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Depressive Symptomatology, Presenteeism Productivity and Quality of Life:  
A Moderated Mediation Model.

**Running Title:** Depressive Symptoms, Productivity and Quality of Life

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## Abstract

In this study we intend to test if presenteeism productivity influences the relationship between depressive symptoms and quality of life and also if this relation is conditional upon levels of information processing speed. Data were collected from 231 participants who completed a neuropsychological test and self-reported measures. Results revealed a significant indirect effect and a significant moderation effect. The association between depressive symptoms and presenteeism productivity was moderated by information processing speed only in their medium and high levels. Our findings suggest that individuals with higher levels of processing speed may have more difficulty in focusing on work without being distracted by health problems. The present investigation has made a significant contribution to the existing literature about cognitive function and productivity in workers with depressive symptomatology and its effects on their quality of life.

**Keywords:** Depressive Symptoms; Productivity despite Sickness Presence; Quality of life; Information Processing Speed.

This study aims to investigate the role of presenteeism productivity on the relationship between depressive symptoms and quality of life and also the moderator role of information processing speed in this relationship. In this proposed moderated mediation model, we wish to understand if depressive symptoms have a greater impact on an individual's productivity when he/she also has higher levels of processing speed and whether that relationship affects the quality of life (Figure 1).

The link between work productivity and quality of life has not been sufficiently studied in the literature [1]. Notwithstanding, the concept of presenteeism has emerged as a new research area in the last few years [2; 3]. It is considered as the act of being physically present at work but, due to certain diseases/health conditions, a loss of productivity occurs [2]. Besides being more difficult to identify, statistics show its costs are much higher compared to absenteeism.

Several studies have provided ample evidence of the impact of work-related factors on presenteeism [4; 5; 6]. On the other hand, the need to study an individual's antecedents of presenteeism has been overlooked. Some researchers have focused on certain personality traits, such as conscientiousness and neuroticism [7; 8]. Even less studied in the area of an individual's antecedents, is the specific role of some cognitive variables and their relationship with mental disorder [9; 10]. Thus, work productivity can be affected by mental disorders [2], and this is one of the biggest public health problems confronting Europe nowadays. The WHO estimates mental disorders affect over a third of the European population each year, making it the chronic disease with the biggest impact on Europeans' well-being [11]. Specifically, depressive symptoms are responsible for 13.7% of disability burden and are the most prevalent disability at work – around 14% - being many times related to productivity losses of between 7 and 11% [12; 2; 13].

Some studies suggest that the relationship between depressive symptomatology and quality of life may be explained by some intermediary variables [14; 15]. Since depression is also related to productivity losses [16], we will explore the effect of productivity within the relationship between

depressive symptoms and quality of life, as well. Our proposition is that, in the presence of depressive symptoms, an individual's ability to focus on work without being distracted by health problems may affect their quality of life.

Depressive symptoms are associated with several cognitive deficits that can negatively affect role functioning and also the quality of life [17; 18], although relatively few studies have attempted to describe the association between cognitive performance in depression and work performance [10]. Due to the impact of cognitive performance on depression [19], it is important to understand which cognitive variables can affect an individual's productivity and contribute to increasing or decreasing the effect of depressive symptoms in an individual's productivity. This study will analyze the role of information processing speed in this relationship. Thus, we would like to understand whether depressive symptoms have a greater impact on an individual's productivity according to different levels of processing speed. Since the literature suggests that individuals with higher intelligence tend to process information faster [20] and also that individuals with higher levels of processing speed tend to exhibit more conscientiousness traits [21], those individuals might be more affected by depressive symptoms, which consequently will result in productivity losses.

### **Depression and quality of life**

*Hypothesis 1 (H1): Depressive symptoms are negatively correlated with quality of life.*

People with mental disorders, including depressive symptoms, often experience dissatisfaction with their lives [22]. Although increased attention has been paid to the link between depressive symptoms and quality of life, this association has not been sufficiently studied in the literature [21; 22]. Quality of life refers to perceived well-being in different areas of life, including domains such as personal happiness, role fulfillment and relationships [23; 22]. Patients with depressive symptomatology have quality of life deficits that are directly linked to mood disturbances [2], to the point that some

authors have recommended using quality of life as a measure of treatment efficacy in the prevention of mood episodes [23]. As a result, quality of life deficits have become a relevant outcome measure in mental health patients and can be seen as an indicator of impairment and the severity of an illness [1].

According to these findings, we wish to prove that there is a direct relation between depressive symptomatology and quality of life.

