



# Utrecht University

**It's bedtime! Investigating the Effect of a Motivational Intervention based on the Theory of Planned Behaviour on Bedtime Procrastination**

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## Abstract

**Background.** Bedtime procrastination, delaying going to bed on time for no reason, is an increasingly common problem in today's world. The negative consequences of bedtime procrastination on both mental and physical health are widespread which calls for effective and evidence-based interventions.

**Objective.** This study investigated an intervention based on the components of the theory of Planned Behaviour (attitudes, subjective norms, perceived behavioural control, intentions) (Ajzen, 1991), that targeted the motivational phase of bedtime procrastination behaviour.

**Method.** This quantitative, pre-post design study measured TPB variables and bedtime procrastination levels before and after the intervention, which was delivered to participants via email.

**Results.** Participant bedtime procrastination levels, measured by the Bedtime Procrastination Scale (Kroese et al., 2014), were significantly improved following this intervention, however some TPB variables remained unchanged (subjective norms and perceived behavioural control).

**Conclusions.** The present study is the first study to apply the TPB to an intervention targeting bedtime procrastination and provides important baseline evidence for future research.

**Keywords:** Bedtime procrastination, Theory of Planned Behaviour, motivation, behaviour

## Introduction

Bedtime procrastination is an emerging topic of research in procrastination studies that has been identified as the driving force behind insufficient sleep for a large portion of the population (Shukla & Andrade, 2023). Kroese and colleagues (2014) defined bedtime procrastination as failing to go to bed at the intended time, despite there being no external circumstances that prevent a person from doing so. This domain of procrastination has gained traction and has become increasingly relevant in recent years partly due to the rapidly developing technological world, which offers individuals more devices that can be used as tools to procrastinate and postpone the time they go to bed at (Chung et al., 2020). General procrastination behaviour is most common among young adults (Kim & Seo, 2015), whereas bedtime procrastination has been found across all age groups in the general population, resulting in widespread insufficient sleep (Kroese et al., 2016). However, some specific groups have been found to be especially at risk for problematic bedtime procrastination, such as new graduates from tertiary education starting a full-time job (Hill et al., 2024). The prevalence of bedtime procrastination in the general population is concerning and highlights the need for more studies, such as the current one, to understand the underlying mechanisms of this type of procrastination. The current study aims to address this problem behaviour by testing a theory-based intervention on bedtime procrastination levels.

Experts recommend that adults and young adults should get seven to nine hours sleep per night and older adults should get seven to eight hours sleep per night to maintain health and well-being (Hirshkowitz et al., 2015). However, it is estimated that about one third of the general population does not get the recommended amount of sleep (Grandner, 2019, p. 2). There have been many factors suggested to explain the prevalence of sleep problems in the population, including socioeconomic status (Chang & Chiang, 2020), irregular working schedules (Weston et al., 2024) caffeine consumption and electronic media use (Owens et al., 2014). However, alternative explanations for sleep insufficiency have also been explored in recent research. A study carried out by Kroese and colleagues (2016) investigated the association between self-regulation, bedtime procrastination and sleep insufficiency and found that bedtime procrastination mediated the relationship between self-regulation and insufficient sleep (Kroese et al., 2016). This highlights the key role of bedtime procrastination in getting the recommended amount of sleep.

Bedtime procrastination has been coined a serious health-interfering behaviour (Chung et al., 2020) due to its association with insufficient sleep and the resulting negative consequences that impact individuals' physical and mental health. This is because bedtime procrastination acts as a major barrier to achieving the recommended sleep every night. If individuals continuously fail to get the recommended amount of sleep per night, they become at risk for experiencing sleep deprivation, which has been linked to an increased risk of developing serious health conditions such as coronary heart disease (CHD) (Hoevenaar-Blom et al., 2011a), type 2 diabetes (Ogilvie & Patel, 2018) and obesity (Di Milia et al., 2013). For example, people who slept for six hours or less per night had a 23% higher risk of developing CHD compared to people who got seven hours or more sleep per night (Hoevenaar-Blom et al., 2011). An increased risk of developing type 2 diabetes has also been linked with insufficient sleep and may also predict worse outcomes for individuals with existing diabetes (Ogilvie & Patel, 2018). These findings emphasise the importance of tackling bedtime procrastination behaviour that may be preventing individuals from getting enough sleep in order to avoid an increased risk of developing serious health conditions.

Insufficient sleep has also been linked to cognitive and mental health conditions. Killgore and colleagues (2010) identified that sleep deprivation has a profound negative effect on aspects of sensory perception, emotion and long-term memory, as well as complex cognitive processes like language, mental flexibility, concept formation and decision making. Impairments of these important cognitive functions can have severe consequences in daily life, making simple tasks more effortful and reducing performance. Getting six hours of sleep or less was identified as the main risk factor for developing clinical burnout among working professionals (Söderström et al., 2012), highlighting how insufficient sleep can impact different groups of people in the population. The link between sleep and depression has also been well documented in the literature, with disturbances of circadian rhythms being a fundamental feature of psychiatric conditions like major depressive disorder (Pandi-Perumal et al., 2020). Increasing the duration and quality of sleep has been found to reduce and regulate depressive symptoms in sleep deprived individuals (Cahuas et al., 2020), further highlighting the importance of addressing challenges individuals face in getting enough sleep, like bedtime procrastination.

Bedtime procrastination may also have more, further reaching consequences apart from insufficient sleep. For example, general procrastination behaviour has been found to have negative emotional consequences which were also significantly related to

procrastination (Blikra, 2022), resulting in a vicious cycle of negative emotions and procrastination. This study also found that procrastination behaviour predicted lower satisfaction with life scores in participants, meaning that people who experienced negative emotions as a result of procrastination were generally less satisfied with their lives. This is a significant consequence as life satisfaction is a key indicator of social, interpersonal, psychological and behavioural outcomes (Proctor et al., 2017).

