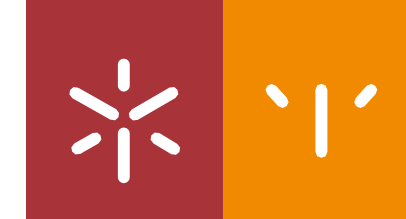
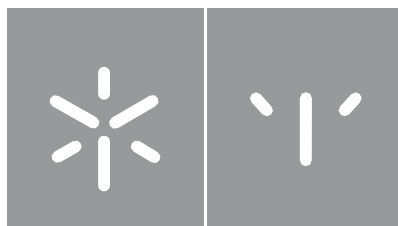




David Rafael Alves dos Santos

**Exploring Bedtime Procrastination
among University Students: The
role of General Procrastination,
Academic Procrastination and
Perceived Importance of Sleep**





Universidade do Minho
Escola de Psicologia

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Perceived Importance of Sleep**

Dissertação de Mestrado
Mestrado Integrado em
Psicologia

Trabalho efetuado sob a orientação do
Professor Doutor Pedro Rosário
e da
Doutora Paula Magalhães

outubro de 2020

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Agradecimentos

O caminho forja-se com cada passo que se dá, mas nem sempre se caminha sozinho. Ao meu lado caminharam várias pessoas que merecem todo o meu agradecimento.

Agradeço à Ana, minha esposa, por toda a ajuda, pela paciência, pelo carinho e pelo apoio incondicional que sempre me deu ao longo desta fase turbulenta.

Agradeço aos meus orientadores, Professor Doutor Pedro Rosário e Professora Doutora Paula Magalhães, por toda as aprendizagens, paciência e disponibilidade para ajudar e ao GUIA por me ter acolhido tão calorosamente.

A todos os meus amigos de Portugal, Espanha e Reino Unido, pelo apoio, pelos sorrisos e pela compreensão.

À minha família que sempre mostrou preocupação e dedicação e em especial à minha mãe, pelo carinho e cuidado que sempre deu.

Obrigado por caminharem comigo.

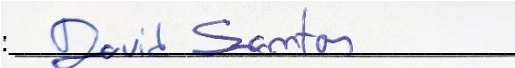
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Signature: 

Resumo

Pouco tempo de sono tem um custo para nosso desenvolvimento e homeostase, daí não surpreender que comportamentos que dificultem uma boa higiene do sono tenham começado a ser examinados com mais atenção. Um desses comportamentos é a procrastinação, mais especificamente a Procrastinação na Hora de Dormir. O objetivo desta investigação foi examinar as relações entre a Procrastinação na Hora de Dormir e outros domínios da vida, bem como expandir o conhecimento sobre o tema, tendo em conta variáveis contextuais e o valor subjetivo do sono. O estudo realizou-se através de um questionário de autorrelato online, direcionado a estudantes universitários. 446 participantes com idade média de 23 anos ($DP=5.48$, amplitude=18-57). Os resultados revelaram um modelo de mediação parcial tendo a Procrastinação Académica, a Procrastinação em Geral e a Importância Percebida do Sono um efeito direto sobre a Procrastinação na Hora de Dormir e um efeito indireto da Importância Percebida do Sono e da Procrastinação em Geral, mediada pela Hora de Acordar e Hora de Jantar, sobre a Procrastinação na Hora de Dormir. Esta investigação demonstra que a procrastinação não é um comportamento simples com uma explicação fácil e direta. Mudanças que ocorram num domínio podem impactar outros e variáveis contextuais podem provar ser ferramentas valiosas ao intervir neste tipo de comportamento.

Palavras-chave: procrastinação na hora de dormir, procrastinação académica, procrastinação geral, saúde, estudantes universitários

Abstract

Lack of sleep comes at a cost to our development and homeostasis, so it is not surprising that behaviors prevent a healthy sleep hygiene have been gaining attention by research. One such behavior is procrastination, specifically Bedtime Procrastination. The purpose of this research is to examine the relationships between Bedtime Procrastination and other life domains, as well as expand our knowledge on the topic by considering contextual variables and the subjective value of sleep. The study was conducted with an online self-report questionnaire aimed at university students. 446 students with an average age of 23 ($SD=5.48$, range= 18-57) completed the survey. Results showed a partial mediation model with Academic Procrastination, General Procrastination and Perceived Importance of Sleep having direct effect on Bedtime Procrastination and indirect effects of Perceived Importance of Sleep and General Procrastination, mediated by Wake-Up Time and Dinner Time. This research has demonstrated that procrastination is not a simple behavior with a straightforward explanation. Changes on one domain may impact others and contextual variables may prove to be valuable tools when intervening on this behavior.

Keywords: bedtime procrastination, academic procrastination, general procrastination, health, university students

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Introduction

Among the various human behaviors, few are as important to the individual's health as exercising, eating healthy, and sleeping enough hours. The absence of these behaviors comes at such a cost that the World Health Organization (2011) associates it with detrimental outcomes, even considering lifestyle related issues as some of the most urgent health topics in need of attention. For instance, needlessly postponing treatment while knowing of its potential negative consequences may have a detrimental impact in one's health (Pyckyl & Sirois, 2016). Procrastination is even more worrisome when it is done every day to seemingly inconsequential tasks, such as sleeping. Despite the increasing attention that sleep has been receiving from the general population, mass media, and relevant stakeholders, together with its importance to wellbeing in general, this topic is still often disregarded and ill-considered (Banks & Dinges, 2007). Thus, this paper analyzed Bedtime Procrastination and its relationships with other life domains.