### **The mediator role of productivity despite sickness presence**

*Hypothesis 2 (H2): Productivity despite sickness presence partially mediates the relationship between depressive symptoms and quality of life.*

The relationship between depressive symptoms and work productivity has been the focus of diverse studies. Findings from several studies have suggested that individuals with depressive symptoms evidence deficits in work performance [24; 25; 26] and these symptoms can also negatively affect quality of life [17; 18]. In some investigations [1] quality of life was associated with diverse types of productivity losses in depressed patients, such as presenteeism, short-term absence from work and long-term absence from work. Empirical assessment of the relationship between productivity and quality of life can be helpful in the design of productivity costs models [1].

The empirical evidence presented above predicts a negative relationship between depressive symptoms and productivity and between productivity and quality of life. Combining these two predictions suggests that productivity despite sickness presence should mediate the relationship between depressive symptomatology and quality of life. However, productivity despite sickness presence may not be the only mechanism linking depressive symptoms with quality of life. For example, some workplace characteristics and non-work factors may also be involved [27; 15]. Hence, partial mediating effects are expected.

## **The moderator role of information processing speed**

*Hypothesis 3 (H3): Information processing speed moderates the relationship between depressive symptoms and productivity despite sickness presence, such that the relationship is stronger when processing speed is higher than when it is lower.*

Assuming the relation between information processing speed and depressive symptoms and following the assumption that processing speed is a risk factor for the onset of depression and not just a characteristic of the depressed individual [20], we want to prove the moderating effect of information processing speed in the relationship between depressive symptoms and productivity despite sickness presence. In brief, we would like to understand whether depressive symptoms have a greater impact on an individual's productivity when he/she also has higher levels of processing speed. It is important to mention that, although previous studies have analyzed processing speed as a potential moderator in several relationships, no earlier study has established this moderation relation [28]. Since scores on processing speed tests are moderately correlated with scores on intelligence tests, some authors argue that individuals with higher intelligence tend to process information faster [20]. The literature also suggests that individuals with higher levels of processing speed tend to exhibit more conscientiousness traits [29]. Graham & Lachman [30] also found that some facets of conscientiousness, such as competence, were associated with faster processing speed. Thus, those individuals might be more affected by depressive symptoms, since processing speed may lead them to experience more frustration and also feel that they are not being sufficiently competent in their work, which will consequently result in productivity losses.

In the present study we intend to test if the effect of depressive symptomatology on productivity despite sickness presence differs according to different levels of information processing speed. Specifically, we believe that individuals with higher levels of information processing speed have

a greater cognitive capacity, so when they are confronted with health problems that awareness may lead to increased stress and have a greater impact on their productivity at work, causing increased productivity losses.

### **The moderated mediation hypothesis**

*Hypothesis 4 (H4): The extent to which productivity despite sickness presence accounts for the association between depressive symptoms and quality of life it is expected to be conditional upon levels of information processing speed.*

In the current study we intend to test if productivity despite sickness presence mediates the relationship between depressive symptoms and quality of life. Several investigations, which have researched the relationship between depression and quality of life, have found that the severity of depressive symptoms was inversely related to quality of life [31] and was also associated with productivity [1; 10; 32].

Authors [33] found that cognitive functions predicted workplace performance and quality of life in individuals with depressive symptoms. These findings reinforce previous data that a correlation exists between severity of depression, work productivity and cognitive function [17]. Cognitive impairment associated with depressive symptoms may lead to the impairment at the workplace in several ways, such as productivity deficits and also by reducing the chances of work progression and promotions [18]. Other study [34] also suggested that an important component of the normalization of functioning in the remission of depressive symptoms is improvements in processing speed.

Despite these evidences, little is known about the relationship between productivity, cognitive deficits and quality of life in individuals with depressive symptoms [23] and the existing literature has found contradictory results [9]. In the present study we intend to test if the effect of depressive symptomatology on quality of life through productivity despite sickness presence differs according to



different levels of information processing speed, in order to make a contribution to filling the known gaps in the literature concerning mental speed in individuals with depressive symptoms and their impact on work productivity.

Considering that higher levels of depressive symptomatology will reduce individuals work performance and that this relationship will affect quality of life, we wish to understand which cognitive variables have an impact on this mediation effect. Specifically, we explore the moderator effect of information processing speed in this relationship. Assuming that information processing speed moderates the relation between depressive symptomatology and productivity despite sickness presence, it may conditionally influence the strength of the indirect relationship between depressive symptomatology and quality of life, demonstrating a moderated mediation model.

