**Introduction**

Physical and mental wellbeing are highly associated with restoring and satisfying sleep. In the occupational area, disrupted and non-restorative sleep increases the risk of accidents or “headline hitting” disasters, particularly in transport, nuclear power, or chemical industries which have significant public and environmental risks associated with them\(^1\). Furthermore, individuals who do not sleep well tend to have impaired work productivity and to consume more medical resources\(^2\). Similarly, employees suffering from insomnia have been shown to have significantly higher rates of absenteeism and to cause increased costs for both employers and the community\(^3,4\). They have also been shown to have a three-fold greater risk of having a road accident, and additional problems such as poor self-esteem at work, less job satisfaction, and decreased efficiency at work\(^5\). Taken together, these concepts indicate that unfavourable sleep conditions may lead to impaired performance at work.

Complementary to these concepts, there is a growing body of research evidence showing that the direction of the relation between sleep patterns and working conditions may be inverted: adverse working conditions may also cause and maintain sleep disturbances. First, with respect to working structures, sleep disturbances may be associated with or mediated by irregular working schedules. In the United States it is estimated that about one fifth of employees are shift workers\(^6,7\) and lifestyle changes have increased the demand for a 24/7 service, particularly within the service industry\(^8\). Second, with respect to psychological factors, results from an investigation of 8,700 Japanese local government and transit company employees showed that occupational stress was a possible risk factor for insomnia\(^9\). Similarly, an increased risk of sleep complaints such as difficulties in falling asleep, maintaining sleep, or waking up early in the morning, were found for white-collar workers who experienced high intragroup conflicts, high job dissatisfaction, and high symptoms of depression\(^10\). Longitudinal studies support the influence of these factors on sleep problems: e.g., at one year follow-up, Linton\(^11\) reported that...
the risk of a new episode of insomnia doubled in relation to a poor psychosocial work environment (i.e., low social support, scarce social appreciation), and Jansson and Linton\textsuperscript{12}) revealed that high work demands increased the risk of developing insomnia one year later. Furthermore, high work demands combined with low influence over decision-making were found to be related to the maintenance of insomnia. Jansson and Linton\textsuperscript{12}) thus concluded that perceived work stressors are related to the development and maintenance of insomnia. Taken together, these findings hold that work-related psychological factors have adverse impact on sleep. It is interesting to note that despite well documented scientific evidence of the close association between sleep disorders and depression\textsuperscript{13}), generalised\textsuperscript{14}), specific\textsuperscript{15}), or state-trait anxiety disorders\textsuperscript{16}), the majority of research into sleep disturbances and working conditions has not taken into account psychiatric factors such as these (although for a notable exception see\textsuperscript{10}).

A third line of investigation emphasizes the extent to which employees such as shift workers face considerable challenges compared to their daytime-working counterparts with respect to family and social life. About 41% of shift workers found it difficult to fulfil domestic responsibilities in terms of finding a satisfying work and family balance\textsuperscript{17}). Social measures such as personal disruption to the partner (e.g., difficulties to cope with marital/partner problems; difficulties to cope with daily family hassles; separation; divorce) rather than biological measures (i.e., blood pressure; heart rate) were the greatest predictors of the shift workers’ personal disruption and well-being\textsuperscript{18–20}). Work-life conflicts can arise from long or socially undesirable working hours, particularly evening or weekend work\textsuperscript{8, 21, 22}). Bohle \textit{et al.}\textsuperscript{8}) observed that increased working hours were negatively correlated with sleeping hours, further impinging upon time available for family and for other activities outside work. In addition, the same authors reported that tiredness and negative mood associated with long working hours had a negative impact on relationships at home. Furthermore, a clear relation between work-family conflict and sickness absence from work has been shown\textsuperscript{23}). Thus, this line of investigation underlines the interdependence of work and social life.

In sum, the direction of influence between sleep disturbances and work strain is somewhat unclear. There is evidence that sleep disorders are directly caused and mediated by psychological work-related factors rather than by structural factors. However, these psychological factors seem to be intertwined with ‘environmental’ conditions such as overtime, commuting time, and unfavourable working time schedules. Furthermore, unfavourable work conditions may negatively influence social and family life, meaning that it may be much more challenging not to become socially isolated while shift working or working over time. Finally, despite the close association between sleep disorders and psychiatric conditions such as anxiety and depression, these factors have not been systematically measured in research into sleep disturbances and working conditions.

