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“Ultramodern times”: consequences of smartphone use on workers

“Tempos ultramodernos”: consequências do uso do smartphone em trabalhadores

“Tiempos ultramodernos”: consecuencias del uso de smartphones en los trabajadores

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Abstract
The ubiquitous and timeless use of smartphones in the workplace has contributed to a rise in musculoskeletal disorders. Objective: To identify the symptoms regarding workers' health as a result of the use of smartphones in the workplace. Methods: Quantitative-cross-sectional study of workers from south of Brazil through online social networks. A questionnaire composed of socioeconomic, device use behavior inside and outside of work and the presence of musculoskeletal symptoms questions were applied. Data were submitted to statistical analysis and association tests. Results: 326 individuals answered and 196 constituted the sample. They are predominantly females (61.54%), incomplete higher education (47.18%), monthly income of up to two salary wages (45.64%), reported always used their smartphone (62%) and perceived it as necessary for their professional performance (55.9%). There was no evidence of association between the daily use of the smartphone and the presence of symptoms conditioned to physical activity. However, the study found that the lower the income, the longer the use of the device during off-hours (P = .0281), even to work. Conclusion: Smartphone is a recent technology, social adjustments are still being negotiated, but lack of regulations of how and when to use it inside and outside work, are discussions that emerge from this context.
Keywords: Smartphone; Behavior; Health promotion; Musculoskeletal symptoms; Worker's health.

Resumo
O uso ubíquo e a todo momento dos smartphones no ambiente de trabalho tem contribuído para o aumento das doenças musculoesqueléticas. Objetivo: Identificar os sintomas associados a saúde dos trabalhadores como o resultado do uso constante dos smartphones no ambiente de trabalho. Métodos: Estudo quantitativo transversal com trabalhadores de uma cidade do sul do Brasil recrutados por meio de chamada em redes sociais online. Foi aplicado um questionário composto por questões socioeconômicas, comportamento de uso dos dispositivos dentro e fora do trabalho e presença de sintomas musculoesqueléticos. Os dados foram submetidos à análise estatística e testes de associação. Resultados: 326 indivíduos responderam e 196 constituíram a amostra. A amostra foi composta predominantemente do sexo feminino (61,54%), ensino superior incompleto (47,18%), renda mensal de até dois salários (45,64%), relataram usar sempre o smartphone (62%) e percebê-lo como necessário para a sua atividade profissional (55,9 %). Não houve evidência de associação entre o uso diário do smartphone com a presença de sintomas condicionados à atividade física. Porém, o estudo constatou que quanto menor a renda, maior é o tempo de uso do aparelho fora do expediente (P = 0,0281), para realizar atividades a ele relacionado. Conclusão: Smartphones são tecnologias recentes, ajustes sociais ainda estão sendo negociados, mas a falta de regulamentação de como e quando usá-lo dentro e fora do trabalho, são discussões que emergem desse contexto.
Palavras-chave: Smartphone; Comportamento; Promoção de saúde; Sintomas musculoesqueléticos; Saúde do trabalhador.

Resumen
El uso omnipresente de los teléfonos inteligentes en el lugar de trabajo en todo momento ha contribuido para el aumento de las enfermedades musculoesqueléticas. Objetivo: Identificar los síntomas asociados a la salud de los trabajadores como consecuencia del uso constante de teléfonos en el lugar de trabajo. Métodos: Estudio cuantitativo transversal con trabajadores de una ciudad del sur de Brasil reclutados a través de llamadas en redes sociales. Se aplicó un cuestionario compuesto por aspectos socioeconómicos, comportamiento de uso de los dispositivos dentro y

fuera del trabajo y presencia de síntomas musculoesqueléticos. Los datos fueron sometidos a análisis estadístico y pruebas de asociación. Resultados: 326 individuos respondieron y 196 constituyeron la muestra. La muestra estuvo compuesta predominantemente por el sexo femenino (61.54%), educación superior incompleta (47.18%), ingresos mensuales de hasta dos salarios (45.64%), reportaron siempre usar el teléfono inteligente (62%) y percibir como necesario para su actividad profesional (55,9%). No hubo evidencia de una asociación entre el uso diario de teléfonos inteligentes y la presencia de síntomas condicionados por la actividad física. Sin embargo, el estudio encontró que cuanto menor es el ingreso, más tiempo se usa el dispositivo fuera de horario (P = 0.0281), para realizar actividades relacionadas con él. Conclusión: Los smartphones son tecnologías recientes, aún se están negociando ajustes sociales, pero la falta de regulación de cómo y cuándo usarlos dentro y fuera del trabajo, son discusiones que surgen de este contexto.
Palabras clave: Teléfonos inteligentes; Comportamiento; Promoción de la salud; Síntomas musculoesqueléticos; Salud del trabajador.