Efforts have been made to understand how the domain of bedtime procrastination operates and how it can be overcome in order to avoid the negative consequences discussed above. Despite these efforts and the burgeoning research base investigating this type of procrastination, bedtime procrastination has yet to be explored through the lens of well-established behavioural theories. The application of theories when designing behaviour change interventions is considered an effective approach, with interventions underpinned by theoretical models widely used when targeting health behaviours (Fortier et al., 2012; Gourlan et al., 2016). A meta-analysis review conducted by Webb and colleagues (2010) investigated the use of theory while designing interventions and concluded that interventions had larger effects when theories were employed (Webb et al., 2010). The use of theoretical frameworks when developing behavioural interventions is important, as theories specify a set of predictors that describe and predict a particular behaviour, which can be targeted by the intervention to generate behaviour change (Lippke & Ziegelmann, 2008).

A popular theory that has been applied to various health behaviours is the Theory of Planned Behaviour (TPB) (Ajzen, 1991), which posits that the intention to engage in a behaviour is determined by attitudes, subjective norms and perceived behavioural control. The TPB accounts for the motivational phase of behaviour which is the first phase of behaviour according to Gollwitzer (1993) and describes the energising process and directing tendency of behaviour (Blanke et al., 2017). TPB-based interventions target behavioural intentions, which in turn should influence actual behaviour, as intentions are considered to be the immediate antecedent of behaviour and are directly linked in the TPB model (Gratton et al., 2007). Motivation and behaviour intentions are intrinsically connected as the strength of the motivation increases or reduces the intention to carry out a particular behaviour (Blanke et al., 2017).

The objective of TPB based interventions is to manipulate the model's determinants (attitude, subjective norms and perceived behavioural control) in order to observe if any

changes in these variables lead to behaviour change in the target behaviour. Interventions based on the TPB have been proven to be effective in targeting behavioural intentions in different domains such as binge drinking (French & Cooke, 2012), smoking (Higgins & Conner, 2003), academic procrastination (Essink, 2022), sleep (Lao et al., 2016) and healthy eating (Gratton et al., 2007). Kothe and colleagues (2012) evaluated how effective the TPB was in increasing fruit and vegetable consumption using a series of TPB-based emails targeting attitudes, subjective norms and perceived behavioural control towards consuming fruits and vegetables. Their results showed an increase in consumption of fruit and vegetables among participants and researchers noted the success of the email-based intervention, which also demonstrated the effectiveness of this mode of delivery for TPB interventions.

The TPB has been shown to be an effective method in affecting change in many health behaviours, as outlined above, however it has yet to be applied to the behaviour of bedtime procrastination. Its success in altering intention and behaviour in other behavioural domains is a promising indicator that it may be effective in influencing bedtime procrastination, which is a relatively newly researched concept in the literature and warrants more investigation.

### **Aims and Hypotheses**

In the current study, the behaviour of bedtime procrastination will be targeted by developing a motivational intervention based on the components of the TPB; attitudes, subjective norms and perceived behavioural control. This intervention will take the form of a series of emails containing information about bedtime procrastination that aims to alter participants' attitudes towards bedtime procrastination, their assumptions about subjective norms surrounding the behaviour and their perception of their level of behavioural control relating to bedtime procrastination. This intervention will aim to influence participants' behavioural intention towards bedtime procrastination, which is hypothesised to consequently impact their actual behaviour, as outlined in the TPB model.

This is a unique study as it is the first time the TPB has been used to attempt to explain the mechanisms of bedtime procrastination and the first time this theory has been applied to an intervention targeting this behaviour. This study will contribute to the general theoretical understanding of bedtime procrastination, while also laying the groundwork for



future researchers exploring motivational and theory-based interventions for this widespread problematic behaviour.

This study hypothesises that bedtime procrastination will decrease from time one, prior to the motivational intervention, to time two, following the intervention. It is also hypothesised that actual bedtime procrastination behaviour will improve from time one to time two. Additionally, it is hypothesised that the TPB components (attitudes, subjective norms, perceived behavioural control and intentions) will change from time one to time two.

## Methodology

### Design

This study was a quantitative, pre-post-test design that measured levels of bedtime procrastination and theory of planned behaviour components including attitudes, subjective norms, perceived behavioural control and intentions in relation to bedtime procrastination. These variables were assessed at two time points: before and after the administration of a motivational intervention for bedtime procrastination. This design was used as it is an important first step in investigating the effects of an intervention on a behaviour before more extensive and larger randomized controlled trials are conducted.

### Participants

Inclusion criteria for participation in this study included being 18 years of age or older and fluency in the English language, which was outlined in the consent form (see Appendix A). Participants were recruited using the convenience sample method and the snowball sampling method and were recruited online via social media platforms such as LinkedIn, WhatsApp, Instagram and Facebook. A variety of social media platforms were used to reach all demographics of participants, in order to gain a representative sample of participants.

The desired sample size for this study was 34 participants, calculated using the G\*Power calculator which is a software used to determine the power for statistical tests, based on a medium effect size. The actual sample size was 42 participants.

The ages of participants ranged from 19 to 65 years ( $M = 30.63$ ,  $SD = 14.3$ ). In terms of gender, 9 participants were male (22%), 31 were female (75.6%) and 1 was non-binary (2.4%). Almost half of participants indicated Ireland as their country of residence (48.8%), followed by the Netherlands (39%), Australia (4.9%), United Kingdom (4.8%) and Germany (2.4%).

This study was granted ethical approval by the Ethical review board of the Faculty of Social and Behavioural Sciences of Utrecht University (reference number 24-0410).

## **Instruments/Measures**

**Bedtime procrastination.** Bedtime procrastination was measured using the bedtime procrastination scale (BPS) (Kroese et al., 2014), a nine-item scale answered on a Likert scale ranging from 1 (*almost never*) to 5 (*almost always*) (see Appendix B). An example of an item on this scale was, 'Often I am still doing things when it is time to go to bed.' A total BPS score ranging from 9-45 is generated by summing all items on the questionnaire for each participants' response. Questions 2, 3, 7 and 9 were negatively phrased and required reverse coding. There have been no clinical cut-off scores established for this scale, however higher scores indicate higher levels of bedtime procrastination. The BPS has been demonstrated to be reliable in previous studies with high internal consistency ( $\alpha = 0.92$ ) (Kroese et al., 2014).