Scientific research into the relationship between sleep and work has been conducted with representative populations\textsuperscript{12}) in a variety of occupational areas including white collar workers\textsuperscript{2, 3, 5, 9, 10, 24}), care workers\textsuperscript{25}), and workers in heavy industry\textsuperscript{17, 26}). However, such scientific efforts have generally failed to focus on one of the largest employment sectors providing 24/7 service —that of hospitality and tourism. In Switzerland about 9% of the working population is estimated to be directly or indirectly engaged in hospitality and tourism services (though with remarkable geographical and seasonal variations) and in 2004 revenues derived from this sector accounted for about 3% of the Swiss gross domestic product\textsuperscript{27}). Thus, the lack of research into the service industry is surprising.

The aim of the present study was to gain greater insight into the interplay between sleep, work, and strain in employees of the hospitality and tourism industry. To achieve this, we assessed work-, private- and social-related strain, sleep-related personality traits, sleep patterns, and working hours. In contrast to previous studies, we also introduced assessment of depressive symptoms and state-trait anxiety. Five hypotheses were formulated.

1. Given a possible 24/7 service with its inherent full-week working schedule\textsuperscript{9}), we hypothesized that the weekly sleeping schedules would not demonstrate a shift towards prolonged sleeping hours on weekends.
2. Working and sleeping hours were expected to be inversely correlated\textsuperscript{7, 8}).
3. We assumed that subjectively judged sleep quality and mood would better predict affective states such as depressive symptoms and anxiety than the mere amount of sleeping and working hours\textsuperscript{22}).
4. We hypothesized that prolonged working hours and weekend work would be correlated with increased strain upon social life\textsuperscript{7, 8, 17, 18}).
5. We predicted that strain at work would be negatively associated with sleep quality\textsuperscript{11, 12}) and favourable sleep-related personality traits.

Results should enable a deeper understanding of how sleep, work, and psychological strain are associated, and broaden knowledge of the work-life balance conditions of employees in the hospitality and tourism sector.

**Subjects and Methods**

**Sample**

One hundred ninety undergraduate students of the
School for Hospitality and Tourism in Passugg (Switzerland) were asked to participate in the study and a total of 92 students (mean age: 23.69 ± 4.55; 74 females (23.17 ± 3.34) and 18 males (25.86 ± 7.51)) took part (response rate = 48.42%). The students were informed about the purpose of the study and assured of the confidentiality of their responses, after which they signed written consent forms. The investigation was approved by the Dean of the school. As part of their vocational training, students were required to do a work experience placement for several months, and data were gathered during this time period. Twenty six students were working within the food and beverage division (four bar attendants, eight waiters and waitresses; 14 without further specifications); 10 were conference and catering managers; 13 were cooks; 18 were engaged within the finance and reception division as accounts receivable clerks; 16 just indicated that they were general placement students, and 9 participants provided no indication as to the nature of their placement. Irrespective of the divisions, students were required to work during weekends and take days off during weekdays, and to work in early, middle, or late shifts.

Assessment of sleep quantity, sleep-related personality traits, and work-related data

Participants were required to complete several psychological, sleep, and sleep-related questionnaires, and to keep a sleep log for seven consecutive days.

The sleep log was based on the Pittsburgh Sleep Quality Index (PSQI28); the German adaptation was taken from a conventional and widely used manual for psychological treatment of sleep complaints29). Participants were asked to fill out the log twice a day for a week, in the evening and in the morning. In the evening, participants answered a question on an eight-point visual analogue scale about mood (8 = very good mood). Additionally, they indicated the total daily working hours. In the morning, the questionnaire asked about sleep quality (8 = very good sleep quality) and mood (8 = very good mood), using the same analogue scale. In addition, details of sleep onset latency (in minutes), the number of awakenings, and the total sleep time (in hours and minutes) were requested.

