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Sickness absenteeism, work performance, and healthcare use due to respiratory infections for shift and non-shift workers

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ABSTRACT

This study aimed to compare sickness absenteeism, work performance, and healthcare use due to respiratory infections, as well as general sickness absenteeism and work performance between shift and non-shift workers. In this study, 589 shift and non-shift workers employed in hospitals were included. For 6 months, participants kept a daily record of their influenza-like illness/acute respiratory infection (ILI/ARI) symptoms using a diary application. After an episode of ILI/ARI symptoms ended, participants (n = 531) were questioned about their sickness absenteeism (occurrence and duration in hours), work performance (on a 10 point scale), and healthcare use during the ILI/ARI episode. At the end of the 6 months follow-up, participants (n = 498) were also asked about general sickness absenteeism and work performance in the past 4 weeks. Mixed-model and regression analyses were used to compare absenteeism, work performance, and healthcare use between shift and non-shift workers. No differences were found in sickness absenteeism [Odds Ratio (OR) = 1.00 (95%–Confidence Interval (CI): 0.61–1.64)] and work performance [Regression coefficient (B) = −0.19 (95%–CI: −0.65–0.26)] due to ILI/ARI between shift and non-shift workers. In addition, healthcare use due to ILI/ARI was similar between shift and non-shift workers. Furthermore, similar general sickness absenteeism rates and work performance levels were found between shift and non-shift workers. As this is the first study that examined the associations with shift work due to ILI/ARI, further studies are needed to confirm our findings.

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Introduction

Nowadays, almost 1 in 5 European employees work outside the standard 9 to 5 working schedule (Eurofound 2016). In the healthcare sector, shift work is necessary to ensure continuity of care. However, shift work is associated with an increased risk for cardiovascular and metabolic diseases, and the associated circadian disruption possibly contributes to this increased risk (Costa 2010; van Drongelen et al. 2017; Vyas et al. 2012). Circadian rhythm disruption might also elevate the risk of acquiring an infectious disease, and aggravate the course of the disease after start of the infection (Castanon-Cervantes et al. 2010). Correspondingly, prior work found shift work to be associated with increased infection susceptibility (Cuesta et al. 2016; Mohren et al. 2002). A recent study of our group suggested that, compared to non-shift workers, shift workers in healthcare have a 20% higher incidence of respiratory infections, and a 22% higher incidence of severe respiratory infections (Loef et al. 2019).

Besides the individual burden, respiratory infections among workers may have consequences for employers and society as a whole, such as increased sickness absenteeism, reduced work performance, and increased healthcare use (Khawaja et al. 2012). Multiple studies have reported that respiratory infections explain almost half of the sickness absenteeism in the workplace (Bramley et al. 2002; Loef et al. 2019). Furthermore, presenteeism, where employees are present at work but do not operate at a maximum capacity due to their illness/health problems, is a common phenomenon (Johns 2010; Kessler et al. 2003; Mohren et al. 2005). Evidence suggests that employees with respiratory infections show a decline in work performance, and if employees must lose time at work, their performance level when they return is still temporarily lower than before their respiratory infection (Dicpinigaitis et al. 2015; Palmer et al. 2010). Sickness absenteeism and reduced work performance due to respiratory infections can thus lead to increased costs for the organization (Dicpinigaitis et al. 2015; Keech and Beardsworth 2008). Furthermore,

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respiratory infections might lead to higher pressure on the healthcare system (Federici et al. 2018). For example, the use of medical resources, e.g., healthcare workers' time and prescribed medication, has been found to be increased during a seasonal influenza episode (Keech and Beardsworth 2008).

Although shift work has been found to be associated with respiratory infections, it is currently unknown whether shift work is also associated with increased sickness absenteeism, reduced work performance, and increased healthcare use due to respiratory infections. Therefore, the primary aim of the current study is to compare sickness absenteeism, work performance, and healthcare use due to respiratory infections between shift and non-shift workers in the healthcare sector.

