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The sociodemographic context of observed solitary and social smoking behaviours using a behavioural ecological approach

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Abstract

This study used a behavioural ecological approach by observing whether solitary and social smoking varied as a function of gender and stress. In sample 1 ($N = 414$), the result was consistent with the tend-and-befriend hypothesis, in that more female smokers were observed to engage in social smoking during high stress. When the number of smokers observed by stress condition was controlled for in sample 2 ($N = 587$), this effect was non-significant. Effect sizes were small for both samples. Discrepancies with previous research suggest that self-reported data might overestimate the interaction of various psychosocial factors on smoking behaviours.

Keywords

coping, gender, smoking, social smoking, social support, stress

Smoking can be done alone (solitary smoking) or in the company of others (social smoking). Smokers have reported a number of motives for smoking such as coping with stress and socialising with others (Delaney et al., 2018). Hence, social smoking (cf. solitary smoking) can be regarded as the smoker engaging in social affiliation with others while using tobacco. Social smoking, as a form of social affiliative behaviour, is reported by smokers to be elicited particularly during psychological stress exposure (Nichter, 2015). The prevalence of social smoking based on self-reported data has ranged from 30 to 70 percent (Berg and Lin, 2019). Social smoking is an important smoking behaviour because of its reported high prevalence and health consequence when used as a form of coping strategy for stress: even when social smoking is done intermittently (e.g. only smoke at social events), it still carries significant health risks (Inoue-Choi et al., 2019). In addition, social smokers tend not to consider themselves as 'smokers', and hence, smoking cessation services are unlikely to target social smokers effectively because social smokers are less likely to seek treatment (Berg et al., 2017).

Taylor et al.'s (2000) tend-and-befriend hypothesis postulates that social affiliative behaviours are not only elicited during periods of psychological stress but this elicitation is

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stronger among women. In this article, we attempt to test the tend-and-befriend hypothesis for social and solitary smoking. If social smokers report using smoking as a form of social affiliation activity, then this hypothesis can be tested for this behaviour. However, the complex evidence (e.g. neuroendocrine pathways, behavioural data from humans and non-human species) reviewed by Taylor et al. (2000) was circumstantial. For example, most evidence reviewed by these authors points to the main effects of stress or gender but does not specifically test the interaction of these factors in predicting social affiliative behaviours. The review also does not cover the neuroendocrine pathways (e.g. testosterone, cortisol) that have been found to regulate social affiliative behaviours among males, which would not support gender differences in social affiliative behaviours. To our knowledge, the only study that was formulated to test this hypothesis directly was reported by Bodenmann et al. (Bodenmann et al., 2015), which analysed the verbal communication between partners engaging in a conversation in a non-smoking context. They found that men's, not women's, positive (e.g. verbal statements that comfort the partner) and negative (e.g. verbal statements that dismiss the partner's experience) social support verbal communication varied more strongly as a function of stress. Our study aims to address the paucity of empirical evidence for this hypothesis using a naturalistic systematic observational approach for smoking behaviours.

In addition, the majority of research on social smoking has relied on self-reported data. For example, Moran et al. (2004) defined social smoking as participants who reported mainly smoking with other people in the last 30 days. There is evidence that smoking is an automatic habitual behaviour where people who smoke might have poor insight into the motives and causes for their smoking (Hagger et al., 2015); self-reported smoking has often been found to be inconsistent with behavioural data such as puffing behaviour (Krebs et al., 2016). In this study, we examine the prevalence and sociodemographic context of solitary and social smoking using a behavioural ecological approach. The academic setting presents a suitable environment to conduct this research because of its predictable cycle of high- and low-stress periods (e.g. Pitt et al., 2018). Using this predictable stress cycle, we observe the sociodemographic profile of individuals who engage in solitary or social smoking behaviours. Based on previous published research, we examine whether the prevalence of social smoking would be higher among women during high stress as put forward by the tend-and-befriend hypothesis (Taylor et al., 2000).

Method

Participants

Our target minimum sample size was 263, assuming a small-medium effect size of Cohen's $w = 0.20$, with the following parameters: alpha $= 0.05$, power $= 0.90$ and $df = 1$. Two samples were acquired: Sample 1 consisted of 414 individuals (256 men and 158 women), while sample 2 consisted of 587 individuals (374 men and 213 women). Sample 1 employed interval recording (i.e. 10 observation sessions done between 12:00 and 14:00 hour on weekdays), while sample 2 employed event recording (i.e. observations of social/solitary smoking prevalence for an equal number of observees between the two stress periods). This is because there are likely to be more people observed smoking during high stress periods (Pitt et al., 2018). Hence, sample 2's observational strategy controls for this. A university campus was selected as the venue for this study. This study has been approved by the institutional review board and is a pre-registered study at the Open Science Framework (www.osf.io; doi: 10.17605/OSF.IO/7GREA).