Participants also completed a single sleep-related personality questionnaire, i.e. a specific questionnaire for assessing personality traits of patients with sleep complaints (Fragebogen zur Erfassung allgemeiner Persönlichkeitsmerkmale Schlafgestörter; FEPS-I and II30); Cronbach’s alpha for internal consistency for both FEPS I and II = 0.91). The FEPS-I questionnaire consists of 64 items describing six sleep personality traits and subjective sleep quality on a 5-point scale ranging from “is not true at all” to “is completely true”. The following dimensions are addressed: attitude to life (satisfied, confident, positive vs. depressive, dissatisfied, resigned, lacking emotion); self-confidence (self-confident, resolved, carefree vs. anxious, unsure, indecisive, easily irritated); mental arousal (relaxed, balanced, calm vs. tense, irritable, exhausted, burdened); physical arousal (relaxed, balanced, without any complaints vs. nervous, over-activated, complaining); aggressive behaviour (externalizing, competitive, sustaining one’s own opinion vs. internalizing, over-controlling, inhibited, evasive); self-perception of body sensations (easy-going, carefree, confiding vs. hypochondriac, complaining), and subjective sleep quality (regenerative, undisturbed, unimpaired vs. impaired, disturbed, not regenerative). The FEPS-II questionnaire consists of 23 items with the following dimensions: “Focussing” refers to the tendency of a person with insomnia to continuously think about the difficulties of getting to sleep, maintaining sleep, waking up early in the morning and/or suffering from increased daytime sleepiness. “Worrying about unresolved problems” refers to the tendency of a person with insomnia to continuously think about and feel preoccupied with unresolved problems. The underlying rationale for these two dimensions assumes that dysfunctional, negative cognitions such as continuously worrying about not being able to sleep or about unresolved problems are the main factors for developing and maintaining sleep problems (see12, 30, 31). The sleep-related personality questionnaire was chosen because it has been shown to be suitable both for patients suffering from sleep disorders and for healthy subjects (see also32).

Furthermore, participants filled out two self-rating questionnaires concerning depressive disorders (Von Zerssen Depression Scale33); Cronbach’s alpha = 0.95) and concerning anxiety disorders (State-Trait-Anxiety Inventory34) Cronbach’s alpha = 0.90). The depression scale asks about typical depression-related symptoms such as decreased mood, lack of satisfying social and leisure activities, thoughts about suicide, hopelessness, and loss of sleep. Answers are given on a 4-point rating scale ranging from “not at all true” (= 1) to “definitely true” (= 4). The higher the score, the more depressive symptoms are pronounced. The State-Trait Anxiety Inventory asks about actual (state) and continuous (trait) anxiety symptoms. Typical items to assess state anxiety are: “I feel tense”, or “I’m worried that something could go wrong”. Typical items to assess trait anxiety are: “I feel relaxed”, “I’m happy”, or “I tend to take everything too

\[a\] The expression “aggressive behaviour”, proposed by the test authors, may be misleading; perhaps the dimension should be translated as “assertive behaviour”.

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seriously”. Answers are given on a 4-point rating scale ranging from “practically always” to “practically never”, with anchor points ranging from 1 to 4 (for some items direction of scores had to be inverted). The higher the score, the more pronounced the state or trait anxiety.

Five items were taken from the Insomnia Severity Index\(^\text{35}\) (Cronbach’s alpha = 0.92). (1) To assess insomnia, participants were asked: “In the last two weeks, how much did you suffer from the following disturbances: difficulty to fall asleep, difficulties to maintain sleep, early morning awakening, increased daytime sleepiness?” Answers were given on a 5-point rating scale ranging from 0 = “not at all” to 4 = “very much”. (2) “How satisfied are you with your sleep?” Answers were given on a 5-point scale ranging from 0 = “very satisfied” to 4 = “very dissatisfied”. (3) “How much does sleep disturbance have a negative impact on your daily performance?” Answers were given on a 5-point scale ranging from 0 = “not at all” to 4 = “very much”. (4) “How much do you think that other people are aware that your sleep disturbance negatively influences your daily performance?” Answers were given on a 5-point scale ranging from 0 = “not at all” to 4 = “very much”. (5) “How much are you actually worried about your sleep disturbance?” Answers were given on a 5-point scale ranging from 0 = “not at all” to 4 = “very much”. The higher the sum score, the more the person believes to suffer from insomnia.

Additionally, an ad-hoc questionnaire asking about strain was administered. The entry question was: “Within the last four weeks, I was concerned about...”, followed by the statements: “…life in the family”, “…relations with peers”, “…relations with the best friend”, “…physical health”, “…my look”, “…the future”, and “…my performance at work” (Cronbach’s alpha = 0.83). Answers were given on a 4-point rating scale ranging from 1 = “not at all true” to 4 = “definitely true”. The higher the mean score, the more pronounced the strain.

