresholds (in this case three) partitioning the latent variable into $K+1$ ordered categories (in this case four). For the thresholds, we chose priors that assigned equal probability mass to each of the four response categories across the latent variable following the procedure described by Kurz (2021). Each threshold prior was normally distributed with a mean defined by the z-score corresponding to the cumulative proportion that would divide the latent variable distribution into four equal parts (i.e., −0.674 for the first threshold, 0 for the second threshold, and 0.674 for the third threshold), and a standard deviation of 1. For the effect parameters, we chose weakly informative and regularizing priors (Gelman et al., 2013), in this case a normal distribution with a mean of 0 and a standard deviation of 1. These priors allocated most of the prior probability to values between −2 and 2 on the Cohen's d scale, assuming, based on general knowledge of effect sizes, that differences in presenteeism outside this range would be highly unlikely.

We defined and estimated several models: (i) an unadjusted model estimating crude differences in presenteeism between private offices (reference category) and the shared and open workspace categories (represented by dummy variables), (ii) a model estimating differences in presenteeism adjusted for demographic and occupational variables, (iii) a model also adjusting for perceived health status and self-certified sickness absence, where any differences observed to a larger extent reflect differences in presenteeism propensity, and (iv) a model with an interaction between office concept and perceived health status to examine how perceived health status moderated differences in presenteeism across office concepts.

Perceived health status and self-certified sickness absence were included in the model as ordinal predictors with monotonic effects based on the procedure by Bürkner and Charpentier (2020). In short, this procedure models the effect of a predictor in terms of a scale parameter b, which represents the expected average difference between two adjacent levels (i.e., the direction and strength of the relationship), and a simplex parameter ζ_i, which describes the expected difference between levels i and $i-1$ as the proportion of the total difference between the lowest and highest levels (i.e., shape of the relationship). In other words, we restricted the overall relationship between perceived health status and presenteeism to be monotonic (i.e., either positive or negative), but took into account that changes between the levels might

differ in size (e.g., the expected change in presenteeism from "very good" to "good" health may not be the same as the expected change from "good" to "neither good nor bad"). This modelling approach aligns well with the general understanding of ordinal variables as comprised of ordered categories not necessarily equally distanced. Methodologically, it represents a middle ground between treating the variable as a continuous predictor and treating it as a categorical variable represented by dummy variables. Thus, it balances underfitting and overfitting (Bürkner & Charpentier, 2020). By assigning a Dirichlet prior with a constant $\alpha = 1$ to the simplex parameters (Bürkner & Charpentier, 2020), we assumed that the overall relationship would be linear but incorporated a high degree of uncertainty about this assumption. For the interaction between office concepts and perceived health status, we specified different monotonic effects of perceived health status in each office concept (i.e., perceived health status as conditionally monotonic on office concept).

Describing the Posterior Distribution

Bayesian methods compute the probability of different parameter values given the observed data and prior expectations, resulting in a distribution of possible parameter values (i.e., the posterior distribution). Describing this posterior distribution (e.g., its centrality and dispersion) allows for intuitive probability statements regarding effects or relationships (Makowski et al., 2019b). Key advantages of a Bayesian approach compared to a frequentist approach include a more intuitive interpretation of findings, as they can be directly interpreted in terms of probability and enable inferences about both the presence and absence of true effects (Makowski et al., 2019b).

In the current study, we used the posterior median and 95% credible intervals based on the highest density interval (HDI) to describe posterior distributions. The posterior median represents the middle value of the posterior distribution, and the 95% credible interval indicates the range containing the 95 percent most probable values. As indices of effect existence and practical significance (in terms of a non-negligible effect as opposed to statistical significance), we used the probability of direction (pd) and the full region of practical equivalence (ROPE), respectively. The pd represents the certainty that the effect is in the most probable direction and is strongly associated with the frequentist p-value (Makowski et al., 2019b). A *higher* direction probability indicates *higher* certainty that the true effect is in that direction. The full ROPE indicates the proportion of the whole posterior distribution that falls within a range considered negligible in size. A *lower* proportion within the ROPE indicates *higher* certainty that the true effect is practically significant. Following Kruschke (2015), we defined this range between −0.1 and 0.1 on the scale of the standardized normal latent factor. Keeping in mind that effect parameters for categorical variables in cumulative probit models can be interpreted on a Cohen's d metric, this range aligns well with current norms in the psychology field, where an effect size of 0.2 are commonly referred to as small. In line with recent guidelines (Makowski et al., 2019b), we used the pd and proportion within the ROPE as continuous indices of effect existence and practical significance rather than binary decision criteria.