**Theory of planned behaviour components.** TPB components (attitudes, subjective norms, perceived behavioural control and intentions) were measured using a TBP questionnaire which was formulated for the purpose of this study using guidelines from Fishbein & Ajzen (2010; see Appendix B). This questionnaire included six items which assessed each component of the TPB in relation to bedtime procrastination. See Table one for an overview of these questions. Participants indicated their answers on a seven-point adjective Likert scale. Scores for each measure were assessed separately, with higher scores indicating stronger attitudes, subjective norms, behavioural control and intentions towards bedtime procrastination (Kothe et al., 2012). Average subjective norm and perceived behavioural scores were calculated as there was two measures for each of these concepts.

**Table 1***TPB questionnaire*

TPB component	Question	Response options
Attitudes	Going to bed at the time I intend to would be:	Very bad, bad, neither good nor bad, good, very good
Subjective norms	My family and friends approve of me going to bed at the time I intend to go at:	Strongly agree, agree, neither agree nor disagree, disagree, strongly disagree
	People similar to me go to bed at the time they intend to:	Strongly agree, agree, neither agree nor disagree, disagree, strongly disagree
Perceived behavioural control	I am confident that I can go to bed at the time I intend to:	Strongly agree, agree, neither agree nor disagree, disagree, strongly disagree
	I can control whether or not I go to bed at the time I intend to:	Strongly agree, agree, neither agree nor disagree, disagree, strongly disagree
Intentions	I plan to go to bed at the time I intend from now on...	Very likely, likely, neutral, unlikely, very unlikely

**Behaviour.** Actual bedtime procrastination behaviour was measured using one item at the end of the survey that asked participants, ‘How many days out of the past 7 days have you successfully went to bed at the time you intended to?’ (see Appendix B).

**Demographics.** Basic participant demographics were collected including gender and age. This was to gain a general understanding of the participants who took part in this study.

Guidelines for asking for gender information on psychological surveys were consulted before creating the gender measure on this survey (Cameron & Stinson, 2019) (see Appendix B).

## **Procedure**

Data collection for this study took place from the 19th of March 2024 until the 10th of May 2024. Recruitment for this study took place predominantly through social media platforms including LinkedIn, WhatsApp, Instagram and Facebook. Participants were provided with a clickable link that led them to the Qualtrics survey. They were presented with an information sheet (see Appendix C) that explained the requirements and details about the study. Participants were then asked to indicate their consent to take part by completing the consent form. If participants answered 'no' on the consent form for any of the items, they were directed to the end of the survey and were not allowed to participate. Once participants completed the survey, they received three emails over the course of five days, on days one, three and five, which contained information on bedtime procrastination which targeted attitudes, subjective norms and perceived behavioural control towards bedtime procrastination. (see Appendix D). The content of these emails was designed using the guidelines from the taxonomy of behaviour change techniques (Abraham & Michie, 2008). These guidelines were developed by carrying out an extensive systematic review to assess whether changing cognitions specified by the Theory of Planned Behaviour resulted in changes in intention and behaviour (Abraham, Kok, Schaalma, & Luszczynska, 2010). See Table two for an overview of the content of the emails sent to participants. Two weeks after participants received the final email, they received another email containing the link to the follow-up survey, which contained the BPS and the TPB survey questions.

**Table 2***Overview of behaviour change techniques used in intervention emails*

TPB component	Definition	Content of email
Attitude	The degree to which a person has a favourable or unfavourable evaluation of behaviour	Provide information relating to the health consequences of bedtime procrastination, and benefits of getting adequate sleep
Subjective norm	Perception of social expectations to adopt a particular behaviour	Encouraging participants to think about their family and friend' behaviour and if it matches their own. Information about how other people judge this behaviour
Perceived behavioural control	Belief about whether one can control their performance of a behaviour	Telling the person that they are capable of overcoming bedtime procrastination and giving them advice on how to do it
Intention	Decision to engage in behaviour	Asking participants if they intend to go to bed on time in the next week. Matches with behaviour question which asks how many days of the previous week they have gone to bed on time at

**Analyses**

Statistical analysis was carried out using the statistical software package SPSS, version 29. The independent variable in this study was the motivational intervention delivered through a series of emails that targeted the TPB components; attitudes, subjective norms, perceived behavioural control and intentions in relation to bedtime procrastination. The dependent variables were bedtime procrastination, as measured by the BPS, and TPB components, as measured through the TPB questionnaire.

Before statistical analysis took place, preliminary analysis of the sample took place using SPSS, to gain an understanding of the profile of the participants that took part in the study. Correlations between these descriptive variables were also analysed.

Assumptions of paired sample T-tests were first checked to ensure the analysis was suitable for the data set. Normality was checked by visually examining the histogram and Q-Q plots and running a Shapiro-Wilks test. Once the assumptions were satisfied, a paired samples t-tests were used to investigate changes in bedtime procrastination and TPB components between two time points, pre-intervention and post-intervention.

## Results

### Preliminary analysis

A total of 94 participants took part in the initial survey at time one, with 42 participants completing the follow up survey at time two. Participants were matched using the unique identifying code they provided in the initial survey. Twenty-four responses were removed as their responses on the initial survey were not complete and 28 people failed to complete the follow-up survey. Incomplete responses were defined as responses from respondents who started the survey but failed to finish it. Fifty-two responses were removed including incomplete responses from the initial survey and responses from participants that did not return to complete the follow up survey. This resulted in an attrition rate of 55.32% from pre- to post-measurement.

Assumptions of paired sample t-tests (Pallant, 2020) were tested before data analysis could be carried out. The assumption of normality was met once one outlier was removed that was deemed an invalid response upon visual inspection. The normality of the dependent variable (BPS scores) was checked by visually inspecting the histogram, which had an approximate bell shaped pattern, and the Q-Q plots which showed no outliers, once the one case was removed. The Shapiro-Wilks test also produced non-significant results once the one outlier was removed. The independence of observations was checked using a scatter plot, which showed a random pattern of responses, indicating independence of observations.