Statistical analyses

T-tests for related samples were applied to calculate differences between means of sleep variables of weekdays and weekend days. Single t-tests for unrelated samples were performed to calculate mean differences between participants with high strain for work performance compared to those with low strain for work performance. Correlations between sleep, sleep-related variables, psychometric variables, and working hours were performed using Pearson’s r correlation coefficient; where appropriate, the coefficient of determination was included, which indicates in percentage the extent to which the variance of one dimension is explained and predicted by the variance of the other dimension\(^\text{36}\). Furthermore, partial correlations between ISI scores and working hours, controlling for depressive and anxiety symptoms, were performed. Test results with an alpha level of below 0.05 are reported as significant. Analyses were conducted using SPSS 15.0 for Windows.

Results

Sleep, sleep-related variables, and working hours between weekdays and weekend days

Morning ratings: To test possible weekdays-weekend shifts, means of weekdays and weekend days were averaged separately and compared using related samples t-tests: total sleep time: week days (7.27 ± 1.14; always mean ± standard deviation) vs. weekend days (7.45 ± 1.74); t(91) = –1.21, p = 0.23; sleep quality: week days (3.24 ± 1.39) vs. weekend days (3.02 ± 1.63); t(91) = –1.56, p = 0.15; mood: week days (3.01 ± 1.33) vs. weekend days (2.99 ± 1.34); t(91) = 0.16, p = 0.88; sleep onset latency: week days (19.76 ± 12.88) vs. weekend days (19.67 ± 20.31); t(91) = 0.60, p = 0.96, and number of awakenings: week days (0.88 ± 0.75) vs. weekend days (0.69 ± 1.16): t(91) = 1.50, p = 0.14. Taken together, comparisons of mean values between weekdays and weekend days did not show any significant differences.

Evening ratings: The same pattern of results was found for the evening ratings: total working hours: week days (8.77 ± 1.54; always mean ± standard deviation) vs. weekend days (8.83 ± 2.43): t(91) = –0.21, p = 0.83; mood: week days (2.63 ± 1.19) vs. weekend days (2.71 ± 1.36): t(91) = 0.60, p = 0.96; number of awakenings: week days (0.69 ± 1.16) vs. weekend days (0.69 ± 1.16): t(91) = 0.60, p = 0.96. Mood did not change in relation to weekdays and weekend days did not show any significant differences.

Intercorrelations between morning ratings, evening ratings and the Insomnia Severity Index

Table 1 shows at a glance the intercorrelations between the morning and evening ratings and the Insomnia Severity Index (ISI) score. The following correlations are highlighted (all correlation coefficients in Table 1): a good sleep quality rating in the morning was correlated with an increased mood, a shortened sleep onset latency, and a decreased number of awakenings, whereas no correlation was found between the sleep quality and the total sleep time.

With respect to the evening ratings, a good sleep quality was positively correlated with an increased mood, and negatively correlated with working hours. The total sleep time decreased in parallel with increasing working hours. The participants’ mood state correlated with sleep quality and mood in the mornings; a negative correlation was found for the number of awakenings.

Thus in the mornings, the ISI score correlated highly
and negatively with sleep quality and total sleeping time, but significantly positively with the sleep onset latency. For the evening ratings, the ISI score correlated positively with working hours: the greater the increase in working hours, the more participants indicated they were suffering from insomniac sleep disturbances. This relationship is illustrated in Fig. 1.

In sum, sleep quality, mood (morning and evening), and the ISI score were highly correlated with morning and evening ratings, and working hours and sleeping hours were highly negatively associated.

To further investigate the relationship between total sleep time and working hours, correlative computations were also performed, distinguishing between weekdays and weekend days. As shown in Table 2, working and sleeping hours correlated negatively not only for the entire week but also for separate weekdays and weekend days.