Sleeping is vital for cognitive functions, growth and development, learning, and overall physical and mental health (Lund, et al., 2010). It enhances performance in several bodily functions, including: neuronal recovery, brain plasticity, and metabolic related functions, and has a key role in maintaining our body's homeostasis (Diekelmann & Born, 2010; Tononi & Cirelli, 2006; Siegel, 2009; Siegel, 2005). Sleep is also important for memory consolidation (Diekelmann & Born, 2010; Krueger et al., 2008), including emotional memory (Nishida, et al., 2008), as well as for intellectual abilities (Kirov, et al., 2011; Schabus et al., 2006). Due to its importance, lack of sleep has been categorized as a major health matter, with some arguing it should be treated as a chronic disease (Kroese & de Ridder, 2016).

Lack of sleep is a widespread problem that not only affects individuals with sleep-related disorders but the general population as well through the simple delay in going to bed. To illustrate, in a Dutch sample, 74% of the inquired reported delaying going to bed at least once a week, thus not having a full night's rest (Kroese et al., 2014b). Similarly, in the US, individuals stated sleeping an average of six hours or less per night, which is far from the recommended seven to nine hours of sleep (Sheehan, et al., 2018; The National Sleep Foundation, 2015). Along with the aforementioned consequences, inadequate sleep has an impact in our health, contributing to type 2 diabetes (Gangwisch et al., 2006), cardiovascular diseases (Buxton & Marcelli, 2010; Irwin et al., 2008; Sabanayagam & Shankar, 2010; Strine & Chapman, 2005), and obesity (Nishiura & Hashimoto, 2010). What is more, sleep insufficiency has other detrimental consequences to the individuals' lives, such as drowsy driving, that can lead up to road accidents and even resulting in deaths (Connor et. al, 2002; National Center for Statistics and Analysis, 2017).

Often individuals cannot prevent a poor sleep hygiene, other times individuals actively contribute to it by engaging in activities incompatible with a good sleep hygiene, such as watching “just one more episode” of a TV show, surfing the web or playing video games until late hours of the night (Kroese et al. 2016; Kroese et al. 2014b). These data suggests that, in many cases, sleep insufficiency may have a motivational origin, being, therefore, categorized as a type of procrastination.

We can define procrastination as a voluntary delay of an intended and necessary activity, despite expecting said delay to have potentially undesirable consequences (Klingsieck, 2013). Some authors also include the following elements in the definition of procrastination: experience of remorse, subjective discomfort, and other negative feelings as consequences to the person postponing the task (Ferrari, 2010; Simpson & Pychyl, 2009). While others approach procrastination as a form of self-regulation failure (De Witt Huberts, Evers, & de Ridder, 2014; Steel, 2007). The reasons for this behavior to occur are likely to vary widely. Some individuals report to procrastinate due to their own confusion and uncertainty with the task, instead of adopting a cost-benefit type of approach (Mann, 2016), while others mention lack of autonomy, stress, poor self-identification with a task, poor formulated intention, and even task aversiveness (Kroese & Ridder, 2016).

Along the years, several reasons have been brought up to explain the reasons for procrastination to occur and they can be roughly divided in to two main views, either as being a context-dependent behavior or as being a trait or innate characteristic of the individual. Some examples of literature developed within the context-dependent view include, the characteristics of the task and of the particular setting individuals are in (e.g., task attractiveness; Steel, 2007), the timing of rewards and/or punishments (Schouwenburg & Groenewoud, 2001; Strongman & Burt, 2000), and the difficulty of the goal to be achieved (Van Eerde, 2000). Conversely, other authors perceive procrastination as being the result of trait characteristics of the individual, which in turn permeates every aspect of a person’s life. In this view, genetic factors have been linked to general procrastination and other personality traits such as impulsivity (Arvey, et al., 2006; Gustavson et al., 2015; Gustavson et al., 2014), whereas other studies have linked general procrastination to high neuroticism and low conscientiousness (Steel, 2007). While general procrastination as a trait is still to be fully verified, it has been associated with negative health consequences (Kroese & Ridder, 2016), pointing towards the need for more research to be conducted on the topic.

Procrastination has been extensively studied in the academic domain and is highly prevalent in this context (e.g., Day, Mensink, & O’Sullivan, 2000; Steel, 2007; Schouwenburg, 2004; Zhang et al., 2018). In fact, it has been estimated that up to 80% of university students procrastinate at some point of their

academic path (O'Brien, 2002) and, inclusively, 40.5% of a Greek university students' sample self-identified themselves as frequent procrastinators (Argiropoulou, Kalantzi-Azizi & Ferrari, 2016). What is more, the detrimental impact of procrastinating academic tasks is substantial and well documented, such as low academic scores, emotional distress, anxiety coupled with a feeling of failure (Clariana, 2009; Kim & Seo, 2015; Van Eerde, 2003), and higher amounts of stress (Pychyl & Sirois, 2016).

Despite procrastination has been extensively studied in some domains, research on procrastination focused on sleep is still limited. Most procrastination arises as to avoid an aversive task, however, sleep is considered by most people an enjoyable task (Gershuny, 2013). Explanations for this behavior have come forth, such as the influence of a person's chronotype (Kadzikowska-Wrzosek, 2018; Kühnel, Syrek, & Dreher, 2018), i.e. eveningness and morningness, with eveningness-type adolescents showing a greater tendency to postpone bedtime; or a self-regulation failure through the lack of self-control and inability to resist distractors (Kroese et al., 2016; Kroese, et al., 2014a). Other reasons for procrastinating bedtime could be the pre-bedtime routines (e.g., flossing, taking out contacts) if they become aversive to the person (Nauts, et al., 2016). Individuals can also procrastinate bedtime by losing track of time due to being engrossed in an activity, or purposely delaying it to fall asleep more easily, and even deliberately delaying it to have more time to engage in other activities (Nauts, et al., 2019).