Materials

Ambient temperature influences smoking behaviours and was measured using a handheld digital metre (Benetech GM1361) which has an accuracy of ± 1°C. Ambient temperate was assessed at the start of each observation session (Table 1).

Table 1. Number of observations (%) by gender, social smoking status, and stress period.

Social smoking status	Solitary	Social	Solitary	Social	Total
Stress period	Low		High		
Sample 1, $N = 414$					
Median (range) ambient temperature, °C	4.6 (8.8)		6.2 (6.6)		
Gender	$n = 165$		$n = 249$		
Men	52 (20.3%)	42 (16.4%)	91 (35.5%)	71 (27.7%)	256
Women	34 (21.5%)	37 (23.4%)	38 (24.1%)	49 (31.0%)	158
Total	86 (20.8%)	79 (19.1%)	129 (31.2%)	120 (29.0%)	414
Sample 2, $N = 587$					
Median (range) ambient temperature, °C	10.5 (6.8)		10.6 (0.7)		
Gender	$n = 294$*		$n = 293$*		
Men	119 (31.8%)	74 (19.8%)	114 (30.5%)	67 (17.9%)	374
Women	58 (27.2%)	43 (20.2%)	59 (27.7%)	53 (24.9%)	213
Total	177 (30.2%)	117 (19.9%)	173 (29.5%)	120 (20.4%)	587

Percentages are computed within each row. *Sampling was done such that there is an equal sample size observed for low and high stress periods.

Procedure

We identified designated observation areas on a university campus where people smoke. These areas were approximately 4 × 4 m in an outdoor area. Social smoking was defined as a person observed smoking with another person or in a group as reflected in previous research using questionnaires (e.g. Moran et al., 2004). In sample 1, we used interval sampling via recording the people observed entering these areas to smoke. In sample 2, we used event sampling by observing 294 smokers during the low-stress period and 293 smokers during the high-stress period (i.e. the number of observed individuals was similar across the two stress periods). Our observations for both samples were done between 12:00 and 14:00 hours on randomly selected weekdays. The observations for samples 1 and 2 were done over the same months but on different days. For each observed smoker, we recorded the gender of the smoker and whether the smoker smoked alone or in a group. If a person smoked in a group, the first person who entered the designated area to smoke was identified as the observee. We defined group membership of a smoker in the following observed behaviours: (1) at least another person accompanied the target observee at the designated area and/or (2) engaging in a conversation with the observee. All observers made their observations at least 2 m from these designated areas to avoid tobacco smoke exposure. In line with previous research (e.g. Pitt et al., 2018), we defined high stress as periods when examinations/formative assessments occur during an academic calendar (e.g. January), while low stress was defined by the academic teaching weeks where the occurrence of formal assessments was low (e.g. November). High- and low-stress observation sessions were picked in months as close to each other as possible to minimise seasonal differences in ambient temperature. Observations were done between November 2018 and February 2019.

Results

The alpha level is set at 0.05. We tested the tend-and-befriend hypothesis in a three-way contingency table (gender × stress × solitary/social smoking behaviour) using the Cochran test of conditional independence and the Mantel–Haenszel test of conditional independence. The latter is a more conservative statistical test. In addition, we used the Mantel–Haenszel common odds ratio (OR) estimate to assess whether the gender × solitary/social smoking behaviour two-way interaction is significant after controlling for the effects of stress.

Sample 1

We observed more male smokers and more smokers during the high-stress period. We used the Cochran test of conditional independence and Mantel–Haenszel test of conditional independence to test the three-way contingency table (stress × gender × social smoking status; Table 1). Gender × social smoking × stress interaction was of borderline significance: the Cochran test of conditional independence, χ^2 (1, n = 414) = 4.19, p = 0.04, Φ = 0.10, the Mantel–Haenszel test of conditional independence, χ^2 (1, n = 414) = 3.77, p = 0.05, Φ = 0.10. According to Cohen (1988), Φ = 0.10 is considered a 'small' effect size. The trend of the observations is consistent with the tend-and-befriend hypothesis: more female smokers were observed engaging in social smoking during high stress than male smokers. Controlling for stress periods, there was a gender difference in social and solitary smoking: the Mantel–Haenszel common odds ratio estimate was significant, OR = 1.52, p = 0.04, 95 percent confidence interval (CI) (2.26, 1.02). When controlling for stress, female smokers were significantly more likely to be observed engaging in social smoking (54.4%) than male smokers (44.1%).