The Bedtime Procrastination Scale demonstrated strong internal consistency in this study with a Cronbach's alpha score of  $\alpha=0.89$ . Scores on the initial Bedtime Procrastination Scale (BPS) ranged from 15 to 39 ( $M = 29.24$ ,  $SD = 5.9$ ) (see Table 3) out of a possible range of 9 to 45. There have been no clinical cut-off scores established for this scale, however higher scores indicate higher levels of bedtime procrastination. Approximately 70% of participants scored over the midpoint score of 27, indicating higher levels of bedtime procrastination. Scores on the BPS in the follow-up survey ranged from 14 to 37 ( $M= 27.49$ ,  $SD= 5.76$ ) (see table 3). Approximately 51% of participants scored above the midpoint score of 27.



**Table 3**

*Mean and Standard Deviation of initial BPS scores and follow-up BPS scores (n= 41)*

	<i>M</i>	<i>SD</i>	<i>P value</i>
Initial BPS scores	29.24	5.898	.002
Follow-up BPS scores	27.49	5.762	.002

### **Paired Sample T-test**

A paired sample T-test was performed to evaluate if there was a significant change in total bedtime procrastination scores before and after the motivational intervention. Results indicated that there was a significant difference between BPS scores before ( $M= 29.24$ ,  $SD= 5.9$ ) and after ( $M= 27.49$ ,  $SD= 5.76$ ) the intervention,  $t(40) = 3.347$ ,  $p = .002$ . This confirms the first hypothesis that BPS scores will decrease from pre-measurement to post measurement.

Paired sample T-tests were also carried out to investigate if there were any significant changes in the components of the theory of planned behaviour (attitude, subjective norms, perceived behavioural control and intention) before and after the motivational intervention (see Table 4). Results showed that there were significant changes in attitudes and intentions towards bedtime procrastination from pre-measurement to post measurement, while there were no significant changes in subjective norms or perceived behavioural control. Participants' attitudes towards bedtime procrastination improved significantly after the intervention ( $M= 4.54$ ,  $SD= .505$ ) compared to before the intervention ( $M= 4.34$ ,  $SD= .530$ ),  $t(40) = -2.720$ ,  $p = < .05$ . The effect size, measured by Cohen's  $d$ , was 0.46, indicating a small to medium effect size (Cohen, 1988). The effect size measures the strength of the relationship between variables (Diener, 2010). Participants' intentions towards bedtime procrastination also significantly improved from pre intervention ( $M= 3.05$ ,  $SD= 1.024$ ) to post intervention ( $M= 3.39$ ,  $SD= .997$ ),  $t(40) = -2.870$ ,  $p = < 0.05$ . The effect size, measured by Cohen's  $d$ , was 0.76, indicating a large effect size. The findings thus partly supported the

second hypothesis that the TPB components of attitudes and intention would change from pre-measurement to post measurement.

A mean subjective norm and perceived behavioural control score was calculated for each participant before the paired sample t-test was run, as these components were both assessed using two measures on the TPB questionnaire. This test revealed no significant change in mean subjective norm or mean perceived behavioural control from before to after the intervention. Therefore, the hypothesis that TPB variables would change after the intervention was partially rejected.

Actual bedtime procrastination behaviour was assessed using one measure which was asked to participants before and after the intervention; “How many days out of the past 7 days have you successfully went to bed at the time you intended to?” There was no significant difference in how many days participants reported going to bed at the intended time before and after the intervention. However, the percentage of participants who reported going to bed at the time they intended to more than 4 nights in the previous week increased from 36.6% to 41.5%. This result means that the hypothesis, that actual behaviour would improve from time one to time two, was not supported. For a list of correlations between variables, see Table 5.

**Table 4***Mean and standard deviation of TPB variables at time one and time two*

	<i>Time one</i>		<i>Time two</i>		<i>P value</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Attitudes	4.34	.530	4.54	.505	.010*
Subjective norms					
Measure one	3.78	.936	3.71	.814	.618
Measure two	3.05	.805	3.17	.892	.360
Average subjective norm					.819
Perceived behavioural control					
Measure one	3.22	1.129	3.56	.923	.037*
Measure two	3.73	.975	3.85	.882	.529
Average PBC					.230
Intentions	3.05	1.024	3.39	.997	.007*

\*Correlation is significant at the 0.05 level (2-tailed)

**Table 5***Correlation Matrix of study variables*

		1	2	3	4	5
1. Gender	Pearson correlation	1	-0.060	-0.220	-0.010	0.111
	Sig (2-tailed)		0.708	0.168	0.950	0.489
	N	41	41	41	41	41
2. Initial BPS score	Pearson correlation	-0.060	1	.524**	-.382*	-0.149
	Sig (2-tailed)	0.708		0.000	0.014	0.354
	N	41	41	41	41	41
3. Follow-up BPS score	Pearson correlation	-0.220	.524**	1	-.434**	-0.305
	Sig (2-tailed)	0.168	0.000		0.005	0.053
	N	41	41	41	41	41
4. Initial behaviour	Pearson correlation	-0.010	-.382*	-.434**	1	.735**
	Sig (2-tailed)	0.950	0.014	0.005		0.000
	N	41	41	41	41	41
5. Follow-up behaviour	Pearson correlation	0.111	-0.149	-0.305	.735**	1
	Sig (2-tailed)	0.489	0.354	0.053	0.000	
	N	41	41	41	41	41

\*\*Correlation is significant at the 0.01 level (2-tailed)

\* Correlation is significant at the 0.05 level (2-tailed)

## Discussion

The current study examined the effect of a motivational intervention targeting the components of Ajzen's Theory of Planned Behaviour (TPB; 1985), attitudes, subjective norms, perceived behavioural control and intentions, on bedtime procrastination levels in a sample of 41 participants. The results supported the first hypothesis of this study that bedtime procrastination scores would decrease following the application of the motivational intervention. The results only partially supported the second hypothesis that the TPB components would change from before the administration of the motivational intervention to after. While attitudes and intentions towards bedtime procrastination increased from pre- to post measurement, there was no significant change in subjective norms or perceived behavioural control from before the intervention to after the intervention. Additionally, the results did not support the third hypothesis, that there would be an improvement in actual bedtime procrastination behaviour after the intervention.

