Mobility and wellbeing during the covid-19 lockdown. Evidence from Spain

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ABSTRACT

The lockdown of March and April 2020 declared by Spanish authorities in the Valencian Region to bending the Covid-19 curve, caused a drastic reduction of the economic activity and a severe limitation of mobility. People were asked to stay at home as much as possible. Education and administrative centers, as well as restaurants, theaters, sport arenas, etc., were closed. Work at conventional workplaces was prohibited for people who could tele-work, and students were compelled to attend classes on-line. Such limitation of mobility and spending so many time at home, could affect the wellbeing of people. The objective of the present paper is to present a study on the differences on wellbeing according to the mobility of respondents during the lockdown.

Information from 1,827 individuals regarding the satisfaction of the basic psychological needs (Autonomy, Competence and Relatedness) and Positive and Negative affect were collected through and web-survey during the first lockdown of the Covid-19 pandemic, together with mobility data and sociodemographic characteristics. Mann-Whitney U tests, Confirmatory Factor Analyses and Structural Equation models are used to find out differences in the wellbeing of people according to their mobility characteristics during the first lockdown, and how these mobility characteristics are associated to the psychological variables studied.

Mobility of people during the first lockdown reduced drastically, especially the youngest ones, and the main travel mode was walking. In general, the youngest participants in this research and females present lower values of the psychological wellbeing variables during the lockdown. A very low or very high degree of mobility is also associated to discomfort, although the more time spent traveling the better people feel. Those who walked more are related to lower values of wellbeing. Some lessons are learned to improve transport and mobility planning during a pandemic.

1. Introduction

The Covid-19 pandemic is causing a health crisis all over the world that is producing a high number of deaths. Last March 14, 2020 the Spanish authorities enacted a lockdown to reduce the spread of Covid-19 that lasted until May 4, when the number of daily positive cases had dropped from its maximum of 7800 on April 1st to 2,479 (Spanish Health Ministry, 2020). From this date, mobility was gradually allowed again. During the lockdown period, people could leave their home only to carry out a limited number of activities: work, food shopping, caring others or visiting the doctor. Restaurants, museums, theatres, sport facilities, education centers at all

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levels, were closed. Civil servants were instructed to work from home. People were asked to stay at home as much as possible. Consequently, tele-work was widely implemented, and tele-education was used at all levels until the end of the second semester of the academic course 2019–2020. The lockdown was even stricter between April 5 and April 19, 2020, when only essential work could be carried out (e.g., health services, groceries, freight transport, urban services maintenance). This coincided with a significant reduction in the transmission of the disease in Spain: 7,562 daily positive cases on April 5th; 4,302 daily positive cases on April 19th, and also, elsewhere (Páez et al., 2020).

The lockdown reduced the economic activity and restricted the mobility of people dramatically. Islind et al (2020) collected data on walking, driving and flying between January and August 2020 from ten European countries as well as in New Zealand. They described a significant decrease in all types of mobility in Europe in March 2020, which gradually increased again, especially driving. They note how Italy and Spain dropped lower in walking and driving than other countries because of the stricter lockdowns. Using phone data, it was estimated a reduction of weekday mobility between 50% and 60% of vehicles-km in Spain (MITMA, 2020). This reduction was high as 80% during weekends. Travels between 0.5 and 2 km decreased between 40% and 50%, and those trips longer than 10 km decreased between 70% and 80%. According to that study, personal mobility during the lockdown period reduced more than half. The limitation of mobility particularly impacted on public transport. Reductions of 90% of riders were registered in all public transport modes during the lockdown.

On the other hand, Páez (2020) identified the effects of mobility on the incidence of Covid-19, and he found that growth appeared to be more strongly driven by parks-related mobility. Noland (2021) has confirmed the effect of staying at home on reducing the contagion rate. Other positive effects of the mobility restrictions was a decrease of emissions and traffic accidents. Nitrogen dioxide diminished about 50% in the city of Valencia (Spain) in the last week of March 2020 (Retema, 2020). The number of deaths in traffic accidents was 52% lower (DGT, 2020) than in the same period of the previous year.

Among the negative effects of the limitation of mobility during lockdown, we are interested in its influence on the wellbeing of people. Staying at home for long periods of time, the need for tele-working and attending classes on-line, and the prohibition of carrying out any out-door activity (except walking the dog), could possibly led people to experience negative feelings. Who was more affected? How the characteristics of the (limited) mobility influenced wellbeing? What transport planning measures can be implemented to alleviate a lockdown impact on the wellbeing of people? The objective of this study is to answer these questions.

The paper is organized as follows. After this Introduction, a Literature Review is presented. Then, the Research Focus and Conceptual Framework of the study are defined. The Hypotheses of the research are specified. The Methods used to collect information are described. The Results obtained from several analyses are detailed and discussed. Finally, the Conclusions of the research end the paper.

2. Literature review

The literature review is divided into four sub-sections to facilitate the introduction of the study of travel and wellbeing in the transportation planning area, and to recollect some works carried during the first lockdown in March and April 2020 imposed by the authorities to bend the Covid-19 pandemic that deal with travel behavior and wellbeing separately. A short review of the first studies published on travel behavior during the first lockdown are presented first. Then, a brief theoretical overview of the existing approaches to study wellbeing of people, followed by a review of some general studies on wellbeing during the first lockdown. Then, a summary of the most important results found in the literature regarding travel and wellbeing. Finally, a reference to the very few studies on mobility and wellbeing during the first lockdown.

2.1. Travel behavior during the Covid-19 pandemic

Several travel behavior research efforts have been conducted during the first wave of Covid-19 on March-April 2020. A study carried out by Streetlight Data shows a drastic drop in vehicle travel across the U.S. by 68 to 72 percent in the last two weeks of March 2020 and the first week of April, compared with the first week of March (Dutzik, 2020).

An analysis of a sample of about 2,500 respondents from the Netherlands Mobility Panel shows that the COVID-19 outbreak has the potential to result in structural changes in travel behavior and activity engagement. Based on the research findings, about 80 percent of people reduced their out-of-home activities; the percentage was higher among older adults. Compared to the same period last year, the number of trips decreased by 55 percent, and distance traveled dropped by 68 percent (de Haas et al., 2020).

Shamshiripour et al (2020) collected data related to travel behavior of the Chicago area from April 25, 2020, to June 2, 2020. They found that working from home carries high potential for moving towards a more sustainable future. The analysis of the information gathered suggests a potential shift from usage of shared mobility options such as pooled ridesharing and transit services to modes that avoid contact—such as walking, biking, using scooters, and personal vehicles. The evidence of the impact of enforced tele-work so far are mixed. Shi et al. (2020) found that only a 23.8% of participants in a study of teleworking productivity during the lockdown in the Puget Sound (Seattle) Region (Washington, US) increased their efficiency.

Beck and Hensher (2020) reported about the impact of Covid-19 on household travel and activities in Australia. They collected activity-travel data from March 30, 2020, to April, 15, 2020. They found that trips had reduced from 23.9 trips per week prior to Covid-19 down to 11.0, which means a reduction of over 50% in weekly household trips. Similar results were found in the MOBIS-Covid19 study (ETH Zurich and University of Basel, 2020), which used mobile phone GPS tracking data to examine the impact of Covid-19 pandemic on the French and German speaking part of Switzerland.

Parady et al (2020) carried out the first wave of a panel web-survey on April 8, 2020 one day after the emergency state declaration

in Japan (non-binding requests for activity restrictions were declared in Japan). Among other information, data regarding travel behavior before and during the pandemic were collected. Leisure, eating out, grocery shopping, and other shopping, were the activities with a higher reduction during the pandemic compared with the previous period.

Abdullah et al (2020) collected data worldwide using an on-line questionnaire between May 9, 2020 and May 31, 2020. They found that people tend to use less public transport and more private car and active modes during the pandemic.

Assoumou (2021) has used data from the Covid-19 Community Mobility Report by Google to find out that more women than men travel to work in order to carry out certain essential jobs and to provide food and other essential products for their families.

2.2. Wellbeing

Psychological literature has addressed the concept of wellbeing from different approaches. Philosophical theory distinguished the hedonic and eudaimonic approaches (Waterman, 1993; Ryan & Deci, 2001).

The hedonic approach holds that human beings seek to maximize their pleasure experiences, which is achieved through the satisfaction of preferences and minimization of pain with the aim of upgrading gratification in terms of happiness (Nordbakke & Schwanen, 2014). Hedonic enjoyment can be measured through Positive affect derived from enjoying both material objects and opportunities an individual wishes to experience. On the contrary, hedonic discomfort could be studied through Negative affect, which appears when an individual does not possess certain objects or experiences (Waterman, Schwartz & Conti, 2008).

On the other hand, the eudaimonic approach considers that living consistently with the true self is what inspires and gives meaning to one's life. The effort to reach the ideal will lead human beings to the achievement of their best potentials. Wellbeing will occur when the individual lives in congruence with his own value system, and discomfort will occur in the opposite case (Vázquez, Hervás, Rahona & Gómez, 2009). Self-Determination Theory (SDT) posits that wellbeing is expressed through a feeling of intense vitality associated with the feeling of living in harmony with oneself (Ryan & Deci, 2001).

Theorists have questioned whether wellbeing is an objective or subjective phenomenon. Subjective wellbeing (SWB) holds that an individual's perceptions and experiences are the basis for evaluations about their own life. While the objective perspective assumes that wellbeing is configured "objectively" from the values, goals, or objectives that people have or achieve (Nordbakke & Schwanen, 2014).

In this way, hedonic wellbeing is equated with SWB, studied through Satisfaction with Life, and Positive and Negative affect (Diener, Suh, Lucas and Smith, 1999). And the psychological wellbeing (PWB) is more like the eudaimonic perspective, focusing on aspects that seek and facilitate the fulfillment and optimal development of human beings (Ryan and Deci, 2001). In addition to contributing to eudaimonic wellbeing, the SDT considers that the satisfaction of the basic psychological needs (Autonomy, Competence and Relatedness) can also promote SWB (Ryan, Huta & Deci, 2008).

2.3. Wellbeing during the Covid-19 pandemic

Many general wellbeing studies have been carried during the first lockdown in March and April 2020 imposed by authorities to bend the curve of the Covid-19 pandemic. We include in this review only those using similar wellbeing constructs to our research. Using data from a monthly longitudinal survey of middle-aged and older Singaporeans, Cheng et al (2020) found large declines in overall life satisfaction and domain specific satisfaction during the Covid-19 outbreak, except satisfaction with health. Zacher and Rudolph (2020) also found that life satisfaction and Positive affect decreased, and Negative affect increased, between March and May 2020 in Germany. Similar results were found in Great Britain by Foa et al. (2020), where positive mood declined when the virus started spreading, and in Israel by Kimhi et al. (2020).

On the other hand, Sibley et al. (2020) did not find significant differences in several subjective wellbeing (SWB) indicators between a pre-lockdown and post-lockdown (surveyed immediately after the government's nationwide lockdown from March 26, 2020 to April 12, 2020) groups of people in New Zealand.

Anglim and Horwood (2020) analyzed the influence of the Covid-19 pandemic on both subjective wellbeing (SWB) and psychological wellbeing (PWB). They collected information from 1,470 Australian undergraduate students from July 13 to August 11, 2020 during the second wave of the pandemic and compared the results with a pre-Covid-19 sample gathered in 2017. They found that Positive and Negative affect were the most influenced wellbeing indicators by the pandemic. There was some evidence in the results of this study of reduced levels of psychological wellbeing, particularly in relation to autonomy, positive relations, and environmental mastery.

Suso-Ribera and Martin-Brufau (2020) collected data during the first three days of lockdown in Spain. Their results indicate that the mood of a sample of individuals at quarantine onset was generally poorer compared to a sample of individuals from the general population recruited before the current Covid–19.

Planchuelo-Gómez et al (2020) studied variations of anxiety, depression stress and emotions during the Covid-19 lockdown collecting two waves of data one month apart. They found an increase of anxiety, depression and stress during the lockdown, but no significant change of the emotions scores.