Sleep procrastination seems to be composed of at least two different facets, Bedtime Procrastination needlessly delaying the time one goes to bed with the intention to sleep and While-In-Bed Procrastination, delaying sleep while already laying inside the bed, both with different factors correlating with them (Magalhães, et al., 2020). Bedtime Procrastination was associated with later waking times and later dinner times. Bedtime Procrastination is associated with depression symptoms before developing into depression, with depression, anxiety, and insomnia (Chung, An & Suh, 2019; Guo, et al., 2020). Needlessly delaying sleep has begun to be research in a variety of populations of all ages, from children, to adults, including the general population (Herzog-Krzywoszanska & Krzywoszanski, 2019; Kadzikowska-Wrzosek, 2018; Kühne, Syrek & Dreher, 2018; Nauts et al., 2016). In the academic population, university students also seem to have engage in more bedtime procrastination, when compared to the general population (Herzog-Krzywoszanska & Krzywoszanski, 2019), which points towards a need to examine the relationship between the already prevalent Academic Procrastination phenomenon in students (O'Brien, 2002), with the sleep domain, specifically Bedtime Procrastination.

Recently, the study of procrastination has seen a shift in terms of conceptual approach from a trait-like vs. context-dependent points of view to a more integrative approach. Particularly, research has begun incorporating both the individual characteristics of the person and the context of the behavior. Kljajic &

Gaudreau (2018) used a procedure which incorporated within-person and between-person comparisons, using both trait-like variables (e.g. procrastination) and contextual variables (e.g. workload). Examining Bedtime Procrastination with contextual variables such as Wake-Up Time and Dinner Time akin to other research in the subject which also looked at similar variables (Herzog-Krzywoszanska & Krzywoszanski, 2019; Magalhães, et al., 2020; Nauts, et al., 2019), while also taking in account trait-like Procrastination, is a new one step towards uncovering the depths of this recently discovered behavior.

Purpose of this study

Sleep Procrastination is not only an emergent topic in the scientific study of Procrastination, but also a health risk factor, that can have a direct and indirect effect on academic results, and thus, influence academic trajectories. Despite being a necessity, sleep is more than ever challenged by different stimuli that capture our attention and focus. This happens before individuals go to bed, be it scrolling through social media, playing games, talking to other people or reading a book. Sleeping is essential for our overall health (World Health Organization, 2011) and is linked to many brain functions important for studying and other academic activities (Diekelmann & Born, 2010; Kirov, et al., 2011; Krueger et al., 2008; Schabus et al., 2006).

Taking in account this newer approach to analyzing these questions, which is, using both contextual and trait-like variables (Kljajic & Gaudreau, 2018) in a network instead of standalone views could possibly bring more knowledge into the increasingly complex subject. More knowledge creates more opportunities to develop and implement more effective interventions, this way improving students' lives, by reducing health problems related to sleep and tilting their academic trajectories to more desirable outcomes. This scenario highlights the significance of exploring the interconnectivity of Bedtime Procrastination with Academic and General Procrastination, while also taking into account the Perceived Importance of Sleep attributed by the students, using Wake-Up Time and Dinner Time as the lens through which these variables may or may not be mediated.

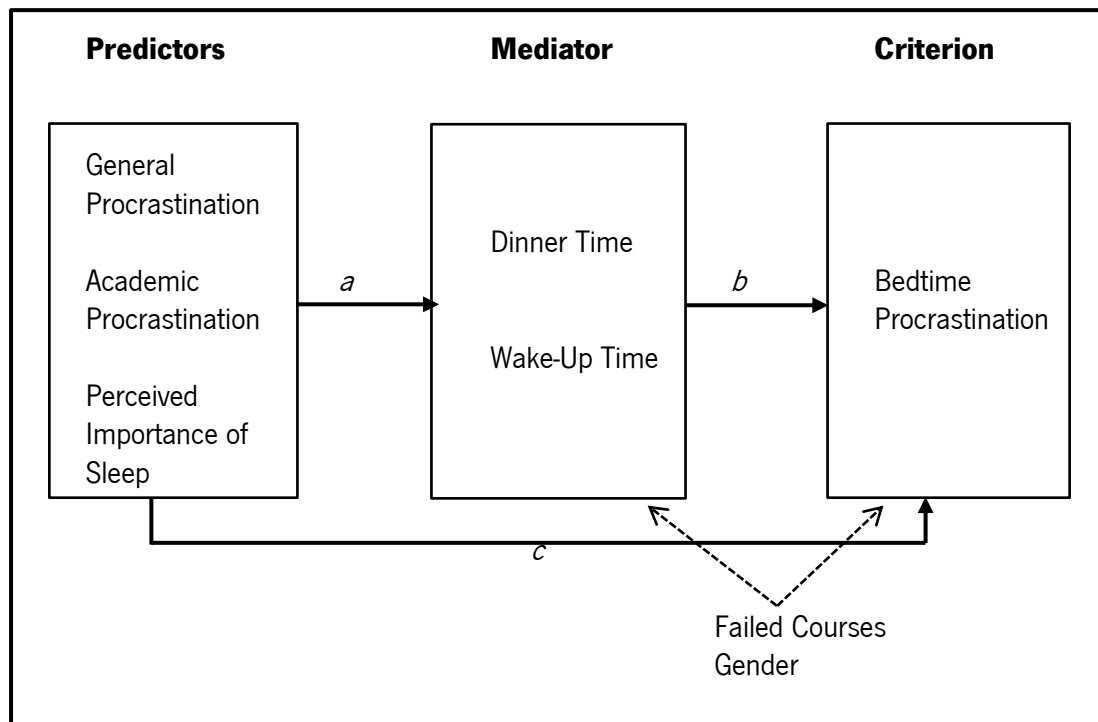
As stated above the purpose of this study was to examine the effect of three predictor variables (General Procrastination, Academic Procrastination, and Perceived Importance of Sleep) over Bedtime Procrastination among college students. Particularly, we examined how this effect is mediated (totally or partially) by the variables Dinner Time and Wake-Up Time, while statistically controlling for the effect of Gender and Failed Courses, both over the mediator variables (Dinner Time and Wake-Up Time) and predictor variables (General Procrastination, Academic Procrastination, and Perceived Importance of Sleep). Three models were devised (see Figure 1): 1) no mediation model, 2) total mediation model, and 3) partial mediation model.