1. Introduction

Since the advent of personal computers, negative effects on the user's health has been reported (Ellegast et al., 2012) and, in recent years, the ubiquitous use of smartphone is contributing to the increase number of some mental and musculoskeletal disorders (Gustafsson et al., 2017; Kim, 2015). Among the reported consequences of such interaction, we can mention RSI (repetitive strain injury) and WRMD (work-related musculoskeletal disorders) due to the overload of hours working without adequate breaks (Pessoa et al., 2010).

In general, diseases related to the musculoskeletal system are already considered as one of the main causes for health problems in workers in Brazil (Oliveira et al., 2015). These problems affect the employee's work productivity who subsequently must undergo a clinical evaluation which not only is expensive for the public health care system (M. S. A. Barbosa et al., 2007). However, this data includes all types of injuries, including those resulting from the excessive use of technologies other than smartphones, which currently have a strong daily presence, causing great health and social consequences (Castells et al., 2006).

Although the literature highlights the occurrence of these problems in youngsters who interact more with the device, little is said about the relationship between the use of smartphones and professional activities and health consequences. In addition, little is known about the perception and the motivation that drive workers to use these technologies (Cavazotte et al., 2014; Cipriano & Nicolaci-da-Costa, 2009). Thus, the aim of this article is to identify in workers the presence of symptoms derived from the continuous use of smartphones in the workplace, associating such symptoms with the use of the device, perception of the worker, the amount of time used and the employee's income.

2. Methodology

2.1 Type of Study, Population and Ethical Issues

We conducted a quantitative descriptive and cross-sectional study. The sample consisted of individuals working a metropolitan area of a city in south of Brazil – Maringá (400 thousand inhabitants), recruited through an online data collection system. The study was approved by the local Ethics and Research Committee (CEP) of the Centro Universitário de Maringá - in 2018, protocol nº 2.840.566. All participants signed informed consent.

2.2 Instruments and Procedures for Data collection

Recruitment was done online, through a visual banner posted on two social networks (Facebook, Instagram) (Figure 1).

After clicking, users were directed to a web page with an online questionnaire providing information about the research, the ethical aspects followed by twenty-five questions, divided into three segments: 1) socio-demographic (age,

gender, income and job or professional duties); 2) objective questions about the use of mobile technologies in the workplace (frequency of use, purpose of use, type of device - personal or provided by employer, among others); 3) identifying health related problems due to smartphone use (presence of musculoskeletal symptoms and how the device is used at work, among others).

The banner was displayed on Facebook and Instagram for 30 consecutive days (beginning October 17, 2018) with an investment cost of U$ 82,00. The duration considered the results of Burgess et al. (2017) who used the targeting strategy of the population given by Facebook and Instagram in a research involving mothers in Australia for a similar amount of time. By configuring the "*Facebook Audience Insights tool*" the banner was "printed" only to those users who, according to their social media profile, were over 18 and located within a 100 km radius of Maringá's city center (known as the publication range).

Figure 1 - banner displaying on Instagram.

Source: Authors.

2.3 Data Analysis

At first, a descriptive analysis of the results was performed to obtain graphs and frequency tables (absolute and percentage for categorical variables), in order to characterize the evaluated individuals.

To calculate the BMI (Body Mass Index) of each individual and identify those who were overweight, we used the recommended (NHLBI - National Heart, 1998) formula Weight (Kg) / Height (m).

In order to evaluate possible associations between nominal variables, the chi-square and Fisher's exact tests were used. And for evaluating the association between two variables conditioned to a third variable, the *Cochran-Mantel-Haenszel* test was applied and finally, for the relationship between variables measured on an ordinal scale, we used Spearman's non-parametric of correlation.

The significance level was set at 5% and all analyzes were performed with the aid of the R statistical environment (TEAM, 2015) version 3.3.1.

3. Results

Data from our social media campaign shows that on *Facebook*® 4,299 individuals viewed our research post, with 572 "likes" and six shares. On *Instagram*® the banner was visible on (displayed) 46,174 accounts and getting 110 clicks to access the link. 326 surveys answered the questionnaire online. After applying the inclusion and exclusion criteria (more than 18 years old and who are active workers), 196 individuals constituted the sample.

