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Activities, time-use and mental health during the first COVID-19 pandemic wave: Insight from Greece

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**ABSTRACT**

The COVID-19 pandemic shocked the global society and caused significant disruptions on various levels of economic and social activity, apart from the purely humanitarian and health perspective. International community and national governments introduced a series of restrictions and other measures to minimize the spread of the virus. This paper provides insight from Greece, focusing on activities and time-use, statements towards mental health and overall wellbeing of citizens during the spring lockdown period of 2020. The analysis is based on data from more than 400 individuals collected through an online survey, which included psychometric attitudes and mental health scales, activity participation and time-use, as well as socio-economic variables and reactions to COVID-19 measures and overall situation. We present results and a respondent segmentation, by employing a latent class cluster analysis, which provides useful insight into the mental health, wellbeing of individuals during the restrictions period and information regarding the activities of the various segments of the population before and during the lockdown. Main findings include the identification of three distinct clusters of the respondents, “Relaxed”, “Worried” and “Cautious” which demonstrated some heterogeneity time-use allocation and activity patterns and feelings/mental health during the lockdown. This is one of the first papers to present activity and time-use data for the 2020 lockdown period in Greece by developing a segmentation approach of the participants based on mental health scales and indicators. Such exploratory efforts are useful in identifying different population segments that may react to government restrictions in a heterogenous way and may exhibit varying mental health statuses.

**Introduction**

The novel strain of SARS-CoV-2, commonly referred to as COVID-19 or coronavirus, has spread all over the globe in 2020–2021 resulting in more than 4.19 million deaths and almost 200 million infections worldwide (World Health Organization and Guidance, 2020). The World Health Organization declared the COVID-19 outbreak as a pandemic as of March 2020. Most governments adopted a variety of response measures to the outbreak, ranging from strict surveillance of vulnerable and infected groups of the population, to restrictions on movement, different varieties of quarantine and restrictions/bans on travel. The pandemic has both imminent and long-term consequences on human society, ranging from disruptive effect on the economy to global trade, tourism, transportation and other sectors.

The unprecedented global situation and the different response measures that governments adopted at regional, national and international level have a prominent effect in the economic, social and personal life of citizens. Especially, due to the nature of the measures, human movement and activity is restricted in ways that were unconceivable in the past, even during wartime. The effect that restriction measures have on social life and human activity is an interesting research topic. For example, a multitude of companies have considered remote working in a more aggressive manner than before and successful implementation has led to a paradigm shift of companies going “fully remote” (e.g. GitLab, Twitter) at least for the foreseeable future. Concerning travel, people seem reluctant to use public transport modes (de Haas et al., 2020), while heavy restrictions were also imposed to people sharing a vehicle.

While research on the impact of COVID-19 and subsequent restrictions and measures is expected to grow in the coming months, findings on the effect of COVID-19 has been already published in different research fields (e.g psychology, transportation, environment). Concerning the impact of COVID-19 on travel and activities, Beck and Hensher (2020) conducted a household survey with 1,073 participants, during the pandemic in Australia (March-April 2020). Their results...
indicated a general trend to support government measures, a significant shift to remote working, decreased willingness-to-use public transport due to health concerns and eventually an increase of car usage and of active transport for short, inner-city trips. Similar findings were reported by de Haas et al. (2020) for the Netherlands (note that the Dutch government issued a “lighter” ban on travel, compared to the Greek and other EU governments), where the number of trips and travel distance during the restrictions were decreased on average by 55% and 68% respectively. Public transport trips were the most affected (90% decrease), while one out of five people stated that they intend to use more active modes and to fly less even after the end of the pandemic. Concerning the activities conducted, the majority of the respondents (80%) stated that they significantly reduced their outdoor activities and increased remote work.