While the association between shift work and sickness absenteeism due to respiratory infections has, to our knowledge, not been studied before, more research is available on the association between shift work and general sickness absenteeism, i.e., due to all physical and mental health issues (Kazemi et al. 2016; Merkus et al. 2012; Ropponen et al. 2019). Nonetheless, despite the available literature on general sickness absenteeism, the evidence for its association with shift work remains inconclusive. A systematic review did not find clear evidence on the association between shift work and general sickness absenteeism due to mixed findings in the included studies (Merkus et al. 2012). Some studies found shift work to be related to increased sickness absenteeism, while other studies did not (Kazemi et al. 2016; Ropponen et al. 2019). Therefore, as a secondary aim, we compared general sickness absenteeism and work performance between shift and non-shift workers in the healthcare sector.

Materials and methods

Study population and design

Data from the prospective cohort study Klokwerk+ were used (Loef et al. 2016). The main objective of Klokwerk+ was to study the associations of shift work with body weight and infection susceptibility. Of the 611 healthcare workers enrolled in the Klokwerk+ study, 589 healthcare workers from different hospitals in the Netherlands were included in the current study (Figure 1). These 589 healthcare workers did not change shift work status during follow-up and did not stop working in shifts in the 6 months before baseline. Measurements took place at a baseline visit between September–December 2016, and at a follow-up visit between April–June 2017 (Loef et al. 2016). Participants enrolled in the study between September-December 2016, dependent on their hospital of employment. Thus, participants enrolled in the study before the start of the influenza/winter season in the Netherlands, which extends from approximately December to March (RIVM 2020). After approximately six months, the participants who enrolled first had their follow-up visit in April and the last enrolled participants had their follow-up visit in June. During the baseline and follow-up visit, participants completed a questionnaire about shift work, health, demographics, and lifestyle. Throughout the period between the baseline and the follow-up visit, participants kept a daily record of their respiratory infection symptoms using a smartphone application (app). During the follow-up visit, the participants completed a questionnaire that also included questions about general sickness absenteeism and work performance. This study received ethical approval from the institutional review board of University Medical Center Utrecht (Utrecht, The Netherlands). All participants provided written informed consent. As two different aims were examined in the current study, this resulted in two slightly different study populations. For the first aim, data from 531 participants who completed the questions in the smartphone app were included to compare sickness absenteeism, work performance, and healthcare use due to ILI/ARI. For the second aim, data from 498 participants who completed the questionnaire at the follow-up visit were included to compare general sickness absenteeism and work performance.

Measures

Shift work

At the baseline and follow-up visit, participants answered questions about their shift work status that were based on an international consensus report (Stevens et al. 2011). Participants were asked whether they currently and ever worked rotating shifts (rotating between day, evening, night, and/or sleep shifts) or night shifts (shifts between 00.00–06.00 hs). Participants were considered shift workers if they worked rotating shifts and/or night shifts at baseline and follow-up. All shift workers worked rotating shifts (n = 450), and for most workers these rotating shift also included night shifts (n = 418, 93%). Participants were considered non-shift workers if they did not work rotating shifts or night shifts, for at least six months prior to the baseline visit. For participants who changed their shift work status between baseline and follow-up, only the app data completed before that point in time were included.

Respiratory infections: ILI/ARI episodes

Influenza-like-illness (ILI) and acute respiratory infection (ARI) episodes were tracked by means of a diary smartphone application. In this app, participants reported on a daily basis whether the following