Results

Table 2 displays demographic and occupational characteristics of the study sample. In terms of office concept, 1615 worked in private offices and 852, 435, and 207 worked in conventional open-plan, conventional shared-room, and non-territorial offices, respectively. More than half reported one or several incidents of presenteeism in the past 12 months. Among those with presenteeism, most reported either one or two–three incidents.

Differences in Presenteeism Across Office Concepts

Table 3 summarises the posterior distributions for the difference in presenteeism between private offices and the shared and open office categories on the latent factor scale. Differences between model 2 (adjusting only for demographic and occupational variables) and model 3 (also adjusting for perceived health status and number of sickness absence episodes) were small. This may indicate that differences in the number of health events did not contribute much to the observed differences in presenteeism prevalence between office concepts after first having adjusted for baseline confounders.

Figure 2 visualises the posterior distributions for the difference in presenteeism between private offices and the shared and open office categories. Proportions of the distributions above and below zero (highlighted by the two colours) represents the certainty that the difference is in one direction rather than the other (i.e., probability of direction; pd). The proportion *inside* the interval marked by the two dashed lines (i.e., the ROPE) represents the certainty that the level of presenteeism in this office concept is practically equivalent to private offices, whereas the proportion *outside* the ROPE indicates the certainty that the difference is practically significant.

Results indicate with 85 percent probability that presenteeism is lower in conventional shared-room offices than in private offices (Median −0.06, 95% CI −0.19, 0.05), while around 72 percent of posterior values are within the ROPE. For conventional open-plan offices, equal proportions of the posterior distribution are located above and below zero (Median 0.00, 95% CI −0.10, 0.10) and around 95 percent of posterior values are within the ROPE. Thus, according to our results, it is highly likely that employees in conventional open-plan offices and private offices are practically equivalent in their levels of presenteeism. For non-territorial offices, 99 percent of posterior values are negative (Median −0.19, 95% CI −0.35, −0.03), indicating that it is highly likely that presenteeism is lower in this office category than in private offices. Around 14 percent of posterior values are within the ROPE, which means that we cannot make any definitive inferences about practical significance.

Figure 3 displays conditional probabilities for responding to each category of the ordinal presenteeism variable for the four office concepts. Employees in non-territorial offices had higher probability of reporting no incidents of presenteeism (Median 0.07, 95% CI 0.01, 0.14) and lower probability of reporting either

Table 2 Sample characteristics overall and by office concept

Variable	Overall N = 3109	Private N = 1615	Shared-room N = 435	Open-plan N = 852	Non-territorial N = 207
Age					
Mean (SD)	46 (11)	48 (10)	44 (11)	44 (11)	42 (12)
Sex					
Male	1692 (54%)	902 (56%)	221 (51%)	469 (55%)	100 (48%)
Female	1417 (46%)	713 (44%)	214 (49%)	383 (45%)	107 (52%)
Education level					
Primary/lower secondary	326 (11%)	164 (10%)	62 (14%)	71 (8.4%)	29 (14%)
Upper secondary	757 (25%)	381 (24%)	114 (26%)	213 (25%)	49 (24%)
University/college 1–4 years	1252 (41%)	644 (40%)	176 (41%)	343 (41%)	89 (43%)
University/college > = 5	752 (24%)	415 (26%)	81 (19%)	217 (26%)	39 (19%)
(missing)	22	11	2	8	1
Occupation group					
Managers	541 (17%)	392 (24%)	43 (9.9%)	98 (12%)	8 (3.9%)
Professionals	1355 (44%)	691 (43%)	186 (43%)	393 (46%)	85 (41%)
Technicians	736 (24%)	338 (21%)	100 (23%)	234 (27%)	64 (31%)
Clerical staff	247 (7.9%)	95 (5.9%)	58 (13%)	68 (8.0%)	26 (13%)
Service/sales workers	110 (3.5%)	48 (3.0%)	22 (5.1%)	25 (2.9%)	15 (7.2%)
Other occupations	120 (3.9%)	51 (3.2%)	26 (6.0%)	34 (4.0%)	9 (4.3%)
Leadership/executive responsibility					
No	1767 (57%)	781 (48%)	277 (64%)	559 (66%)	150 (73%)
Yes	1334 (43%)	830 (52%)	157 (35%)	291 (34%)	56 (27%)
(missing)	8	4	1	2	1
Perceived health status					
Very good	1159 (37%)	589 (36%)	171 (39%)	335 (39%)	64 (31%)
Good	1515 (49%)	786 (49%)	195 (45%)	418 (49%)	116 (56%)
Neither good nor bad	364 (12%)	199 (12%)	60 (14%)	85 (10.0%)	20 (9.7%)
Bad or very bad	69 (2.2%)	41 (2.5%)	8 (1.8%)	13 (1.5%)	7 (3.4%)
(missing)	2	0	1	1	0
Presenteeism					
Never	1368 (44%)	714 (44%)	191 (44%)	366 (43%)	97 (47%)
Once	524 (17%)	266 (16%)	73 (17%)	148 (17%)	37 (18%)
Two–three	875 (28%)	443 (27%)	129 (30%)	247 (29%)	56 (27%)
Four or more	342 (11%)	192 (12%)	42 (9.7%)	91 (11%)	17 (8.2%)