No mediation model. This model predicts only the direct effects of the predictor variables (General Procrastination, Academic Procrastination, and Perceived Importance of Sleep) over the criterion variable (Bedtime Procrastination). It is hypothesized that the three predictor variables explain directly and significantly Bedtime Procrastination. Particularly, it is expected that both General and Academic Procrastination positively explain Bedtime Procrastination, whereas the Perceived Importance of Sleep negatively explain Bedtime Procrastination. Moreover, indirect effects of the predictor variables over the criterion variable are not expected, through either Dinner Time or Wake-Up Time. In Figure 1, coefficients c will be statistically significant and positive, whereas coefficients a and b will not be statistically significant.

Total mediation model. This model predicts indirect effects. It is hypothesized that the predictor variables (General Procrastination, Academic Procrastination, and Perceived Importance of Sleep) explain Bedtime Procrastination only indirectly (through Dinner Time and Wake-Up Time). Particularly, it is expected that the indirect effects are positive for general and academic procrastination, and negative for perceived importance of sleep. In Figure 1, coefficients c will not be statistically significant, whereas coefficients a and b will be statistically significant.

Partial mediation model. This model predicts direct and indirect effects. It is hypothesized that the predictor variables (General Procrastination, Academic Procrastination, and Perceived Importance of Sleep) explain the criterion variable (Bedtime Procrastination) both directly, as well as indirectly through the mediator variables (Dinner Time and Wake-Up Time). Particularly, it is expected that the direct and indirect effects are positive for general and academic procrastination, and negative for perceived importance of sleep. In Figure 1, all coefficients (a , b , and c) will be statistically significant.

Figure 1. Prediction model of the bedtime procrastination.



Note. Total mediation model (only coefficients a and b are statistically significant); Partial mediation model (coefficients a , b and c are statistically significant); Non mediation model (only coefficients c are statistically significant). Failed courses and gender are treated as covariates to statistically control their effect.

Method

Participants

Participants ($N = 733$) were asked to complete an online questionnaire on Qualtrics. Of the initial sample, 287 were excluded from the analysis because they did not complete the questionnaire (completion rate of 60.8%). Of the 446 participants that voluntarily completed the survey, 312 (70.0%) were female. The mean age was 23.7 years ($SD = 5.49$, range 18-57), 174 (39.0%) were undergraduate students, 206 (46.2%) were postgraduate students and 66 (14.8%) were PhD students. Table 1 summarizes sociodemographic measures.

Instruments and measures

Socio-Demographic Questionnaire. Demographic questions about the participants included age, sex, course, current year of enrollment, and nationality.

General Procrastination Scale (GPS-9). Is a short version of Lay's General Procrastination Scale (GPS) that reliably assesses global, trait-like tendencies towards procrastination across a variety of

tasks (Sirois, Yanga & Van Eerde, 2019). This is a nine-item instrument (e.g., “I am continually saying I'll do it tomorrow”, “I generally delay before starting work I have to do.”), with three of these items being reverse scored. All items are answered in a five-point Likert-like scale from 1 (Almost Never) to 5 (Almost Always). Total scores range between nine to 45, with higher scores indicating a greater tendency towards chronic procrastination. The current adapted version for the Portuguese population has a Cronbach's alpha of .89.

Bedtime Procrastination Scale. An adapted version of the Bedtime Procrastination Scale developed by Kroese et al. (2014) was used to evaluate bedtime procrastination. The adapted version is a nine-item instrument (e.g., “I go to bed later than I had intended”), with four of these items being reverse scored. All items are answered in a five-point Likert-like scale from 1 (never) to 5 (always). Total scores range between nine to 45 with higher scores indicating more engagement in bedtime procrastination (Cronbach's alpha for the current study = .90).

Academic Procrastination Scale. To measure procrastination towards academic/school tasks was used the instrument developed by Kljajic and Gaudreau (2018). This is a three-item instrument (“Please indicate the extent to which you procrastinate in your schoolwork in general”) and items are answered on a five-point Likert-like scale from 1 (Never) to 5 (Always). Totals scores ranged from three to 15 with higher scores indicating more procrastination on academic tasks (Cronbach's alpha of .95). The current adapted version to the Portuguese population has a Cronbach's alpha of .85.

Perceived Importance of Sleep Scale. Was developed for the purposes of this study with the aim of capturing participants' perceived value pertaining to. This is a three-item instrument (“How important is it for you to have a good night's sleep?”) and items answered on a five-point Likert-like scale from 1 (Not important) to 5 (Very important). Totals scores ranged from three to 15 with higher scores indicating higher perceived value (Cronbach's alpha of .90).

Table 1.

Socio-demographic characteristics.

	Total <i>N</i> =446		Male <i>n</i> =134		Female <i>n</i> =312	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Nationality						
Angolan	1	0,2	0	0,0	1	0,3
Brazilian	25	5,6	7	5,2	18	5,8
Portuguese	417	93,5	127	94,8	290	92,9
Romanian	1	0,2	0	0,0	1	0,3
Spanish	2	0,4	0	0,0	2	0,6
Registered course year						
1st year	30	6,7	13	9,7	17	5,4
2nd year	62	13,9	23	17,2	39	12,5
3rd year	82	18,4	22	16,4	60	19,2
4th year	78	17,5	23	17,2	55	17,6
5th year	128	28,7	36	26,9	92	29,5
Phd	66	14,8	17	12,7	49	15,7
Course						
Arts and Humanities	21	4,7	9	6,7	12	3,8
Health	89	20,0	15	11,2	74	23,7
Economics and Management	37	8,3	12	9,0	25	8,0
Law and Jurisprudence	10	2,2	2	1,5	8	2,6
Sciences and Technology (STEM)	149	33,4	74	55,2	75	24,0
Social Sciences	127	28,5	18	13,4	109	34,9
Other	13	2,9	4	3,0	9	2,9

Procedure

Participants were recruited via Psychology's experimental participation system, University of Minho's institutional e-mail, social media (e.g., Facebook, WhatsApp), and personal contacts. *Qualtrics Survey Software © 2019 Qualtrics®* was used as the primary tool in the construction and data collection of the survey. An informed consent was obtained from each participant prior to their participation in the study. Participation was voluntary, anonymous, and unpaid. Students were invited to respond individually to the self-report questionnaires that included all the aforementioned measures. Completion of the survey took an average of 10 minutes.