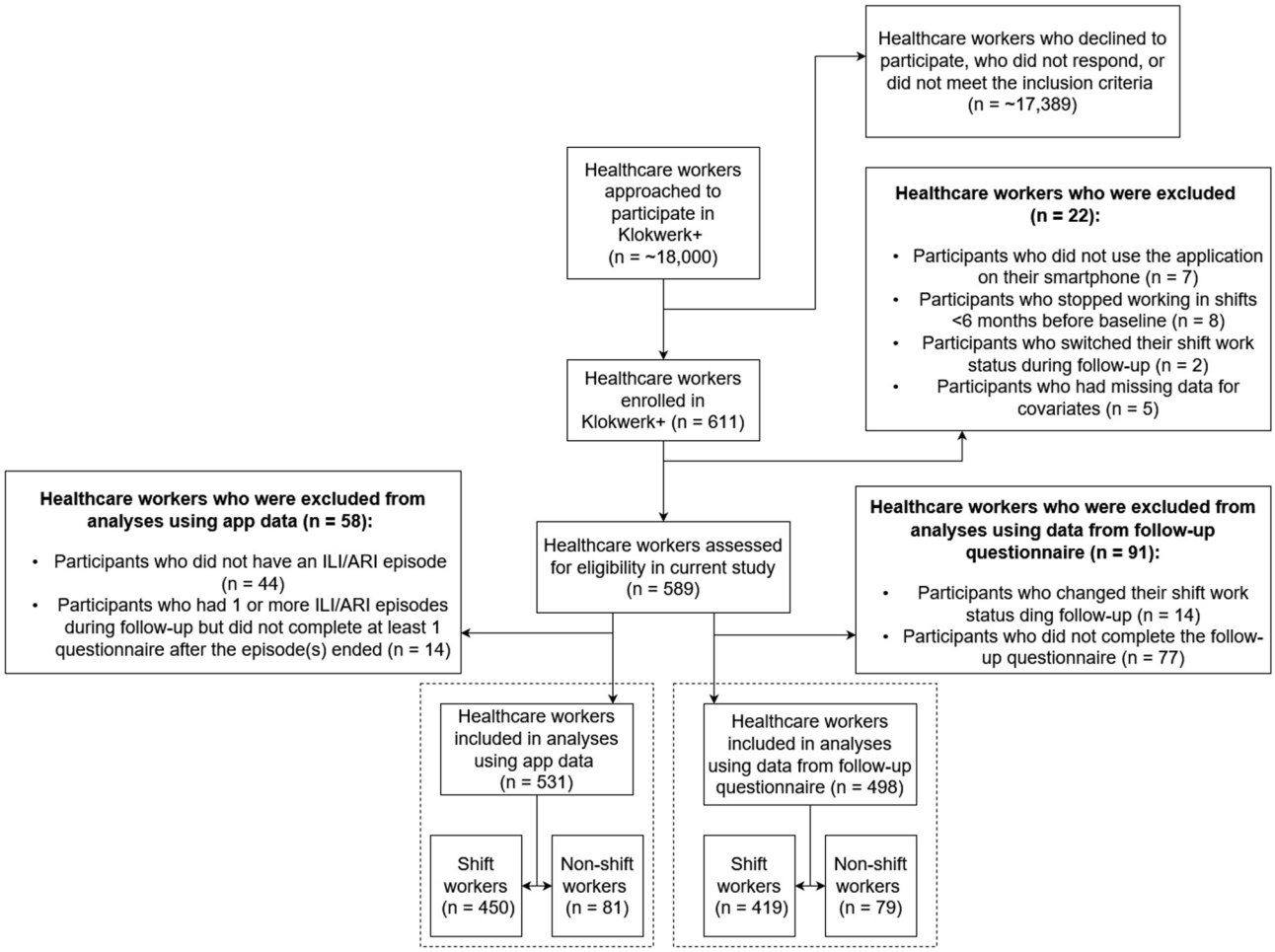

Figure 1. Flowchart of study participants.

symptoms were present (yes/no): cough, runny/blocked nose, sore throat, shortness of breath, malaise, fever, coughing up mucus, and hoarseness. The start and the end of an ILI/ARI episode were classified based on diary records, using built-in algorithms. The start of an ILI/ARI episode was defined as having ≥2 symptoms on the same day or ≥1 symptom on two consecutive days. If the participants did not report symptoms for two consecutive days, an episode ended (Loef et al. 2019). After an episode ended, participants received additional questions in the app about their sickness absenteeism and work performance during the ILI/ARI episode, and whether a general practitioner (GP) and/or specialist was consulted and also whether medication was used due to the ILI/ARI episode. In the app, participants could additionally report the symptoms of sneezing and wheezing, but these symptoms were excluded from the definition of ILI/ARI to prevent classifying allergy symptoms as ILI/ARI.

Sickness absenteeism

Sickness absenteeism because of an ILI/ARI episode was assessed using the smartphone app. After an ILI/ARI episode ended, participants were asked if they had missed paid working days due to their ILI/ARI symptoms (yes/no). Those who indicated to have had missed paid working days were additionally asked to report the number of hours of paid work they had missed.