Note. For the occupation group variable, groups 6, 7, 8, 9, and 0 were merged into one category due to few participants reporting doing office work

two–three (Median −0.04, 95% CI −0.07, −0.01) or four or more (Median −0.03, 95% CI −0.06, −0.01) incidents compared to employees in private offices. Probability of reporting one incident of presenteeism was approximately equal across office concepts.

Table 3 Summary of parameter estimates for differences in presenteeism between private offices and shared and open workspace categories

	Model 1				Model 2				Model 3			
Parameter	**Median**	**95% CI**	**pd**	**% ROPE**	**Median**	**95% CI**	**pd**	**% in ROPE**	**Median**	**95% CI**	**pd**	**% ROPE**
Shared-room office	−0.03	−0.14, 0.09	66%	88%	−0.07	−0.20, 0.05	86%	67%	−0.06	−0.19, 0.05	85%	72%
Open-plan office	0.00	−0.09, 0.09	52%	97%	0.00	−0.09, 0.09	50%	96%	0.00	−0.10, 0.10	51%	95%
Non-territorial office	−0.11	−0.26, 0.05	92%	45%	−0.16	−0.31, 0.02	98%	22%	−0.19	−0.35, −0.03	99%	14%

Note. Reference category is private office for all categories. Model 1 is unadjusted. Model 2 is adjusted for age, sex, education level, occupation group, and leadership/executive responsibility. Model 3 is adjusted for covariates in model 2 and perceived health status and the number of sickness absence episodes. 95% CI = 95% highest density interval. pd = probability of direction. ROPE = region of practical equivalence

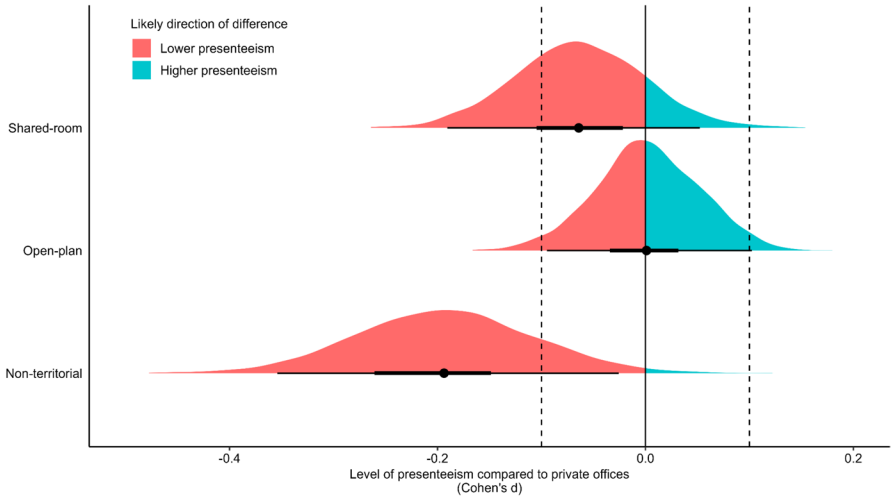

Fig. 2 Presenteeism in shared-room, open-plan, and non-territorial offices compared to private offices. Posterior medians, 50% and 95% credible intervals. Posterior distributions shown with probability of direction (pd). Dashed lines mark region of practical equivalence (ROPE)

