ALGERIAN PERCEPTION ON COVID-19 AND ITS IMPACT ON POST LOCKDOWN MOBILITY: A SURVEY STUDY

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ABSTRACT

In this work, the Algerians perception of COVID-19 is analyzed using the results of a national online survey, carried out among 1000 people. Indeed, we are interested in their point of view on this disease and its dangerousness as well as the indicators which influence these perceptions. In addition, this study examines how the Algerian perception of COVID-19 affects their mobility during and after lockdown. Finally, a simulation is carried out to examine the impact of mobility and compliance with precautionary measures after the lockdown on the risk of a new spread. Among the most relevant results one can retain the fact that Algerians' dangerousness perception does not affect their mobility, but has a direct effect on their decision to come back work. Furthermore, the simulations' results highlighted the level of precautions needed to avoid a high risk of contamination upon lifting the lockdown.

KEY WORDS: COVID-19; Mobility; Algerian perception.

JEL CLASSIFICATION : C15; C25; D1; I18

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PERCEPTION DES ALGÉRIENS DU COVID-19 ET SON IMPACT SUR LA MOBILITÉ POST-CONFINEMENT : ETUDE DE CAS

RÉSUMÉ

Dans ce travail, la perception algérienne du COVID-19 est analysée à l'aide des résultats d'une enquête nationale en ligne, menée auprès de 1000 personnes. En effet, nous nous intéressons à leur point de vue sur cette maladie et sa dangerosité ainsi qu'aux indicateurs qui influencent ces perceptions. De plus, cette étude examine comment la perception algérienne du COVID-19 affecte leur mobilité pendant et après le confinement. Enfin, une simulation est réalisée pour examiner l'impact de la mobilité et le respect des mesures de précaution après déconfinement sur le risque d'une nouvelle propagation. Parmi les résultats les plus pertinents, on peut retenir le fait que la perception de la dangerosité des Algériens n'affecte pas leur mobilité, mais a un effet direct sur leur décision de reprendre le travail. En outre, les résultats des simulations ont mis en évidence le niveau de précautions nécessaires pour éviter un risque élevé de contamination lors de la levée du confinement.

KEY WORDS : COVID-19 ; Mobilité ; Perception Algérienne.

JEL CLASSIFICATION : C15; C25; D1; I18

تصور الجزائريين حول وباء كوفيد-19 وتأثيره على التنقل بعد رفع الحجر الصحي : تحليل نتائج المسح

ملخص

قمنا بتحليل تصورات الجزائريين حول جائحة كوفيد -19 في هذ العمل باستعمال نتائج مسح وطني عبر الخط مسّ حوالي 1000 شخص. وعلى هذا اهتممنا بوجهات نظر الممسوحين حيال هذه الجائحة وخطرها، وكذا المؤشرات التي أثرّت على تصوراتهم. ودرس هذا البحث أيضا، كيف أثرّت الجائحة على حركة المواطنين خلال وبعد الحجر الصحي. وفي الأخير لجأنا لمحاكاة لفحص تأثر الحركة واحترام الاجراءات الاحترازية بعد رفع الحجر على خطر عودة الوباء من جديد. ومن ضمن النتائج التي تم التوصل إليها وجدنا أن تصور الجزائريين حول خطورة الوباء لا تؤثر على درجة حركتهم ولكنها تؤثر بشكل مباشر على قرارهم بالعودة للعمل. وفضلا عن ذلك أشارت نتائج المحاكاة إلى مستوى الاجراءات الاحترازية الضرورية لتفادي أي خطر كبير للعدوى عند رفع الحجر الصحي..

كلمات مفتاحية: كوفيد 19 ; التنقل ; نظرة الجزائريين

تصنيف جال: C15; C25; D1; I18

1- INTRODUCTION

The early months of 2020 marked the world by the emergence of a new Corona virus which shook up several aspects of millions people daily lives. In front of the inability to manage the quick spread of this virus, one of the most important measures applied at the international scale was mobility restriction. As well as all the countries around the world, Algeria was affected by this disease and several measures were taken in order to limit the casualties. Among them, we investigate the one concerning the mobility restriction. In this direction, it is important to firstly understand the perception of Algerian people on this disease dangerousness. Indeed, a higher dangerousness perception is logically supposed to induce higher mobility drop. Before starting the study, let us take a look on what is COVID-19.

I.1- Overview of the general knowledge on Covid-19

Corona-VIrus Disease 19 (COVID-19) is a disease caused by the new virus Severe Acute Respiratory Syndrome Coronavirus-2 (SARS CoV2) which appeared through the last month of 2019 in Wuhan, Hibei Provence, China. The contaminated people can suffer in the worst case from severe pneumonia, acute respiratory distress syndrome, sepsis and septic shocks, which potentially lead to death [16].

The difficulties related to the pandemic management of COVID-19 are essentially due to the lack of epidemiological information. Indeed, as it is a new virus, many questions such as the human immunity [14,8], the spread speed [9] and the treatments [12] are still open ones. However, the first studies estimated that, on average, one infected person will infect between two and three other persons. All these reasons led to a quick dispersion of the virus all around the world.