General sickness absenteeism was measured using two questions from the World Health Organization's Health and Work Performance Questionnaire (WHO-HPQ) that participants completed at follow-up (Kessler et al. 2003). These questions were used to determine missed working days due to health complaints, i.e., not specifically due to the ILI/ARI (Kessler et al. 2003). Participants were asked how many days they missed an entire or part of a working day in the past four weeks due to problems with their physical and mental health. This information was used to create two variables on the

occurrence (yes/no) and the duration (number of missed working days per four weeks) of general sickness absenteeism.

Work performance

Work performance during an ILI/ARI episode was measured using a question from the WHO-HPQ (Kessler et al. 2003) in the smartphone app. Participants had to rate their overall work performance during the ILI/ARI episode, scaled from 0 to 10, where 0 corresponds to the lowest possible performance and 10 the best possible performance. In the follow-up questionnaire, participants were asked to rate their general work performance in the past four weeks using the same question from the WHO-HPQ.

Healthcare use

Healthcare use was operationalized as the consultation of a medical doctor and medication use (OECD 2017). After an ILI/ARI ended, participants were asked in the application on their smartphone whether they consulted a GP or medical specialist because of their ILI/ARI symptoms (yes/no) and whether they used (extra of) the following medication because of their ILI/ARI symptoms: painkillers, antibiotics, inhalation medication, nose drops, cough drops, medication to stop coughing, or other medication.

Covariates

Information on participants' age, gender, occupation (nurse/other healthcare worker), working hours according to contract of employment, and educational level (low: intermediate vocational education or higher secondary education/high: higher vocational education or university) was collected using the baseline questionnaire. Other covariates were general perceived health (measured on a 5-point Likert scale (excellent–bad)), job satisfaction (measured on a 5-point Likert scale (very satisfied–very unsatisfied)), and whether participants received the seasonal influenza vaccination (yes/no). General perceived health (very good, excellent versus bad) and job satisfaction ((very) satisfied versus (very) unsatisfied) were dichotomized.

Statistical analysis

Differences in baseline characteristics between shift workers and non-shift workers were tested using independent samples t-test and X^2-test. For our first aim, logistic (expressed as odds ratios, ORs), negative binomial (expressed as incidence rate ratios, IRRs), and linear mixed-model (expressed as regression coefficients, B) analyses were used to examine the associations between shift work and sickness absenteeism, work performance, and healthcare use due to ILI/ARI episodes with the number of completed diaries as offset variable (Christensen et al. 2007). For the second aim, logistic, negative binomial, and linear regression analyses were conducted to determine the association between shift work and general sickness absenteeism and work performance using data from the follow-up questionnaire. For the dichotomous variables including sickness absenteeism (due to ILI/ARI episodes), consultation of a medical doctor, and medication use, logistic regression/mixed-model analyses were used. For the count variables absenteeism due to ILI/ARI episodes and absenteeism in days, negative binomial regression/mixed-model analyses were used. For the continuous variable work performance (due to ILI/ARI episodes), linear regression/mixed-model analyses were used.

All analyses were adjusted for age, gender, occupation, working hours, educational level, influenza vaccination status, general perceived health, and job satisfaction. Moreover, possible effect modification by occupation and gender was assessed by including the interaction terms of shift work with the potential effect modifiers to the crude model. Analyses were not stratified, because the *p*-value of the interaction terms was >.05. Analyses were conducted with IBM SPSS Statistics, V.24.0 (IBM Corporation, New York).

Results

Study population

For the 531 included participants to compare sickness absenteeism, work performance, and healthcare use due to ILI/ARI, shift workers were younger [40.4 (Standard Deviation (SD) = 12.0) y/46.9 (SD = 10.8) y], less often higher educated (55.8%/74.1%), and more often a nurse (82.9%/33.3%) than non-shift workers (Table 1). Shift workers reported on average more ILI/ARI episodes [3.7 (SD = 2.2) episodes] than non-shift workers [2.9 (SD = 1.7) episodes].

Sickness absenteeism, work performance, and healthcare use due to ILI/ARI episodes

Overall, 450 shift workers completed the questionnaire that was sent after an ILI/ARI episode ended for 1527 ILI/ARI episodes, and 81 non-shift workers completed this questionnaire for 221 ILI/ARI episodes (Table 2). During 13.2% of the ILI/ARI episodes in shift workers, shift workers were one or more days absent; and among those who were absent, on average 18.9 working hours per episode were missed. For non-shift workers, these numbers were 14.0% and 19.8 h, respectively (Table 2).