Differences in Presenteeism along different Levels of Perceived Health Status

The average relationship between perceived health status and presenteeism is positive in all office concepts (Table 4, *b* parameters). The *strength* of the relationship is similar in private (median 0.29, 95% CI 0.19, 0.42) and conventional shared-room (median 0.29, 95% CI 0.06, 0.53) and open-plan (median 0.30, 95% CI 0.14, 0.49) offices, but weaker and less certain in non-territorial offices (median 0.15, 95% CI −0.07, 0.36). The *shape* of the relationship is similar across all four office concepts (Table 4, ζ parameters). The shape deviates from a linear relationship only slightly in that a larger share of the total difference between "very good" and "bad or very bad" perceived health is realized later in private and conventional shared-room offices. Figure 4 illustrates that because of the weaker relationship between perceived health status and presenteeism in non-territorial offices, the difference in presenteeism between non-territorial offices and private offices *increases* as perceived health *deteriorates*, thus providing evidence for a moderating role of perceived health status for this contrast. For the two other contrasts, no clear pattern emerged.

Discussion

Although sickness presenteeism is widespread in contemporary working life and receives increased attention in the scientific literature (Ruhle et al., 2020), the topic has been largely ignored by research on office concepts and employee well-being. Determining whether and how different office concepts influence employees' tendency to attend work when faced with health complaints represents a crucial step

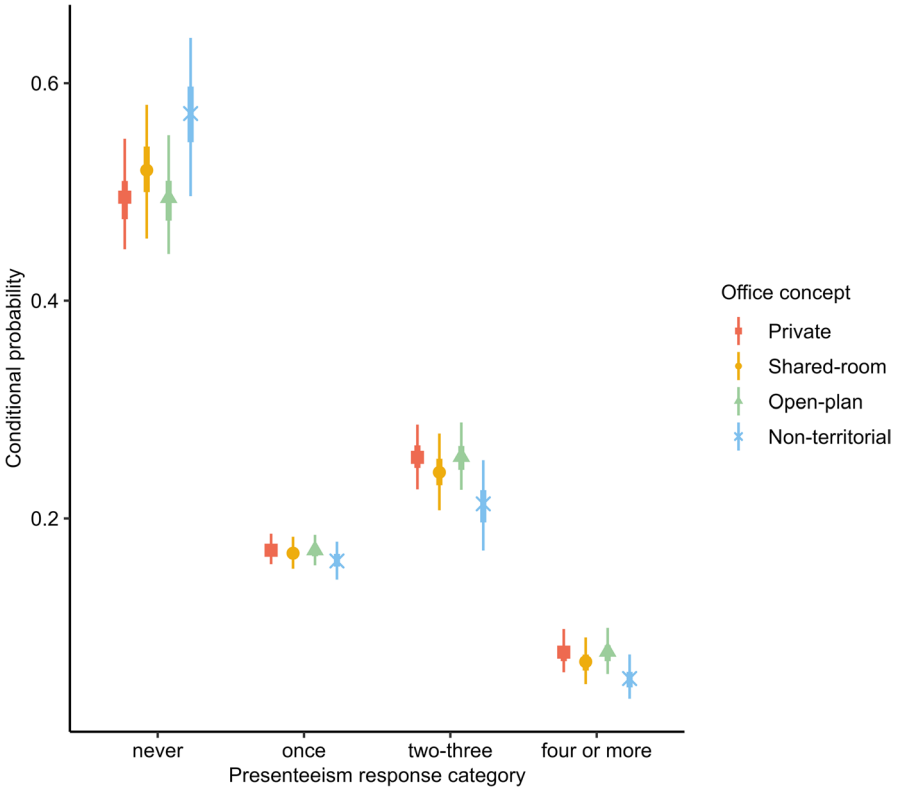

Fig. 3 Conditional probabilities of responding to the different response categories of presenteeism, by office concept. Posterior medians, 50% and 95% credible intervals

towards a complete understanding of attendance patterns across different office concepts. It may also improve our understanding of what lies behind observed differences in sickness absence between private offices and shared and open workspaces. The main findings in the current study suggest that presenteeism levels among employees in conventional open-plan offices and private offices are practically equivalent, whereas presenteeism likely is lower among employees in non-territorial offices. We also found that the difference in presenteeism between non-territorial and private offices increased as employees' perceived health status deteriorated.