I.2- COVID-19 timeline

On January, 9th 2020, the Chinese Centre for Disease Control and Prevention identified the novel Corona virus SARS CoV-2 as the cause of the outbreak COVID-19.

On January, 23rd 2020, 581 confirmed cases were reported in both Asia and America. The most cases were located in China whereas

Thailand, Vietnam, Japan, South Korea and the United State of America registered their first cases. Furthermore, 17 deaths were reported in China. At this stage, the Chinese authorities imposed some restriction on the mobility, by deleting flights, trains and suspending buses, subways and ferries.

On February, 15th 2020, more than 50,000 cases were confirmed in China while 500 confirmed cases and the first death outside China were registered.

On March, 11th 2020, the number of confirmed cases over the world exceeded 121,000 and the World Health Organization (WHO) declared the COVID-19 as a global pandemic. In fact, nowadays, more than 180 countries all over the world are affected by the COVID-19 pandemic.

In Algeria, the first case was reported on February 25, 2020. Since then, the number of cases has continued to increase. According to the statistics of Algerian Ministry of Health (June 18th), the total number of cases reached 11,267 spread across the 48 wilayas(departments), with a number of deaths equals to 800. In the MENA region, Egypt has the highest number of cases, more than 49,200 cases. Morocco recorded more than 8,900 cases. Tunisia, Jordan and Lebanon recorded a number below 1,500 cases. Despite the fact that Algeria has a low number of cases affected by SARS CoV 2 compared to certain countries in the MENA region such as Egypt, the ratio (the number of deaths over the number of infected people) is equals to 7% which is relatively high compared to 4% for Egypt and 4.4% for Tunisia (see Figure N°1 and N°2). Regarding the general management of the COVID-19 outbreak crisis, Algerian authorities introduced progressively several measures, which are summarized in Figure N°3.

Figure n°1. Evolution of the cumulated number of cases in the selected MENA countries

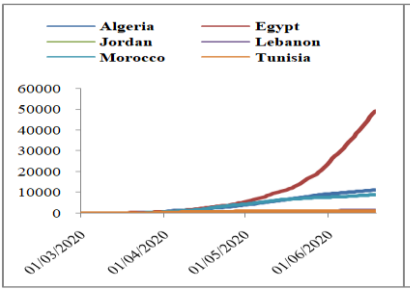
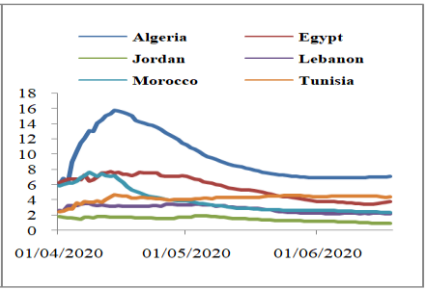


Figure n°2. Evolution of the death ratio in the selected MENA countries



Source: Computed by the authors using statistics of European Centre for Disease Prevention and Control.

I.3- COVID-19 and mobility

In order to deal with this pandemic, most of the concerned countries opted for a partial or complete lockdown. These strategies seem to be the most efficient way to stop the spread of the virus. Indeed, the lockdown aims to reduce the people mobility and then their interactions. Due to this reduction, the virus spreading will be limited.

Kraemer et al.[5] studied the contributing parameters to the SARS CoV 2 spread from Wuhan to the other cities. To this purpose, they analyzed the mobility of infected persons that have been in Wuhan and travelled elsewhere before the instauration of the mobility restrictions (also called "cordon sanitaire"). Their main finding is that, the correlation between the mobility and the contaminated number decreases with time increasing after the cordon sanitaire instauration. That is to say, travel restriction is particularly useful at an early stage. However with time going, the increase of the contaminated number is better explained by factors unrelated to the human mobility. Other studies were carried out to analyze the impact of human mobility and the exportation of SARS CoV 2 from Wuhan to other cities. For instance, Lai et al. [6] showed that 834 infected persons travelled from Wuhan to 382 cities during the two weeks prior Wuhan's lockdown. Moreover, Chinazzi et al. [2] pointed the fact that the travel quarantine of Wuhan

delayed the overall outbreak progression by only 3 to 5 days in mainland China but had more marked effect on the international scale where case importations were reduced by nearly 80% until mid February.

Klein et al. [4] analyzed the mobility of U.S. people by quantifying the distances they cross before and during the lockdown. The main purpose of this study is to understand the impact of the taken policies, especially the smart work or the work at home on mobility. The authors found that these policies have been reduced by a half the overall mobility in major U.S. cities. Wellenius et al. [15] have also studied the U.S. policies impact on the mobility. However they focused on the following policies: state emergency declaration, shelter in place order and social distancing. Furthermore, they used the relative change in the time spent away from places of residence with the change in the number of visits to places of work, grocery and pharmacies, transit stops and parks rather than the crossed distance by people. Pepe et al. [11] gave the first quantitative assessment of the Italian measures on the mobility. As results, the total trips between Italian provinces were reduced by 50% following the lockdown. Moreover, the average user's radius of gyration was also reduced by 50%. Pullano et al. [13] studied how mobility in France changed before and during lockdown. In this direction, they investigate behavioral response to announcements of interventions and to the epidemic burden. As results, a reduction of trips with a distance less than 100 Km by 65% is reported whereas the long trips (>100 km) were reduced by 85%.