**Table 1. Intercorrelations between morning and evening ratings and the Insomnia Severity Index**

<table>
<thead>
<tr>
<th>Ratings</th>
<th>Morning ratings</th>
<th>Evening ratings</th>
<th>ISI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morning ratings</td>
<td>1 Sleep quality</td>
<td>0.65***</td>
<td>–0.37**</td>
</tr>
<tr>
<td>2 Mood</td>
<td></td>
<td>0.16</td>
<td>0.31**</td>
</tr>
<tr>
<td>3 Sleep onset latency</td>
<td></td>
<td>0.16</td>
<td>0.31**</td>
</tr>
<tr>
<td>4 Number of awakenings</td>
<td></td>
<td>0.09</td>
<td>–0.30**</td>
</tr>
<tr>
<td>5 Total sleeping time</td>
<td></td>
<td>–0.21</td>
<td>–0.46***</td>
</tr>
<tr>
<td>Evening ratings</td>
<td>6 Mood</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>7 Working hours</td>
<td></td>
<td>–0.20</td>
<td></td>
</tr>
<tr>
<td>8 ISI score</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ISI = Insomnia Severity Index (Bastien et al., 2001); higher scores refer to an increased sleep disturbance. Person’s r correlation coefficients. Rating variables such as “sleep quality” or “mood”: a higher score means that this dimension is increased; e.g.: a high score in “sleep quality” means that a person thinks that she/he sleeps well. *p<0.05, **p<0.01, ***p<0.001.

**Table 2. Intercorrelations between working hours and sleeping hours**

<table>
<thead>
<tr>
<th>Working and sleeping hours</th>
<th>Working hours</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working hours</td>
<td>Whole week</td>
<td>–</td>
<td>0.93***</td>
<td>–0.64***</td>
<td>–0.46***</td>
<td>–0.50***</td>
<td>–0.21*</td>
</tr>
<tr>
<td></td>
<td>Week days</td>
<td>0.28*</td>
<td>–0.44***</td>
<td>–0.53***</td>
<td>–0.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Weekend days</td>
<td>–0.33**</td>
<td>–0.21</td>
<td>–0.44***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleeping hours</td>
<td>Whole week</td>
<td>–</td>
<td>0.91***</td>
<td>0.75***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Week days</td>
<td>–</td>
<td>0.41***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Weekend days</td>
<td>–</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pearson’s r correlation coefficients. *p<0.05, **p<0.01, ***p<0.001.

**Fig. 1. Correlation between the sum of the Insomnia Severity Index (ISI) and the weekly working hours (Pearson’s r = 0.49, p<0.001).**
Sleep ratings, working hours, symptoms of depression, and anxiety and ISI scores

Table 3 shows at a glance the correlations between the symptoms of depression and anxiety with sleep-related values, sleeping and working hours, and the ISI scores. Statistically significant correlations are highlighted (all correlation coefficients in Table 3): High sleep quality and good mood correlated significantly with low scores on symptoms of depression and trait and state anxiety. No correlative relationships were found between sleep time and symptoms of depression and anxiety, with one exception: As sleeping hours during weekend days increased, so too did scores on the depression scale. A more differentiated picture was observed with respect to the working hours: Whereas prolonged working hours during the week were positively correlated with increased values of depression, prolonged working hours during weekend saw a significant decrease in the values of depressive symptoms and trait anxiety. In other words, the more hours the participants worked on weekend, the less they showed depressive and anxious symptoms.

The majority of ISI scores were significantly positively correlated with the depressive symptoms, and with state and trait anxiety scores. Furthermore, increased ISI scores were negatively correlated with the total sleep time over the whole week and for the weekdays, but not for weekend days. In addition, increased ISI scores were positively correlated with the working hours for the entire week, and for those of the weekdays, but not for the working hours during the weekend days. Using as cut-off points the median of the Insomnia Severity Index (ISI) (median: 7.00) and the median of the total weekly working hours (median: 7.30), participants with increased weekly working hours were 3.2 times more likely to report heightened ISI scores than those with lowered weekly working hours (OR = 3.2; 95% CI: 1.25–8.21).

To disentangle ISI scores and working hours from depressive and anxiety symptoms, partial correlations controlling for depressive and anxiety symptoms were performed. Correlations between ISI scores and working hours was $r = 0.49$, $p<0.001$, though, controlling for depressive symptoms, partial correlation increased to $r = 0.66$, $p<0.001$; controlling for trait anxiety, correlation increased to $r = 0.68$, $p<0.001$, suggesting that depressive and anxiety symptoms exerted a counterintuitive influence, that is, the absence of these psychiatric symptoms did not attenuate but increase the association between disturbed sleep and working hours.

To sum up, decreased sleep quality, negative mood, and increased ISI scores correlated with depressive and state and trait anxiety symptoms, whereas sleep and working hours were less indicative. Furthermore, depressive symptoms were positively correlated with increased sleep time during weekend days. Increased ISI scores were negatively correlated with total sleep time during weekdays but not during weekend days, and they highly positively correlated with increased working hours during weekdays. Importantly, the last correlation increased, when controlling for depressive and anxiety symptoms.