Conceptual and Empirical Contributions

This is the first study to examine differences in presenteeism across office concepts with data from a nationwide probability sample. We are also the first to highlight the importance of distinguishing presenteeism propensity from observed prevalence when examining such differences. Using a recommended statistical technique to approximate differences in presenteeism propensity (Hansen & Andersen, 2009; Ruhle et al., 2020), we found little evidence of any differences between *conventional*

Table 4 Summary of parameter estimates for the relationship between perceived health status and presenteeism in each office concept

Parameter	Median	95% CI	pd	% in ROPE
Private office				
Average effect of perceived health (*b*)	0.29	0.19, 0.42	100%	0%
Very good vs. good (ζ_1)	0.34	0.19, 0.55	-	-
Good vs. neither good nor bad (ζ_2)	0.23	0.03, 0.45	-	-
Neither good nor bad vs. bad or very bad (ζ_3)	0.44	0.11, 0.68	-	-
Shared-room office				
Average effect of perceived health (*b*)	0.29	0.06, 0.53	100%	4%
Very good vs. good (ζ_1)	0.26	0.02, 0.63	-	-
Good vs. neither good nor bad (ζ_2)	0.14	0.00, 0.47	-	-
Neither good nor bad vs. bad or very bad (ζ_3)	0.57	0.05, 0.85	-	-
Open-plan office				
Average effect of perceived health (*b*)	0.30	0.14, 0.49	100%	0%
Very good vs. good (ζ_1)	0.23	0.03, 0.46	-	-
Good vs. neither good nor bad (ζ_2)	0.37	0.10, 0.69	-	-
Neither good nor bad vs. bad or very bad (ζ_3)	0.38	0.00, 0.67	-	-
Non-territorial office				
Average effect of perceived health (*b*)	0.15	−0.07, 0.36	92%	32%
Very good vs. good (ζ_1)	0.31	0.00, 0.74	-	-
Good vs. neither good nor bad (ζ_2)	0.29	0.00, 0.73	-	-
Neither good nor bad vs. bad or very bad (ζ_3)	0.31	0.00, 0.76	-	-

Note. Parameter estimates adjusted for age, sex, education level, occupation group, leadership/executive responsibility, and the number of sickness absence episodes
95% CI = 95% highest density interval; pd = probability of direction; ROPE = region of practical equivalence; *b* = average effect of perceived health in each office concept; ζ_i = proportion of total difference between the lowest and highest level of perceived health realized between two adjacent levels

shared and open workspaces and private offices. These findings are in line with the one previous study that has examined sickness presenteeism across different office concepts, where no statistically significant differences in presenteeism were observed (Platts et al., 2020). Yet, compared to the study by Platts and colleagues (2020), our Bayesian statistical approach allowed us to infer about both the presence and absence of true differences across office concepts (Makowski et al., 2019b). Almost the entire posterior distribution of the difference between conventional open-plan and private offices were within our defined ROPE. Our evidence thus suggests practically equivalent levels of presenteeism among employees in these two office concepts. Evidence for or against a difference between conventional shared-room offices and private offices is less conclusive. A moderate proportion of posterior values were negative, which *might* suggest that employees' presenteeism propensity is slightly lower in conventional shared-room offices. Still, a sizeable proportion was within the ROPE. Taking a conservative view, the overall evidence suggests that the

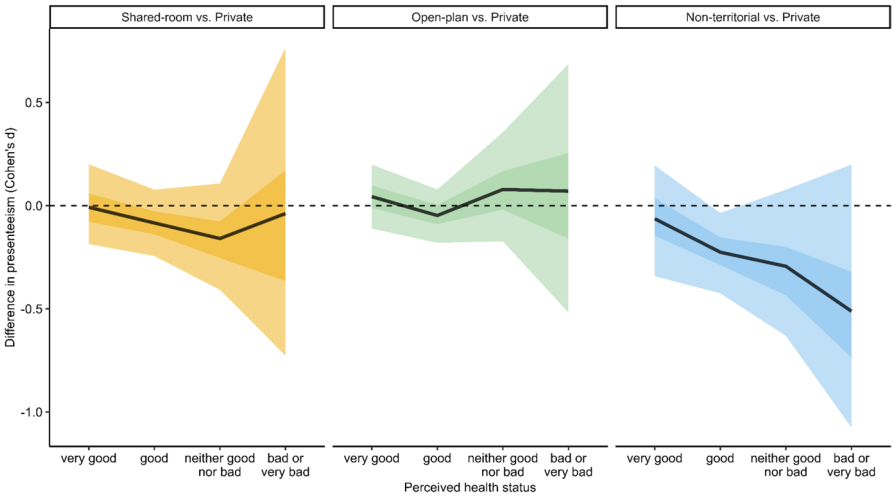

Fig. 4 Differences in presenteeism between private offices and shared and open workspaces across levels of perceived health. Black lines represent posterior medians. Coloured ribbons represent 50% and 95% credible intervals

contribution of presenteeism propensity to observed differences in sickness absence between private offices and conventional shared and open workspaces is limited.