Data analysis

The data were analyzed as follows. First, we analyzed the statistical properties of the variables included in the study (means, standard deviations, asymmetry, kurtosis), as well as the correlation matrix

and the missing values. As the percentage of missing values was low ($n = 21$; 0.59%), they were treated through the multiple imputation procedure. Secondly, the path models of figure 1 (no mediation, total mediation, and partial mediation) were fit with the AMOS 22 program in SPSS (Arbuckle, 2013). The strategy followed for the adjustment of the three models was the following: (i) calculate the adjustment of the three basic models (no mediation, total mediation, and partial mediation); (ii) select the best model of the three and adjust it again including the two covariates (gender and failed courses); (iii) re-specify the model eliminating statistically non-significant coefficients. The final mediational model was fitted using the bootstrapping procedure. This procedure is very useful when the sample of participants is not very large, as in our case, and its objective is to reduce bias within the analysis, and thus ensure accurate statistics, thanks to the random resampling of the sample.

The models were adjusted and their results were evaluated according to the typically used criteria: Chi-square, Root Mean Square Residual (RMR), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Tucker-Lewis Coefficient (TLI), Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), Akaike Information Criterion (AIC), Bayes Information Criterion (BIC), and Expected Cross-Validation Index (ECVI). While the first seven give us information on the degree of fit of the theoretical model to the collected data, AIC and BIC are used to decide which competing model best fits. Finally, ECVI informs us of the extent to which these results could be replicated in an independent sample. There is evidence of a good fit when χ^2 has a $p > .05$, RMR $< .05$, GFI, AGFI and TLI $\geq .90$, CFI $\geq .95$, and RMSEA $\leq .06$. The best model is the one that gets the smallest AIC and / or BIC. On the other hand, there is evidence of safety in the data obtained when the ECVI of our model is lower than that of the saturated model. The effect size of the regression coefficients was evaluated using Cohen's (1988) d statistic.

Results

Descriptive statistics

Table 2 shows the descriptive statistics and correlation matrix of the variables included in the model. Results show that 67.8% of the correlations are statistically significant and that the Bartlett sphericity test indicates that the correlation matrix is adequate for the analysis ($\chi^2_{28} = 560.34$, $p < .001$). Moreover, the Kaiser-Meyer-Olkin for the sampling adjustment is acceptable (KMO = .649). Additionally, regarding the criteria established by Gravetter and Walnau (2014), asymmetry and kurtosis indicate a normal univariate distribution of the data except for the variable Perceived Importance of Sleep. Altogether, the Mardia coefficient suggests a multivariate normality of the data ($M = 1.685$; $t = 1.407$; $p > .05$).

Correlational tests indicate no statistically significant difference between females and males

regarding the three types of procrastination (General, Academic, and Bedtime). However, females show a tendency to ascribe more value to sleep (Perceived Importance of Sleep) than males, but less to Wake-Up Time. In addition, females have less failed courses than males. Finally, the three procrastination variables are highly positively associated among each other, and significantly positively correlated with Dinner Time and Wake-Up Time.

Table 2.

Descriptive statistics and Pearson correlations.

	GP	AP	PIS	BP	DT	WU	FC	GE
GP	—							
AP	.714**	—						
PIS	-.060	.021	—					
BP	.429**	.388**	-.242**	—				
DT	.161**	.119*	-.171**	.195**	—			
WU	.178**	.145**	-.113*	.161**	.202**	—		
FC	.150**	.159**	-.043	.036	.049	.124**	—	
GE	-.073	-.055	.149**	-.050	-.013	-.222**	-.094*	—
M	3.122	3.314	4.624	3.234	2.560	2.520	0.314	1.700
SD	0.818	0.883	0.602	0.885	0.610	0.865	0.465	0.459
SK	-0.114	-0.130	-1.813	-0.341	0.176	0.261	0.805	-0.873
KU	-0.417	-0.436	3.467	-0.756	-0.401	-0.682	-1.359	-1.234

Note: General procrastination (GP); Academic procrastination (AP); Perceived importance of sleep (PIS); Bedtime procrastination (BP); Dinner Time (DT); Wake-Up (WU); Failed courses (FC); Gender (GE; 1=boys, 2=girls); Mean (M); Standard deviation (SD); Skewness (SK); Kurtosis (KU).

* $p < .05$; ** $p < .01$

Selection of the best model

The three aforementioned models were tested: no mediation model (Model 1 in Table 3), total mediation model (Model 2 in Table 3), and partial mediation model (Model 3 in Table 3). Considering the criteria previously enunciated (i.e. Chi-square, RMR, GFI, AGFI, TLI, CFI, RMSEA), results of the goodness of fit of the models indicate that the total mediation model (Model 2) has to be rejected (all indices indicate a poor adjustment). Similarly, the no mediation model (Model 1) shows some level of adjustment although not completely satisfactory (see Table 3). The RMR, GFI, and the AGFI scores allow for the acceptance of Model 1, still, other parameters such as TLI or CFI and, especially, RMSEA, suggest rejection of the model. Lastly, Model 3 includes direct and indirect effects (partial mediation model), shows a good fit; however, the model is unstable since it has zero degrees of freedom, which means that no probability level can be assigned to the chi-square statistic. Thus, we added some free parameters, i.e. those parameters that were not statistically significant. Consequently, the result of the fit of the partial mediation model re-specified (Model 3-R in Table 3) was completely satisfactory. Lastly, Model 3-R was fit by adding

gender and failed courses as co-variables (Model 3-R' in Table 2). Results indicate a good fit of the model, although not as good as the fit of Model 3-R without the co-variables.