Overall, our sample had more women (61.54%), more individuals who had not completed their higher education (47.18%), with an income of up to two minimum wages (45.64%) (1 wage is U$ 240,72 monthly) - (9.74%) said to earn more than 4 minimum wages; 53.85% reported practicing some type of physical activity and 36.4% were overweight. From our sample, 56.41% have been using their smartphone at work for over 2 years and 42.56% reported using it "sometimes" outside of work (data not shown).

Among the participants, 56.41% indicated to have been using the device for more than 2 years at work, followed by 19.49% for over a year and only 11.28% for less than 6 months, while 12.31%, between 6 months to one year (data not shown).

In terms of daily smartphone use, it can be seen from Table 1 that only one individual answered as never having used the device during the day, while 1.5% said they rarely use it and most indicated that they always use it which is relative to 62.6%.

Table 1 - Frequency distribution of characteristics of study participants related to smartphone use at work.

Variable	Frequency (%)
Use of Smartphone	
Always	122 (62.6%)
Many times	49 (25.1%)
Some times	20 (10.3%)
Rarely	3 (1.5%)
Never	1 (0.51 %)
Hours of smartphone use per day at work	
Less than 2 hours	51 (26.15%)
2 to 4 hours	42 (21.54%)
Between 4 and 6 hours	45 (23.08%)
6 to 8 hours	29 (14.87%)
More than 8 hours	27 (13.85%)
Did not respond	1 (0.51%)
Smartphone use is necessary for your job	
Cell phone use is forbidden at work	1 (0.51%)
Not recommended by boss or supervisor	20 (10.26%)
No but it's a personal choice	64 (32.82%)
Yes, it's part of my job/profession	109 (55.9%)
Did not respond	1 (0.51%)
Smartphone availability	
Did not respond	1 (0.51%)
No, I use my own	145 (74.36%)
Yes, owned by the business/boss	49 (25.13%)
Smartphone use beyond working hours	
No	3 (1.54%)
Yes, for work related activities	2 (1.03%)

Yes, for personal activities	87 (44.62%)
Yes, for both personal and work-related activities	102 (52.31%)
Did not respond	1 (0.51%)
Smartphone use beyond working hours	
Less than 2 hours	27 (13.85%)
Between 2 and 4 hours	64 (32.82%)
From 4 to 6 hours	35 (17.95%)
From 6 to 8 hours	24 (12.31%)
More than 8 hours	44 (22.56%)
Did not respond	1 (0.51%)
Frequency of smartphone use outside of work for work related activities	
Never	27 (13.85%)
Almost never	39 (20%)
Sometimes	83 (42.56%)
Frequently	45 (23.08%)
Did not respond	1 (0.51%)

Source: Authors.

Table 1 shows that the reported daily use was less than 2 hours for 26.15% of the subjects, between 2 and 4 hours for 21.54% of them, between 4 and 6 hours for 23.08%, from 6 to 8 hours for 14.87% and over 8 hours for 13.85%.

In addition, Table 1 shows information on the use of the device beyond scheduled working hours. In this sense, we can see that only 1.54% of individuals don't use their smartphones outside working hours, while more than half (52.31%) indicated that they use it for personal and work-related matters. 22.56% of the respondents pointed out using the device for more than 8 hours outside their working hours. Regarding the availability of the device, 74.36% of the subjects answered using their own device and 25.13% reported using a device provided by the company or boss.

When asked if they considered the smartphone necessary for their work, 55.9% stated that it's necessary for their job/profession and only 1 person replied that it's forbidden to use it in the workplace.

Analyzing the symptoms found in the participants, we saw that 19.49% of them did not show symptoms due to the use of smartphones in the last 6 months and 66.15% indicated having some symptoms. "Neck" (9.23%) and "head and neck" (9.23%) were the most common parts of the body with symptoms among respondents, but "all of the above" (which include shoulders, neck, hands, wrists and fingers) represented 11.28%.