Turning to non-territorial offices, we observed lower presenteeism compared to private offices, particularly after adjusting for sickness absence and perceived health status. As nearly all posterior values were negative, our evidence could be interpreted in favour of lower presenteeism propensity among employees in non-territorial offices. We further found that this difference increased as perceived health status deteriorated. Thus, employees in non-territorial offices seemed to differ from employees in the three other office types, who had similar levels of presenteeism, both on average and at different levels of perceived health status. These findings run counter to the findings by Platts and colleagues (2020), who observed no statistically significant differences in presenteeism *prevalence* between private offices and non-territorial offices. Yet, effect sizes reported by Platts and colleagues (2020) did indicate a lower frequency of presenteeism in non-territorial offices that was bordering statistical significance. Considering their non-territorial office category included only 38 employees, this seems worth mentioning. Yet, it is important to note that given our attempt to infer about presenteeism propensity rather than observed prevalence, findings may not be directly comparable.

Keeping in mind our definition of presenteeism as a neutral attendance behaviour, a timely question is why non-territoriality may shift employees' preference away from attending work when faced with a health complaint. In line with Lohaus and Haberman's (2021) decision model, one relevant factor may be that having your own personalized space at work gives a sense of predictability and comfort (e.g., Elsbach, 2003; Laurence et al., 2013), which may increase the expectancy of presenteeism (i.e., the belief that attending work with a health complaint is possible without further compromising health). Another possible explanation is that non-territoriality

may decrease the instrumentality of presenteeism (i.e., the belief that attending work when ill will be rewarded), as non-attendance may be less obvious in office environments where the same workstations are shared among several employees (Gonsalves, 2020). Regardless of the true mechanisms, future studies that examine differences in sickness absence between non-territorial offices and other office types should keep potential differences in presenteeism propensity in mind.

The explanation regarding expectancy may also inform our findings regarding the moderating role of perceived health status. In line with the conservation of resources model (Hobfoll, 1989), having a personalized space to recuperate during the day may become increasingly important if you feel that your individual capacity at work is restricted. This feature of the work environment may be particularly relevant for employees with chronic or recurrent health complaints, as it could contribute to employees' overall job leeway, that is, the opportunities available to "self-regulate work activities while self-managing day-to-day symptom fluctuations" (Shaw et al., 2023, p. 582).

Methodological Implications

Previous work on presenteeism have highlighted the importance of distinguishing between presenteeism prevalence and propensity (Gerich, 2015, 2016; Ruhle et al., 2020). This distinction seemed particularly relevant for the current study, as previous research indicates differences in employee health and well-being between shared and open workspaces and private offices (James et al., 2021; Masoudinejad & Veitch, 2023; Richardson et al., 2017). This implies that office concepts may differ in the number of health events they trigger, and examining only observed prevalence could therefore distort true differences in presenteeism propensity. Contrary to this expectation, we observed only minor differences in estimates before and after including variables meant to account for differences in the number of health events triggered. This may suggest that the office concepts in the current study did not differ much in the number of health events they triggered. Alternatively, we might have adjusted for some of the differences in health events by already including demographic and occupational covariates.

It is important to note that this finding does not mean that future research can ignore the distinction between observed prevalence and propensity when examining differences in presenteeism across office concepts. If presenteeism as attendance behaviour is of primary research interest, one should strive to examine presenteeism propensity to ensure conceptual clarity and methodological rigor (Ruhle et al., 2020). We must also acknowledge the inherent uncertainties in studying the unobservable phenomenon that is presenteeism propensity with frequency measures of observed prevalence. Thus, initiatives to develop measurement instruments that capture presenteeism propensity is highly needed.