Table 3. Correlations between symptoms of depression and anxiety, sleep-related dimensions, sleep and working hours, and the Insomnia Severity Index (ISI) scores

<table>
<thead>
<tr>
<th>Psychiatric symptoms</th>
<th>Depression scale</th>
<th>State anxiety</th>
<th>Trait anxiety</th>
<th>ISI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleep quality</td>
<td>$-0.61^{***}$</td>
<td>$-0.32^{**}$</td>
<td>$-0.58^{***}$</td>
<td>$-0.51^{***}$</td>
</tr>
<tr>
<td>Mood; morning</td>
<td>$-0.53^{***}$</td>
<td>$-0.37^{***}$</td>
<td>$-0.60^{***}$</td>
<td>$-0.03$</td>
</tr>
<tr>
<td>ISI</td>
<td>$0.31^{**}$</td>
<td>$0.30^{**}$</td>
<td>$0.22^{*}$</td>
<td>—</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total sleep time</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole week</td>
<td>0.09</td>
<td>0.03</td>
<td>0.10</td>
<td>$-0.25^{*}$</td>
</tr>
<tr>
<td>Week days</td>
<td>$-0.04$</td>
<td>$-0.05$</td>
<td>$-0.05$</td>
<td>$-0.31^{**}$</td>
</tr>
<tr>
<td>Weekend days</td>
<td>$0.27^{**}$</td>
<td>$-0.16$</td>
<td>$-0.16$</td>
<td>$-0.04$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Working hours</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole week</td>
<td>0.15</td>
<td>$-0.06$</td>
<td>$-0.02$</td>
<td>$0.49^{***}$</td>
</tr>
<tr>
<td>Week days</td>
<td>$0.22^{*}$</td>
<td>0.00</td>
<td>0.04</td>
<td>$0.53^{***}$</td>
</tr>
<tr>
<td>Weekend days</td>
<td>$-0.29^{*}$</td>
<td>$-0.18$</td>
<td>$-0.25^{*}$</td>
<td>0.06</td>
</tr>
</tbody>
</table>

ISI = Insomnia Severity Index (Bastien et al., 2001); higher scores refer to an increased sleep disturbance. Always Pearson’s $r$ correlation coefficients. Rating variables “sleep quality” and “mood”: a higher score means, that this dimension is increased; e.g.: a high score in “sleep quality” means that a person thinks that she/he sleeps well. Psychopathological symptoms: a higher score means that this dimension is increased; e.g.: a high score in “state anxiety” means that she/he feels to be actually more anxious. *$p<0.05$, **$p<0.01$, ***$p<0.001$. 

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In sum, unfavourable sleep values such as sleep quality, mood (morning), and ISI scores were associated with increased strain. Increased total sleep time for the whole week was associated with increased strain for the best friend, whereas prolonged working hours during weekend were correlated with greater strain for family life and peers.

### Strain, sleep quality, and sleep-related personality traits

In a further step, we questioned the extent to which general and work-related strain was associated with sleep-related personality traits. We first correlated the general strain score with the item scores of the sleep-related personality questionnaire (FEPS I and II), and then performed single t-tests using a dichotomized variable for the strain of performance at work. The dichotomization was performed pooling the answers “not at all true” and “slightly true” to one category \(n = 64\), and the answers “often true” and “definitely true” to the other \(n = 28\). This procedure was chosen to detect more pronounced and clear-cut tendencies in our investigation of whether specific worries about strain about performance at work were also reflected in sleep-related personality traits.