Concerns about the future usage of active modes and public transport are also expressed in Hadjidemetriou et al. (2020) in their study of the United Kingdom government’s measures and their impact on human behavior and travel. The authors observed an expected shift from public transportation to private car, while overall mobility was reduced in a range of 60% to 80% (depending on the mode) compared to 2019. In another paper, Axhausen (2020) presented recent findings from Switzerland also demonstrating a significant decline in daily trips, activity spaces and passenger kilometers. Using a sample of more than 1,000 participants in a tracking app (MOBIS project), the author presented an abrupt fall in car and train trips followed by a rise in cycling trips during the days of the restrictions. Furthermore, De Vos (2020) discussed the potential implications of social distancing and other restrictive measures in travel, human behavior and society. The author claimed that less demand for travel, especially involving public transport or other shared modes is expected, while an increase in car usage and active modes seems unavoidable.

Transportation Research Interdisciplinary Perspectives publishes a collection of articles discussing the effect that the pandemic has on transportation. Overall, travel behavior varies significantly between the pre-pandemic and the pandemic periods. Regarding mode choice, we observe significant shift away from public transportation to private or active modes across cultures and locations: in Sweden (Jenelius and Cebeauer, 2020), the United States (Padmanabhan et al., 2021), India (Bhaduri et al., 2020) and other parts of the world. Apart from mode choice, travel behavior, activity and time-use patterns are topics of interest to researchers. Irawan et al. (2020), present findings from Indonesia in which gender, education and income seem not to affect participation to different type of activities during the pandemic. On the other hand, younger people are more likely to participate in outdoor activities including maintenance, leisure, recreation, and social activities during the pandemic. Authors also comment on the incapability of virtual (remote) activities to sufficiently supplement physical activities (as they highlight in the case of e-shopping but also extended to mandatory activities). Most of the people who reduced their outdoors activities are expecting (or hoping) to retain a similar, pre-pandemic level for such activities after the emergency as reported by de Haas et al. (2020) in the Netherlands. However, it seems that for a significant portion of the sample (27%), working remotely has led them considering working more from home after the pandemic. Such findings indicate that the pandemic may have acted as an “accelerator” regarding a major shift to remote work that was discussed for the most of the 10 s but never really happened in a full scale.

An important aspect of the pandemic and the societal resilience against it has to do with mental health and the sensitivity that citizens have towards the news regarding COVID-19, their feelings and mental health status, the way the perceive and follow government issued directions and guidelines and the array of attitudes and perceptions regarding the pandemic (Budd and Json, 2020). Taylor et al. (2020) discuss a network analysis of worries, avoidance and coping mechanisms during the pandemic, utilizing attitudinal variables regarding belief in conspiracy theories, anti-vaccination attitudes, avoidance of supermarkets and other public places, compulsive checking, worrying of coming into contact with contaminated surfaces or carriers of the virus, xenophobic worries, disregard for social distancing, practice of personal hygiene, stockpiling and impulsive buying and use of personal protective equipment. We utilize relevant attitudinal variables in our approach to identify and classify individuals regarding health sensitivity, worrying and anxiety during the pandemic. Varga et al. (2021) conduct a longitudinal analysis of 200.000 Europeans and present interesting results especially regarding perception of fear and anxiety about becoming ill (or a loved one becoming ill), high levels of loneliness among younger people, women, and people self-isolating because of a chronic or other ongoing illness and individuals with mental illness history. Parady et al. (2020) explore the correlation of activity participation and travel with the perception and fear sentiment during the pandemic in Japan and reveal that more fearful individuals are more likely to participate less in non-essential out-of-home activities and reduce trip frequencies.

Our paper contributes to the above growing literature by exploring and quantifying the effect of COVID-19 response measures, especially measures imposing restrictions on travel and activities, on the indoor and outdoor activity durations, time-use, mobility patterns and level of boredom experienced by individuals in Greece. To the best of our knowledge, this is one of the first papers to provide such a quantitative research for the 2020 lockdown period in Greece.

The remainder of the paper is structured as follows. The situation in Greece is first presented, followed by the description of our research approach. Then, we present the data collection and analysis, while presenting next the latent class cluster model developed. The last section concludes the paper including policy implications of our research.