Table 1. Characteristics of the study population of healthcare workers with ILI/ARI episodes stratified for shift workers and non-shift workers (n = 531).

	Shift workers (n = 450)	Non-shift workers (n = 81)
Characteristics	% (number) or mean(SD); median	% (number) or mean(SD); median
Age	40.4* (12.0); 40.0	46.9* (10.8); 49.0
Gender (% female)	88.7% (399)	86.4% (70)
Occupation (% nurse)	82.9%* (373)	33.3%* (27)
Contractual working hours per week	30.4 (6.5); 32.0	29.9 (6.9); 32.0
Educational level (% high)	55.8%* (251)	74.1%* (60)
Influenza vaccination (% yes)	14.7% (66)	23.5% (19)
General perceived health (% very good, excellent)	43.3% (195)	35.8% (29)
General job satisfaction (% (very) satisfied)	80.9% (364)	82.7% (67)
Number of ILI/ARI episodes	3.7* (2.2); 3.0	2.9* (1.7); 3.0

*Statistically significant difference ($p < .05$) between shift workers and non-shift workers tested with independent samples t-test or X^2-test.

The effect estimates for differences in sickness absenteeism, work performance, and healthcare use due to ILI/ARI episodes between shift and non-shift workers are shown in Table 2. No difference in the odds of being absent due to ILI/ARI episodes was found between shift and non-shift workers [Odds Ratio (OR) = 1.00 (95%-Confidence Interval (CI): 0.61-1.64)]. Among those who reported to have been absent due to ILI/ARI episodes, shift workers did not have statistically significantly more hours of sickness absenteeism than non-shift workers [Incidence Rate Ratio (IRR) = 1.18 (95%-CI: 0.75-1.66)] (Table 2). Furthermore, shift and non-shift workers had a similar work performance level during the ILI/ARI episodes [Regression coefficient (B) = −0.19 (95%-CI: −0.65-0.26)]. There was also no difference in the odds of consulting a medical doctor [OR = 1.10 (95%-CI: 0.56-2.15)] and using medication [OR = 1.06 (95%-CI: 0.67-1.67)] due to ILI/ARI episodes between shift and non-shift workers (Table 2).

Sickness absenteeism and work performance in general

Regarding sickness absenteeism in general, 14.8% of the shift workers were absent in the past 4 four weeks, and among those who reported to have been absent due to health complaints in the past 4 weeks, shift workers were on average 5.0 days (SD = 7.6) absent (Table 3). For non-shift workers, these numbers were 19.0% and 3.5 days (SD = 3.9), respectively. These differences were not statistically significant (Table 3). After adjustment for covariates, the odds of being absent was 0.61-times higher in shift workers compared to non-shift workers [OR = 0.61 (95%-CI: 0.30-1.24)]. However, among the absent healthcare workers, shift workers reported 51% more hours [IRR = 1.51 (95%-CI: 0.75-3.05)] of sickness absenteeism compared to non-shift workers (Table 3). Both differences were found to be not statistically significant. Further, shift and non-shift workers reported a similar work performance level [B = −0.09 (95%-CI: −0.38-0.20)].

Discussion

In the current study among healthcare workers, no differences in sickness absenteeism, work performance, and healthcare use due to respiratory infections were found between shift and non-shift workers. In addition, general sickness absenteeism and work performance also did not differ between shift and non-shift workers.

Shift work has been found to be associated with circadian rhythm disruption and disturbed sleep, especially when night shifts are included (Akerstedt 2003; Gan et al. 2015; Proper et al. 2016; Wang et al. 2014). Circadian rhythm disruption and disturbed sleep may act as the underlying mechanisms linking shift work to poorer health outcomes (Knutsson 2003; Puttonen 2010). Sleep is particularly likely to play an important role with respect to infection susceptibility, because sleep can modulate immune functioning (Almeida and Malheiro 2016). Correspondingly, in a recent study, poor sleep quality was found to mediate the association between shift work and increased incidence of respiratory infections (Loef et al. 2020). Furthermore, poor sleep is associated with increased absenteeism rates (Doi et al. 2003). Therefore, an increased absenteeism rate among shift workers with ILI/ARI was hypothesized in the current study. Nonetheless, the comparable sickness absenteeism rates due to respiratory infection episodes that we found agree with earlier studies that did not observe higher absenteeism rates among shift workers compared to non-shift workers (Alexopoulos et al. 2008; Higashi et al. 1988).