Sample 2

The gender × social smoking × stress interaction was non-significant: the Cochran test of conditional independence, χ^2 (1, n = 587) = 3.03, p = 0.08, Φ = 0.07, the Mantel–Haenszel test of conditional independence, χ^2 (1, n = 587) = 2.72, p = 0.10, Φ = 0.07. Controlling for stress, the gender × social smoking was also non-significant for this sample, and the Mantel–Haenszel common odds ratio estimate was significant, OR = 1.35, p = 0.08, 95 percent CI (1.91, 0.96).

Discussion

We believe our study is the only study that has examined the psychosocial context of solitary and social smoking using a behavioural ecological approach. Our results provided inconsistent support for the tend-and-befriend hypothesis (Taylor et al., 2000) with relation to observed social smoking behaviours. In sample 1, our results were consistent with this hypothesis: female smokers were marginally more likely to engage in social smoking than male smokers during high-stress periods. However, this gender difference in social smoking was also present for both low- and high-stress periods. Results from sample 2 indicate that a significant factor in the borderline significant results obtained in sample 1 was partly due to the sample size differences obtained between high- and low-stress periods. Regardless of its statistical significance, we found that the effect sizes associated with this hypothesis were small.

Previous research found that college students reported that they were more likely to engage in social smoking during periods of high stress as a coping strategy (Nichter, 2015). Our observational data did not support this finding: in both samples, the prevalence of social smoking, a specific form of smoking observed in our samples, did not increase as a function of stress. The increase in social smoking observed in sample 1 during the high-stress period is due to the higher number of people observed (solitary and social) smoking during this period. When this sample size difference was controlled for, social smoking had a stable prevalence across the two stress levels. The prevalence of social smoking that we have observed in our two

samples was lower when compared to that derived from self-reported data: when compared to what previous research has found (Berg and Lin, 2019), self-reported data overestimated the prevalence of social smoking by about 10–30 percent when compared to our observations. Our observational data were congruent with national survey data that reported a higher prevalence of smoking behaviours among men when compared to women (http://ons.gov.uk) as well as higher smoking likelihood during high stress (Pitt et al., 2018).

The relative contextual stability of social smoking, a specific form of smoking behaviour, found in our two samples suggests that people's tendency to engage in social or solitary smoking is likely to be an automatic and stable behaviour rather than one that fluctuates significantly with changes in psychosocial context. Such habit stability could be due to personal preference towards solitary/social smoking, the half-life of nicotine and its association with craving and withdrawal symptoms (e.g. every 2 hours) or at specific regular events (e.g. meal times; Pokhrel et al., 2015). Our results suggest the need to validate questionnaire-based findings about the social and psychological motives surrounding smoking behaviours using other non-self-reported data. The discrepancies between self-reported and observed smoking behaviours suggest that smokers might have poor psychological insight about the causes and motives that influence their habitual behaviours such as smoking (Hagger et al., 2015).

Our study has a few limitations. First, our results do not reject the proposition that there are significant main effects for stress and gender that influence smoking behaviours. On the contrary, our data are consistent with the main effects of stress and gender on smoking behaviours. We did not, however, find consistent or strong evidence to indicate that people's tendency to engage in social smoking varied as a function of the interactive effects of gender and stress levels. In other words, more men smoke, more people smoke when under stress, but women do not necessarily smoke more with others when under stress. Second, our operationalisation of social smoking did not include this behaviour as observed in other venues (e.g. at parties). The higher prevalence of social smoking reported in previous research might be due to smokers using a specific salient context where socialising is a core activity (e.g. at parties) as a reference point to overestimate their average social smoking frequency (i.e. confirmatory bias). Third, our observations did not include whether a social smoker smokes regularly or not; our studies were anonymous observations and did not collect within-person smoking behaviour data. Finally, we classified the gender of our observees based on physical appearance, and gender identity could not be assessed via observational methods. However, a meta-analysis found that the prevalence of discrepancies between sex and gender identity (e.g. gender dysphoria) is low (i.e. 4.6/100,000; Arcelus et al., 2015), and hence, gender misclassification is unlikely to affect our results significantly. Future research might wish to apply our methods to address these limitations. In addition, although ambient temperature was similar across the stress periods within each sample, future studies could conduct observations across a wider ambient temperature range and include them into the statistical model.

In conclusion, our studies found that the effects for the tend-and-befriend hypothesis among female smokers are inconsistent and weak. Significant result for this hypothesis could partly be explained by the sample size difference observed for smoking between high- and low-stress periods. The patterns of observed solitary and social smoking behaviours are also discrepant with previous research based on self-reported data. Our naturalistic systematic observation of smoking behaviours suggests caution in concluding smoking behaviours based on what smokers' report about the circumstances and motivations influencing their smoking habits, that is, a smoker's psychological representation of their smoking behaviours might not be congruent with their actual smoking behaviours.

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