Participant scores on the bedtime procrastination scale were significantly lower following the intervention on the one-week follow up survey, as measured by the bedtime procrastination scale, a nine-item self-report scale. As discussed previously, bedtime procrastination has been termed as a serious health interfering behaviour (Chung et al., 2020). Bedtime procrastination is a relatively newly explored concept in the procrastination literature (Kroese et al., 2014) which calls for studies, like the current one, that explore potential approaches to tackling this behaviour and establishing a strong theoretical groundwork for future research. The significance of bedtime procrastination interventions is increasingly pertinent in today's society, with work and lifestyle routines facing increasing demands due to globalisation trends, new technology and changing working culture (Antilla et al., 2021). This study's results are promising, as they provide the first evidence for the usefulness of motivational interventions for reducing bedtime procrastination and provides the possibility of investigating the effect of such interventions on other procrastination behaviours.

The intervention tested in this study was a motivational intervention, which targeted people's motivation to engage in bedtime procrastination behaviour by directly manipulating the TPB components, attitudes, subjective norms, perceived behavioural control and intentions towards bedtime procrastination. The TPB targets the motivational aspect of behaviour, as it involves individuals developing their behavioural intention towards a certain

behaviour based on their attitude, subjective norm, and perceived behavioural control (Gratton et al., 2007). According to Ajzen (1991), the intention to engage in a certain behaviour is determined by these components, which are linked to actual behaviour in his theoretical model. Results from this study showed positive increases in attitudes and intentions towards bedtime procrastination after the application of the motivational intervention, which should theoretically have a positive impact on behavioural intention, and therefore on actual bedtime procrastination behaviour according to Ajzen's model. However, there was no significant change in actual bedtime procrastination behaviour, assessed by asking how many nights from the previous 7 days did participants go to bed on time at. This was an interesting finding due to the significant change in intentions from pre-measurement to post measurement. However, there could be a number of alternative reasons to bedtime procrastination for people not going to bed at the time they intended to, including irregular working schedules and late social events. Despite the absence of a significant result, there was a positive trend in how many days participants went to bed on time at in the previous seven days in the follow-up survey. Some researchers propose that Ajzen's theory does not account for factors such as past behaviour, habitual behaviour, social comparison and personality traits, and their role in connecting intention to behaviour (Ajzen, 2011). This intention-behaviour gap could explain why there was a significant decrease in scores on the BPS yet there was no improvement in actual sleep behaviour recorded in this study. The intention-behaviour gap seen here is a major criticism of the TPB and has been seen in other health behaviour studies (Sultan et al., 2020). A more accurate and targeted measure of bedtime procrastination behaviour may also be warranted in this context, for example by asking participants how long they stayed awake after the time they intended to go to bed at, in order to more accurately assess the extent of the intention-behaviour gap in this case.

The lack of significant change in subjective norms and perceived behavioural control after behavioural interventions has been seen in other studies. In a study investigating an intervention based on the TPB components on academic procrastination (Essink, 2022), there was no change in TPB components following the intervention. This result mirrors the findings in Gratton and colleagues' study (2007), who found that their motivational intervention targeting TPB components to promote children's fruit and vegetable consumption did not have a significant effect on any of the TPB variables. Given that there was a significant change observed in attitudes and intentions after the intervention in the

current study, this may suggest that TPB based interventions may be more effective in changing certain behaviours compared to others.

The mode of delivery for the motivational intervention in the current study was via participant email, which was modelled from a similar study by Kothe et al., (2012). This mode of delivery was chosen due to its convenience, low cost and previous success in delivering behavioural interventions. For example, Kothe and colleagues' findings suggested that an intervention based on automated emails could be effective in targeting their behaviour of interest, fruit and vegetable consumption in young adults (Kothe et al., 2012). Additionally, Essink's 2022 study on academic procrastination delivered their intervention via email with positive results. In the current study, there was a high drop-out rate from participants completing the baseline survey to the follow-up survey, with 28 participants failing to complete the follow-up survey two weeks after the intervention was finished. The design of the intervention should be considered in future studies, in terms of the length of the intervention. On the one hand, a longer intervention than the current study's one week duration consisting of three emails, may not be optimal. On the other hand, a longer study duration may also offer the opportunity to observe the longer-term effects this motivational intervention on bedtime procrastination which could be useful to examine. Additionally, participant feedback on the current study noted that they often forgot about emails and did not monitor their inbox frequently, which might have hindered the effectiveness of the intervention.

### **Limitations**

While the design of the current study was important to demonstrate that an intervention based on the TPB components could be applied to the behaviour of bedtime procrastination, the design also has some limitations. The pre-post measurement analysis that was conducted in the present study may limit the extent to which the effect of the motivational intervention can be interpreted. Of note, this design was not able to determine definitively if the change in the TPB components post-measurement was determined by the effects of the intervention. However, the present study's findings provides preliminary evidence to suggest that this motivational intervention may be effective in decreasing levels of bedtime procrastination, but the replication of these findings using a more rigorous scientific analysis is warranted. A randomised controlled trial design with a control group

would provide clearer evidence of any potential intervention effects and address the limitations of the current study.

The follow-up time allowed in this study after the administration of the motivational intervention may represent another limitation. The follow-up survey was sent to participants via email two weeks after the final intervention email was sent. This relatively short follow-up period was used in order to avoid a large attrition rate from time one to time two and for the purpose of completing data collection in a reasonable time. Given this follow-up time period, it is difficult to determine if the effects of the intervention seen on bedtime procrastination scores are likely to be maintained over time. Therefore, a long follow-up period may be more useful to allow participants to implement changes in their routine. Despite the short follow-up period and the use of reminder emails, the drop-out rate in this study was approximately 55%. This could be due to the chosen mode of delivery of the intervention in this study, via email. Once the email is sent, it is of the participants own volition whether they open the email and read the information presented. If someone does not have notifications activated on their device, they may not discover the email until they check their inbox. Participant engagement plays a crucial role in how successful email based interventions are (Danaher & Seeley, 2009). More steps should be taken in future interventions to make the email format more appealing and engaging for participants to avoid a large attrition rate on the follow-up survey. A more effective mode of delivery may be through an interactive app that delivers notifications regularly straight to participants mobile device. This would also offer the opportunity for researchers to adjust the follow-up period as desired and collect data on more variables. This mode of delivery was not possible in the current design due to time and financial constraints.