Situation in Greece

The first COVID-19 cases in Greek appeared in February 26, 2020. Travelers from Italy and the Middle East returned to Greece and unintentionally spread the virus in their local communities initiating the outbreak in the country. There have been more than 3,500 recorded cases of COVID-19 and almost 200 deaths in Greece, until July 7, 2020, before rising to almost 40,000 cases and 625 deaths in November 1 and eventually to 485,000 cases and over 12,000 deaths until July 2021 (Organization, 2020). During the first days of the outbreak, the government issued mostly localized response measures focused on cities where the first cases were recorded. The Greek government, was obviously affected by the severe situation in other EU countries such as Italy and Spain, issued early restrictions: on March 10 (2 weeks after the first recorded case) schools and educational units were closed nationwide, while 3 days later, March 13, most leisure, sports and cultural facilities were also closed down. On March 16, all remaining commercial businesses were closed, while strict restrictions regarding religious activities and places were put in place. The stricter measures, including a universal ban on non-essential travel were put in place during the last week of March (23rd of March) and were active until the 4th of May. The current research presents data from the period of the first wave and lockdown (2020).

During the first, one-month period of strict restrictions in travel activities (23/3–4/5) in Greece, citizens could exit their residence for specific, essential activity purposes. These included a visit to the doctor, supply of essential groceries, a short walk or exercise near their home, helping relatives in need or walking their pets. Additionally, essential workers could move freely, only for work-related travel purposes. Considering this situation, our study carries out a questionnaire survey and conducts a comprehensive analysis, as described in the next section. For reference, Greece had a relatively successful response to the first wave of the pandemic, followed by a limited “opening” of the country to receive tourists from abroad during the summer. This opening, along with other conditions led to a second wave of COVID-19 outbreaks which forced a second strict lockdown in November 2020, which was
continued until May 2021. Data in this paper is collected during the first lockdown period.

Methods

This paper presents the findings of an on-line survey that was administered during the lockdown period. The study was launched on April 1st, 8 days after the lockdown and 35 days after the first report case of COVID-19 and the data collection lasted until the end of April, when lockdown measures were still in place. The participants of the survey were recruited through the network of the University of the Aegean, including students, professors, researchers and administrative staff of the university, as well as through social media and existing research networks. The survey was addressed to adults aged 18 and above. The participants were asked to: a) report the duration of different activities conducted in-house and outdoor before and during the COVID-19 lockdown; b) reply to attitudinal questions to assess their level of boredom using a multidimensional boredom scale, as well as for identifying attitudes towards hygiene and health; and c) provide their demographic characteristics, such as age, gender, occupation etc.

The collected data are analysed by employing two main methods: i) descriptive, statistical analysis of the collected variables, including socio-economic, attitudinal, time-use and activity data, and ii) latent class cluster analysis to classify the respondents into distinct cluster based on their responses on the health sensitivity and hygiene attitudes, identifying relaxed, rationally and irrationally worried individuals. This approach has significant advantages as it allows probabilistic class membership of each data row (individuals) and handles different data scales (continuous, ordinal, nominal, etc.). Vermunt and Magidson (2013) present the methodological framework of the latent class clustering method. A 3-class cluster model outperforms 2, 4 and 5 class models when considering AIC3 and other comparative indicators, as well as interpretability of results (see Table 4). We utilize LatentGold in order to estimate the latent class cluster model. It should be noted that utilizing the latent class cluster method allows for a probabilistic class membership and descriptive profiling of classes based on covariates (Vermunt and Magidson, 2013).