3.1 Association

In order to assess whether there is any association between the characteristic of individuals, the use a smartphone and the presence of symptoms, we performed association and correlation tests with the following results:

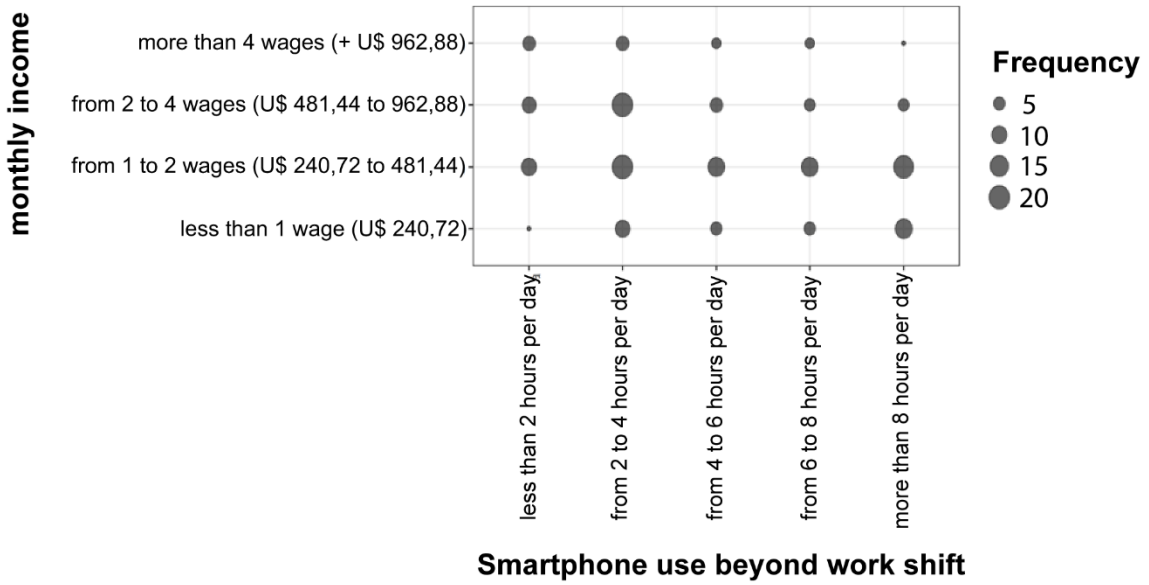
Table 2 - Frequency distribution of characteristics of study participants according to the presence of symptoms in the last 6 months and results for chi-square and Fisher's exact tests.

Variable	Symptom				p-Value
	No		Yes		
Average Income[f]					
Up to 1 salary	6	15.79%	28	21.71%	
Up to 2 salaries	16	42.11%	56	43.41%	0.4982
2 to 4 salaries	13	34.21%	29	22.48%	
More than 4 salaries	3	7.89%	16	12.40%	
Exercises					
No	16	42.11%	60	46.51%	0.7687
Yes	22	57.89%	69	53.49%	
Education[f]					
Did not finish high school	0	0.00%	4	3.13%	
High School diploma	6	15.79%	13	10.16%	
Did not finish university	18	47.37%	58	45.31%	0.4363
University diploma	7	18.42%	37	28.91%	
Master's/Doctorate (complete/incomplete)	7	18.42%	16	12.50%	
Hours of *smartphone* use per day at work[f]					
Less than 2 hours	15	39.47%	27	20.93%	
2 to 4 hours	10	26.32%	30	23.26%	
5 to 6 hours	3	7.89%	32	24.81%	0.074
6 to 8 hours	5	13.16%	19	14.73%	
More than 8 hours	5	13.16%	21	16.28%	
Hours of *smartphone* use per day outside of work[f]					
Less than 2 hours	11	28.95%	14	10.85%	
2 to 4 hours	14	36.84%	41	31.78%	
5 to 6 hours	6	15.79%	20	15.50%	**0.0281***
6 to 8 hours	2	5.26%	22	17.05%	
More than 8 hours	5	13.16%	32	24.81%	

*p-Value < 0.05; [f] : Fisher's exact test used; [c] : Chi-square association test used. Source: Authors.

As for the presence of symptoms within the last 6 months, Table 2 shows that there was no significant association between this variable and the average income (P = .4982), physical activity (P = .7687) or education (P = .4363). Although there is a difference in the relative frequencies of those who had and those who did not show symptoms, according to the hours of smartphone use at work, we could not reject the hypothesis of null association at 5% significance (P = .074). However, it was possible to detect an association between the presence of symptoms and the hours of smartphone use per day outside work (P = .0281).

Figure 2: Association between monthly income x Smartphone use beyond work.



Source: Authors.

We can see in Figure 2 a linear trend behavior between the levels of variable income and time of smartphone use beyond the scheduled work shift. For this case, a negative correlation was found, where the coefficient was equal to -0.399 and the associated p-value was less than 0.001, indicating a significance in this relationship between the studied variable levels. It can be understood that there is a tendency where the lower the income, the longer the use of the device during non- scheduled working hours.