The overall score of strain correlated significantly with an increased direction towards a depressive, dissatisfied and resigned attitude towards life \((r = 0.50, p<0.0001, R^2 = 0.25)\), an unsure, anxious, indecisive and easily irritated form of self-confidence \((r = 0.39, p<0.01, R^2 = 0.15)\), a tense and irritable state of mental arousal \((r = 0.35, p<0.01, R^2 = 0.12)\), worrying about unresolved problems \((r = 0.42, p<0.001, R^2 = 0.17)\), and a focus on potential sleep disturbances \((r = 0.41, p<0.01, R^2 = 0.17)\). No significant correlations were found for physical arousal, subjective sleep quality, aggressive behavior and self-perception of body sensations (all \(r’s <0.2\), and \(p’s >0.1\)).
Compared to participants with low strain for performance at work, those with high strain showed higher scores for a depressive, dissatisfied, and resigned attitude towards life (3.75 ± 1.24 vs. 2.94 ± 1.21; always mean ± standard deviation); \( t(90) = -2.40, p = 0.019 \); a tensed and irritable mental arousal (4.00 ± 2.07 vs. 2.69 ± 1.58); \( t(90) = -2.79, p = 0.007 \); a subjectively deteriorated sleep quality (6.50 ± 2.67 vs. 5.09 ± 2.36); \( t(90) = -2.18, p = 0.032 \); a focusing on potential sleep disturbances (4.50 ± 1.15 vs. 3.41 ± 1.31); \( t(90) = -3.06, p = 0.003 \), and increased values in the direction of pronounced worrying about unresolved problems (5.50 ± 1.86 vs. 3.56 ± 1.36); \( t(90) = -4.73, p = 0.000 \). No significant mean differences were found for the dimensions self-confidence, physical arousal, aggressive behaviour, and self-perception of body sensations (all \( t \)'s between -1.15 and -0.64; all \( p \)'s >0.1).

Taken together, work-, personal-, and social-related strain correlated with unfavourable personality traits such as a dissatisfied attitude towards life, decreased self-confidence, irritable mental arousal, worrying about unresolved problems, and focusing on sleep problems. Particularly, participants with high strain to perform well at work showed unfavourable values with respect to dimensions such as attitude towards life or mental arousal, compared to participants with low strain to perform well at work.

Discussion

The aim of the present study was to gain greater insight into the interplay between sleep, work, and strain of employees in the hospitality and tourism industry. Five hypotheses were formulated and each of these is now considered in turn.

Our first hypothesis was that given the 24/7 nature of the service industry with its inherent full-week working schedule, no shift towards prolonged sleeping hours on weekends would be demonstrated. The results support this hypothesis: participants’ sleep logs showed that the general pattern of sleep and sleep-related dimensions did not change between weekdays and weekend days. These data are in line with previous findings, showing that a 24/7 service leads to peculiar working schedules without attenuated weekday-weekend shifts (e.g.,\(^9\)).

Our second hypothesis was also confirmed: Working and sleeping hours were highly negatively correlated. This confirms previous research\(^7\),\(^8\) and suggests a reciprocal interdependence between sleep and working time.

The third hypothesis was that subjectively judged sleep quality and mood would better predict affective states such as depressive symptoms and anxiety than the actual amount of sleeping and working hours. This was borne out by the results: decreased sleep quality, negative mood, and increased Insomnia Severity Index scores correlated with depressive and state and trait anxiety symptoms, whereas it seemed that sleep and working hours did not allow to provide further indications. Thus, our data fit well into the broad body of research in psychiatry which underlines the close relationship between sleep disorders and generalised\(^14\), specific\(^15\), or state-trait anxiety disorders\(^16\) and depression\(^13\). Furthermore, our data provide evidence that the mere registration of sleep time is not sufficient to reliably indicate work-related sleep disturbances, confirming the findings of Nishikitani et al\(^2\). Our results are also in line with previous findings which showed that the perceived psychological work load was not necessarily reflected by the amount of working hours\(^37\).

Our fourth hypothesis was that prolonged working hours and weekend work would be correlated with an increased strain upon the individual’s social life. Increased working hours for the entire week were associated with increased strain for the best friend, whereas prolonged working hours during the weekend were correlated with more strain for family life and peers\(^7\),\(^17\),\(^18\). These results suggest a differentiated impact of work schedules on social life with a variety of social responsibilities and commitments being affected. In particular, weekend workers are at risk of ending up in a “temporal ghetto\(^6\)” in which they become socially isolated.

The fifth and final hypothesis was that participants under high strain to perform well at work would have poorer sleep quality and unfavourable values on sleep-related personality traits. Compared to participants with low strain at work, those with high strain showed unfavourable values with respect to dimensions such as their attitude towards life and mental arousal\(^11\),\(^12\). In addition, work-, personal-, and social-related strain correlated with unfavourable personality traits such as a dissatisfied attitude towards life, decreased self-confidence, irritable mental arousal, worrying about unresolved problems, and focusing on sleep problems. Importantly, since the sleep-related personality traits questionnaire rather reflects medium- and long-term processes and attitudes than short peaks of mental status\(^30\), findings derived from and in relation to this questionnaire suggest that rather longer lasting psychological dimensions and processes were assessed.