Practical Implications

Our findings suggest that whether you have a personalized desk at work may be a relevant factor when employees choose between attending and not attending work

when faced with a health complaint. We also found that this factor may be particularly salient for employees with lower perceived health status. Most research on presenteeism has focused on how attending work with health complaints will be counterproductive and even harmful in most situations (Lohaus & Habermann, 2019; Miraglia & Johns, 2016). From this perspective, our findings suggest that office workplaces without fixed seating could reduce the negative pressure of attending work when you ought to take sick leave, for instance by making the attendance behaviour of individual employees less visible to colleagues and management.

Yet, novel perspectives have emerged (e.g., Karanika-Murray & Biron, 2020; Patel et al., 2023; Ruhle et al., 2020), arguing that presenteeism is better understood as being in itself neutral and a result of how different factors (i.e., person-related, work-related, organizational, environmental (Lohaus & Habermann, 2019)) shift employees' preferences towards either attending or not attending work when faced with a health complaint. From this perspective, having your own office or a personalized desk may be a *facilitator* of the adaptation to work (e.g., Karanika-Murray & Biron, 2020), rather than a pressure factor pushing employees towards a self-endangering health behaviour. Likewise, non-territoriality may then be a *barrier* to work adaptation, particularly for employees with low perceived health status, who run a higher risk of labour market withdrawal in the first place. Thus, private offices and personalized workstations may represent a potential venue for facilitating work participation for employees with lower work ability, such as those with chronic or recurrent health complaints. Based on our findings, organizations should be aware that implementing a non-territorial office concept may result in differing effects for employees depending on their individual health capacity.

Financial concerns, rather than employee health and well-being, continue to be the primary driver of organizational decision-making regarding office concepts. This means that organizations may not find presenteeism an important enough outcome to consider when deciding what on-site office concept to implement. Thus, the practical implications of our findings may be somewhat limited. Yet, it is important to note that, at the behavioural level, presenteeism and absenteeism are opposite outcomes of the same decision-making process and therefore interchangeably connected. Put simply, lower presenteeism propensity may imply higher absence rates. Absenteeism is costly for organizations, and determinants of absenteeism is usually of great interest to the practice field. Additionally, the influence of on-site office concept on employee well-being may gain increased relevance with return-to-office mandates recently emerging in many countries.

Strengths and Limitations

The current study has several strengths and limitations. The data came from a large nationally representative sample of Norwegian employees. This increases the external validity of the results to a general working population of office employees. The sample also included a sizeable proportion of employees working in non-territorial offices. Furthermore, employees in Norway are entitled to full financial compensation from the first day of sickness absence. This limits financial concerns as

a potential driver of presenteeism, which arguably increases the chances that our measure reflects presenteeism arising from the interplay of individual and work-related factors. Yet, it may limit the generalisability of findings to countries with stricter compensation schemes where financial constraints on absence-taking are stronger.

The study is based on non-experimental survey data and participants self-reported their own presenteeism retrospectively. Although we adjusted for several potential confounders and excluded participants who had changed employer during the reporting period, observed differences could be due to unmeasured confounders. One potential confounder is one's status or power in the organization. Private offices are more common among senior employees (Bennis et al., 2022). Seniority is also a potential driver of presenteeism (e.g., the pressure to attend work may be higher among leaders and managers because of lower irreplaceability). Several of our adjustment variables were meant to address this concern. The self-reported variable regarding leadership and executive responsibility likely adjusted for some of the status differences directly. The other covariates (i.e., age, sex, education level, and occupation group) are also known drivers of status and power in organizations. Thus, by including these, we may have adjusted for some of the remaining differences. Yet, we may not have succeeded in evening out all status differences and can therefore not rule it out as an alternative explanation for lower presenteeism among employees in non-territorial offices.

Office concepts were not perfectly measured in the survey. Participants working in private offices did not receive the question regarding assigned versus unassigned seating. It was therefore not possible to investigate the sharing and territoriality dimensions separately or independently of each other. We therefore opted for office categories, as is common in the office concepts literature (e.g., Mauss et al., 2023). In Norway, and likely in most other countries, it is unusual for employees to have a private office that is not also assigned to them. It is therefore unlikely that we could have studied the two dimensions separately in practice, even if we had all the necessary information. Additionally, telework from home was not measured as part of the survey and we were therefore unable to consider any differences in telework from home across the office concepts.