The similar sickness absenteeism rates between shift and non-shift workers might be due to the healthy worker effect in which the shift working population is relatively healthy and does not call in sick even though employees report ILI/ARI symptoms (Merkus et al. 2012). Furthermore, the higher wages on the night shift may also be related to the motivation to remain doing shift work despite being ill. On the other hand, we found similar work performance levels between shift and non-shift workers. This is not in line with the reasoning that shift workers may more often decide to continue working

Table 2. Differences in Sickness absenteeism, work performance, and healthcare use due to ILI/ARI episodes between shift and non-shift workers (n = 531).

	Shift workers			Non-shift workers			Shift workers vs. non-shift workers		
	Number of shift-workers (%)	Number of episodes	% (number of episodes) or mean(SD); median	Number of non-shift workers (%)	Number of episodes	% (number of episodes) or mean(SD); median	Effect size	Crude	Adjusted†
Sickness absenteeism due to ILI/ARI (yes/no)	450 (85%)	1527	13.2 (201)	81 (15%)	221	14.0 (31)	OR (95% CI)	0.96 (0.61–1.49)	1.00 (0.61–1.64)
Hours of sickness absenteeism due to ILI/ARI[a]	158 (85%)	201	18.9 (14.2); 16.0	27 (15%)	31	19.8 (19.2); 14.5	IRR (95% CI)	1.02 (0.68–1.52)	1.18 (0.75–1.66)
Work performance (0–10)[b,c]	449 (85%)	1524	7.0 (2.4); 7.0	81 (15%)	221	7.2 (2.2); 8.0	B (95% CI)	−0.18 (−0.60–0.24)	−0.19 (−0.65–0.26)
Consulted a medical doctor (yes/no)[c]	449 (85%)	1523	4.0 (61)	81 (15%)	221	4.5 (10)	OR (95% CI)	0.96 (0.52–1.77)	1.10 (0.56–2.15)
Used medication (yes/no)[c]	448 (85%)	1521	36.1 (549)	81 (15%)	221	37.6 (83)	OR (95% CI)	1.02 (0.67–1.53)	1.06 (0.67–1.67)

B, regression coefficient; OR, odds ratio; IRR, incidence rate ratio's.
†Adjusted for age, gender, occupation, working hours, educational level, influenza vaccination status, general perceived health, and job satisfaction.
[a]Based on 158 shift workers and 27 non-shift workers who reported to have been absent due to ILI/ARI episode(s).
[b]A higher score indicates a better work performance.
[c]1 or 2 shift worker(s) excluded, because the participant failed to complete at least 1 question about work performance or the consultation of a medical doctor or about medication use.

despite feeling ill, because the literature indicates that ill employees who continue to work show a reduced work performance (Martinez and Ferreira 2012).

As reported, the results suggest that when a respiratory infection is present, shift workers are not more or longer absent than non-shift workers. Nevertheless, as shift workers were found to have a higher incidence rate of respiratory infection episodes (Loef et al. 2019, Table 1), a similar sickness absenteeism rate due to respiratory infections might suggest that shift workers are cumulatively (e.g., during an entire winter season) more often absent than non-shift workers. For example, if shift workers as well as non-shift workers are on average absent during approximately 15% of the ILI/ARI episodes (Table 2), but shift workers report 20% more ILI/ARI episodes per winter season (Loef et al. 2019), than the total number of absenteeism spells will be higher in shift workers. Future research may focus on the prevention among shift workers of succumbing to respiratory infection episodes.