The current investigation has some methodological issues that must be kept in mind when interpreting the results, and when considering future research. One initial difficulty is the use of self-reported measures both for assessing sleep schedules and psychological dimensions such as strain and sleep-related personality traits. Although this is a very common methodological approach
in this type of research, self-reported data may be potentially biased. To counter this, the present investigation was conducted without gathering personal data, and all participants filled in the questionnaires anonymously; therefore potential conflicts of interest, or the possible risk that the questionnaires were compiled in accordance to a socially desirable image in order to impress the school administration or possible future employers are very unlikely. Furthermore, participants were not rewarded. A related problem is the participation rate of about 49%; although this sort of participation rate is not uncommon in this type of study, it restricts the generalizability of the findings. Therefore, we draw conclusion only about participants willing and able to participate at the study.

It is also important to emphasize that our findings were largely based on correlative computations: As a consequence, we were only informed about bivariate correlations between the domains of sleep, and depressive and anxiety symptoms, and not about the nature of the inter-relationships between the three areas at the same time. However, partial correlations controlling for depression and anxiety showed that the relation between sleep disruption (ISI scores) and working hours was even higher. Furthermore, correlations generally do not allow one to draw conclusions about causality; therefore, it could be argued that the issue of whether unfavourable sleep patterns lead to a loss of work quality or vice versa remains largely unanswered. However, longitudinal studies investigating the association of perceived work stress and insomnia (e.g.,\textsuperscript{11, 12, 38}) suggest that work stress causes or mediates the sleep disturbance and not vice versa. Thus, even if not evidenced by the data and therefore highly speculative, we hold that cognitive arousal\textsuperscript{12, 31} might be one of the main links in the chain between job strain and sleep problems.

It is possible that an investigation conducted with students from a school for hospitality and tourism may not adequately reflect the basic occupational and mental health status of employees working within this industry, and that the participants might have behaved according to each division’s requirements during the study period of one week. Perhaps placement students felt particularly under pressure to do their jobs well in order to achieve favourable evaluations from their employers and enhance the chance for possible future employment. Alternatively, perhaps the students’ perceived pressures are less than those experienced by individuals who are actually working in the hospitality industry. Regardless, neither alternative negates the finding that the beliefs of the set of individuals in the present study resulted in emotional consequences such as depression and anxiety, which in this instance were probably particularly associated with evaluative concerns.

We consider this finding as complementary to the growing body of research derived from other occupational areas, which underlines the close relationship between unfavourable sleep patterns and work strain\textsuperscript{9, 10, 12, 24, 25}. Bohle et al.\textsuperscript{39} referred to similar difficulties between working schedules, life-work-balance, and social life among regular and casual employees in the hotel industry.

Final potential shortcomings of the present study are that participants were not objectively assessed for physical and psychiatric disorders, which may bias the results of self-assessed sleep schedules and psychological dimensions. Similarly, consumption of substances influencing sleep and consciousness such as alcohol, caffeine, nicotine, THC, other drugs, stimulants or medicaments were not measured. Although information about the use of these substances was asked for in the daily sleep log, most participants left the answering space blank or crossed it out, and consequently statistical analyses were not possible.

**Conclusions**

Employees in the hospitality and tourism industry offer a 24/7 service but the ‘personal costs’ of this provision may be underestimated. Employees with prolonged working hours are at risk of developing symptoms of insomnia, weekend workers are at an increased risk of developing problems in managing their social interactions with family and peers, and those with decreased sleep quality are at risk of depression and anxiety.

The present study therefore adds to and confirms findings derived from similar investigations across a broad range of occupational areas (cf.\textsuperscript{21–24}). Future research should include larger samples of full-time employees and focus on refining the assessment of work-related strain. In addition, it would be useful to assess coping strategies and resources to shed some light upon how people manage short- and long-term difficulties at work. A prospective longitudinal study design should allow more clarification of the causal chain between sleep patterns and work conditions. Interestingly, our results suggested that relationships between the dimensions investigated are not necessarily linear (see for instance correlations between depressive symptoms and working hours); therefore in future studies data collection and analyses should be more fine-grained.

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