Other *Spearman* rank correlation tests indicated that there is no significant correlation between the frequency of smartphone use during the day and the level of education (p-value .669) and there is no significant correlation between the level of education and the number of hours of daily smartphone use at work (p = 0.898). Thus, similarly to the previous cases, there was no correlation between frequency of daily smartphone use and income (there is no correlation at 5% of significance between the variables under the study (rho = -0.092, p-value = .199).

4. Discussion

Women, which are more predominant in our sample, are the most affected by musculoskeletal symptoms, manifested in those who have an active working life(van Tulder et al., 2007). This is mainly due to the double or triple work shift of women and because musculoskeletal disorders are cumulative and overlap, aggravating symptoms (Vanzella, 2010).

Although we cannot verify in our data a specific association between the presence of musculoskeletal symptoms in those who do or don't regularly practice a physical activity, Barbosa et al. (2008) highlight that physical activity is a protective factor against musculoskeletal disorders in frequent smartphone users. Sharan et al. (2014), however, warn that regardless of physical activity, the use of the smartphone for some time and improper posture are harmful to both groups of individuals (those who practice and those who don't).

Overweight, observed in just over 1/3 of the sample, is responsible for the higher frequency of musculoskeletal symptoms, mainly related to those who are sedentary, with postural and physiological compensations (Regiani Bueno et al., 2019). In fact, musculoskeletal pain is more frequent in overweight or obese individuals, as pointed out by Saporiti et al (2010)

when studying truck drivers in Brazil. It is also recognized that computers have introduced, in recent years, jobs where sitting in front of the screen occurs daily, which contributes to a more sedentary behavior and, consequently, the development of chronic diseases (Bygholm & Kappelsgaard, 2019). Reducing sedentary behavior in a computerized work environment is especially important because the activity consumes many hours per day and studies show an increase in more "sedentary" occupations (Church et al., 2011). According to Brown et al. (2013) , in more than 71% of the time worked in an office, employees spend most of their time sitting (Guertler et al., 2015).

The fact that practically ¾ of the sample with a complete or an incomplete higher education degree and the ownership of a smartphone is in line with the trend observed by the Brazilian Institute of Geography and Statistics (IBGE, 2018) where 97.5% of those with higher education use smartphones and 62% for those who only finished high school. We also observed that there is a direct relationship between education and the perceived need to use the smartphone, which may be the result of a pressure for professional updating that requires more educational training (Ferretti & Silva Júnior, 2000). The adoption of these mobile technologies may also represent a phenomenon of precariousness of work (Antunes, 2018). According to Antunes (2018), it's the advent and expansion of a *new digital age proletariat*, whose work, more or less intermittent, more or less constant, has gained new momentum with the ICTs that connect, via mobile phones, the most diverse types of jobs.

Stawarz and Benedyk (2013) point out that the smartphone is the 21st century work tool, and employees are often pressured to use it. The multifunctionality of the device and its portability encourage more intense use while combining work and leisure moments (Castells et al., 2006). Unlike the personal computer or laptop, we carry our smartphone at all times, thus blending what would normally be well defined times to rest and to work (Perry et al., 2001). This telework or telecommuting has negative consequences for employees who, without a social life, are deprived of social and collective interaction and no union representation (Antunes, 2018).

We must take into account that, as we have seen in our results, few smartphones are provided by companies/employers. Thus, when the employee uses his or her own device, its useful life is reduced and such investments rest on the individual (Kakihara & Sorensen, 2002). However, having the device provided by the company, as we saw in ¼ of the sample, can generate a sense of obligation to answer the phone and respond to work related messages during free time (Cipriano & Nicolaci-da-Costa, 2009).

The number of hours worked, as we saw in the sample, even points to a greater number of hours worked and beyond what is established within the consolidated labor laws of most professions. This aspect shows, according to Lunde et al. (2014), that we live in environments of uncertainty regarding the regulation of this type of technology at work. For Cavazotte, Lemos and Brollo (2014) this uninterrupted connectivity promotes the naturalization of work beyond the established work hours and individuals may feel compelled to respond to demands in real time or, in turn, consider such demands as natural" (Cavazotte et al., 2014) We have seen that the vast majority of our sample often use the device outside working hours to solve issues related to work, even during the so-called "dead time" (during the commute, at breakfast, waiting in line, at the doctor's office or the airport) and don't see the act of reading and answering emails as work related activities (Perry et al., 2001). This situation is aggravated as the lower the income, the more the use of smartphones outside of work to solve work related issues, where the device then creates "virtual shackles", that prevent the worker from leaving work, "(...) because it is understood that, thanks to mobile technologies, there is no reason why demands should be delayed." (Cavazotte et al., 2014).