## **Implications and Recommendations**

One of the main implications of the current study is that the results offer tentative support for the usefulness of applying theory when designing behavioural interventions to produce effective, theory-driven interventions that target variables influencing the problematic behaviour. Research has confirmed that interventions designed using behavioural theories are effective in changing behaviour in 'real world' settings (Hagger & Weed, 2019). In particular, the current study offers support for the use of theory based motivational interventions to reduce levels of bedtime procrastination, a relatively unexplored behaviour in



the literature. Specifically, this study tested the application of Ajzen's TPB to bedtime procrastination, a behaviour that this theory has not yet been applied to, as far as the researchers are aware. The TPB has been successfully applied in a number of studies investigating behaviour change in behaviours such as fruit and vegetable consumption (Gratton et al., 2007; Kothe et al., 2012) and healthy sleep behaviour (Lao et al., 2016) and has been considered by some researchers to be the most strongly supported model of intention and behaviour (Guillaumie et al., 2010). Despite this, few studies have explored the extent to which the behaviour change occurs through the theorised pathways outlined in the TPB (Elliott & Armitage, 2009), like the present study. This is a positive implication as understanding and applying such theories is essential for creating and implementing health promotion programmes, as well as for developing and refining theoretical pathways (Lippke & Ziegelmann, 2008).

While some components of the TPB did not change significantly following the intervention, attitudes and intentions towards bedtime procrastination showed significant positive improvements at the follow-up survey which is a promising result as intentions are closely linked to behaviour in the theoretical model. Regardless, more high-quality experimental tests of the theory in this context are required to investigate further. To establish if the change in the TPB components was due to the effectiveness of the intervention went beyond the scope of the current study. However, observations about the direction of the changes in TPB components and the manipulation of the components in the intervention can offer some valuable insights for future studies. For example, the positive changes in attitudes and intentions may be useful for future researchers to consider when designing interventions. This study may be a useful precursory baseline study for researchers who want to investigate how manipulating components of the TPB may result in behaviour change using a more rigorous scientific approach such as a randomised clinical trial.

It is recommended that future studies employ a more rigorous scientific test like a randomised control trial to investigate intervention effects further and provide more concrete evidence for the effectiveness of this intervention. It is also recommended that future researchers consider the mode of delivery of such an intervention carefully to maximise participant engagement with the intervention. Given that there was no significant improvement in actual bedtime procrastination behaviour in the present study, it could be worthwhile to combine this motivational intervention with a volitional intervention, such as implementation intentions. This would target the two phases of behaviour change as

described by Gollwitzer (1993) and Heckhausen (1991), the motivational phase and the volitional phase, and would help bridge the intention-behaviour gap in relation to bedtime procrastination behaviour more effectively.

### **Conclusion**

The present study has demonstrated that a motivational intervention based on the TPB components (attitudes, subjective norms, perceived behavioural control and intentions) was effective in reducing scores on the bedtime procrastination scale (Kroese et al., 2014). Previous research has found interventions based on the TPB have been effective, but such an intervention had never been applied to the behaviour of bedtime procrastination. The current study's results offer preliminary evidence to support the use of motivational interventions in positively influencing bedtime procrastination behaviour. However, these findings should be interpreted with caution as actual bedtime procrastination behaviour was not significantly improved post-measurement. Further investigation is also warranted into the role of the TPB components in motivational interventions as only attitudes and intentions showed significant improvements following the intervention. The present study represents the first action in applying a TPB based intervention to the behaviour of bedtime procrastination and is a useful precursory baseline study for future theory-based motivational interventions and adds to the growing literature on bedtime procrastination behaviour.

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## Appendix

### Appendix A: Consent form

**Title of research:** Investigating if a motivational intervention based on the Theory of Planned Behaviour is effective in reducing Bedtime Procrastination.

**Researcher:** Emma Bell ([e.j.bell@students.uu.nl](mailto:e.j.bell@students.uu.nl))

**Research supervisor:** Prof. Laura Weiss ([l.a.weiss@uu.nl](mailto:l.a.weiss@uu.nl))

**Faculty:** UU Social and Behavioural Sciences

*Please tick the relevant response Yes/No*

I confirm that I am 18 years of age or older

**Yes** \_\_\_ **No** \_\_\_

I confirm that I have read the attached information sheet and that I understand the information provided therein.

**Yes** \_\_\_ **No** \_\_\_

I have had the opportunity to consider the information presented to me, ask questions and have had these answered satisfactorily.

**Yes** \_\_\_ **No** \_\_\_

I understand that the data collected for this study will be kept entirely confidential and is to be used as part of the researcher's Master's thesis.

**Yes** \_\_\_ **No** \_\_\_

I understand that my participation in this study is entirely voluntary and that I am free to withdraw at any time, without giving any reason and without any penalisation for doing so.

**Yes** \_\_\_ **No** \_\_\_

I consent to my email address being used by the researcher to contact me as part of this study

**Yes** \_\_\_ **No** \_\_\_

I consent to participate in this research study

**Yes** \_\_\_ **No** \_\_\_

**Signed** \_\_\_\_\_ **Date** \_\_\_\_\_

**Appendix B: Questionnaire**

**What is your age? (in years) \_\_\_\_\_**

**Which gender do you most identify with? (Please select the relevant box)**

Female \_\_\_

Male \_\_\_

Non-binary \_\_\_

Not listed (Please specify) \_\_\_\_\_

Prefer not to say \_\_\_

**What country do you currently reside in? \_\_\_\_\_**

**Please provide an email address that you can be contacted by as part of this study:**

\_\_\_\_\_

Your email address will be used to deliver a series of (three) emails over the course of five days which will provide you with information about bedtime procrastination. You will then be contacted by email after a period of two weeks to complete a short follow-up questionnaire.