In line with our findings, multiple studies did not find shift workers to be more absent due to health complaints in general than non-shift workers (Merkus et al. 2012; Tuchsen et al. 2008; van Drongelen et al. 2017). It is suggested that shift workers more than non-shift workers might consider non-severe complaints, such as not feeling well or irregular sleep patterns, as a part of their work and not as a reason to report in sick (van Drongelen et al. 2017). This might be due to the perception of the shift workers about their work, in which shift work is known for being associated with a disrupted sleep pattern (Hulsegge et al. 2018). Furthermore, it has been hypothesized that the relationship with colleagues between shift workers differs from that of non-shift workers (Kleiven et al. 1998; van Drongelen et al. 2017). For example, the shift workers (e.g., nurses) in healthcare in our study often work in groups, while the non-shift workers, such as doctors and physiotherapists, may more often work individually. Therefore, it might be that shift workers are more inclined to continue working despite feeling ill due to loyalty toward their colleagues. Consequently, shift workers might decide less often to be absent than non-shift workers (Costa 1996; Taylor 1967). This phenomenon has also been described in the blue-collar industry (van Drongelen et al. 2017).

To our knowledge, no previous research explored the work performance of shift workers during a respiratory infection episode. It was expected that work performance during respiratory infections of shift workers would be lower compared to non-shift workers, because earlier studies found shift workers to also have lower work performance levels in general than non-shift workers (Dall'Ora et al. 2016; Kazemi et al. 2016). Nonetheless, work performance during respiratory infections as well as general work

Table 3. Differences in general sickness absenteeism due to health complaints, and work performance at follow-up between shift and non-shift workers (n = 498).

	Shift workers		Non-shift workers		Shift workers vs. non-shift workers		
	Number of shift-workers (%)	% (number) or mean(SD); median	Number of non-shift workers (%)	% (number)or mean(SD); median	Effect size	Crude	Adjusted†
Sickness absenteeism due to health complaints (yes/no)	419 (84%)	14.8 (62)	79 (16%)	19.0 (15)	OR (95% CI)	0.74 (0.40–1.38)	0.61 (0.30–1.24)
Days of sickness absenteeism due to health complaints[a]	62 (81%)	5.0 (7.6); 2.0	15 (19%)	3.5 (3.9); 2.0	IRR (95% CI)	1.41 (0.75–2.67)	1.51 (0.75– 3.05)
Work performance (0–10)[b]	419 (84%)	7.7 (1.1); 8.0	79 (16%)	7.8 (0.9); 8.0	B (95% CI)	−0.11 (−0.37–0.15)	−0.09 (−0.38–0.20)

B, regression coefficient; OR, odds ratio; IRR, incidence rate ratio's.
†Adjusted for age, gender, occupation, working hours, educational level, influenza vaccination status, general perceived health, and job satisfaction.
[a]Days of sickness absenteeism due to health complaints among the absent shift workers (n = 62) and absent non-shift workers (n = 15).
[b]A higher score indicates a better work performance.

performance was found to be similar between shift and non-shift workers. The observed difference in work performance between shift and non-shift workers of 0.19 (during respiratory infections) and 0.09 (general work performance) on a scale from 0–10 is considered small, also in light of findings in earlier work (Mills et al. 2007).

Furthermore, because the work performance level of the participants in this study was generally high (i.e. 7.7 on a scale from 0–10) (de Vries et al. 2012), this might have resulted in a ceiling effect, which is known to occur when using the WHO-HPQ to measure work performance in a relatively healthy population (Gardner et al. 2016). Consequently, due to the possible lack of variability (Garin 2014), it may have been difficult to find differences between shift and non-shift workers.

In the Netherlands, it is unusual for a relatively healthy population to consult a medical doctor because of respiratory infection symptoms, because the symptoms are often mild and disappear without intervention within a few days (Keech et al. 1998; RIVM 2019). This is in line with our finding, as only a few employees (4.1%) consulted a medical doctor due to their respiratory infections. Furthermore, rates for consulting a medical doctor and using medication because of respiratory infection symptoms were similar for shift and non-shift workers, indicating that healthcare use due to respiratory infections of shift workers is not different from that of non-shift workers.

Strengths and limitations

A strength of the current study was that assessment of respiratory symptoms was performed using a smartphone app on a daily basis and that questions about sickness absenteeism, work performance, and healthcare use due to respiratory infection episodes were sent to the participant immediately after an episode ended. Therefore, recall bias was minimized. In addition, the amount of missing data in the data collected with the smartphone application was very limited. In total, 92% of all questionnaires that were sent after the ILI/ARI episodes ended were completed, and this high completion rate was similar for shift and non-shift workers.