Tang et al. (2020) evaluated the posttraumatic stress disorder (PTSD), depressive reactions and psychological consequences in college students approximately one month after the COVID-19 outbreak in China. They found relatively low rates of PTSD (2.7%) and depression (9%).

2.4. Travel and wellbeing

Travel behavior and wellbeing has been studied since not long ago. The approach more commonly used is the SWB (Chatterjee et al. 2019) to study the role of each travel mode on wellbeing. For example, a literature review carried out by Ettema et al. (2016) indicates that using active travel modes results in higher travel satisfaction than using the car and in particular public transport. In this line, Morris and Guerra (2015) found that bicyclists present higher values of positive affect, followed by car passengers and car drivers. They also found that users of bus and train experience the most negative emotions, though a small part of this can be attributed to the fact that public transport is disproportionately used for the despised trip to work or school.

More recently, Singleton et al (2019) found that walking/bicycling is associated with high values of health, confidence, and Positive affect. Cycling commuters scored higher on distress, fear, and lower on security. On the contrary, results from the study of Zhu et al. (2019) indicate that the SWB of residents who commute walking or cycling was lower than that of those who commute by other travel modes. Respondents in this study lived in rural areas and cities with low urbanization, which could partially explain these results. They also found that the longer the commute time, the lower the SWB, which is in line with results from Stutzer and Frey (2008), who found that people with longer commuting time report systematically lower SWB among public transport users. Lunke (2020) has also found that train commuters present highest levels of SWB.

2.5. Travel and wellbeing during the Covid-19 pandemic

Burdett et al (2021) used data from the UK Household Longitudinal Study (UKHLS) and Google COVID-19 Mobility Reports and found evidence of reduced park mobility during the initial period of the first UK lockdown and confirm existing evidence of worsening psychological wellbeing. The General Wealth Questionnaire (GWQ) including 12 items was used, which assesses general mental health in a one single measure.

Devaraj and Patel (2021) also studied Google COVID-19 Mobility Reports and reported psychological distress collected from a two-wave longitudinal survey to panelist from the Understanding America Study. They found some evidence of a small increase of psychological distress associated with a decline in mobility during the lockdown in US, specifically for females.

Chakrabarti et al (2021) studied the impact of mobility restrictions in the US during the first Covid-19 pandemic lockdown on several indicators related to wellbeing (unemployment, food insufficiency, no medical care, default on rent or mortgage and mental health problems). The information was collected via an online questionnaire. They found that African American individuals with low income, Hispanic individuals and women had higher risk of experiencing wellbeing problems during the lockdown.

The results of the very few existing studies that associate mobility with wellbeing during the first lockdown of March and April 2020 imposed to bend the Covid-19 pandemic, indicate that people felt worse in terms of general mental health, psychological distress or socioeconomic indicators related to wellbeing. As expected, not being able to travel in the way one prefers (e.g., due to driving cessation) can imply that individuals cannot undertake activities they value, and wellbeing can diminish (Nordbakke, 2013). On the other hand, if mobility limitation is considered as reduction of time spent traveling, Morris and Guerra (2015) argues that travel is associated with more positive affect than the average of all other activities.

As mentioned earlier, general wellbeing studies have been developed during the first Covid-19 pandemic lockdown in 2020, using a variety of wellbeing indicators that include Life Satisfaction; Positive and Negative affect; some psychological wellbeing indicators (autonomy, relation), anxiety, depression, stress and emotions; and posttraumatic stress disorder. On the other hand, many travel and wellbeing studies have been conducted before the pandemic, using existing psychological scales or developing new scales ad-hoc. However, no study has focused on how different degrees of mobility during the lockdown influenced wellbeing of people using specific wellbeing scales.

3. Research focus and conceptual framework

The forced mobility limitations experienced during Covid-19 lockdown in Spain offers a unique opportunity to study differences on wellbeing according to the mobility of respondents during the lockdown, which, to the best of our knowledge, is absent in the literature.

The Basic Psychological Needs Theory (BPNT) is part of the Self-Determination Theory (Ryan and Deci, 2000), which is a broad framework for the study of human motivation and personality. According to the BPNT, psychological or eudaimonic wellbeing is based on Autonomy (the need to behave of self-interest), Competence (the need to experiment dominance and efficiency on own abilities) and Relatedness (the need to feel linked, supported or cared for others). The mobility restrictions imposed by the lockdown may have affected the satisfaction and frustration of the BPN to a greater or lesser extent depending on the degree of mobility of each person.

On the other hand, the mobility restrictions imposed by the lockdown may have also affected the feelings and mood of people, which contribute to measure subjective or hedonic wellbeing (Waterman et al., 2008). According to Watson et al. (1988) "Positive affect reflects the extent to which a person feels enthusiastic, active and alert (…). In contrast, Negative affect is a general dimension of subjective distress and unpleasurable engagement that subsumes a variety of aversive mood states". Wellbeing is achieved trying to increase Positive affect, but also attempting to reduce Negative affect.

Therefore, PWB indicators (satisfaction and frustration of Competence, Autonomy and Relatedness) and Positive and Negative affect, are selected for this research, which are measured through the following constructs:

- Satisfaction and frustration of three basic psychological needs in the SDT (Autonomy, Competence and Relatedness).

- Positive and Negative affect.

In this study, mobility during the lockdown is characterized by the degree of mobility and the percentage of walking per week when exit from home during the lockdown. Degree of mobility is included in the conceptual framework by two variables: the number of times leaving home and time spent traveling per week during the lockdown to carry out allowed out-of-home activities.

As described before, the satisfaction of the basic psychological needs (Autonomy, Competence and Relatedness) can promote SWB. Therefore, Positive and Negative affect are influenced by Satisfaction and Frustration of the basic psychological needs, and by characteristics of the mobility during the lockdown and sociodemographic characteristics (Fig.1).

4. Hypotheses

The reduction of mobility during the lockdown has negatively affected the wellbeing of people (Burdett et al., 2021; Devaraj and Patel, 2021; Chakrabarti et al., 2021). These results obtained during the pandemic are in line with what was expected (Nordbakke, 2013; Morris, 2015). Therefore, we estimate a positive association between mobility during the lockdown and the satisfaction of the basic psychological needs in the SDT, and a negative association between mobility during the lockdown and the frustration of the basic psychological needs in the SDT:

- H1: A reduction of mobility during the lockdown is associated with less satisfaction and more frustration of the basic psychological needs, and an increase of mobility during the lockdown is associated with more satisfaction and less frustration of the basic psychological needs.

During the lockdown, Zacher and Rudolph (2020) found that Life satisfaction and Positive affect decreased, and Negative affect increased, between March and May 2020 in Germany. We suppose that the relation with mobility during the lockdown is similar: a positive association with Positive affect, and a negative association with Negative affect:

- H2: A reduction of mobility during the lockdown is associated with less Positive affect and more Negative affect, and an increase of mobility during the lockdown is associated with more Positive affect and less Negative affect.

There is much evidence in the pre-pandemic literature that associates walking with high values of wellbeing (Olsson et al, 2013; Martin et al., 2014; Friman et al., 2017; Singleton, 2019; Chatterjee et al., 2020). Regarding car use, the findings are mixed. For example, Chng et al. (2016) found that individuals who walked to work and underground commuters had higher life satisfaction than car drivers. The reviews carried out by Ettema et al. (2016) and Chatterjee et al. (2020) indicate that satisfaction with active travel modes is higher than travel by car and public transport, and that satisfaction with travel is lowest for different forms of public transport. Considering the contribution of car use to general mobility, we hypothesize a positive association between walking and car use during the lockdown and satisfaction of the basic psychological needs in the SDT, and a negative association between walking and car use during the lockdown and the frustration of the basic psychological needs in the SDT:

- H3: More walking and car use during the lockdown are associated with more satisfaction and less frustration of the basic psychological needs in SDT, and less walking and car use during the lockdown are associated with less satisfaction and more frustration of the basic psychological needs in SDT.
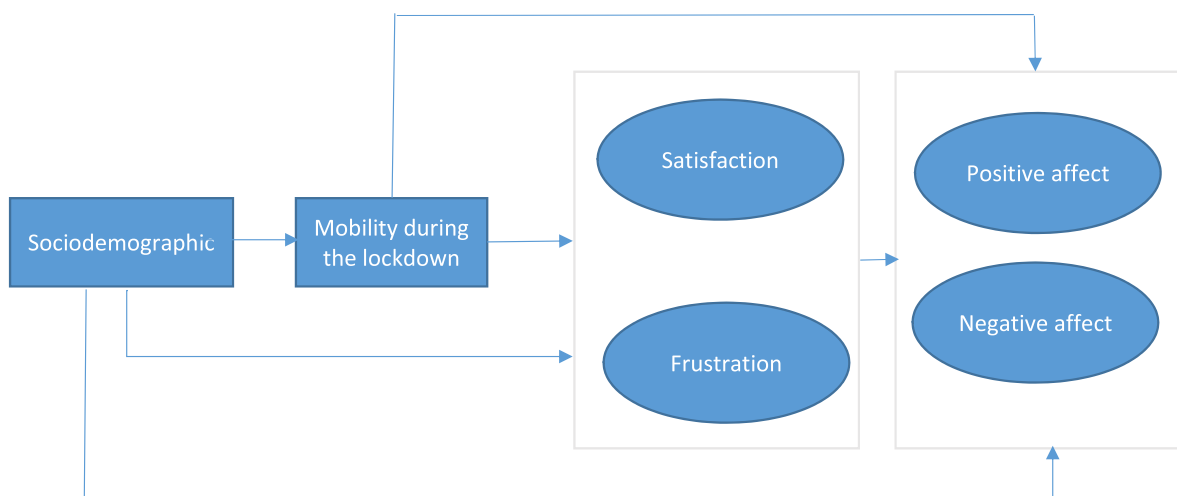

Fig. 1. Theoretical framework.

Similarly, we hypothesize that walking and car use during the lockdown is positively associated with Positive affect, and negatively associated with Negative affect:

- H4: More walking and car use during the lockdown are associated with more Positive affect and less Negative affect, and less walking and car use during the lockdown are associated with less Positive affect and more Negative affect.

Ryan et al. (2008) posited that the satisfaction of the basic psychological needs in SDT can also promote SWB. Consequently, we assume that during the lockdown there is a positive association between the satisfaction of the basic psychological needs in SDT and Positive affect, and a negative association with Negative affect. On the other hand, there is a negative association between the frustration of the basic psychological needs in SDT and Positive affect, and a positive association with Negative affect:

- H5: More satisfaction and less frustration of the basic psychological needs in SDT during the lockdown, are associated with more Positive affect and less Negative affect. Less satisfaction and more frustration of the basic psychological needs in SDT during the lockdown, are associated with less Positive affect and more Negative affect.

Finally, sociodemographic characteristics also play a role on the wellbeing of people. For example, women present a higher negative impact on the subjective wellbeing caused by travel commuting (Roberts et al., 2011). In a study of mobility and wellbeing during the lockdown in the US, Devaraj and Patel (2021) found that reduced mobility increased psychological distress of women to a greater extent. It is also expected that, considering how Covid-19 affect people according to their age, the youngest participants in this research may feel worse than older people under similar reduction of mobility:

- H6: A reduction of mobility during the lockdown is more strongly associated with less satisfaction and more frustration of the basic psychological needs in SDT and less Positive affect and more Negative affect for females and the youngest participants in this research."

Table 1
Definition of sociodemographic and mobility variables.