## **Method**

### **Sample and Procedures**

This study consisted of 231 individuals (134 female) aged between 20 and 69 ( $M=40.57$ ;  $SD=11.74$ ) who voluntarily participated and provided informed consent. Among the participants, 75 stated having attended the ninth grade, while 63 stated having completed high school and 93 a university degree. In this convenience sample the participants were recruited from two sources: i) among relatives and friends of the medical team in a hospital in the north of Portugal, ii) from the research team, among relatives and friends and by word of mouth. All participants were aware of the nature of this study.

An inclusion criterion for the study was being part of the working population. Exclusion criteria for the study were having a neurological disorder, history of alcohol or drug abuse and regular dosage of antidepressants or anxiolytics. Data collection was previously approved by the Portuguese Data Protection Authority and by the ethical committee of the hospital where the data were collected.

Thirty participants were removed from analysis because they did not fulfill the Stanford Presenteeism Scale (SPS-6) criteria, which was that the only subjects eligible were those who reported having health problems in the last six months.

There were administered four tests: the neuropsychological test was administered first and then the other three tests. The administration of all of the tests for the current study took approximately 30 minutes.

### **Measures:**

Within this study the following variables were measured: depressive symptoms, productivity despite sickness presence, quality of life and information processing speed. We also controlled for two demographic variables, age and gender.

### **Depressive symptoms**

Depressive symptomatology was measured using the Beck Depression Inventory – BDI [35]. BDI is one of the most self-reported instruments used for evaluating the severity of depressive symptoms in psychiatric patients and in normal populations [36]. The scale has a Portuguese version, which was used in this study [36].

The scale has 21 items; each one of them consists of four self-evaluative sentences scored 0 to 3, with increasing scores indicating greater severity of depression [36]. Examples of items are: “*I am sad all the time*”; “*I feel quite guilty most of the time*” and “*I feel more worthless as compared to other people*”. Cronbach alpha was .85.

### **Quality of life**

Quality of life was measured through the Portuguese version of the Flourishing Scale [37]. This instrument was developed by [38] and evaluates individuals’ positive functioning in relevant areas such

as self-esteem, optimism, feelings of competence, purpose in life and relationships [39; 37]. The scale has eight items, rated on a 7-point Likert scale ranged between 1 (strongly disagree) and 7 (strongly agree). Higher scores indicate that subjects have a positive self-image in important areas of functioning [37]. Cronbach alpha for this scale was .85. Examples of items are: “*I am engaged and interested in my daily activities*”; “*I am competent and capable in the activities that are important to me*” and “*I am a good person and live a good life*”.

### **Productivity despite sickness presence**

Productivity was measured using the Portuguese adaptation of the Stanford Presenteeism Scale (SPS-6)[40], the original version of which is from the authors Koopman et al [41]. This instrument was designed to assess the relationship between presenteeism, health problems and productivity in working populations [41]. This scale measures cognitive, emotional and behavioral aspects of accomplishing work despite health problems [41], using items such as: “*Despite having my health problem, I was able to finish hard tasks in my work*” and “*I felt hopeless about finishing certain work tasks, due to my health problem*”. The SPS-6 includes two dimensions: ‘Completing work’ (items 2, 5 and 6), which focuses on the amount of work accomplished, and ‘Avoiding Distraction’ (items 1, 3 and 4) which refers to the ability to concentrate on the process of doing work. The items in this last dimension are reversed.

Scale items were scored on a 7-point Likert-type response scale ranging from ‘*strongly disagree*’ to ‘*totally agree*’. Lower scores indicate lower productivity and higher scores indicate higher productivity. Cronbach alpha was .81 for ‘Completed work’ dimension and .78 for ‘Avoiding Distraction’ dimension.

Only subjects who report having health problems in the last six months are eligible for this measure. Despite criticism of self-report methods for assessing work functioning, there are various kinds of evidence that indicate this tool has excellent psychometric characteristics [41; 3].

## **Information processing speed**

This study was part of the validation of the Brief Repeatable Battery of Neuropsychological Tests (BRBN-T) for the Portuguese population, which consists of five tests including verbal learning and delayed recall (*Selective Reminding Test* – SRT), visuospatial learning and delayed recall (*10/36 Spatial Recall Test* – SPART), sustained attention and concentration (*Paced Auditory Serial Addition Test* – PASAT and *Symbol Digit Modalities Test* – SDMT) and phonemic verbal fluency (*Word List Generation* – WLG). The administration of the total neuropsychological test battery took approximately one hour and was administered by two well-trained neuropsychologists.