Data analysis

Sample characteristics

On total more than 1,200 respondents participated in the survey. However, due to the intensive nature of reporting daily activities, the final analysis of time-use and daily activities is conducted using a subset of 414 participants, after data cleaning and not considering observations with missing information. Since data collection is almost exclusively focused on the academic community of the university, the sample is skewed towards younger people: mean age is 32.5 years old with a range from 18 to 73 years. The sample includes mostly employees of the public and private sector, students and freelancers. Most of the respondents live either in city centers or in nearby suburbs, with 11.8% living in rural and private sector, students and freelancers. Most of the respondents live from 18 to 73 years. The sample includes mostly employees of the public and private sector, students and freelancers. Most of the respondents live either in city centers or in nearby suburbs, with 11.8% living in rural

| Variable                          | Value   |
|-----------------------------------|---------|
| Age                               | 32.5    |
| Mean age                          | 32.5    |
| Millennials (1981–1996)           | 31.7%   |
| Zoomers (1996–)                   | 38.6%   |
| Older generations (born earlier than 1981) | 29.7%   |
| Sex                               |         |
| Female                            | 62.3%   |
| Male                              | 37.7%   |
| Occupation                        |         |
| Employee (public and private sector) | 43.0%  |
| Freelancer                        | 13.5%   |
| Student                           | 38.2%   |
| Unemployed                        | 3.1%    |
| Other                             | 2.2%    |
| Household characteristics         |         |
| Average number of household members | 2.9    |
| Average number of kids per household | 0.9    |
| Place of residence                |         |
| Live in city center               | 46.1%   |
| Live in suburbs                   | 37.6%   |
| Live in rural areas               | 11.8%   |
| Income                            |         |
| Income much lower than average    | 24.0%   |
| Income much lower than average    | 23.0%   |
| Average income                    | 27.0%   |
| Income higher than average        | 22.7%   |
| Income much higher than average   | 3.3%    |
| Specific population group         |         |
| Not in a high-risk population group | 86.8%  |
| Health workers                    | 1.7%    |

clusters all around the country.

Time use and activities: post and during COVID-19 imposed restrictions

Regarding the time use before and during the lockdown, Fig. 2 presents a general overview of the activities performed within the day, indicating the percentage of time used for each reported activity. The results indicate that work and out-of-home education are the activities mostly affected by the lockdown. This finding is reasonable, considering that during the lockdown, educational facilities and several workplaces were shut down. It should be noted that the survey did not separate remote work from the work activity meaning that the almost 120-minute decrease in work activity includes both essential workers and remote workers. Remote education, on the other hand, was separated from physical-presence education, and we observed an increase of almost an hour on average for remote education during the lockdown. This is explained by the fact that a lot of the educational institutions in the country offered partial or full access to online courses during the period of the lockdown. The largest increase of time use during the lockdown was observed in in-house recreation activities, followed by time spent for sleep and relaxation, while outside recreation, fitness and shopping activities were decreased. Time allocated for walking also decreased during the lockdown (from 0.6 to 0.35 h before and during the lockdown respectively), although it was one of the few exceptions to travel restrictions. This result indicates that citizens supported the government’s measures to stay at home and minimized the range and the extent of even this activity. Finally, other activities such as caring for elder relatives and for pets, did not show any significant variation from post-COVID conditions.

Mobility: post and during COVID-19 imposed restrictions

Fig. 3 presents aggregated data regarding the daily number of trips
and the sum time consumed in travel before and during the lockdown in the different geographical areas of the data collection (city centres, suburban and rural areas). People in urban areas tended to conduct more trips, with a longer average travel time than people in suburban rural before the restrictions but the decrease is large for both areas for trips and travel time registered during the lockdown. For the whole sample, as expected, we observe an abrupt decrease in both daily trips and travel time during the lockdown period. Number of tips were

Fig. 1. Heatmap of respondents’ stated residence during the quarantine.

Fig. 2. Time-use and activity duration before and during lockdown.