To summarize, the goodness-of-fit indexes suggest that the model of the direct and indirect effects re-specified (partial mediation model), without co-variables, is the best fit among the three models tested. Additionally, statistics of the AIC and BIC of this model are the smallest of the three models (AIC = 37.929; BIC = 111.735). Therefore, all converge to select Model 3-R as the best fit. Lastly, Model 3-R is the only in which the ECVI value is lower than that of the saturated model (default model = .085 vs. saturated model = .094). This finding suggests that this model is reliable to predict future models with good fit in independent samples of similar size.

Table 3.

Selecting the best of competing models

	Direct Effects Model (No Mediation) Model 1	Indirect Effects Model (Total Mediation) Model 2	Direct and Indirect Effects Model (Partial Mediation- R) Model 3-R	Partial Mediation Model-R (with Gender and Failed Courses as covariables) Model 3-R'
χ^2	37.248	109.313	1.929	33.403
<i>df</i>	6	3	3	14
<i>p</i>	<.001	<.001	.587	.003
RMR	.051	.087	.009	.021
GFI	.974	.932	.999	.981
AGFI	.909	.526	.990	.952
TLI	.843	.070	.968	.928
CFI	.937	.786	.987	.964
RMSEA	.108	.282	.032	.056
AIC	67.248	145.313	37.929	77.403
BIC	128.753	219.119	111.735	167.610
ECVI				
Default model	.151	.327	.085	.174
Saturated model	.094	.094	.094	.162

Direct, Indirect, and Total Effects in the Bedtime Procrastination Model (Model 3-R)

Table 4 shows the standardized regression coefficients of the direct and indirect effects, as well as the co-variances, confidence intervals at 90%, estimation errors, significances for the estimated coefficients, and the effect size for the fit of Model 3-R (partial mediation model).

Data support the partial mediation model of Dinner Time and Wake-Up Time on the relationship between General Procrastination, Academic Procrastination, and Perceived Importance of Sleep and Bedtime Procrastination. Inclusion of the co-variables Gender and Failed Courses in the model did not result in a better fit of the model. Figure 2 displays the direct effects that were statistically significant.

First, the three predictor variables (General Procrastination, Academic Procrastination, and Perceived Importance of Sleep) directly explain the criterion variable (Bedtime Procrastination). Likewise, General Procrastination and Perceived Importance of Sleep also explain Bedtime Procrastination indirectly through the mediator variables Dinner Time and Wake-Up Time. Contrary to our hypothesis, Academic Procrastination only has a direct effect over Bedtime Procrastination. Overall, data indicate the more the General and Academic Procrastination, and the less the Perceived Importance of Sleep, the more the Bedtime Procrastination.

Regarding the indirect effects, data indicate that the total indirect effects are smaller than expected, i.e. smaller than the direct effects. Dinner Time and Wake-Up Time are only marginally mediator variables (the size of the indirect effects is not excessively relevant). Furthermore, regarding the independent variables of the model (General Procrastination, Academic Procrastination, and Perceived Importance of Sleep) only the procrastination variables are related with each other. Lastly, it is important to highlight that the criterion variable of the model (Bedtime Procrastination) is significantly explained by the model, despite the modest amount of variance explained (25%).

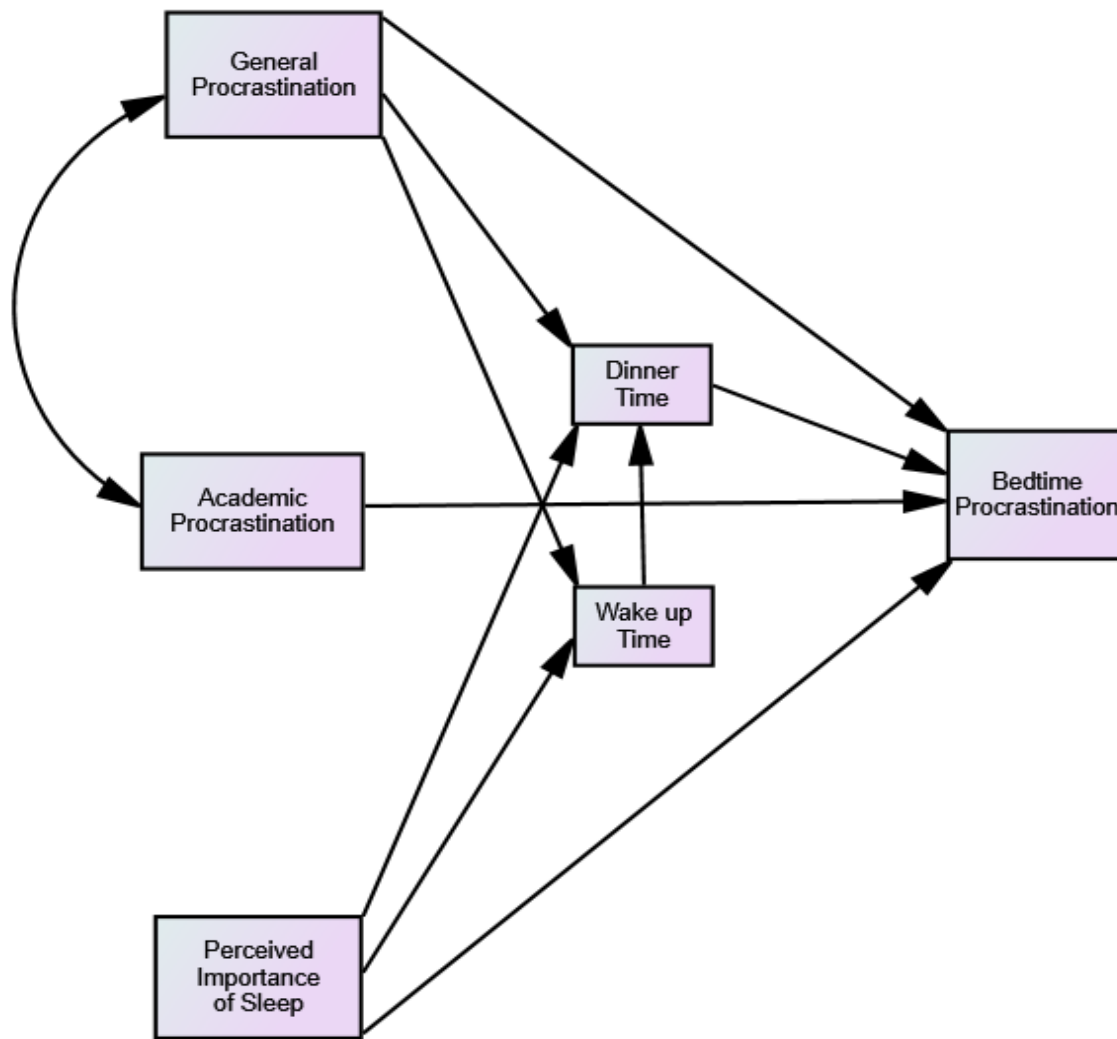
Table 4.