Variables	Description	Type
Sociodemographic		
Age	Age of the respondent	Continuous
Gender	0 = male; 1 = female	Categorical
Education	1 = none; 2 = Primary; 3 = Vocational; 4 = Secondary; 5 = Baccalaureate; 6 = Non-university; 7 = University	Categorical
Household size of respondents	Number of members in the house, including the respondent	Counts
Household members > 70	People over 70 in respondent's household	Counts
Household members < 6	People under 6 in respondent's household	Counts
6 <= HH members < 12	People between 6 and 12 in respondent's household	Counts
12 <= HH members < 18	People between 12 and 18 in respondent's household	Counts
Household disable members	People with functional limitations in respondents' household.	Counts
Type of housing	1 = Apartment; 2 = Detached or semi-detached house without garden nor private open-air space; 3 = Detached or semi-detached house with garden and private open-air space; 4 = Other	Categorical
Occupation	1 = Student; 2 = Employed, 3 = Self-employed; 4 = Student and employed; 5 = Unemployed; 6 = Retired; 7 = Homemaker; 8 = Other	Categorical
Changes on Internet use	1 = I do not use it; 2 = Less than before; 3 = Same as before; 4 = More than before; 5 = Much more than before	Categorical
Working at home before the lockdown	1 = Yes; 2 = No	Categorical
Working at home during the lockdown (different from housekeeping)	1 = Yes; 2 = No	Categorical
Degree of work organization at home	Likert scale: 1 = Very bad; 5 = Very good	
Home location	1 = Center of a big city (>100.000 inhab.); 2 = Suburbs of a big city; 3 = Mid-size city (10.000–100.000 inhab.); 4 = Small town (2.000–10.000 inhab.); 5 = Village (<2.000 inhab.); 6 = Low density city area; Other	
Net monthly income	1 = None; 2 = <1.000 Euro; 3 = 1.000–2.000 Euro; 4 = 2.000–3.000 Euro, 5 = 3.000–4.000 Euro; 6 = >4.000 Euro	
Mobility during the lockdown		
Trips 1	=1 if number of times leaving home per week <= 1.25; =0 otherwise	
Trips 2	=1 if number of times leaving home per week > 1.25 and <= 2.25; =0 otherwise	
Trips 3	=1 if number of times leaving home per week > 2.25 and <= 6.00; =0 otherwise	
Trips 4	=1 if number of times leaving home per week > 6.00; =0 otherwise	
P_Walk	Percentage of walking when exit from home per week	Continuous
P_Car	Percentage of car use when exit from home per week	Continuous
Time_Travel 1	=1 if time traveling per week <= 15 min; =0 otherwise	Categorical
Time_Travel 2	=1 if time traveling per week > 15 AND <= 40 min; =0 otherwise	
Time_Travel 3	=1 if time traveling per week > 40 AND <= 120 min; =0 otherwise	
Time_Travel 4	=1 if time traveling per week > 120; =0 otherwise	

5. Methods

5.1. Survey description and data collection

The dataset used for this research was collected by a web-based survey that was designed ad-hoc for this study. The main aim of the survey was to gather information regarding the characteristics of out-of-home activities and the associated mobility during the lockdown in Spain, PWB indicators and Positive and Negative affect of people. The survey started on April 10, 2020 and ended on April 26, 2020. Respondent recruitment was done using two e-mailing lists including professional and personal contacts of the researchers, and senior students of the Universitat Politècnica de València. Besides, the web-survey was disseminated through personal and institutional on-line social media. Participants lived in the Valencian Region of Spain.

The sampling method used produced a convenience sample, which is not representative of the population of study. Convenience samples have been used frequently during the pandemic because they are easy to achieve (Astroza et al., 2020; Jamal and Páez, 2020). Besides, recruitment of respondents by e-mail and on-line social media biased the sample against those who do not use Internet-based tools on a daily basis. Nevertheless, respondents were well distributed by gender, occupation, age and travel mode used during the lockdown. Therefore, it is possible to infer how different degree of mobility affected the wellbeing for each sociodemographic or travel mode related group.

The survey was divided in three parts. In the first part of the survey, respondents were asked to estimate their daily, weekly or monthly number of times they left home to perform each of the following out-of-home activities: working, grocery shopping, caring tasks, walking the dog, visiting the doctor, other shopping, and other activities (e.g., bank business). The usual travel mode associated to each activity, average time spent traveling and carrying out each activity per week were also collected. The second part of the survey includes questions to characterize PWB and Positive and Negative affect. Sociodemographic information is collected in the third part of the survey.

5.2. Variables and measurements

The variables included in the analyses are presented in Table 1. Categorical variables are used to measure the degree of mobility during the lockdown, and the categories are defined considering the quartiles of the distribution. Continuous variables are used to measure walking and car use.

Satisfaction and frustration of the three basic psychological needs were collected using the Spanish version for adults of the general Basic Psychological Need Satisfaction and Frustration Scale (BPNSNF) (Chen et al., 2015). This scale includes six four-item subscales to measure Autonomy satisfaction (e.g. "*I feel a sense of choice and freedom in the things I undertake*"), Autonomy frustration (e.g. "*Most of the things I do feel like I have to*"), Relatedness satisfaction (e.g. "*I feel that the people I care about also care about me*"), Relatedness frustration (e.g. "*I feel excluded from the group I want to belong to*"), Competence satisfaction (e.g. "*I feel confident that I can do things well*") and Competence frustration (e.g. "*I have serious doubts about whether I can do things well*"). Respondents were asked to use a five-point Likert scale to declare if they totally disagree (1) or totally agree (5) with each statement.

Information regarding Positive and Negative affect were collected using the Positive and Negative Affect Scale (PANAS) (Watson et al., 1988) translated to Spanish by the authors of this research. PANAS includes 10-item self-report measure of Positive affect (attentive, active, alert, excited, enthusiastic, determined, inspired, proud, interested and strong) and 10-item self-report measure of

Table 2
Sample sociodemographic characteristics.

	Respondents		2020 Valencian Region Census
	N°	Percentage	
Gender			
Male	908	49,7%	49.3%
Female	919	50,3%	50.7%
Age			
18–25	265	14,5%	6.2%
26–35	319	17,5%	13.7%
36–45	301	16,5%	19.4%
46–55	372	20,4%	20.0%
56–65	378	20,7%	16.5%
>65	192	10,5%	24.2%
Occupation			
Employed	924	50,6%	47.9%
Student and employed	130	7,1%	
Self-employed	115	6,3%	
Student	223	12,2%	9.8%
Retired	293	16,0%	10.8%
Unemployed	67	3,7%	16.2%
Other	54	3,0%	8.5%
Homemaker	21	1,1%	6.8 %[1]

(1) Data from 2019 Spanish Census.

Negative affect (hostile, irritable, ashamed, guilty, distressed, upset, scared, afraid, jittery, nervous). High Negative affect represents subjective distress and unpleasurable engagement, and low Negative affect represents the absence of these feelings. On the other hand, Positive affect symbolizes the extent to which and individual experiences pleasurable engagement with the environment. For example, emotions such as enthusiasm and alertness are related to high Positive affect, whilst lethargy and sadness characterize low Positive affect. Positive and negative mood are analyzed separately as people not only seek positive sentiments but also try to avoid misery. A five-point Likert scale was used in this scale as well.

6. Results

6.1. Sample characteristics

1,827 respondents provided valid data to all parts of the survey after validations and cleaning, which included a review of acquiescence bias in responses, detection of outliers related to travel and activity durations, and consistency of all responses of each participant. The distribution of the sample according to gender is reasonably balanced (Table 2). However, those whose age is between 45 and 64 are overrepresented in the sample. Similarly, those who are working (employed, self-employed and students that also worked), are overrepresented in the sample as well.

One third of respondents belong to households that they share with only another person (household size = 2) (Table 3). Respondent's household size equal to three are 24.7% of the sample, slightly higher than those equal to four (23.1%). Those who live alone are 12.1% of the sample. And those who live in households of five or more people are 7.3% of the sample. One-person households are underrepresented in the sample, while those households with 4 or more members are slightly overrepresented.

Respondents living in apartments are most of the sample (78.8%). Those living in attached or semi-detached with garden and private open-air space are 16.0% of the sample.

Those living in big cities (100.000 or more inhabitants) are overrepresented in the sample; they are 60.3% of the sample. Respondents living in mid-size cities (10.000–100.000 inhabitants) are 20% of the sample.

6.2. Mobility during the lockdown

The average number of times respondents left home to carry out any of the allowed activities during the lockdown was 4.9 per week, and the median value is 2.25. Considering that the sample is overrepresented in those with age between 45 and 64, and those employed, the real value of the mobility rate of the participants in the study during the lockdown will be somehow lower. In any case, that value contrasts with the estimated mobility before the Covid-19 pandemic in the Valencian Region of Spain: average of 2.5 daily trips per person (Generalitat Valenciana, 2018). To compare both mobility rates, journeys to walk the dog (42% of the times leaving home per week), should be removed from the mobility rate of the sample during the lockdown. And it is assumed that every journey is comprised of two trips during the lockdown. On the other hand, mobility rates before the pandemic are estimated from household travel surveys, which suffer from 20 to 25% underreporting of short walking or irregular trips (Stopher et al., 2007). It is assumed that the daily mobility rate before the pandemic is similar every day of the week. Therefore, the participants in the survey during the lockdown made approximately 5.6 trips per week. And the mobility rate before the pandemic was approximately 21.7 trips per week.

Table 3
Sample residence characteristics.

	Respondents		2020 Valencian Region Census
	N°	Percentage	
Household size			
1	221	12,1%	24.1%
2	600	32,8%	30.8%
3	451	24,7%	21.8%
4	422	23,1%	17.9%
5+	133	7,3%	5.3%
Type of housing			
Attached or semi-detached with garden and private open-air space	293	16,0%	NA
Attached or semi-detached without garden nor private open-air space	38	2,1%	NA
Other	71	3,9%	NA
Apartment	1425	78,0%	NA
Home location			
Center of a big city (>100.000 inhab.)	690	37,8%	29.3 %[1]
Suburbs of a big city	412	22,6%	
Mid-size city (10.000–100.000 inhab.);	366	20,0%	53.0 %[1]
Small town (2.000–10.000 inhab.);	151	8,3%	13.7 %[1]
Low density city area	109	6,0%	NA
Village (<2.000 inhab.);	79	4,3%	4.1 %[1]
Other	20	1,1%	NA

(1) Data from 2011 Valencian Region Census.
(2) N/A: Not available.

Consequently, the reduction of mobility during the lockdown was approximately 74.2%, much more than the reductions reported by Ministerio de Transportes in Spain using cellphone data (a reduction between 40% and 53% of vehxkm on the weekdays of the second half of March 2020) (MITMA, 2020). The higher decline of mobility estimated for the respondents in this research can be partially explained bearing in mind that the sample of respondents could be biased towards people who can tele-work, and those who cannot do it are underrepresented. On the other hand, it should be considered that the lockdown was even stricter between April 5 and April 19, 2020. During these two weeks, only essential work could be carried out. Additionally, cellphone data can hardly identify short trips, which were reduced even more because leaving home was not allow except for carrying out a short list of activities.

Mobility during the lockdown was a slightly higher for men than for women and increased with age. Men left home a median value of 2.5 times per week, and women 2.25 times per week. On the other hand, those whose age is <26 presented the lowest mobility, leaving home only 1.5 times per week. Respondents between 26 and 45 years old left home 2.25 times per week. The highest mobility during the lockdown were performed by those between 46 and 65 years old, who left home 3.0 times per week. And the older respondents presented a mobility during lockdown of 2.0 exits from home per week.

The median value of time spent traveling per week during the lockdown was only 20 min for those younger than 26. This value increased to 33 min for respondents between 26 and 35 years old, and the value is a slightly higher for those between 26 and 45 years old. Participants between 46 and 55 years old spent the maximum time per week traveling: 58.7 min. Those between 56 and 65 years old spent a median value of 55 min traveling per week. And those older than 65 spent 38.1 min per week during the lockdown (Fig. 2).

The mobility was relatively high for self-employed respondents, who left home a median value of 3.25 times per week. Employed respondents left home 2.5 times per week. This difference may be explained considering that many self-employed respondents have jobs that do not allow for remote work. For example, those in the following sectors in which workers are mostly self-employed: the freight transport sector, agricultural, construction. Students who also work left home 2 times per week, and students only left home 1.5 times per week. Those who do not work, nor study left home 2 times per week during the lockdown.