More than half of those in our sample perceives the device as "a necessity" for his/her professional performance and about one third indicated that, although not necessary, they use it for work as a personal option. Kakihara & Sorensen (2002) pointed out that the smartphone is increasingly perceived as an indispensable for the daily activities in a large part of the population today. It is also recognized that periods of economic crisis potentiate the precarious situation, with a drop in the formal employment (DIEESE, 2017).

Considering that more than half of our sample reported using their smartphone sometimes and often outside of work hours for work-related matters, and recognizing that increased workload and accumulation of daily work functions affect health (Pereira Junior & Caetano, 2009), we looked into associating the time of use with the places showing higher and lower frequency of health issues and symptoms. We also observed that the worker who reported using the smartphone, shows more musculoskeletal signs and symptoms compared to those who reported using it less frequently. The musculoskeletal overload to which these individuals are subjected, due to the use of the device inside and outside work, requires movements and postures that aren't ergonomically favorable and controlled to prevent disorders related to the cervical areas, shoulder girdle, neck and upper limbs (Gustafsson et al., 2017). More than half of the sample stated that they already had health symptoms in different parts of the body, especially in the cervical spine region. In fact, head, neck, shoulders and upper limbs are most affected by smartphone use (Hush et al., 2006). The psychological consequences of smartphone use already point to increased anxiety, sleep disturbances, depression, phobias, as well as tired eyes and feeling of fatigue (Demirci et al., 2015).

Continuous use of the smartphone, when taking into account the size of the screens, the continuous movement of typing into a small device, as well as the posture are factors that when clinically compared to other devices, such as a desktop, caused great damage to the health of workers (Oliveira et al., 2015). Although identifying the root of the problem to the use of the smartphone, a little more than 1/10 of the sample sought professional help for health issues and none reported taking time off from work due to the problem. This behavior may reflect a culture of naturalization of occupational risks in which the problems entailed are denied or accepted as inevitable.

Thus, the context of smartphone use at work has some contradictions. It's an important tool for communication and mediation where some professions were born from the need to interact with the device. Its ubiquitous for formal and informal worker, blurring the boundaries between work and off hours, in other words, the private/family life and work. Initially promoted as a mediator and important for socially valued professions (physicians, entrepreneurs and lawyers), its popularization and context of use make it a villain in several situations, including for aggravating musculoskeletal disorders.

Finally, is important to highlight that this study was applied before the covid-19 pandemic. As the internet usage increase worldwide during the year of 2020 and home-office became more spread (because of social distancing recommendations), some researchers have pointed out the increase general anxiety that driving us to use more digital technologies in and out the work context (Shim & Lee, 2020). In Brazil, recent studies show that during the pandemic, workers have reported a higher frequency of pain in the neck, shoulder and they are more in risk of developing vocal disorders (Siqueira et al., 2020). The intense use of smartphone during this period can also increase the depression symptoms, anxiety and vision/eye problems (Elhai et al., 2020; Mohan et al., 2021).

5. Conclusion

The aim of the research was to identify the presence of health issues derived from the continuous use of smartphones in the workplace. The use of the smartphone beyond working hours to perform work related activities, was the most worrying aspect, because we know that it increases the chance of presenting symptoms. Differences in income, physical activity and education did not directly influence, in our sample, the appearance of musculoskeletal symptoms associated with smartphone use. However, it was observed that the lower the income, the more likely the use of the device outside working hours, which may be a consequence of the precarious working conditions and financial instability. This also confirms that the boundaries between personal life and work are not well defined when it comes to the use of smartphones. Lack of regulations in the industrial and/or commercial sectors, in smartphone conduct and protocols inside and outside work, are examples of discussions that emerge from this context. Because it's a fairly recent technology, social adjustments are still being negotiated.

Finally, studies of our nature have limitations coming from the use of an instrument published in social networks, which may predispose the participation of users more adept to the use of devices. The study also focused on workers from a midsize city in the south of Brazil, which makes room for regional comparative research. Also, different countries present different aspects of the same problem, based on labour laws and cultural perceptions of the use of smartphone across nations. Considering that scientific literature focuses on one or other type of labor activity (e.g. uber drivers, delivery service) a more comparative and universal research still needed.

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