Email addresses will be kept confidential and will only be used by the researcher.

**Bedtime procrastination Scale (Kroese et al., 2014)**

For each of the following statements, please decide whether it applies to you using a scale from 1 (almost) never to 5 (almost) always.

1. I go to bed later than I had intended.

1- Almost never 2- Never 3- Sometimes 4- Always 5- almost always

2. I go to bed early if I have to get up early in the morning.

1- Almost never 2- Never 3- Sometimes 4- Always 5- almost always

3. If it is time to turn off the lights at night I do it immediately.

1- Almost never 2- Never 3- Sometimes 4- Always 5- almost always

4. Often I am still doing other things when it is time to go to bed.

1- Almost never 2- Never 3- Sometimes 4- Always 5- almost always

5. I easily get distracted by things when I actually would like to go to bed.

1- Almost never 2- Never 3- Sometimes 4- Always 5- almost always

6. I do not go to bed on time.

1- Almost never 2- Never 3- Sometimes 4- Always 5- almost always

7. I have a regular bedtime which I keep to.

1- Almost never 2- Never 3- Sometimes 4- Always 5- almost always

8. I want to go to bed on time but I just don't.

1- Almost never 2- Never 3- Sometimes 4- Always 5- almost always

9. I can easily stop with my activities when it is time to go to bed.

1- Almost never 2- Never 3- Sometimes 4- Always 5- almost always

### Theory of Planned Behaviour Questionnaire – Bedtime Procrastination

Instructions: Please indicate the answer you feel is most appropriate by selecting the box in relation to the following statements.

#### *Attitude*

1. Going to bed at the time I intend to would be:

Very Bad

Bad

Neither good nor bad

Good

Very good

#### *Subjective norm*

2. My family and friends approve of me going to bed at the time I intend to go at:

Strongly agree

Agree

Neither agree nor disagree

Disagree

Strongly disagree

3. People similar to me go to bed at the time they intend to:

Strongly agree

Agree

Neither agree nor disagree

Disagree

Strongly disagree



*Perceived Behavioural control*

4. I am confident that I can go to bed at the time I intend to:

Strongly agree

Agree

Neither agree nor disagree

Disagree

Strongly disagree

5. I can control whether or not I go to bed at the time I intend to:

Strongly agree

Agree

Neither agree nor disagree

Disagree

Strongly disagree

*Intention*

6. I plan to go to bed at the time I intend from now on...

Very likely

Likely

Neutral

Unlikely

Very unlikely

**Behavioural question (to include in the initial questionnaire and the follow up questionnaire):**

**Q.** How many days out of the past 7 days have you successfully went to bed at the time you intended to?

\_\_\_\_\_

## **Appendix C: Information Sheet**

**Title of research:** Investigating if a motivational intervention based on the Theory of Planned Behaviour is effective in reducing Bedtime Procrastination

**Researcher:** Emma Bell ([e.j.bell@students.uu.nl](mailto:e.j.bell@students.uu.nl))

**Research supervisor:** Prof. Laura Weiss ([l.a.weiss@uu.nl](mailto:l.a.weiss@uu.nl))

**Faculty:** UU Social and Behavioural Sciences

This research is being conducted as part of the researchers Master's thesis and is under supervision by Prof. Laura Weiss. The aim of this study is to investigate if a programme based on the Theory of Planned Behaviour components – attitudes, subjective norms and perceived behavioural control is effective in changing levels of bedtime procrastination.

### **Background research of research**

Bedtime procrastination is defined as not going to bed at the intended time despite there being no reason to prevent an individual from doing so (Kroese et al., 2014). A theory that has been applied to various health behaviours is the Theory of Planned Behaviour (TPB) (Ajzen, 1991), which suggests that the intention to engage in a behaviour is determined by attitudes, subjective norms and perceived behavioural control. Interventions based on the TPB have been proven to be effective in targeting behavioural intentions in different behavioural domains such as exercising and health eating.

### **Can I participate in this research study?**

To participate in this study, you must be 18 years of age or older you must also have a high level of understanding of the English language.

### **What will happen if I participate in this research study?**

You will be asked to indicate that you read and understand this information sheet and the nature of the research study, as well as indicating your consent to take part.

If you agree to participate, you will first be asked to complete a short survey consisting of a number of questions relating to bedtime procrastination. Following this, you will be asked to provide your email address in order to receive a series of three informative emails over the course of 5 days following the initial questionnaire. Two weeks after the final email, you will be asked to fill in a short follow-up questionnaire.

### **How will my anonymity and confidentiality be protected?**

Confidentiality and anonymity are ensured for all data contributed by participants. Although the programme used in this survey collects your IP address, this will not be attached to your submitted data or used throughout the process of this investigation. You will be asked to provide your email address for the purpose of this study, however email addresses will only be accessed by the researcher and will be stored on a secure computer. Email addresses will be deleted permanently at the end of this study.

All data collected will be saved for the duration of the study in a password protected file on a password protected computer which will only be accessible to the principle investigator, student researcher and examiner. All data will be completely discarded once the study has concluded. Study results will be retained for a minimum of 7 years if unpublished and 10 years if published. This is in accordance with the appropriate VSNU guidelines. You can read more information about privacy on the website of the Personal Data Authority: <https://autoriteitpersoonsgegevens.nl/nl/onderwerpen/avg-europese-privacywetgeving>.

### **What are the benefits of participating?**

There are no guaranteed benefits to participants for taking part, however, participants may gain a better understanding of their sleep procrastination behaviour which may be helpful to them. Additionally, the results of this project may contribute to our understanding of this topic within psychology. Participants who choose to take part in the research process may find it an interesting experience and gain a better understanding of how research in this area is conducted.

### **Will there be any risks involved with participating?**

It is not anticipated that there will be a high level of risk associated with participating in this research study. If you have questions or comments about the study, you can contact [a.c.usecherosania@students.uu.nl](mailto:a.c.usecherosania@students.uu.nl), who is an independent party to this study.