Self-employed participants in the study spent the maximum time traveling per week during the lockdown: a media value of 90 min. Employed respondents spent a much lower amount of time traveling per week: 45 min. Those who studied and were employed part-time spent 25 min per week traveling. Students spent the minimum amount of time traveling per week during the lockdown: a median value of 24.3 min (Fig. 3).

The travel mode most used when the participants of the study exit from home during the lockdown was walking: the percentage of walking was 77.5%. The second travel mode more used was car, but with only 18.9% of all times respondents left home. The rest of travel modes was hardly used: public transport (2.0%), Bicycle (0.8%), Others (0.8%). It is important to note that almost half of the individuals (49.2%) in the sample only walked when exit from home during the lockdown. In the case of those who used car, 29.7% did not used other travel mode.

Women walked a little bit more than men when leaving home during the lockdown (Fig. 4). They also used less the car. Public transport was used by 3% of males, but only by 1% of females.

The high percentage of walking is due to the consideration of home exits for walking the dog, an out-door activity allowed during the lockdown: more than half of the number of times respondents left home walking was to take their dog for a walk (53.3%) (Fig. 5).
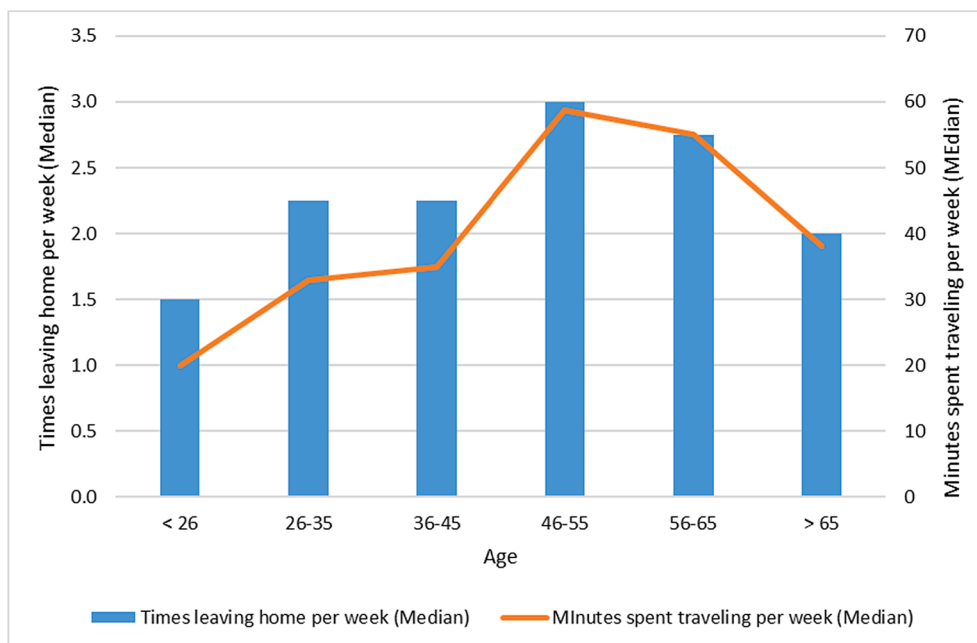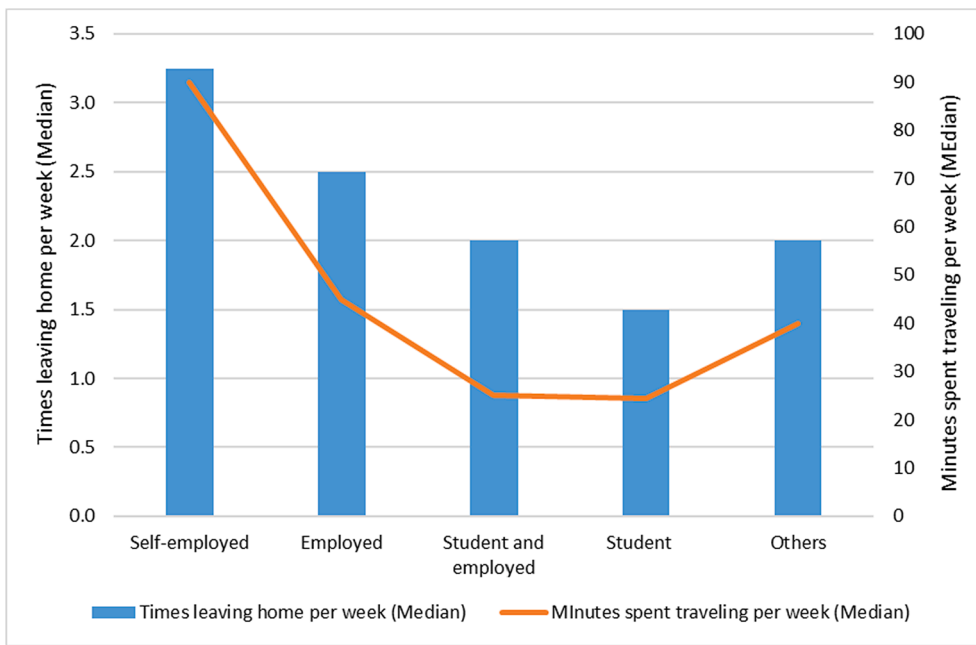

Fig. 2. Degree of mobility during the lockdown by age.

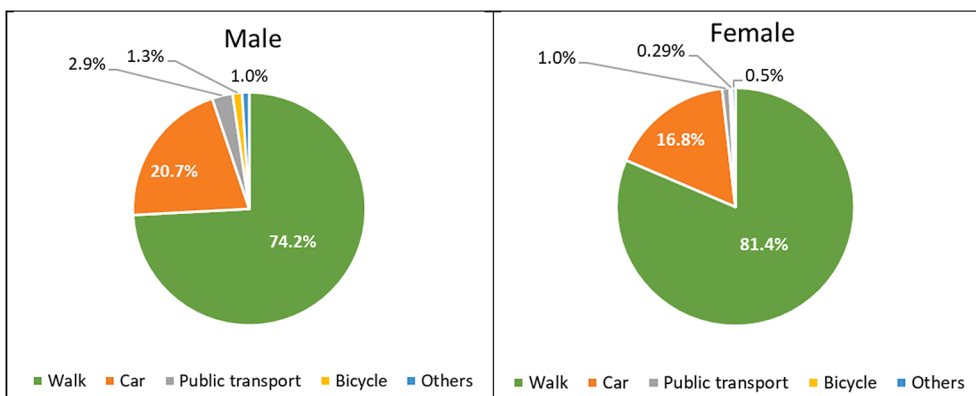**Fig. 3.** Mobility during the lockdown by employment status.

Fig. 4. Travel mode used by gender.

The second most important motive for leaving home walking is grocery shopping (26.7%). On the other hand, when respondents left home using the car during the lockdown was mainly for going to work (46.6%). Grocery shopping (32.3%) and caring others (14.4%) are the following motives to exit home using car in order of importance.

When leaving home during the lockdown, the youngest respondents were those who walk the most (87.9%). In contrast, the walk share of those between 36 and 45 years old is 69.8% (Fig. 6).

6.3. PWB variables, positive and negative affect, mobility during the lockdown and sociodemographic characteristics

Figs. 7 to 12 represent median values of the distribution of the latent constructs according to gender, age and mobility characteristics of the respondents during the lockdown. These figures support the exploratory analysis carried out using Mann-Whitney U tests, which is used to detect statistically significant differences between pairs of the non-symmetrical latent construct's distributions.

For each subgroup of respondents according to their degree of mobility during the lockdown ($<=1.25$, 1.25–2.25, 2.25–6.00, >6.00 times leaving home per week), we first conducted Mann-Whitney U tests to find out differences according to gender and age. We compared the distributions of each latent construct for pairs of groups of respondents: e.g., males vs females; <26 years old vs 26–35 years old; <26 years old vs 36–45 years old; and so on.

Then, for each subgroup of respondents according to their degree of mobility during the lockdown, we conducted Mann-Whitney U tests to find out differences by time spent travelling per week, percentage of walking, percentage of car use, and only walkers versus
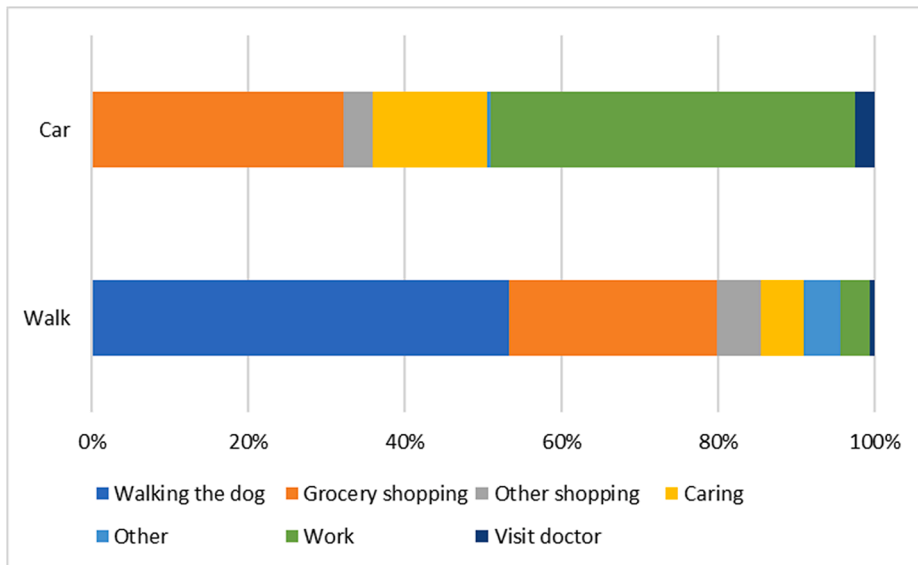
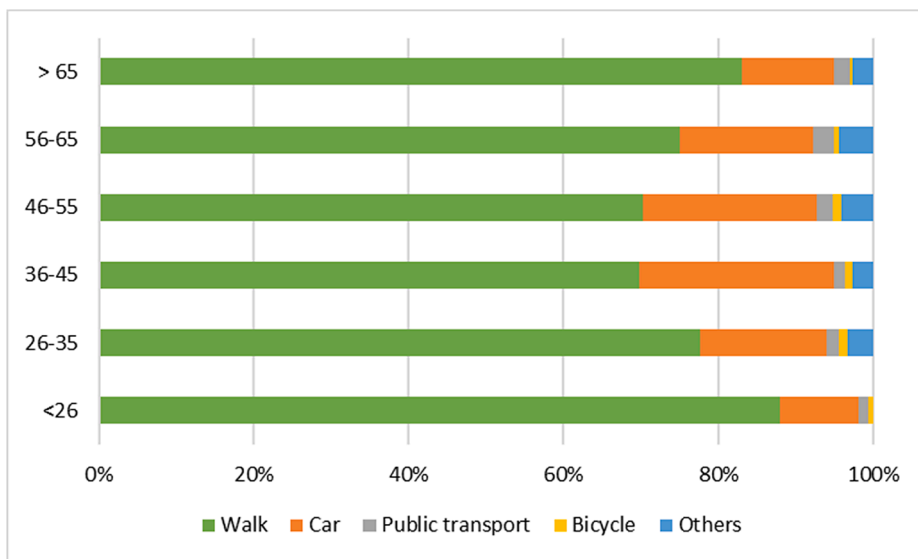**Fig. 5.** Motives for leaving home by car and walking during the lockdown.

Fig. 6. Travel mode used by age.

only car users when leaving home. Similarly, we compared the distributions of each laten construct for pairs of groups of respondents: e.g., <=15 min/week vs 15–40 min/week; <=15 min/week vs 40–120 min/week; and so on.