In the current study we included only the Symbol Digit Modalities Test (SDMT) because there is a need to understand the relationship between depressive symptoms and cognitive performance such as information processing speed [42].

SDMT is used to assess information processing speed, attention and visual scanning, as a measure for screening organic cerebral dysfunction in both children and adults [43]. The test consists of patients examining a series of nine geometric figures and, for each symbol in the sequence, having to find a key for that symbol and substitute (orally or in writing) a number for the symbol [43]. Impaired performance in this test has been associated with a number of conditions, including depression, but it has also been administered to normal populations [43].

## **Control variables**

Age was measured in years and gender was measured as a dichotomous variable coded as 0 for male and 1 for female.

## Results

### Statistical Analysis

All analyses were conducted using IBM SPSS Statistics V.23. As recommended by Hayes [44], the indirect effect of depressive symptoms on quality of life, the mediation and the moderating effect were first examined. PROCESS is a macro for SPSS developed by Hayes [44] and was used to test mediation, moderation and the moderated mediation hypotheses. PROCESS estimates both conditional and unconditional direct and indirect effects and also produces a table containing the conditional effect for various values of the moderator in the moderation-mediated model [44]. Each analysis utilized 10000 bootstrap estimates for the construction of a 95% bias-corrected confidence interval for the indirect effects and the conditional indirect effects. Bootstrap confidence intervals use the rationale that the indirect effect is statistically significant when zero is not included between the lower and upper bounds of the 95% bias-corrected confidence interval generated by PROCESS [44].

Hypothesis 1 and hypothesis 2 were tested by means of a simple mediation analysis (Model 4 in PROCESS macro); hypothesis 3 was tested using moderation analysis (Model 1 in PROCESS macro) and the moderation-mediated model (hypothesis 4) was examined using the model 7 in PROCESS. In the moderation-mediated hypothesis, the indirect effects of depressive symptoms on quality of life were estimated through productivity despite sickness presence at different values of information processing speed. This analysis provides the slope of the line reflecting the association between the moderator and the indirect effect and the values of the conditional indirect effects on the specific levels of the moderator (-1 SD, Mean, + 1 SD) [44].

### Preliminary Results

Linearity, normality and homoscedasticity for all variables were found to be acceptable based on the results of histogram, normal probability plot, scatter plot and bivariate correlations.

Mean, standard deviation and bivariate correlations among variables are presented in Table 1. Consistent with Hypothesis 1, depressive symptomatology was negatively correlated with quality of life ( $b = -.048, t_{(197)} = -3.245, p < .05$ ).

### Mediation Analysis

Productivity despite sickness presence was examined as a mediator between depressive symptoms and quality of life. Gender and age were entered as covariates of both M and Y variables. The full model with productivity despite sickness presence included as a mediator was significant ( $F_{(4,196)} = 17.25, p < .001, R^2 = .26$ ). Results revealed the significant effects of the depressive symptoms on productivity despite sickness presence (path a) ( $b = -.0489, t_{(197)} = -3.2455, p < .05, 95\% \text{ CI } [-.0787, -.0192]$ ) and on the productivity despite sickness presence on quality of life (path b) ( $b = .0983, t_{(196)} = 2.1873, p < .05, 95\% \text{ CI } [.0097, .1870]$ ). The direct effect (path c') of the depressive symptoms on quality of life after accounting for productivity despite sickness presence remained significant ( $t_{(196)} = -7.0260, p < .001, 95\% \text{ CI } [-.0879, -.0494]$ ). Although path c' remained significant, there was a significant indirect effect of depressive symptomatology on quality of life through productivity, demonstrated by the bootstrapped 95% CI of the indirect effect ( $b = -.0048, SE = .0029, 95\% \text{ CI } [-.0124, -.0004]$ ). These results suggested a partial mediation between depressive symptomatology and quality of life through productivity, consistent with hypothesis 2.

### Moderation Analysis

Information processing speed was examined as a simple moderator of the relationship between depressive symptomatology and productivity despite sickness presence. Covariates in the model were entered as covariates of both M and Y variables. The overall model was significant ( $F_{(5,195)} = 4.2938, p < .05, R^2 = .09$ ). Consistent with hypothesis 3, there was a significant interaction between depressive symptoms and information processing speed ( $b = -.0023, t_{(195)} = -2.4057, p < .05$ ), which indicates that information processing speed is a significant moderator between depressive symptoms and productivity

despite sickness presence. Specifically, the results indicated that the association between depressive symptomatology and productivity despite sickness presence increases in magnitude from low ( $b = -.0170t_{(195)} = -.98401, p = .40$ ) to moderate ( $b = -.0454t_{(195)} = -2.9971, p < .05$ ) to high ( $b = -.0738t_{(195)} = -4.0685, p = .001$ ) levels of information processing speed. However the relationship between depressive symptoms and productivity is only moderated by information processing speed in their moderate and high levels, and not in their low levels of information processing speed (Figure 2).