Results of the fit of Model 3-R (partial mediation model) with bootstrapping procedure (500 bootstrap samples).

	Estimate	LO90	UP90	SE	<i>p</i>	<i>d</i>
Direct Effects						
AP → BP	.195	.079	.316	.071	<.001	0.319
GP → WU	.172	.097	.240	.045	<.001	0.355
GP → DT	.151	.049	.200	.046	.006	0.253
GP → BP	.276	.165	.387	.066	<.001	0.429
PIS → WU	-.102	-.187	-.025	.049	.026	0.209
PIS → DT	-.162	-.221	-.055	.050	.018	0.303
PIS → BP	-.229	-.278	-.152	.038	<.001	0.502
WU → DT	.164	.084	.236	.047	<.001	0.338
DT → BP	.093	.020	.163	.043	.030	0.212
Total Indirect Effects						
GP → BP via DT	.014	.005	.031	.007	.067	0.174
PIS → BP via DT	-.015	-.035	-.004	.009	.076	0.169
WU → BP via DT	.015	.004	.033	.008	.071	0.171
Covariances						
AP → AG	.515	.450	.575	.038	<.001	1.425
AP → PIS	.011	-.026	.053	.024	.645	0.043
PIS → AG	-.030	-.062	.011	.022	.187	0.120

Note: Estimate (standardized regression weights), LO90 (Lower 90%), UP90 (Upper 90%), SE (standardized errors), General procrastination (GP); Academic procrastination (AP); Perceived importance of sleep (PIS); Bedtime procrastination (BP); Dinner Time (DT); Wake-Up (WU).

Figure 2. Direct effects on the Bedtime Procrastination Model.



Discussion

Resting the ideal number of hours is vital for various brain functions (Lund, et al., 2010; Sheehan, et al., 2018), learning (Kirov, et al., 2011; Krueger et al., 2008), and the maintenance of an overall good physical and mental health (Diekelmann & Born, 2010; Krueger et al., 2008). Procrastinating bedtime is a way to miss the full-recommended hours of rest, thus becoming an obstacle to good health (Kroese et al. 2016). The purpose of this paper was to explore the interrelationships among Bedtime Procrastination, Academic Procrastination, General Procrastination, Wake-Up Time, Dinner Time and Perceived Importance of Sleep. This study also tested the mediating effects of Wake-Up Time and Dinner Time on the relationships between the variables aforementioned.

Our results show a strong connection between Academic Procrastination and General Procrastination, particularly, the higher the procrastination towards academic tasks, the higher the procrastination in general tasks. This coincides with previous research on Academic Procrastination that

found a robust link with General Procrastination (Klingsieck, 2013; Mann, 2016; Steel, 2007). This result highlights the influence of a person's personality trait-like nature of procrastination, i.e. each individual has an underlying tendency to procrastinate to a certain degree but also directs towards a more trait-like type of procrastination as a note-worthy explanation for the behaviors, which considers various aspects of a person's personality (Gustavson, et al., 2014; Schouwenburg, 1995; Sirois, 2014; Steel, 2007; Steel & Ferrari, 2013).

Concerning the direct effects present on this model, both Academic Procrastination and General Procrastination were positively associated with Bedtime Procrastination's and Perceived Importance of Sleep was negatively associated with Bedtime Procrastination. The connection between General Procrastination and Bedtime Procrastination suggests that individuals who are more prone to procrastinate in general (e.g., daily life tasks), are also more likely to delay their intended hour of going to bed. Although there is a lack of research on this relationship Li, et al., (2019) found that General Procrastination was indeed associated with shorter sleep times and overall worse sleep quality, which, according to our results, could be the result of Bedtime Procrastination.

Academic Procrastination and Bedtime Procrastination's association leads us to believe that the same scenario may happen to people, where procrastinating on an academic task (e.g. finishing a paper) may result in delaying bedtime. Although there is a lack of literature on the subject, an association between Academic Procrastination and bedtime has been drawn (Chen, 2019) and in fact poor sleep quality and excessive sleepiness is related to poorer grades (Gaultney, 2010; Ma, et al., 2020;).