To calculate the statistic U, all responses for all items included in each latent construct are used. For examples, to compare the distributions of Competence satisfaction (Com_sat) for males and females that left home<1.25 times per week, we have:

$U(Com\_sat_{1.25,m}) = n_{1.25,m}n_{1.25,f} + ((n_{1.25,m}(n_{1.25,m} + 1))/2)\text{-}R_{1.25,m}.$

$U(Com\_sat_{1.25,f}) = n_{1.25,m}n_{1.25,f} + ((n_{1.25,f}(n_{1.25,f} + 1))/2)\text{-}R_{1.25,f}.$

Where $n_{1.25,m}$ is the number of observations or participants in the first group (degree of mobility < 1.25 and males), $n_{1.25,f}$ is the number of observations or participants in the second group (degree of mobility < 1.25 and females), $R_{1.25,m}$ is the sum of the ranks assigned to the first group and $R_{1.25,f}$ is the sum of the ranks assigned to the second group. The null hypothesis (both distributions are similar) is rejected if the p corresponding to the $min(U(Com\_sat_{1.25,m}), U(Com\_sat_{1.25,f}))$ is smaller than the p or the α predetermined threshold (Nachar, 2008).

For those with the lowest degree of mobility during the lockdown (a median value of times leaving home per week lower than 1.25), statistically significant differences between men and women are found for only for the distributions of Relatedness satisfaction and Negative affect. Females present higher values of Relatedness satisfaction than men (U = 39122.5, Sig = 0.028). On the other hand,

Rel_sat= Relatedness satisfaction; Neg_aff= Negative affect; Aut_sat= Autonomy satisfaction;
Com_fru= Competence satisfaction; Neg_aff= Negative affect; Com_fru= Competence frustration
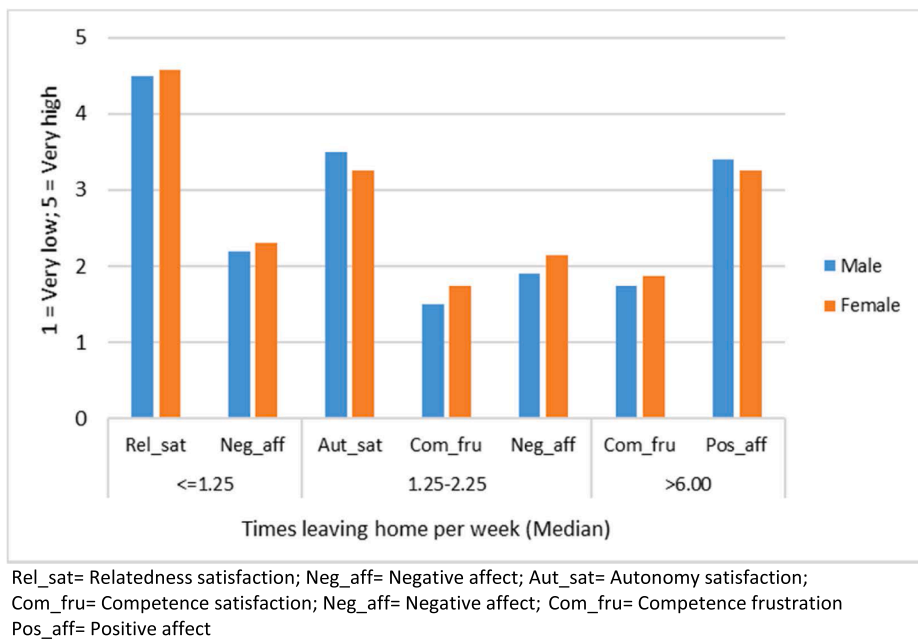Pos_aff= Positive affect

Fig. 7. Median values of PWB indicators and positive and negative affect by degree of mobility during the lockdown and gender.

females also have higher values of Negative affect (U = 38451.0, Sig = 0.013).

For those with a moderate degree of mobility during the lockdown (a median value of times leaving home per week between 1.25 and 2.25), statistically significant differences between men and women are found for the distributions of Autonomy satisfaction, Competence frustration and Negative affect. Females present lower values of Autonomy satisfaction than men (U = 11489.5, Sig = 0.021), and higher values of Competence frustration than men (U = 11543.5, Sig = 0.039), and higher Negative affect than men (Z = 11082.0, Sig = 0.007).

Similarly, for those with the relatively highest degree of mobility during the lockdown (a median value of times leaving home per week higher than 6.0), statistically significant differences between men and women are found for only the distributions of Competence frustration and Positive affect. Females present higher values of Competence frustration (U = 19977.5, Sig = 0.013) and lower values of Positive affect (U = 20276.0, Sig = 0.035) than men.

Therefore, in general females feel worse than men for those with a moderate and very high mobility during the lockdown. Females bear a higher burden of household work and childcare during the lockdown (Collins et al., 2021), which is also true in Spain (Farré et al., 2020). This extra-work could exacerbate Relatedness frustration and Negative frustration. Females in Spain, like in many other countries, were slightly more likely to lose their job than men (Farré et al., 2020). Women have a higher presence in "quarantine" sectors and non-essential jobs that do not allow for remote work, which can be related to lower Competence satisfaction and Positive affect.

Fig. 8 represents age trends of median values of all constructs for all mobility groups during the lockdown by age ranges. For each latent construct (PWB, Positive and Negative affect) and degree of mobility during the lockdown, almost all differences between the distributions of age group < 26 and the rest are statistically significant. For the other pairs, the higher the age difference, the more differences in the distributions are statistically significant.

It can be observed in Fig. 8 that for any degree of mobility during the lockdown, the youngest present the lowest median values of Autonomy satisfaction, Relatedness satisfaction, Competence satisfaction and Positive affect. Except for the relatively highest degree of mobility, they also present the lowest values of Autonomy frustration, Relatedness frustration and Competence frustration.

On the other hand, for any degree of mobility, the oldest respondents present the highest median values of Autonomy satisfaction. They also present the highest median values of Relatedness satisfaction, Competence satisfaction and Positive affect for the lowest and the highest degree of mobility.

Youngest participants in this research usually have the highest mobility rates under normal conditions (Generalitat Valenciana, 2018). But during the lockdown, they are the ones with the lowest mobility. This fact could explain why they are feeling worse than older respondents. They have the lowest values of PWB, Positive and Negative effects, unless their mobility during the lockdown is relatively high, which confirm our explanation. The oldest respondents feel better even if they present the lowest degree of mobility. The pandemic is more dangerous for them, so they feel safer at home.

Fig. 9 represents median values of PWB, Positive and Negative affect by degree of mobility and time spent travelling per week during the lockdown. Only median values of constructs whose distributions are significantly different from others are included in Fig. 9. For those with the lowest degree of mobility during the lockdown, statistically significant differences in the distribution of Relatedness satisfaction are found between those who spent less than or equal to 15 min traveling per week and those who spent
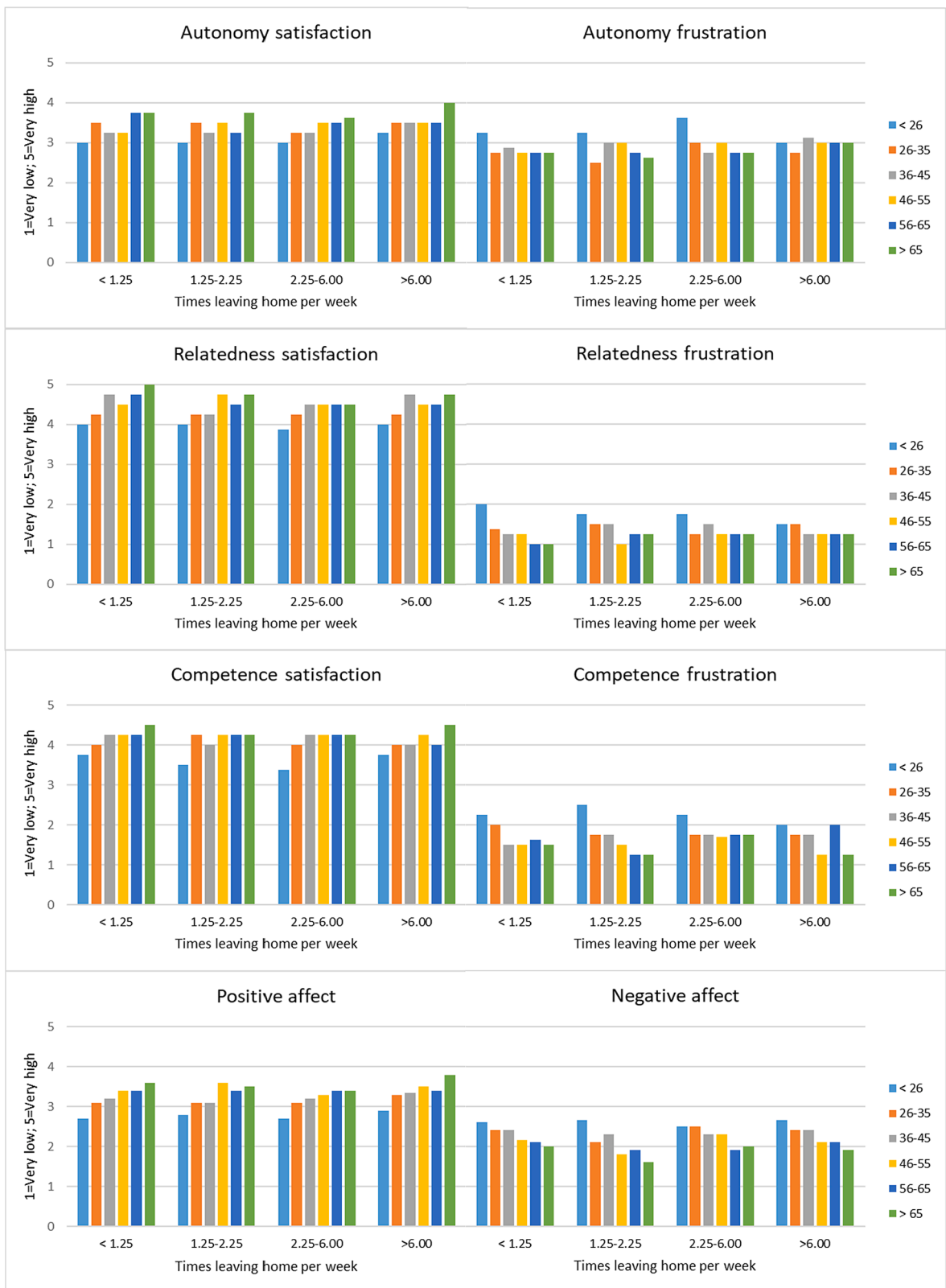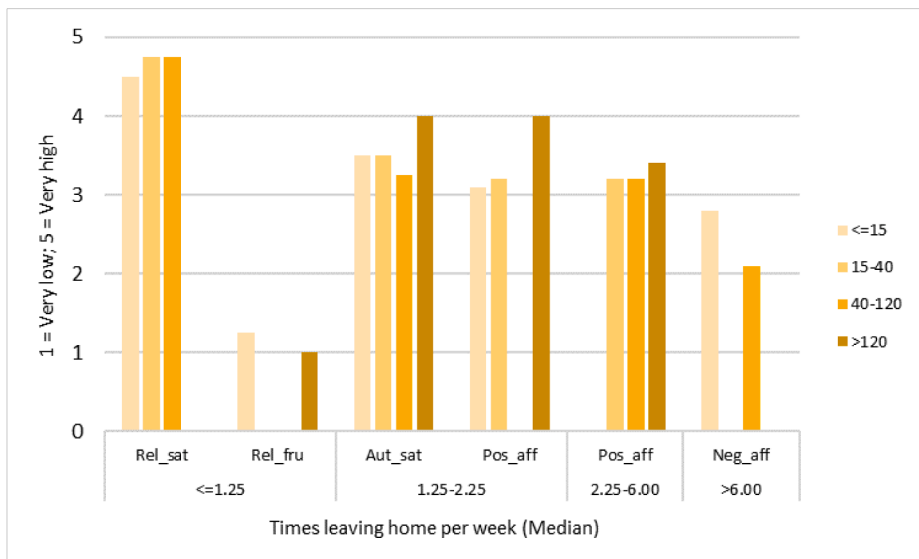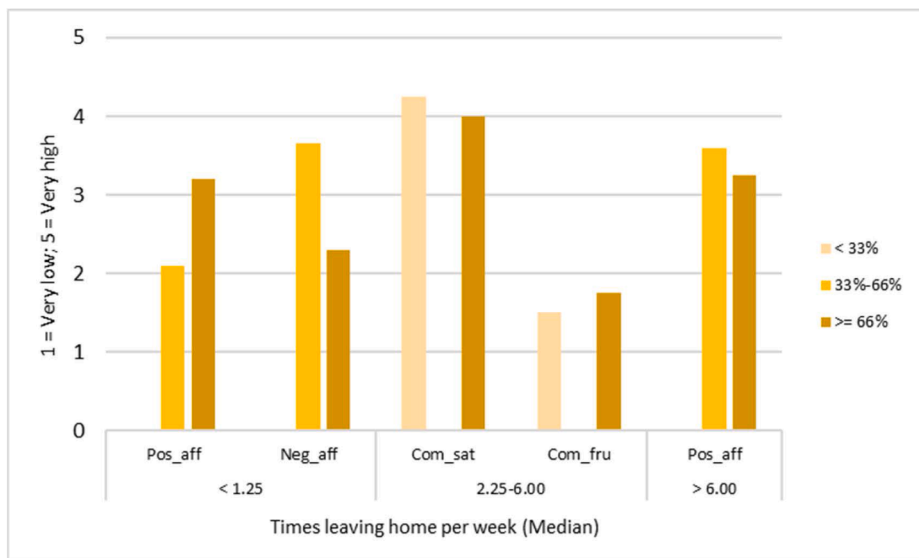
Fig. 8. Median values of PWB indicators, positive and negative affect by degree of mobility during the lockdown and age.