Time-use & Activities before and during the lockdown
(avg. hours/day)

| Activity            | Before | During |
|---------------------|--------|--------|
| Sleep               | 6.65   | 3.23   |
| Work                | 3.34   | 2.16   |
| Education           | 5.23   | 2.26   |
| Recreation inside   | 2.13   | 1.36   |
| Recreation outside  | 3.74   | 2.04   |
| Caring and Food     | 3.00   | 1.47   |
| Relaxation          | 2.42   | 0.92   |
| Shopping            | 2.18   | 0.69   |
| Fitness             | 0.79   | 0.35   |
| Going for a walk    | 0.56   | 0.35   |
| Other               | 0.47   | 0.48   |
reduced by 50%, while travel time dropped to ~25 min from over 45. Similar findings have been reported by recently published studies on the impact of COVID-19 on travel behavior (de Haas et al., 2020; Beck and Hensher, 2020; Hadjidemetriou et al., 2020; Axhausen, 2020; De Vos, 2020).

Multidimensional boredom scale: during the COVID-19 restrictions

The survey includes questions on several psychometric attitudes which the respondents answered during the COVID-19 restrictions. The set used is the “Multidimensional State Boredom” scale which has been developed and validated by Fahlman et al. (2013). The descriptive statistics of the responses of the whole sample are shown in Table 2. The participants responded to the attitudinal questions on a scale from 1 to 7, where 1 means that they completely disagree with the statement, while 7 mean that they completely agree with it. Additional to the boredom scale questions, we also included two questions regarding the fear of the participants running out of food or medicine. Due to the lack of comparable, business-as-usual data it is difficult to comment on the results. However we observe some highly ranked responses especially regarding

| Attitudinal variable | Mean | Median | SD |
|----------------------|------|--------|----|
| I feel like I'm sitting around waiting for something to happen | 4.72 | 5 | 1.72 |
| I am wasting time that would be better spent on something else | 3.67 | 4 | 1.83 |
| I want something to happen but I'm not sure what | 4.00 | 4 | 1.78 |
| I am indecisive or unsure of what to do next | 3.64 | 4 | 1.85 |
| Everything seems to be irritating me right now | 3.60 | 4 | 2.05 |
| It is difficult to focus my attention | 3.88 | 4 | 1.89 |
| I feel agitated | 3.3 | 3 | 1.90 |
| I feel happy | 3.7 | 4 | 1.69 |
| I am more moody than usual | 3.74 | 4 | 1.86 |
| I am annoyed with the people around me | 3.29 | 3 | 1.86 |
| I am impatient right now | 4.19 | 4 | 1.82 |
| I am lonely | 3.27 | 3 | 1.91 |
| I feel empty | 2.99 | 2 | 1.90 |
| I feel cut off from the rest of the world | 3.89 | 4 | 2.03 |
| I feel depressed | 3.06 | 3 | 1.90 |
| I am bored | 3.88 | 4 | 2.23 |
| I am more nervous than usual | 3.42 | 3 | 2.02 |
| I am more violent than usual | 2.21 | 2 | 1.57 |
| It seems like there's no one around for me to talk to | 2.79 | 2 | 1.89 |
| My mind is wandering | 3.85 | 4 | 1.95 |
| My attention span is shorter than usual | 2.99 | 2 | 1.88 |
| Time is moving very slowly | 3.12 | 3 | 2.02 |
| I am afraid I will run out of food/supplies | 2.31 | 2 | 1.64 |
| I am afraid I will run out of medicine | 2.48 | 2 | 1.70 |

Table 3
Sensitivity to hygiene and health attitudes (1: completely disagree, 7: completely agree).

| Attitudinal variable | Mean | Median | SD |
|----------------------|------|--------|----|
| It bothers me when people sneeze without covering their faces | 6.5 | 7 | 1.0 |
| I am sure that I will catch a virus/infection that is spreading around | 3.4 | 4 | 1.5 |
| I feel comfortable sharing a water bottle with friends | 3.1 | 3 | 2.0 |
| I don't like writing with a pencil somebody else has used | 5.1 | 6 | 2.0 |
| I have a history of being susceptible to illnesses | 2.2 | 2 | 1.5 |
| When I shake hands, I want to wash my hands as soon as possible | 3.3 | 3 | 1.9 |
| I am sensitive to common cold, viruses, other transmitted diseases | 3.3 | 3 | 1.8 |
| From my social circle I am the most prone to catching a cold or virus | 2.5 | 2 | 1.6 |
| I don't feel that my hands are dirty after touching paper money | 2.5 | 2 | 1.7 |
| I don't worry when I am around sick people | 2.9 | 3 | 1.7 |
| My immune system protects me from illnesses that affect other people | 3.5 | 4 | 1.7 |