### **Moderated Mediation Analysis**

Whether the indirect effect of depressive symptomatology on quality of life through productivity despite sickness presence was conditional upon levels of information processing speed was examined. Age and gender were entered as covariates of both M and Y variables. The overall model was significant ( $F_{(4,196)} = 17.25, p < .001, R^2 = .26$ ). The direct effect (pathc') of depressive symptoms on quality of life after controlling for productivity despite sickness presence, information processing speed and the interaction of productivity despite sickness presence and information processing speed remained significant ( $t = -7.0260, p < .001$ ). There was a conditional indirect effect of depressive symptoms on quality of life through productivity despite sickness presence, with the indirect effect significant at moderate ( $b = -.0045, SE = .0028, 95\% CI [-.0122, -.0003]$ ) and high ( $b = -.0073, SE = .0045, 95\% CI [-.0181, -.0001]$ ) levels of information processing speed, but not at low levels of information processing speed ( $b = -.0017, SE = .0024, 95\% CI [-.0088, .0015]$ ). This suggests that productivity despite sickness presence mediates the relationship between depressive symptomatology and quality of life only for those who display moderate to high levels of information processing speed. However, the index of moderated mediation that tests the difference between conditional indirect effects was not significantly different from zero ( $b = -.0002; SE = .0002, 95\% CI [-.0007, .0000]$ ),

which revealed a non-significant moderated mediation effect. Thus, hypothesis 4 was not corroborated. Results of all models are shown in Table 2.

## **Discussion**

This study examined the relationship between depressive symptomatology, productivity despite sickness presence and information processing speed in quality of life, testing a moderated mediation model in which the association between depressive symptoms and quality of life is accounted for by productivity despite sickness presence and conditional upon levels of information processing speed.

As expected, results suggest that depressive symptoms are negatively related to quality of life, and that this relationship is weaker in the presence of productivity despite sickness presence. Productivity despite sickness presence was found to partially mediate the link between depressive symptomatology and quality of life. In other words, decreased productivity despite sickness presence partially accounted for the relationship between depressive symptoms and quality of life. This fact suggests that the workers' own perception of their capacity to deal with some health problems influences quality of life [1].

Information processing speed was a significant moderator between depressive symptoms and productivity despite sickness presence; however, only for medium and high levels of information processing speed. The impact of depressive symptomatology on productivity despite sickness presence is stronger for medium and high levels of information processing speed, and this relationship does not occur at the lower levels. Moreover, information processing speed was a significant moderator of the indirect effect of depressive symptoms on quality of life through productivity despite sickness presence, for medium and high levels of information processing speed. Notwithstanding, this conditional effect was non-significant, which reveals the absence of a moderated mediation model.

The present study constitutes one of the first attempts to link the impact of cognitive variables and depressive symptomatology to workers' productivity and quality of life. This investigation made a



significant contribution to the existing literature on quality of life [23], productivity and cognitive functioning in individuals with depressive symptoms. These results offer glimpses into the mechanisms through which depressive symptoms are manifested in work environments and also about the impact of different levels of information processing speed on a worker's productivity and quality of life.

### **Theoretical implications**

Depressive symptomatology has been associated with lower levels of quality of life [23; 45; 46; 22]. Consistent with this view, the results of our sample suggest that higher levels of depressive symptoms were reported as being associated with a lower quality of life, making an important contribution to quality of life literature. However, the present investigation goes further in this research area by studying the link between these two variables in a working, non-clinical and non-medicated population. An individual's clinical and medicated status may be a confounding factor in the study of the deficits associated with depressive symptoms, so our results contribute to new findings in this area, by studying these variables in an unmedicated sample of the population. The present findings may help organizations to promote interventions that increase employees' well-being.

The mediation results in this study provide evidence that workers with depressive symptoms show deficits in productivity and also in quality of life, which is consistent with results from previous investigations [26; 24; 18; 16]. Notwithstanding, our investigation goes further and shows that there is an intermediate step between depressive symptoms and quality of life: in the presence of adverse health conditions, the workers' own perception of efficacy and that they are capable of maintaining their productivity level influence their quality of life. As far as we know, this is also one of the first studies to examine presenteeism and its relationship with quality of life.