Rel_sat= Relatedness satisfaction; Rel_fru= Relatedness frustration; Aut_sat= Autonomy satisfaction;
Pos_aff= Positive affect; Neg_aff= Negative affect;

Fig. 9. Median values of PWB indicators and positive affect by degree of mobility and time spent travelling per week during the lockdown.

Pos_aff= Positive affect; Neg_aff=Hegative affect; Com_sat= Competence satisfaction;
Com_fru= competence frustration; Pos_aff= Positive affect

Fig. 10. Median values of PWB indicators and Positive affect by degree of mobility and % of walking use during the lockdown.

between 15 and 40 min (U = 24977.0, Sig = 0,031), or 40 and 120 min (U = 10759.0, Sig = 0,005). The former feels lower Relatedness satisfaction than the latter. Statistically significant differences in the distributions of Relatedness frustration are also found between those who spent<15 min and those who spent between 40 and 120 min (U = 10994.0, Sig = 0,005). In this case, the latter present the lower values than the former.

Statistically significant differences in the distributions of Autonomy satisfaction and Positive affect are found for those with a moderate degree of mobility during the lockdown: statistically significant differences exist between those who spent>120 min traveling per week and all the other groups.

For those with a high degree of mobility during the lockdown, statistically significant differences in the distributions of Positive affect are found between those who spent 15–40 min and those who spent>120 min travelling per week (U = 5824.0, Sig = 0,033), and between those who spent 40–120 min and those who spent>120 min traveling per week (U = 8677.5, Sig = 0,009). In this case, those
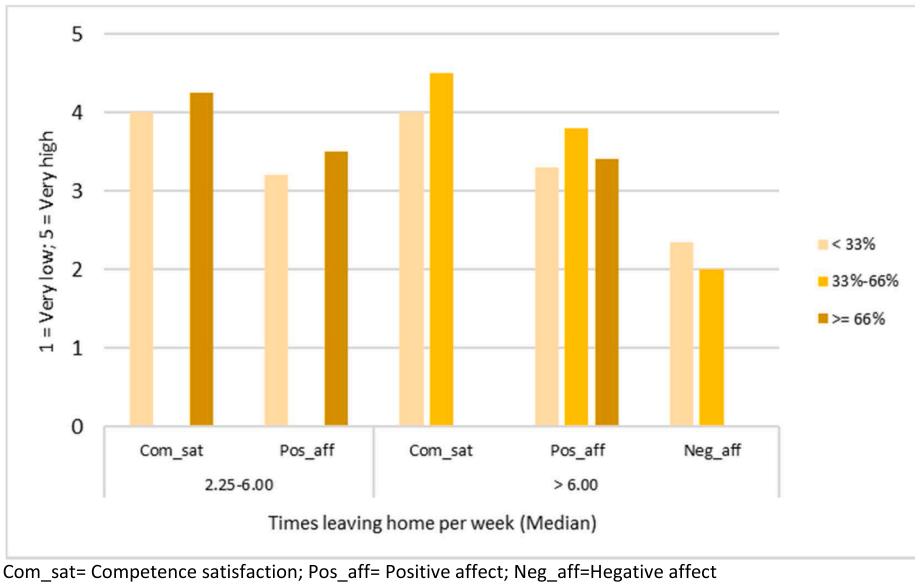
Com_sat= Competence satisfaction; Pos_aff= Positive affect; Neg_aff=Hegative affect

Fig. 11. Median values of PWB indicators and positive and negative affect by degree of mobility and % of car use during the lockdown.

Com_sat= Competence satisfaction; Com_fru=Competence_frustration; Pos_aff= Positive affect
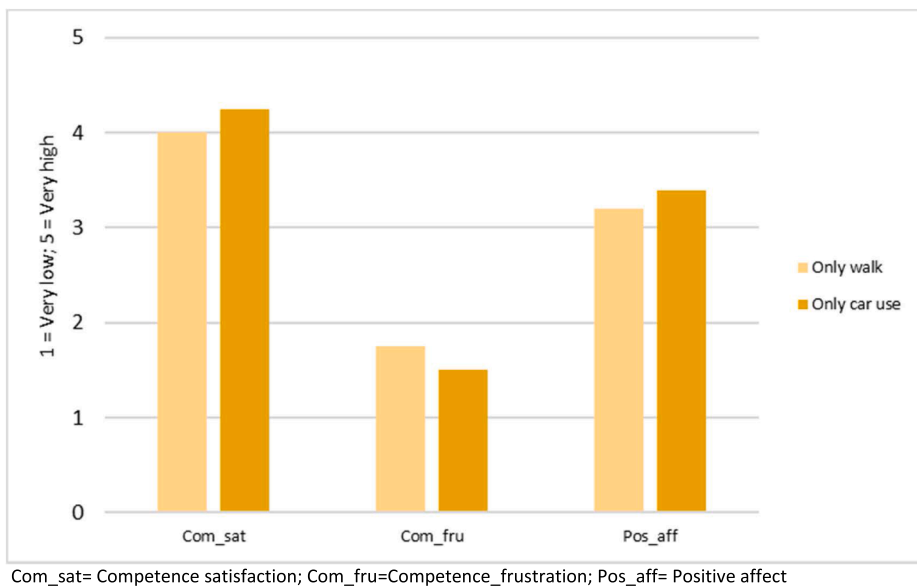
Fig. 12. Median values of PWB indicators and positive affect by only walkers versus only car users during the lockdown.

who spent>120 feel more Positive affect than those who spend less time.

For those with the relatively highest mobility during the lockdown, a statistically significant difference is found between the distributions of those who spent<15 min travelling per week and those who spent 40–120 min (U = 245.0, Sig = 0.031). The latter present a lower value of Negative affect.

In general, the more time participants in this study spent traveling during the lockdown, the better they felt. This is particularly true for those with a moderate degree of mobility. For example, respondents who shopped groceries far from home felt better than those who shopped groceries near home. Spending time out-of-home during the lockdown with a purpose (go for a walk was not allowed during the lockdown) improved wellbeing.

Those who had a low degree of mobility during the lockdown and a percentage of walking higher than 66%, present statistically significant different distributions, with higher values of Positive affect (U = 58.0, Sig = 0.046) and lower values of Negative affect (U = 39.5, Sig = 0.032) than those with a percentage of walking between 33% and 66% (Fig. 10).

On the other hand, participants who had a high degree of mobility during the lockdown and a low percentage of walking, present

statistically significant different distributions, higher values of Competence satisfaction (U = 14112.5, Sig = 0.012) and lower values of Competence frustration (U = 14687.0, Sig = 0.047) than those with a percentage of walking higher than 66%.

Similarly, respondents who had a very high degree of mobility during the lockdown and a percentage of walking between 33% and 66%, present statistically significant different distributions, with higher values of Positive affect (U = 6137.5, Sig = 0.019) than those with a percentage of walking higher than 66%.

Those with a high or very high degree of mobility during the lockdown, the more they walk, the worse the feel. The differences are small but statistically significant according to the results of the Man-Whitney U tests. This is not in line with the findings in the literature before the pandemic, where it is found that active modes are associated with high values of wellbeing (Olsson et al, 2013; Martin et al., 2014; Friman et al., 2017; Singleton, 2019; Chatterjee et al., 2020), even for those whose habitual travel modes are car or public transport (Lira and Páez, 2021). The analysis carried out later in this paper using SEM confirm this result. During the lockdown people felt more insecure when walking because of the possibility of contagion, which was amplified in urban areas with insufficient

Table 4
Results of exploratory and confirmatory factor analyses.

Statistics	EFA	CFA			
Variable	Factor loading	STDYX Stand. Loadings	S.E.	Est/S.E	P-Value
Satisfaction-Autonomy					
BP_7_SA	0.665	0.731	0.017	42.065	0.000
BP_13_SA	0.721	0.709	0.017	41.363	0.000
BP_19_SA	0.675	0.737	0.016	45.062	0.000
Frustration-Autonomy					
BP_8_FA	0.797	0.636	0.021	30.495	0.000
BP_14_FA	0.775	0.709	0.019	38.201	0.000
BP_20_FA	0.678	0.745	0.017	44.447	0.000
Satisfaction-Relatedness					
BP_3_SR	0.753	0.719	0.020	35.104	0.000
BP_9_SR	0.766	0.731	0.021	35.627	0.000
BP_15_SR	0.724	0.740	0.018	40.830	0.000
BP_21_SR	0.624	0.679	0.019	35.238	0.000
Frustration-Relatedness					
BP_4_FR	0.550	0.656	0.023	29.075	0.000
BP_10_FR	0.724	0.746	0.021	35.418	0.000
BP_16_FR	0.558	0.691	0.021	33.265	0.000
BP_22_FR	0.608	0.642	0.021	29.881	0.000
Satisfaction-Competence					
BP_5_SC	0.777	0.743	0.017	42.727	0.000
BP_11_SC	0.667	0.823	0.014	58.692	0.000
BP_17_SC	0.468	0.751	0.017	45.337	0.000
BP_23_SC	0.609	0.772	0.015	51.303	0.000
Frustration-Competence					
BP_6_FC	0.722	0.639	0.020	31.211	0.000
BP_12_FC	0.633	0.695	0.019	35.931	0.000
BP_18_FC	0.640	0.690	0.019	36.241	0.000
BP_24_FC	0.634	0.766	0.016	48.311	0.000
Positive Affect					
PA_1_AP	0.523	0.476	0.024	19.880	0.000
PA_3_AP	0.683	0.762	0.014	54.907	0.000
PA_5_AP	0.725	0.695	0.016	42.201	0.000
PA_7_AP	0.651	0.592	0.018	33.309	0.000
PA_9_AP	0.627	0.572	0.018	32.187	0.000
PA_11_AP	0.752	0.768	0.013	57.935	0.000
PA_13_AP	0.729	0.723	0.014	53.520	0.000
PA_15_AP	0.820	0.860	0.009	96.955	0.000
PA_17_AP	0.702	0.682	0.017	41.280	0.000
PA_19_AP	0.824	0.791	0.011	68.757	0.000
Negative Affect					
PA_2_AN	0.760	0.815	0.011	72.711	0.000
PA_4_AN	0.602	0.697	0.016	42.914	0.000
PA_6_AN	0.470	0.467	0.023	20.597	0.000
PA_8_AN	0.756	0.486	0.022	21.637	0.000
PA_10_AN	0.582	0.597	0.019	31.016	0.000
PA_12_AN	0.676	0.760	0.013	60.051	0.000
PA_14_AN	0.444	0.457	0.023	19.592	0.000
PA_16_AN	0.826	0.780	0.014	55.641	0.000
PA_18_AN	0.843	0.746	0.014	52.730	0.000
PA_20_AN	0.787	0.529	0.021	24.912	0.000
KMO = 0.947		X^2/df = 2930.396/ 807		SRMR = 0.050	
	BARLETT = 19863.387 (df = 253, Sig = 0.000)	CFI = 0.939		REMSEA = 0.038	
		TLI = 0.932			

pedestrian infrastructure (Ferrer et al., 2015; 2018). Besides, walking along completely empty streets increase the sense of insecure (Ferrer et al., 2015). Moreover, the inability to adapt to walking more for those that were not used to do it, could also explain this result (e.g., shopping groceries near home because malls were closed) during the lockdown.