Perceived Importance of Sleep has a negative relationship with Bedtime Procrastination, meaning that the people who value sleep less, were more inclined to procrastinate when it was time to go to bed. This subjective value can vary well be an alternative explanation to the delay. Although there is also a lack of research on the matter, it is akin to other theoretical mechanisms which try to explain the behavior. These mechanisms typically focus on either the characteristics of the person, such as different chronotypes, self-control resources available, sensation seeking (Chen, 2019; Kadzikowska-Wrzosek, 2018; Kühnel, Syrek & Dreher, 2018), while others emphasize the context of the task and/or person, for example, the place of residence, cohabitation with adults and/or children or the difficulty of the goal to achieve (Herzog-Krzywoszanska & Krzywoszansk, 2019; Van Eerde, 2000). Perceived Importance of Sleep can be considered a contextual variable and fits in with the literature in this view. This means that changes on personal views about Sleep could also bring changes upon Bedtime Procrastination and other behaviors as well, or the other way around.

Indirect effects, mediated by Wake-Up Time and Dinner Time, of General Procrastination and

Perceived Importance of Sleep, on Bedtime Procrastination, were also observed. Perceived Importance of Sleep was negatively associated with both Wake-Up Time and Dinner Time. One possible explanation could be that people who wake up earlier and have dinner earlier (lower Wake-Up Time and Dinner Time values) would attribute more value to Sleep. Conversely, General Procrastination was positively associated with both variables. This suggests that procrastinating on tasks along the day could be the result of waking up later than intended. In turn, waking up later than intended could result in a delay of the dinner time (higher Wake-Up Time and Dinner Time values), thus reducing time before going to bed and possibly increasing Bedtime Procrastination. Only one other research has looked at these specific contextual variables (Wake-Up Time and Dinner Time) and had similar results regarding Bedtime Procrastination, i.e. Bedtime Procrastination was associated with later waking times and later dinner times (Magalhães, et al., 2020). As it stands these variables contributes to a continuously expanding context-dependent view of procrastination.

Our results support both trait-like and contextual dependent viewpoints of procrastination. These are consonant with recent findings regarding the causes for procrastination (Kljajic & Gaudreau, 2018). A tendency to procrastinate may be innate to individuals but the context of the situation may influence the degree to which it is expressed, i.e. by increasing or decreasing procrastination (Kljajic & Gaudreau, 2018; Nordby, Klingsieck & Svartdal, 2017).

Limitations and Future Studies

This research has some potential limitations that should be acknowledged when interpreting the results. Firstly, it has a correlational design, which does not provide solid grounds for causality of the effects. Future research on the subject could use a longitudinal design to understand for certain how stable throughout time these behaviors are. If possible, an experimental design, where either Perceived Importance of Sleep, Wake-Up Time, Dinner Time, or a combination of the three, could further deepen this subject and test the mediation effects present in this study. One way would be training/informing subjects on Sleep, aiming to change their Perceived Importance of Sleep. Second, the data collection was done online through a self-report questionnaire, however since the measures used reported a high reliability, we believe that this limitation did not affect our results.

Our results, which suggest that personal routines may be an important contextual factor in Bedtime Procrastination, further strengthened the subject of sleep procrastination. This study brings up more avenues to explore different contextual variables. It opens new types of research and interventions on the underlying mechanisms of procrastination, for example intervening on subject's wake-up time and/or dinner time could diminish the consequences of General Procrastination.

Finally, it contributed to a more recent body of knowledge and viewpoint, in which procrastination seems to be dependent on both the context of the task and the unique characteristics of the subject performing it. These findings will certainly help in understanding the reasons behind people engaging in this type of behavior, one which undermines the person's health and well-being.

Conclusions

It is becoming more evident that procrastination may be detrimental to our health. Increased research in this domain has revealed that sleep procrastination is a complex, multifaceted, psychological phenomenon that relies on different aspects of a person's life. To our knowledge, this study is the first to reveal the mediating and indirect roles of Wake-Up Time and Dinner Time on Bedtime Procrastination, and to consider the subjective value attributed to sleep. It is also the first to study relationships between Academic Procrastination, General procrastination, and Bedtime Procrastination. Future research in this area may contribute to shed some light over the variables that maintain sleep procrastination in the hope of helping to overcome this detrimental behavior.

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Universidade do Minho

Conselho de Ética

Comissão de Ética para a Investigação em Ciências Sociais e Humanas

Identificação do documento: CEICSH 087/2020

Relatores: Emanuel Pedro Viana Barbas Albuquerque e Marlene Alexandra Veloso Matos

Título do projeto: *Mapeamento de variáveis motivacionais em tempo de pandemia COVID-19*

Equipa de Investigação: Pedro José Sales Luís da Fonseca Rosário (IR), Centro de Investigação em Psicologia (CIPsi), Escola de Psicologia, Universidade do Minho; Paula Magalhães, Jennifer Cunha e Cátia Silva, Investigadoras Júnior no Centro de Investigação em Psicologia (CIPsi), Escola de Psicologia, Universidade do Minho; Armanda Pereira, investigadora Pós-doc no Centro de Investigação em Psicologia (CIPsi), Escola de Psicologia, Universidade do Minho e ainda Estudantes inscritos no MIPsi/MPA/Doutoramento em Psicologia Aplicada na Escola de Psicologia da Universidade do Minho

PARECER

A Comissão de Ética para a Investigação em Ciências Sociais e Humanas (CEICSH) analisou o processo relativo ao projeto de investigação acima identificado, intitulado *Mapeamento de variáveis motivacionais em tempo de pandemia COVID-19*.

Os documentos apresentados revelam que o projeto obedece aos requisitos exigidos para as boas práticas na investigação com humanos, em conformidade com as normas nacionais e internacionais que regulam a investigação em Ciências Sociais e Humanas.

Face ao exposto, a Comissão de Ética para a Investigação em Ciências Sociais e Humanas (CEICSH) nada tem a opor à realização do projeto, emitindo o seu parecer favorável, que foi aprovado por unanimidade pelos seus membros.

Braga, 30 de setembro de 2020.

O Presidente da CEICSH

(Acílio Estanqueiro Rocha)