The mediation model tested in the present study also offers advances over the antecedents of the presenteeism research area. As suggested by Johns [47], it is important not only to study the work-

related factors associated with presenteeism but also the individual factors, a topic that has been overlooked. Our approach in this study emphasizes the importance of the individual. The results of this investigation provide new findings regarding the role of productivity despite sickness presence in the relationship between depressive symptoms and quality of life and, to our knowledge, it is one of the first attempts to explore depressive symptomatology and productivity as predictors of quality of life.

The moderation results revealed that depressive symptoms and information processing speed interact in the prediction of productivity despite sickness presence. Specifically, the impact of depressive symptoms on productivity was stronger at high and moderate levels of information processing speed. A potential explanation for these findings is that individuals with higher levels of information processing speed have greater cognitive capacity so, when they are confronted with some health problems, that awareness will have a greater impact on their productivity at work. Likewise, since individuals with higher levels of information processing speed also tend to exhibit more conscientiousness traits [29], they might be more affected by depressive symptoms and experience more feelings of frustration and that they are not being sufficiently competent in their work, which consequently results in productivity losses.

Since few studies have attempted to investigate the impact of cognitive performance on depression and work performance [10], our investigation may help to clarify under which conditions this impact is most preeminent, particularly by analyzing the role of information processing speed, a cognitive variable that has been less studied in individuals with the characteristics our sample [48;42]. To the extent of our knowledge, this is also one of the first studies to combine a self-reported presenteeism measure (SPS-6) and a cognitive measure (SDMT) in the same investigation. Since SPS-6 was also designed to measure cognitive aspects of managing to work despite having health problems [41], more studies that analyze the relationship between productivity despite sickness presence and cognitive variables are necessary.

Another innovation of the present study was the moderated mediation model tested. We believe this is the first time that cognitive variables have been tested as a moderator between the relationship of depressive symptoms and quality of life through a productivity measure. The results of the present study helps to fill the known gaps in the literature concerning mental speed in individuals with depressive symptoms and their impact on work productivity.

We found that productivity despite sickness presence mediates the relationship between depressive symptomatology and quality of life but only for those who displayed moderate to high levels of information processing speed. Although the moderated mediation effect was non-significant, the conditional indirect effect of depressive symptoms on quality of life through productivity despite sickness presence demonstrates that different levels of processing speed have different impacts on productivity, which adds to the existing findings concerning productivity, cognitive deficits and quality of life in individuals with depressive symptoms [10; 21].

### **Practical Implications**

There are some implications in our study for the development of management practices. The relationship between cognitive performance and quality of life is a relatively unexplored area, especially in individuals with depressive symptoms. However, cognitive programs or interventions are needed, in order to improve employees' productivity [9; 18]. It is important to study what domains of cognitive functioning in individuals with depressive symptoms are related to quality of life, so more suitable cognitive programs to improve productivity in employees can be designed [9]. The present study emphasizes the importance of information processing speed in the relationship between productivity and quality of life. In a general way, it is also crucial that organizations develop programs to identify individuals who are depressed and to ensure those individuals receive effective treatment

[49], since cognitive deficits associated with depression may have a negative impact on workers' productivity [10].

One of the reasons why organizations do not invest in these types of programs may be the significant variability of results in this research area [21]. Our results highlight the fact that certain cognitive variables can affect the relationship between productivity and quality of life in individuals with depressive symptoms differently. Bearing this in mind, organizations could design specific programs that promote improvements in quality of life and productivity through cognitive stimulation and training, since specialized interventions which also target cognitive functions may be more appropriate for certain profiles of individuals [21].

The findings of this study also provide knowledge that may help organizations develop specific training and counseling to help employees with higher levels of information processing speed to manage depressive symptomatology, so that it does not affect their productivity and, indirectly, their quality of life. Such interventions could help them deal with these specific conditions and manage difficulties in maintaining a work-life balance.

Finally, since presenteeism is also affected by work-related factors [47], attention should also be paid to variables such as supervisor support and role ambiguity, since that may help reduce the effects of depressive symptomatology and employees can remain effective despite health problems [50].

### **Limitations and directions for future research**

The limitations of this study should be considered. One of them is the self-reported instrument used to measure productivity. Despite evidence indicating that SPS-6 has good psychometric characteristics [3; 41], future studies would benefit from additional assessment methods. Also, thirty participants had to be removed from the study because they did not fill the SPS-6 criteria, that the only eligible subjects are those who reported having health problems in the last six months. We also

consider that caution must be exercised when generalizing from the present data, essentially due to the relatively small sample size.