As only 3% of the healthcare workers who were approached to participate in Klokwerk+ enrolled in the study, the participants may not be entirely representative for the general healthcare working population in the Netherlands. From the literature, it is known that persons in better health more often participate in studies than persons in poorer health (Bergstrand et al. 1983; Galea and Tracy 2007). In addition, more sickness absenteeism days have been observed among persons who do not participate in studies (Bergstrand et al. 1983). Reasoning along this line, it is possible that especially workers who have poorer health and are more frequently absent did not participate in the study, implying that the number of absent healthcare workers may be underestimated in this study thus give rise to an underestimation of the association between shift work and sickness absenteeism.

All participants in the Klokwerk+ study were healthcare workers whose jobs involved contact with patients. Most participants were nurses, but other included occupations were physicians and medical professionals, such as dieticians, physiotherapists, and occupational therapists. By recruiting shift and non-shift working healthcare workers from the same hospitals, we aimed to recruit participants with similar work environments and job tasks. However, because shift workers and non-shift workers differed with respect to their educational level and occupation (Table 1), it is likely that shift workers on average performed other job tasks than non-shift workers. Unfortunately, within the current study, information on specific occupational tasks of the workers was lacking. For future research, it is recommended to also include this type of information to better examine differences in exposures between shift and non-shift workers.

Furthermore, the measurement of the outcome variables, including sickness absenteeism (occurrence and duration), was based on self-reported data, and, therefore, may be prone to bias. Namely, it is possible that employees are less inclined to report their absenteeism when participating in a study compared to an objective measurement of absenteeism. In line with this reasoning, a study among white-collar workers found that self-reported absenteeism did not match with the recorded absenteeism in almost halve (49%) of the participants (Severens et al. 2000). Furthermore, the self-reported measurement of work performance might also be prone to bias. Namely, this measurement might not always be reliable (Letvak et al. 2012), because persons might give a socially desirable answer (Rosenman et al. 2011). For example, employees who choose to go to work while they are sick might (unconsciously) modify their reported work performance level to justify that they are still going to work. This type of misclassification might be a limitation of the current study. Nonetheless, we have no reason to assume that this bias in the self-report of the outcome variables would be different for shift workers and non-shift workers. Therefore, our data could still be considered suitable for making such comparisons.

As the assessment of respiratory infection episodes was based on self-reported symptoms, it was possible that an episode could be caused by relatively mild symptoms. Therefore, it is possible that these milder respiratory infection episodes generally caused less absenteeism than could have been expected from more severe episodes, for example, those episodes including fever. For that reason, we performed a sensitivity analyses among the more severe respiratory infection episodes of the shift and non-shift workers. A severe episode was defined as having ≥1 symptom rated as severe, ≥2 symptoms rated as moderate, or ≥3 symptoms of any severity at the onset of the episode (Loef et al. 2019). A similar absenteeism occurrence [IRR = 1.03 (95%CI: 0.63–1.70)] and duration [IRR = 1.10 (95%-CI: 0.74-1.62)] was found for shift and non-shift workers.

In the current study, a small number of the shift workers (n = 33) rotated between day and evening shifts and did not work night shifts. As the largest impact of shift work on health may be expected when night shifts are included (Conway et al. 2008), an additional analysis was performed in which shift workers who did not work night shifts were excluded. Nonetheless, as was found in the total study population, including shift workers without night shifts, the absenteeism rates (occurrence [IRR 0.89 (95%-CI: 0.53–1.44)] and duration [IRR 1.05 (95%-CI: 0.71–1.55)]) due to respiratory infection episodes between shift and non-shift workers were similar in this additional analysis.

Conclusion

In the current study among healthcare workers, no differences were found between shift and non-shift workers in sickness absenteeism, work performance, and healthcare use due to respiratory infections, based on self-reported symptoms. In addition, no differences were found in general sickness absenteeism and work performance due to health complaints between shift and non-shift workers. As this study was the first to investigate sickness absenteeism, work performance, and healthcare use due to respiratory infection episodes among shift and non-shift workers, future research is needed to confirm our findings.

Declarations of interest

The authors report no conflicts of interest.

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