Our retrospective presenteeism measure is prone to recall bias and other limitations inherent in self-report measures. It also had relatively crude categories (i.e., "never", "once", "two–three", and "four or more"). Our method of approximating presenteeism propensity by adjusting for perceived health status and the number of sickness absence episodes runs the risk of both under- and overestimating differences across office concepts. On one hand, the two variables might not have accounted for all the differences in health events triggered across office concepts. Thus, we might have failed to fully isolate the propensity path from the health events path. On the other hand, we might have partially adjusted for office concept factors influencing propensity, if these also influenced presenteeism through perceived health status (i.e., conditioning on a descendant; Cinelli et al. (2022)). Finding good ways to capture presenteeism propensity is notoriously difficult (Ruhle et al., 2020). One alternative option suggested by Gerich (2015) is to estimate presenteeism propensity by dividing the reported presenteeism frequency by the sum of both

absenteeism and presenteeism frequency. At first glance, this method seems to give a more precise indication of propensity. It may, however, introduce a false sense of accuracy since self-report frequency measures are prone to recall bias. We were unable to use this approach as presenteeism was measured on an ordinal scale.

Future Research Directions

Our study is among the first to examine whether and how presenteeism varies across different office concepts and points to promising avenues for future research. We had access to data from a large nationwide probability sample, with important advantages for external validity and generalizability. Our study is, however, limited in terms of studying the decision-making process directly, with explicit links to expectancy theory as a theoretical framework. Thus, a natural next step in future research is to conduct more in-depth or experimental research that taps into employees' actual decisions regarding presenteeism and absenteeism in different office concepts.

Several recent contributions suggest that presenteeism is not created equal. Effects may depend on the context in which presenteeism occurs (Ruhle et al., 2020) and the individual reasons for attending work when faced with a health event (e.g., Lohaus et al., 2022; Van Waeyenberg, 2023). Karanika-Murray and Biron (2020), for instance, distinguish between different types of presenteeism (i.e., therapeutic, functional, dysfunctional, overachieving), depending on specific combinations of an employee's individual capacities (i.e., physical and mental capabilities defined by an employee's health condition), flexible work resources (i.e., assets in the work environment used to adjust job demands or working conditions when health is compromised), and expected consequences for health and performance. The current study included only a generic measure of presenteeism. Thus, there may be differences in the types and consequences of presenteeism between private offices and shared and open workspaces that we did not capture, considering private offices may provide more psychological privacy (e.g., James et al., 2021; Masoudinejad & Veitch, 2023) and opportunities to adjust working conditions (e.g., Borge et al., 2024; Hootegem & Witte, 2017; Nielsen et al., 2023). Examining the nature of presenteeism across office concepts with more nuanced measures therefore represents an interesting avenue for future research. The propensity for and consequences of presenteeism may also differ depending on the nature of the health complaint (e.g., acute versus chronic, mental versus physical health complaints). These processes may interact with office concepts, as some health conditions may be easier to cope with in non-territorial or open offices than others.

Conclusions

The current study represents an important step towards a better understanding of overall attendance patterns across different office concepts. We found similar levels of presenteeism among employees in office concepts with assigned workstations. Thus, having your own office at work does not seem to be a facilitator for attending

work when faced with a health complaint. Our findings consequently undermine presenteeism propensity as a likely explanation for differences in sickness absence between these office concepts observed in previous research. In contrast, our findings do indicate that presenteeism propensity may be lower among employees in non-territorial offices, particularly among those with lower perceived health status. This suggests that whether you have a personalized desk at work may be a relevant factor when deciding between attending and not attending work when faced with a health complaint. Future studies examining differences in sickness absence between non-territorial offices and other office types should therefore keep this in mind when making inferences about potential mechanisms. Studies that better capture the complexity of presenteeism, as well as other research designs, are needed to fully understand patterns of presenteeism across different office concepts.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s41542-025-00223-4.

Author Contributions RHB and MBN conceived of the study. RHB prepared and analysed the data and wrote the first draft of the manuscript. MBN, HAJ, and KIF critically reviewed and commented previous versions of the manuscript. All authors read and approved the final manuscript.

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Data Availability Data may be obtained from a third party and are not directly publicly available. Statistics Norway has an established policy for data sharing. Information about data requests may be accessed here: https://sikt.no/en/omrade/research-data

Declarations

Ethics Approval The study is based on observational data. The data collection was carried out by Statistics Norway according to statutory rules. Statistics Norway has appointed its own privacy ombudsman, approved by the Norwegian Data Inspectorate.

Informed Consent Informed consent was obtained from all individual participants in the study.

Competing Interests We have no relevant financial or non-financial conflicts of interests to disclose.

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