Another limitation is that the data used in this investigation was cross-sectional. Although the present findings are certainly promising, the cross-sectional nature of the present study does not allow us to determine the exact nature of the association between depressive symptoms, cognitive functioning, productivity and quality of life. Since improving individuals' quality of life can be a slow process [45], a useful next step would be to conduct experiments or longitudinal studies to examine the causal sequences in the relationships among depressive symptomatology, productivity and quality of life, and whether the association between these factors is mediated by additional variables. Cross-cultural differences must also be considered in future research. Lu and colleagues [51] found negative effects of presenteeism behavior in employees' well-being across western and eastern cultures, hence it is worth considering to what extent our findings are culturally invariant.

Our sample exhibits only modest levels of depressive symptomatology. Since cognitive impairments can differ according to the severity of depression [33; 52], future studies with samples that presented higher levels of depressive symptoms are needed. It is also important to explore the effects of age, since this variable is associated with a progressive decline in neurocognitive functioning [53] and it is usual to find effects of age in the performance of depressed individuals during the performance of neuropsychological tasks [54]. Another factor that should be considered regarding the impact of depression on cognitive performance is the medication status of the patients. Exposure to several types of psychotropic medication for a long period of time is negatively associated with cognitive functioning [54], and some cognitive functions may be more susceptible to the negative effects of drug use [33]. Notwithstanding, not all studies of depressed patients found this association between antidepressant treatment and a general impairment of cognitive functions [55]. Therefore, the effects of

psychotropic medication may be a confounding factor in the study of neurocognitive impairment in depression [53] and should be investigated more profoundly in future research.

Furthermore, since presenteeism can differ according to the nature of the job [41] coming investigations should also analyze the effect of different types of jobs in the relationship between depressive symptomatology, quality of life, productivity and cognitive variables. Lastly, the present model should also be tested on other medical conditions. A person's ability to work is greatly affected by their health and numerous studies have shown a link between employees with more health risks and higher health care costs [3]. Therefore, it is important to study cognitive variables in the relationship with the other most prevalent conditions in the workplace, such as allergies, chronic pain, arthritis and also anxiety disorders [2; 3].

## **Conclusion**

In conclusion, our study shows that different levels of information processing speed can have distinct impacts on a worker's productivity, especially in individuals with depressive symptomatology. Our findings have revealed that individuals with higher levels of processing speed may have more difficulty focusing on work without being distracted by health problems, and also present lower levels of quality of life, in contrast with individuals with reduced processing speed. The present investigation has made a significant contribution to the existing literature about cognitive functioning and productivity in workers with depressive symptomatology, and the effects on quality of life. To our knowledge, this is the first time that cognitive variables have been tested as a moderator between the relationship of depressive symptoms and quality of life through a productivity measure.

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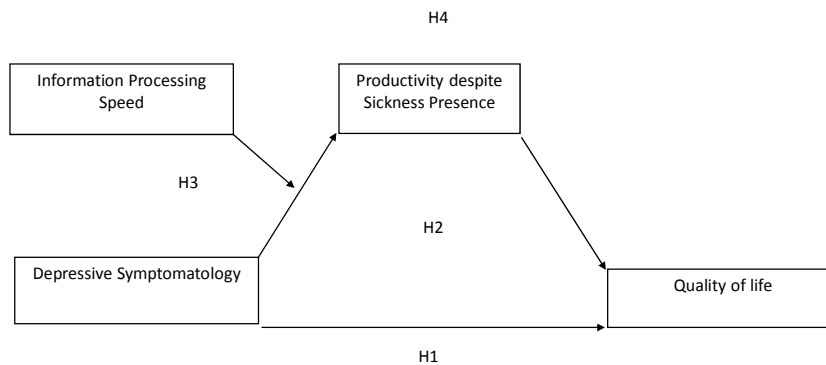
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## Figure Captions

### Figure 1. Proposed moderated mediation model

Moderated mediation model: the effect of depressive symptomatology on quality of life through productivity despite sickness presence differs according to different levels of information processing speed.