Latent class cluster analysis

The next step in our analysis comprises of a latent class cluster analysis, utilizing a the sensitivity to hygiene and health attitudes presented in Fig. 4. Overall, we found that creating three clusters leads to an interesting narrative and improves our explanatory capabilities of the sample segments (Fig. 5).

Based on the final cluster centers, three distinct clusters are identified as follows: Cluster 1: “Relaxed”, which includes the most calm respondents, Cluster 2: “Worried”, including the most nervous and worried participants, without medical history and self-assessed risk of getting a virus and Cluster 3: “Cautious”, which comprises of respondents sensitive and fearful of the pandemic who have a medical history. Each respondent falls into one cluster, giving us the opportunity to present cluster-wise descriptive statistics, providing useful insight into the socio-economic, time-use and activity participation behavior of each cluster. Table 5 presents the final cluster centers, essentially the
means of each attitudinal variable within each final cluster.

Table 6 presents the demographic characteristics of each cluster. Cluster 1, which refers to more relaxed people includes the younger age cohort of our sample. It also includes a significant number of students and the least percentage of females among all clusters. These respondents obeyed the least to the government’s directions regarding travel in comparison with the other clusters. More worried people (cluster 2) include more females, while a significant number of freelancers and private sector’s employees also belong to this cluster. Most of them obeyed to the government’s directions regarding travel and social distancing. Cluster 3 includes the most females and people who stocked supplies the most and are worried about their job. In terms of other socio-demographic factors, they are mostly evenly spread between the clusters.

Table 4

|          | LL     | BIC(LL)  | AIC(LL)  | AIC3(LL) | Class.Err. |
|----------|--------|----------|----------|----------|------------|
| 1-Cluster| -7545.6153 | 15488.9378 | 15223.2307 | 15289.2307 | 0          |
| 2-Cluster| -7289.8004 | 15381.041 | 14845.6008 | 14978.6008 | 0.0599     |
| 3-Cluster| -7112.4257 | 15430.0245 | 14624.8513 | 14824.8513 | 0.0572     |
| 4-Cluster| -7017.611 | 15644.1282 | 14569.222 | 14836.222 | 0.0683     |
| 5-Cluster| -6940.6749 | 15893.9891 | 14549.3499 | 14883.3499 | 0.0641     |

Fig. 4. Time-use and activities by cluster before and during COVID-19 restrictions.
Regarding the time-use and activity participation of the three clusters, before and during the government restrictions, Fig. 4 presents the average hours spent at each activity by cluster. Generally people slept more during the lockdown and worked significantly less. Remote education was higher among respondents of all clusters, as well as indoors recreation, especially for cluster #1. Outdoors recreation was significantly reduced among members of all clusters. Largest reduction in work time is observed in Cluster #2, in which respondent also report the least time allocated to indoors recreation. On the other hand, participants in Cluster #2 (worried) also report the most time allocated to relaxing, fitness and caring activities in-home (food preparation, household chores, etc.) and shopping. Other activities such as going for a walk, caring for elders or pets present with similar means across clusters.

A further step in our analysis includes the presentation of attitudes and perceptions regarding feelings of worry, happiness, boredom and loneliness or emptiness. We generally observe a homogenous response regarding feelings among clusters, with the notable exception of feelings of irritation (significantly more prominent in worried and cautious clusters) and in the self-reported behavior regarding fears of running out of medicine and food (again higher in cautious and highest in worried clusters).