Those who had a high degree of mobility during the lockdown and a low percentage of car use, present statistically significant different distributions, with lower values of Competence satisfaction (U = 14674.0, Sig = 0.024) and Positive affect (U = 14341.0, Sig = 0.022) than those with the higher percentage of car use (Fig. 11).

Respondents who had a very high degree of mobility during the lockdown and a low percentage of car use, present statistically significant different distributions, with lower values of Competence satisfaction (U = 4585.0, Sig = 0.009) and Positive affect (U = 3729.0, Sig = 0.000) than those who use the car between 33% and 66% when leaving home. They also have statistically significant higher values of Negative affect (U = 4814.5, Sig = 0.027) than those with higher percentage of car use.

In general, the higher percentage of car use when leaving home during the lockdown, the better the respondents felt. Although car use is associated with high values of wellbeing before the pandemic, in the context of the lockdown, and considering the results related

Table 5
Results of structural equation model.

	Estimates	S.E.	Est/S.E	P-Value
Effects on Positive Affect				
Aut_fru	−0.208	0.049	−4.241	0.000
Rel_sat	0.898	0.172	5.213	0.000
Com_fru	−0.631	0.080	−7.872	0.000
Trips 2	0.049	0.024	2.044	0.041
Time_Travel 3	0.055	0.021	2.628	0.009
Time_Travel 4	0.099	0.021	4.755	0.000
Effects on Negative Affect				
Aut_fru	0.469	0.040	11.833	0.000
Rel_sat	−0.081	0.036	−2.247	0.025
Com_fru	0.254	0.049	5.189	0.000
Trips 2	−0.071	0.019	−3.695	0.000
Age	−0.151	0.025	−6.063	0.000
Gender	0.043	0.020	2.150	0.032
Student	−0.074	0.025	−2.979	0.003
Effects on Satisfaction-Autonomy				
Age	0.173	0.031	5.625	0.000
Gender	−0.053	0.022	−2.438	0.015
Detached wo garden	0.028	0.017	1.640	0.101
Student	−0.115	0.034	−3.373	0.001
Effects on Frustration-Autonomy				
Trips 3	0.057	0.023	2.458	0.014
Trips 4	0.069	0.024	2.890	0.004
Age	−0.097	0.033	−2.940	0.003
Student	0.180	0.036	5.049	0.000
Effects on Satisfaction-Relatedness				
Trips 2	−0.034	0.019	−1.784	0.074
Age	0.228	0.030	7.508	0.000
Gender	0.040	0.018	2.279	0.023
Time_Travel 2	0.027	0.016	1.707	0.088
Student	−0.124	0.038	−3.249	0.001
Employed	0.075	0.026	2.911	0.004
Effects on Frustration-Relatedness				
Age	−0.178	0.031	−5.743	0.000
Student	0.147	0.042	3.529	0.000
Employed	−0.091	0.026	−3.490	0.000
Effects on Satisfaction-Competence				
Age	0.208	0.030	6.915	0.000
Gender	−0.054	0.022	−2.477	0.013
Student	−0.167	0.040	−4.164	0.000
Employed	0.075	0.023	3.214	0.001
Self-employed	0.034	0.020	1.678	0.093
P_Walk	−0.065	0.018	−3.514	0.000
Effects on Frustration-Competence				
Age	−0.221	0.030	−7.256	0.000
Gender	0.077	0.020	3.837	0.000
Student	0.193	0.041	4.727	0.000
Employed	−0.116	0.025	−4.601	0.000
Self-employed	−0.051	0.021	−2.492	0.013
P_Walk	0.053	0.018	2.897	0.004
X^2/df = 34617.310/1462		SRMR = 0.033		
CFI = 0.928		REMSEA = 0.043		
TLI = 0.921				

to walking, respondents who predominantly used a car felt safer against the virus.

Among those who present the relatively highest degree of mobility (left home>6 times per week), the highest Positive affect is associated to those who used the car on an intermediate level. Those who used the car less also walked, which explains the lower Positive affect. On the other hand, those who used the car more present a lower Positive affect than those who used it on an intermediate level, which can be related to keep being "locked up", in this case in the car, whenever they left home.

Considering the earlier results related to the associations of walking and using car with wellbeing during the lockdown, it is interesting to study what happens with those who only walked or used a car when leaving home. Respondents who only walked when leaving home during the lockdown (n = 899) present statistically significant different distributions, with lower values of Competence satisfaction (U = 79202.5, Sig = 0.001) and Positive affect (U = 81319.0, Sig = 0.027) than those who only used car (n = 208) (Fig. 12). They also present statistically significant different distributions, with higher values of Competence frustration (U = 80191.5, Sig = 0.005).

Although differences are small, they are statistically significant as described. Therefore, those who only used car when leaving home during the lockdown felt a little bit better than those who only walked. This result is in line with the earlier finding related to the percentage of walking when leaving home during the lockdown.

6.4. Descriptive analysis and scale reliability

Slightly signs of asymmetry and non-normality were found in the distribution of PWB variables and Positive and Negative affect. Thus, a robust model estimator was selected to consider such deviations in the model estimation. Next, Cronbach's Alpha is obtained for each latent variable to measure internal consistency, which indicates how closely related a set of items is as a group and validates the scale reliability. Appropriate results are obtained for both Satisfaction and Frustration measurements (Satisfaction-Autonomy: 0.765; Frustration-Autonomy: 0.736; Satisfaction-Relatedness: 0.822; Frustration-Relatedness: 0.778; Satisfaction-Competence: 0.854; Frustration-Competence: 0.794) and Affect (Positive-Affect: 0.891; Negative-Affect: 0.900). Then the scale reliability can be assumed. Next, Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) is obtained to determine the proportion of variance in the variables that might be caused by the underlying factors. Because high values are observed (>0.9), it can be assumed that the factor analysis technique is appropriate for this sample. The next step consists in the assessment of Bartlett's Test of Sphericity, for which a null value was obtained. This result also supports the use of the factor analysis technique. Pearson's correlation matrix shows a high correlation between Satisfaction and Frustration latent variables. Therefore, these correlations are later included in the formulation of the model. Besides, Exploratory Factor Analysis (EFA) is conducted based on the theoretical constructs that represents the latent variables. Varimax rotation is used and a factor loading of 0.40 is selected as the threshold to maintain items in the factor. Lastly, Confirmatory Factor Analysis (CFA) is carried out. In this case, the theoretical posited relationships of the observed indicators to the latent variables are declared. These hypothesized constructs are validated, as it can be observed in Table 4. Two items (BP_7_SA, BP_2_FA) were removed from the analysis because their factors loading were too small, which means that they do not measure the constructs Satisfaction-Autonomy and Frustration-Autonomy. Positive affect is specially influenced by indicators related to Active and Determined, while Negative affect by Jittery and Nervous.

*6.5. Model estimation and results*

The hypothesized relationships described in the theoretical framework are checked in the Structural Equation Model (SEM). This model represents the relationships between the three dimensions of Satisfaction and Frustration with Positive and Negative Affect. In addition, the possible relations between mobility during the lockdown and those variables are explored. Last, sociodemographic characteristics are also included in the model. Maximum likelihood with Huber-White covariance adjustment (MLR) is used for parameter estimation (Yuan and Bentler, 2000). This estimator uses White's sandwich-based method to yield test statistics that are robust in presence of non-normality and non-independence (multiple data provided by a single respondent) (White, 1980). Only statistically significant variables are included in the model (Table 5 and Fig. 13).

Goodness of fit indexes are assessed, which confirm the strength and robustness of the model: Chi-Square/df = 34617.310/1462, Comparative Fit Index (CFI) = 0.928, Tucker Lewis Index (TLI) = 0.921, Standardized Root Mean Square Residual (SRMR) = 0.033 y Root Mean Square Error of Approximation (REMSEA) = 0.043.

Results are discussed below in separated subsections according to the type of relationship: mobility during the lockdown and wellbeing; psychological variables of wellbeing and Positive and Negative affect; sociodemographic characteristics and wellbeing.

6.6. Mobility during the lockdown and wellbeing

The degree of mobility during the lockdown is measured using two variables: number of times leaving home per week, and time spent travelling per week. A moderate value of times leaving home per week is positively associated with Positive affect, and negatively related to Negative affect and Relatedness satisfaction, whereas a high or very high value of times leaving home per week is positively related to Autonomy frustration. This result indicates that the degree of mobility was good for wellbeing, but only to a certain extent, which partially confirmed our hypothesis. People feel locked up if the number of exits from home per week during the lockdown was very low or none, which caused a reduction of wellbeing and an increase of discomfort, which is in line with results obtained during the pandemic by Devaraj and Patel (2021) and Burdett et al. (2021). On the other hand, a high number of exits from home during the lockdown denote an obligation to carry out different out-of-home activities (work, shopping, caring), which probably increased fear of
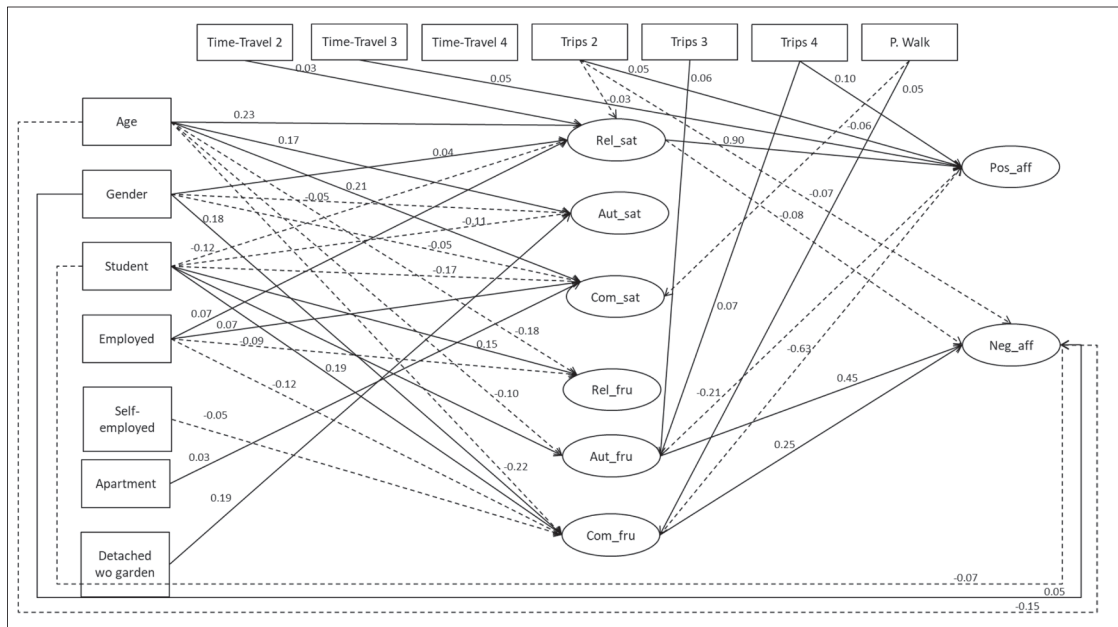
Rel_sat= Relatedness satisfaction; Aut_sat= Autonomy satisfaction; Com_sat= Competence satisfaction; Rel_fru= Relatedness frustration; Aut_fru= Autonomy frustration.
Com_fru= Competence frustration; Pos_aff= Positive affect; Neg_aff= Negative affect; Time-travel 2= time travelling per week 15-40min; Time-travel 3= time travelling per week 40-120min.
Time-travel 4= time travelling per week >120min; Trips 2= 1.25-2.25 times leaving home; Trips 3= 2.25-6.00 times leaving home; Trips 4= >6.00 times leaving home; P_Walk= % of walking
when exit from home per week

Fig. 13. Results of structural equation model.

people of being infected, thus reducing wellbeing and increasing discomfort as well.