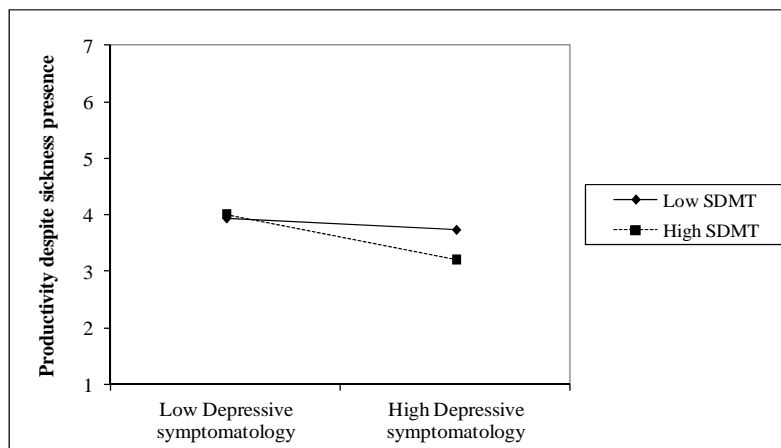
Figure 1. Proposed moderated mediation model.



**Figure 2.**Interaction of Depressive Symptomatology and Information Processing Speed (SDMT) in predicting Productivity despite Sickness Presence.

The relationship between depressive symptoms and productivity is only moderated by information processing speed in their moderate and high levels, and not in the lower levels of information processing speed.

**Figure 2.** Interaction of Depressive Symptomatology and Information Processing Speed (SDMT) in predicting Productivity despite Sickness Presence.



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**Table 1. Mean, standard deviations and inter-correlations among variables**

Variable	M	SD	1	2	3	4	5
1. Age	40.57	11.74	-				
2. Gender	.58	.49	.00	-			
3. Depressive symptoms	5.65	5.35	.041	.162*	-		
4. Quality of life	5.82	.75	.117	-.081	-.471**	-	
5. Productivity despite sickness presence	4.84	1.03	.140*	-.055	-.218**	.254**	-
6. Information processing speed	55.41	12.6	-.598**	.080	-.047	-.069	-.081

\* $p < .05$

\*\*  $p < .01$ ;

**Table 2.** Mediation, Moderation and Moderated Mediation Model Results

<b>Mediation</b>	<b>b</b>	<b>SE</b>	<b>t</b>	<b>p</b>	<b>CI (lower)</b>	<b>CI (upper)</b>
X <sub>1</sub> --> M (a)	-.0489	.0151	-3.2455	<.05	-.0787	-.0192
M --> Y (b)	.0983	.0449	2.1873	<.05	.0097	.1870
X <sub>1</sub> --> Y (c)	-.0686	.0098	-7.0260	<.001	-.0879	-.0494
X <sub>1</sub> --> Y (c')	-.0734	.0096	-7.6441	<.001	-.0924	-.0545
X <sub>1</sub> --> M--> Y (a1*b1)	-.0048	.0030			-.0123	-.0005
<b>Moderation</b>	<b>b</b>	<b>SE</b>	<b>t</b>	<b>p</b>	<b>CI (lower)</b>	<b>CI (upper)</b>
X <sub>1</sub> --> Y	.0910	.0603	1.5094	=.13	-.0279	.2100
W --> Y	.0141	.0103	1.3735	=.17	-.0061	.0343
X <sub>1</sub> * W --> Y	-.0025	.0010	-2.4057	<.05	-.0045	-.0004
Conditional effect for low processing speed	-.0170	.0202	-.8401	=.40	-.0569	.0229
Conditional effect for medium processing speed	-.0454	.0152	-2.9971	<.05	-.0753	-.0155
Conditional effect for high processing speed	-.0738	.0181	-4.0685	<.001	-.1096	-.0380
<b>Moderated Mediation</b>	<b>b</b>	<b>SE</b>	<b>t</b>	<b>p</b>	<b>CI (lower)</b>	<b>CI (upper)</b>
X <sub>1</sub> --> M (a)	.0910	.0603	1.5094	=.13	-.0279	.2100
M --> Y (b)	.0983	.0449	2.1873	<.05	.0097	.1870
X <sub>1</sub> --> Y (c')	-.0686	.0098	-7.0260	<.001	-.0879	-.0494
X <sub>1</sub> * W --> M	-.0025	.0010	-2.4057	<.05	-.0045	-.0004
Conditional effect for low processing speed	-.0017	.0024			-.0088	.0015
Conditional effect for medium processing speed	-.0045	.0028			-.0122	-.0003
Conditional effect for high processing speed	-.0073	.0045			-.0181	-.0001



Index of Moderated Mediation	-.0002	.0002	-.0007	.0000
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*NOTE: for all models, covariates included age and gender.*

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