Finally, regarding travel behavior, we observe a significant reduction in average daily trips and travel time, mainly due to the travel restrictions during the first wave in Greece. However, cluster #3 respondents travel, on average, once per day and worried individuals (cluster #2) have the smaller travel time (as they had before the pandemic too).

**Conclusions**

This paper presents an analysis of individual’s time use and activities allocation during the restrictions imposed in Greece due to the COVID-19 pandemic, while exploring the effect of self-isolation in their mental health and well-being.

Overall, survey participants complied with the measures taken by the government for restricting the virus spread within the community (more
regarding the recreation activities out-of-home, while the more relaxed leisure activities, we observe a similar pattern across all clusters. Cluster 3 consisted of the more worrying individuals with a history apparent, rational reason (previous sickness or sensitivity to viruses), calm and relaxed, Cluster 2 had more worried individuals without an apparent, rational reason (previous sickness or sensitivity to viruses), while Cluster 1 included individuals that during the restrictions were more relaxed, independent of their perception of health and hygiene. The first wave of the virus, on understanding the effect of future measures and restrictions. For instance, more sensitive and worried people need to be targeted and obtain support for their mental health if a new lockdown is foreseen.

Our findings should be considered within the context of the limitations of our research approach and data analysis. The sample is not representative of the overall Greek population; thus, caution is needed in the interpretation of our results. Additionally, the COVID-19 cases in Greece were significantly less than neighboring or other EU countries, a fact that may have affected the research outcome. The effectiveness of the measures taken by the Greek government during the first wave, along with the support and compliance of Greek citizens, are widely acknowledged. As mentioned above, this is also evident by the number of reported COVID-19 cases in the country (World Health Organization and Guidance, 2020) at the time. Further research is needed to identify policy directions to address the diverse and heterogeneous effects of lockdown and mobility restrictions to people’s mental health and overall wellbeing and to provide safe and

than 85% reported that they were obedient). This is also evident by the significant decrease observed in the number of daily trips conducted and the average trip duration during this period.

To explore the relationship of the participants’ worries and health/hygiene attitudes with time use and activities participation, a latent class cluster analysis was conducted that led to the identification of three clusters. Cluster 1 includes individuals that during the restrictions were calm and relaxed, Cluster 2 had more worried individuals without an apparent, rational reason (previous sickness or sensitivity to viruses), while Cluster 3 consisted of the more worrying individuals with a history of health problems. Regarding activities and time-use, when considering leisure activities, we observe a similar pattern across all clusters regarding the recreation activities out-of-home, while the more relaxed participants spend a lot more time in leisure activities inside the house during the lockdown. Additionally, respondents minimize the time allocated to walks, shopping and caring for elders and pets all of which either happen or can happen outside the house. This finding is interesting because it indicates that both relaxed and more worried individuals minimize their out-of-home activities during the first lockdown, independent of their perception of health and hygiene. Additionally, the more worried clusters reported a stricter following of the rules regarding travel and social distancing than the relaxed cluster, however 4 out of 5 in the relaxed cluster reported that they strictly followed government measures regarding social distancing. The first lockdown took a heavy toll on participants feelings and self-assessed mental health status. Significant variability among clusters is observed in terms of irritability and fear or running out of supplies, medicine and food.

This paper contributes in several ways to existing COVID-19 related literature. It is one of the first studies exploring the effect of COVID-19 restrictions on time use and activities allocation that are also linked to mental health. To the best of our knowledge, this is the first study to provide such information about Greece. Furthermore, our findings can be useful to policy makers and public authorities while preparing for the second wave of the virus, on understanding the effect of future measures and restrictions. For instance, more sensitive and worried people need to be targeted and obtain support for their mental health if a new lockdown is foreseen.