If you have an official complaint about the investigation, please send an email to the Complaints Officer at [klachtenfunctionaris-fetcsocwet@uu.nl](mailto:klachtenfunctionaris-fetcsocwet@uu.nl) or contact the UU Data Protection Officer at [privacy@uu.nl](mailto:privacy@uu.nl).

### **Can I change my mind and withdraw from the study?**

Your participation in this study is completely voluntary, you can choose to withdraw from the study at any stage if you feel uncomfortable or distressed with no penalty. You may withdraw your data up until the point of submission. You may do this by exiting out of the survey link on

your device. Unfortunately, if you withdraw from the study after the data is collected, due to the anonymous nature of the responses it will not be possible to delete your data.

**How do I find out about the results of the project?**

Results of the project are available upon request from the researcher, once the study is completed, for a limited time. You may contact the student researcher ([e.j.bell@students.uu.nl](mailto:e.j.bell@students.uu.nl)) for further information

## Appendix D: Emails

### Bedtime Procrastination Study Email One

Dear participants,

Thank you for participating in this study!

This is the first instalment of three emails that aims to provide you with useful information about bedtime procrastination and sleep that you may not know. This email will only take a few minutes of your time to read and it may benefit you!

#### **What is bedtime procrastination?**

Bedtime procrastination is when you delay the time you intend to go to bed at, even though there is no reasonable explanation for you to do so.

You may decide to engage in activities such as scrolling on your phone, reading a book, watching TV or playing video games which delays the time you go to bed at.

Oftentimes, people with busy schedules during the day engage in these activities close to bedtime as they feel like they have no 'me time' otherwise.

#### **How can bedtime procrastination impact my sleep?**

If you procrastinate your bedtime regularly, you may not get enough sleep every night which puts you at the risk of sleep deprivation.

Adults should get 7-9 hours of good quality sleep on a regular schedule every night.

#### **What are the consequences of lack of sleep?**

Short term effects of sleep deprivation can include:

- Feeling unfocused and listless
- Inability to perform physically and mentally during the day
- Difficulty managing your emotions

Longer term effects of sleep deprivation can include:

Increased risk of:

- Cardiovascular disease and coronary heart disease
- Obesity
- Diabetes
- Increased blood pressure
- Depression, anxiety and other mental health conditions

Sleep deprivation, even at a low level, can also have a negative impact on your immune system which impacts how we feel on a daily basis and how susceptible we are to illnesses.

**What are the benefits of getting enough sleep every night?**

- Helps to regulate your immune system, hormones and weight
- Allows you to think more clearly and perform better during the day
- Improves mood and reduces stress
- Lowers your risk of developing serious health problems such as heart disease, high blood pressure and diabetes

Thank you for reading the first instalment of this email series about bedtime procrastination. You will receive the next instalment in your inbox in the coming days!

Kind regards,  
Emma Bell.

## **Bedtime Procrastination Study Email Two**

Dear participants,

Thank you for participating in this study!

This is the second instalment of three emails that aims to provide you with useful information about bedtime procrastination and sleep that you may not know. This email will only take a few minutes of your time to read and it may benefit you!

### **What does the research say about bedtime procrastination?**

A recent study asked a number of people who procrastinated their bedtime why they did not go to bed at the time they intended and they were able to identify that it was their own problematic behaviour that was keeping them from going to bed on time. For example, they would stay awake for longer in order to watch another episode of their favourite Netflix series or to read another chapter of their book.

A large European survey that measured how many hours of sleep people got per night on average revealed **64%** of people were not getting the recommended minimum of 7 of sleep per night. Bedtime procrastination was identified as one of the main reasons why people were not getting enough sleep!

Experts recommend that individuals who procrastinate their sleep should take steps to reduce their procrastination in order to get more sleep every night and avoid sleep deprivation and its associated negative side effects.

Why not ask your friends and family what they think about bedtime procrastination and find out if they engage in this behaviour. Think about what advice you would give to a friend or family member who is procrastinating their sleep.

Thank you for reading the second instalment of this email series. The final instalment will be delivered to your inbox soon and will focus on helpful ways you can reduce bedtime procrastination!

Kind regards,  
Emma Bell.

### **Bedtime Procrastination Study Email Three**

Dear participants,

Thank you for participating in this study!

This is the final instalment in this email series that aims to provide you with useful information about bedtime procrastination and sleep. This email will only take a few minutes of your time to read and it may benefit you!

Even a simple change in behaviour can have a positive impact on your bedtime routine and decrease the amount of time you spend procrastinating your sleep.

Here are some simple steps you can take to overcome bedtime procrastination, as recommended by the experts:

- Recognise that you may be procrastinating your bedtime - this is the first step!
- Create a realistic bedtime routine – if you want to create a sustainable bedtime routine that works, set a realistic time to go to bed and stick to it. If you want to go to sleep earlier, gradually reduce your bedtime in short increments.
- Try to go to bed and get up at the same time every day. It may also help to write down your desired bedtime and waketime on paper or use your phone to set a reminder of your bedtime.
- Remove electronic devices – remove any electronic devices from your bedroom that may act as a tool to procrastinate with e.g. your laptop, TV, PlayStation etc
- Dedicate time before you go to bed for an activity that you enjoy doing e.g. reading, watching an episode of your favourite show. Make sure to set a time limit for these activities to avoid delaying your bedtime further!

Hopefully you find these simple steps useful in reducing your bedtime procrastination – why not put them into action!

Thank you for participating in this study and reading these emails, you will be contacted again in two weeks to fill out a quick follow up questionnaire similar to the first questionnaire you have completed. It is important for the study that you fill this in, so please keep an eye on your inbox!

Kind regards,  
Emma Bell.



## **Bedtime Procrastination Study Follow-up Survey**

Dear participants,

Thank you for participation so far in this study! This email contains the link to the follow-up survey, which is the final part of your participation. The follow-up survey will only take 2 minutes to complete.

LINK: [https://survey.uu.nl/jfe/form/SV\\_4Z7n8vT6SYkM42q](https://survey.uu.nl/jfe/form/SV_4Z7n8vT6SYkM42q)

Hopefully this study provided you with useful information about sleep and bedtime procrastination.

Kind regards,  
Emma Bell.