Moderate values of time spent travelling during the lockdown are positively associated with Positive affect. This is particularly true if the number of times leaving home per week is moderate. High or relatively very high values of time spent travelling during the lockdown is positively related to Positive affect as well. This result confirms our hypothesis. As expected, the more time spent outdoors, the better people feel.

Mobility was also characterized by the percentage of walking and car use when leaving home during the lockdown. The higher the percentage of walking, the lower the Competence satisfaction and the higher the Competence frustration. Similar results are found in the Mann-Whitney *U* test presented earlier for those with a high degree of mobility during the lockdown. Moreover, those with the highest degree of mobility during the lockdown and a percentage of walking between 33% and 66% present statistically significant higher values of Positive affect than those with a percentage of walking higher than 66%. Only those with a low degree of mobility during the lockdown present statistically significant higher values of Positive affect and lower values of Negative affect when walking more, because for them exiting home with any mode was positive for their wellbeing. These results contrast with the findings related to walking and SWB elsewhere and reject one of our hypotheses. During the lockdown people felt more insecure walking because of the possibility of contagion, which was amplified in urban areas with insufficient pedestrian infrastructure (Ferrer et al., 2015). Besides, walking along complete empty streets increase the sense of insecurity (Ferrer et al., 2015, 2018). Moreover, the inability to adapt to walking more for those that were not used to do it, could also explain this result: (e.g., shopping groceries near home because malls were closed) during the lockdown. It is necessary to consider that the information on wellbeing was collected during the first lockdown in March and April 2020, when very little was known about the virus, and the quarantine rules were very strict. These circumstances influenced to a greater extent how people felt when they exit home walking. Therefore, it is expected that in the post-covid era people will enjoy again walking as much as in the past.

Some statistically significant differences in the distributions of latent constructs are found when considering the percentage of car use, although no significant interrelation was found in the SEM model including this variable. Results from the Mann-Whitney *U* test reveal that the more car use, the better respondents feel in terms of Competence satisfaction and Positive affect, and lower values of Negative affect. Using car during the lockdown was perceived by people as more secure. During the first weeks of the lockdown, authorities recommended to use private vehicles to those that had to leave home. This fact emphasized the sense of security associated with car, but deteriorated the health security perception of public transport, which persist until today. It is worth noting that If most of the exits from home are carried out by car, the feeling of keeping "look up" can contribute to a lower Positive affect compared with an intermediate level of car use.

Using a subsample of those who only walked or only used car when leaving home during the lockdown, Mann-Whitney U tests confirm previous findings: those who only walked felt somewhat worse than those who only used car in terms of Competence satisfaction, Positive affect and Competence frustration.

6.7. Psychological wellbeing and positive and negative affect

The hypotheses related to the influence of the psychological variables of wellbeing on Positive and Negative affect are confirmed. As expected, positive associations are found between Relatedness satisfaction and Positive affect, and between Autonomy and Competence frustration and Negative affect. Similarly, Autonomy frustration and Competence frustration are negatively related to Positive affect, and Relatedness satisfaction is negatively associated with Negative affect. These results are in line with the Self Determination Theory that posit that the basic psychological needs can influence on subjective wellbeing (Ryan et al., 2008).

6.8. Sociodemographic characteristics and wellbeing

Several sociodemographic characteristics are associated with the psychological variables and Positive and Negative affect, which confirm our hypotheses. Females are related to higher Relatedness satisfaction than males. However, females present higher Negative affect than males. This is particularly true for females with a moderate degree of mobility during the lockdown. Women are also negatively associated with Autonomy satisfaction, Competence satisfaction, and positively related to Competence frustration. Women can experiment positive feelings thanks to the possibility to connect with others through information and communication technologies (ICT). However, they feel a low sense of integrity. Their actions, thoughts and feelings are not considered self-endorsed and authentic. They also do not feel to be able to interact effectively with the environment. And they feel that they are thwarted to carry out all the activities they are used to in the way they can, related, for example, with household work and childcare (Zhou et al., 2020; Farré et al., 2020; Collins et al., 2021). Other studies carried out during the pandemic also found that women suffered from a higher increase in stress and reduction in social encounters than men during the lockdown (Oved et al., 2021) and experience worse wellbeing problems than men in that period (Zhou et al., 2020; Kowal et al., 2020; Chakrabarti et al., 2021).

During the lockdown, older respondents are associated with lower Negative affect, Autonomy Frustration, Relatedness frustration and Competence frustration, and they are related to higher Autonomy satisfaction, Relatedness satisfaction and Competence satisfaction. On the contrary, the youngest participants in this research present statistically significant higher values of Autonomy frustration, Competence frustration and Relatedness frustration than the rest of age groups for all degrees of mobility except the highest one. The youngest participants also present statistically significant lower values of Autonomy satisfaction, Competence satisfaction and Relatedness satisfaction. SEM analysis confirms these findings for students. Other studies carried out during the pandemic also confirm that young people are the one who felt worse during the lockdown (Oved et al., 2021; Kowal et al., 2020). This result confirms our hypothesis and can be explained considering that young people were used to have the highest mobility before the pandemic, and they presented the lowest number of times leaving home during the lockdown. Furthermore, many of them possibly did not understand why they must be at home if only old people were affected by the Covid-19. Besides, the tele-education experience could have a negative effect. On the other hand, older participants felt much better than the rest of age groups. Although this result is in line with the findings of Knepple Carney et al. (2021), it is somehow surprising because they are the second group with lowest degree of mobility during the lockdown. Though the difference between their mobility before and during the lockdown could be the smallest. Moreover, they felt safer at home, and the seniors that participated in the research are well connected to others via ICT. Besides, these findings are consistent with the strength and vulnerability integration (SAVI) model that posits that older adults are motivated to enhance positive well-being (Charles, 2010), and are better at regulating their negative affect when exposed to daily stressors, compared to younger adults (Scott et al., 2013).

The positive associations found for employees and self-employees with Competence satisfaction, and negative relations to Competence frustration can be explained by the type of work carry out by the participants in the research, which allow most of them to work at home. Besides, employees are also positively associated to Relatedness satisfaction, and negatively related to Relatedness frustration, which can be justified by the possibility of tele-working and be connected using smartphones and e-mails. These results are in line with Soiné et al. (2021) and Kuhn et al. (2020) who found that unemployed people experienced a higher risk perception and more negative psychological consequences (Kuhn et al. 2020) than employed. Although, Möhring et al. (2021) have recently found mixed findings in relation with the wellbeing of employees during the lockdown in UK and France: some employees suffered during the lockdown, while other were flourishing. They identified perceived changes in financial situation and physical health as well as experienced boredom as the prominent factors that distinguished these groups.

The type of house where respondents spent the lockdown influence on their wellbeing. Living in a detached or semi-detached house without garden nor private open-air space is related to higher Autonomy satisfaction. Detached or semi-detached houses usually have more space available, which can explain this result. This result is in line with Amerio et al. (2020), who have found that students of Milan living in small apartments (<60 m2) during the lockdown had a higher risk of having depression symptoms. Similar houses with garden or private open-air space should have a similar influence, which has been found in the literature to be positively related with reducing mental fatigue and mitigating emotional states such as anger, anxiety, sadness and depression (Cohen-Cline et al., 2015). But no significant result has been obtained because of lack of sample related to respondents living in this type of houses.

7. Conclusions, limitations and practical implications

7.1. Conclusions and practical implications

This paper presents a study of the differences on wellbeing according to the mobility of respondents during the lockdown of March and April 2020 imposed by the authorities to bend the curve of the Covid-19 pandemic in the Valencian Region of Spain.

Sociodemographic characteristics of the participants in the research, their mobility attributes, satisfaction and frustration of basic psychological needs and positive and negative affect are considered. Descriptive, exploratory analyses, and a structural equation model, are used to test the proposed theoretical framework and hypotheses of the study. The results obtained partially confirmed the posited relationships.

The mobility of participants in this study dropped drastically during the lockdown. When respondents left home, they did so mainly walking, especially females and the youngest participants in this research. Car was also used by a significative amount of people, but the use of public transport was extremely small.

Small but statistically significant differences are found in the wellbeing of respondents according to gender, age, degree of mobility and travel mode used during the lockdown. Women and young respondents felt a little bit worse than males and the oldest ones. Despite the participants in this research walked a lot during the lockdown, results indicate that those who walked more and those who only walked when leaving home felt somewhat worse compared with those who only used car. There is a need to improve pedestrian infrastructures to provide enough space for people to walk, considering not only the level of service but also health security, which is a factor that should be considered in all transportation planning studies from now on.

Wellbeing of people was different considering the degree of mobility during the lockdown and the extent to which they walked. Those who left home a certain number of times per week during the lockdown felt better than those whose degree of mobility was very small or nonexistent, or than those who left home much more. Therefore, the measures that limit the mobility of people should consider this aspect, allowing people to exit home to a certain degree, depending on the health conditions. On the other hand, to avoid an excess of mobility during the lockdown that led to some discomfort, alternatives should be offered especially to workers and students. For example, offering the possibility to attend their job or study place, and proposing an alternative closer to their household in co-working sites; company travel plans including workers who alternate at their job place; compressed work/school schedules or four-day week; or full tele-working and tele-education.

In line with the previous recommendation, results of the study emphasize that older participants in the research felt better during the lockdown. Therefore, tele-working would be more indicated the older the age of people. Companies should organize their employees so that older work from home, and younger carry out those tasks that require presence.

On the other hand, home coexistence problems during the lockdown could be the origin of the lack of wellbeing, especially among the youngest participants in this research /students and women. Awareness campaigns regarding good habits at home should be designed and implemented: homework distribution, alternate home exits for shopping and other errands, advise on dealing with arguments, etc.

In general, Relatedness satisfaction present relatively high values among respondents, except for students. The extensive use of ICT among participants in this study could explained this finding. Public policies and measures that facilitate the use of ICT among people with low income should be implemented.

7.2. Limitations

The results obtained in this study must consider the following limitations. The sampling method used produced a convenience sample, which is not representative of the population of study. The sample of people includes an overrepresentation of people age between 45 and 64, workers, living in apartments and inhabitants of big cities. Nevertheless, respondents were well distributed by gender, occupation, age and travel mode used during the lockdown. Therefore, it is possible to infer how different degree of mobility affected the wellbeing for each sociodemographic or travel mode related group.

The methods used to recruit participants (e-mail, online social networks) and the tool used to collect the information, a web-survey, causes that people who responded were well connected via Internet. Therefore, it is very likely that most the participants could tele-work from home. The possible underrepresentation in the sample of essential workers and people who do not use online social networks and other Internet-based tools on a daily basis, should be considered to inference population results from the outcomes of this research, which are based on the available sample.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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