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### Table 5

**Final Cluster centers.**

| % of sample | #1: Relaxed (37%) | #2: Worried (34%) | #3: Cautious (29%) |
|-------------|--------------------|-------------------|--------------------|
| Indicator   | Coefficient z-value | Coefficient z-value | Coefficient z-value |
| It bothers me when people sneeze without covering their faces | -0.5539 | -3.7684 | 0.8255 | 3.2634 | -0.2716 | -1.7602 |
| I am sure that I will catch a virus/infection that is spreading around | -0.5665 | -6.9101 | 0.0823 | 1.1336 | -0.4842 | 5.3019 |
| I feel comfortable sharing a water bottle with friends | 0.3371 | 6.5462 | -0.2131 | -3.2181 | -0.1229 | -1.9215 |
| I don’t like writing with a pencil somebody else has used | -0.1249 | -3.0717 | 0.1369 | 2.7162 | -0.0119 | -0.2435 |
| I have a history of being susceptible to illnesses | -0.1707 | -2.3839 | -0.2263 | -2.6472 | 0.397 | 5.8375 |
| When I shake hands, I want to wash my hands as soon as possible | -0.2682 | -5.003 | 0.0578 | 1.0066 | 0.2103 | 3.2942 |
| I am sensitive to common cold, viruses, other transmitted diseases | -0.5565 | -6.892 | 0.0181 | 0.2843 | 0.5384 | 7.1605 |
| From my social circle I am the most prone to catching a cold or virus | -0.979 | -3.9416 | -0.4165 | -2.2821 | 1.3955 | 3.7534 |
| I don’t feel that my hands are dirty after touching paper money | 0.3137 | 4.5069 | -0.5268 | -4.8131 | 0.2131 | 2.9059 |
| I don’t worry when I am around sick people | 0.4433 | 6.0194 | -0.5556 | -4.3879 | 0.1123 | 1.2027 |
| My immune system protects me from illnesses that affect other people | 0.5271 | 6.8163 | -0.18 | -2.6691 | -0.3471 | -4.5677 |

Fig. 5. Travel behavior among cluster members before and during lockdown.
sustainable path to the future. Such effects have a global dimension which makes the identification of the suitable measures and rapid adaptations of great importance, especially given that some of these measures are unprecedented in democracies and may also provoke indignation and unrest among stressed or worried citizens.

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.

Table 6
Socio-economic characteristics of clusters.

|                      | #1: Relax | #2: Worried | #3: Cautious | Total sample |
|----------------------|-----------|-------------|--------------|--------------|
| Age (mean)           | 31.88     | 33.75       | 33.84        | 33.03        |
| Sex (%)              | 0.59      | 0.61        | 0.68         | 0.62         |
| Occupation (%)       |           |             |              |              |
| Public sector employee | 0.23     | 0.25        | 0.30         | 0.25         |
| Private sector employee | 0.23   | 0.22        | 0.17         | 0.21         |
| Freelancer           | 0.14      | 0.16        | 0.08         | 0.13         |
| Home keeper          | 0.00      | 0.02        | 0.01         | 0.01         |
| Student              | 0.39      | 0.33        | 0.35         | 0.36         |
| Unemployed           | 0.02      | 0.01        | 0.07         | 0.03         |
| Pensioner            | 0.00      | 0.01        | 0.03         | 0.01         |
| Household characteristics (averages) |            |             |              |              |
| Average number of household members | 2.91   | 2.99        | 2.89         | 2.93         |
| Average number of kids per household | 0.89 | 0.88        | 0.83         | 0.87         |
| Place of residence (%) |          |             |              |              |
| Live on an island    | 0.29      | 0.36        | 0.34         | 0.32         |
| Live in city center  | 0.43      | 0.45        | 0.53         | 0.46         |
| During the COVID-19 lockdown (%) |            |             |              |              |
| Is working remotely  | 0.43      | 0.49        | 0.43         | 0.45         |
| Followed directions regarding travel | 0.87 | 0.90        | 0.86         | 0.87         |
| Followed directions regarding social distancing /meeting with friends | 0.81 | 0.89        | 0.89         | 0.86         |
|Stocked supplies      | 0.26      | 0.25        | 0.35         | 0.28         |
|Their work is at stake | 0.20   | 0.22        | 0.23         | 0.21         |

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