The aforementioned works used mobile phones Data of persons that allows the use of their locations. To improve this task several applications aiming to target the behavioural mobility are elaborated [3][7].

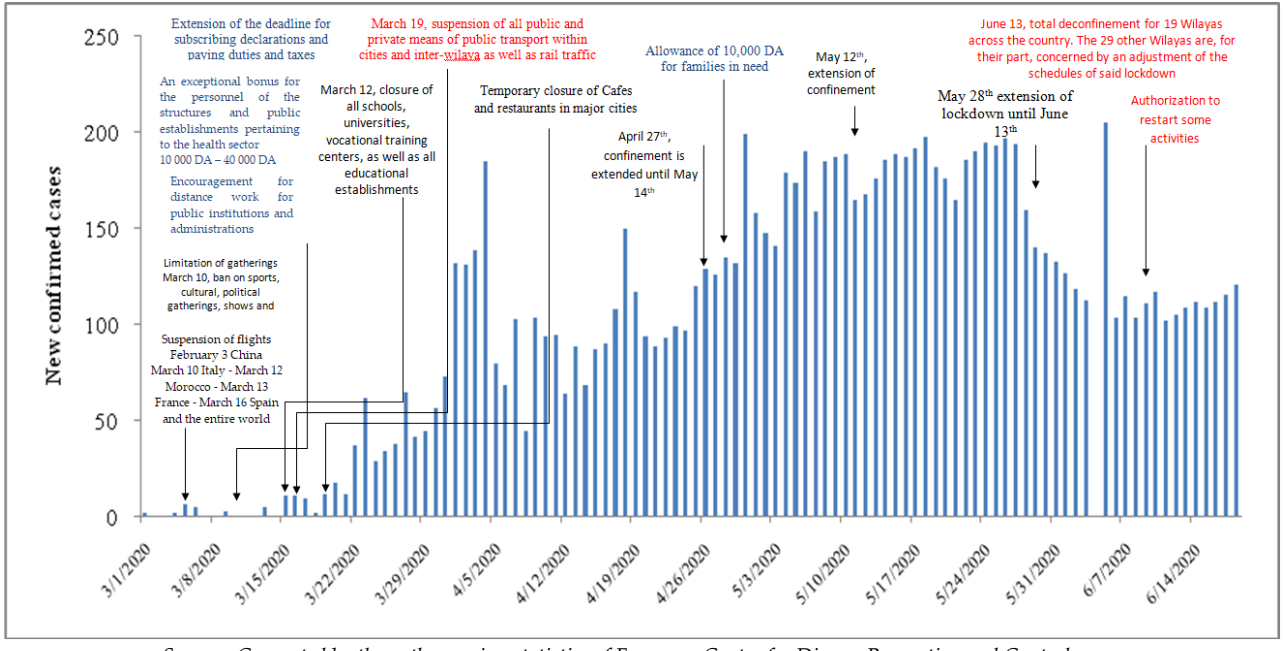
Askitas et al. [1] showed the order in which public policies help curb the pandemic and that these effects are conciliated by the way they change population mobility patterns. Furthermore, Müler et al.[10] established that removing infection in the public transport system allows a reduction of the virus spread speed and the height of the peak by about 20%.

The present work aims to study the impact of the COVID-19 pandemic on Algerians' mobility, in order to assess their post-lockdown

behaviour and its eventual effects on a new contamination risk. To this end, a prior analysis on the Algerians' perception about the COVID-19 is done. Indeed, this analysis is necessary for a better comprehension of Algerians' understanding about COVID-19 and their mobility's role in its spreading. The used data are collected through an online survey. The obtained results of the statistical analysis allow us to simulate the risk of a new contamination upon stopping the lockdown. To the best of our knowledge, no study has been performed in this direction.

The rest of this paper is outlined as follows, section II is devoted to the used methodology whereas the Algerian perception on covid-19 is presented in section III. Section IV concerns the COVID-19 impact on Algerian mobility and section V the risk simulation. Finally, a conclusion is drawn in section VI.

Figure n°3. Covid-19 Cases & Policy TimeLine



Source: Computed by the authors using statistics of European Centre for Disease Prevention and Control.

2- METHODOLOGY

Due to lockdown measures, and in order to keep social distancing, we opted for a web-based survey spread on social networks groups and emails from May 31st until June 13th (This date corresponds to the partial lifting of lockdown).

First, the questionnaire was tested on 20 people in order to be improved. Then, the survey was lunched through social media, 1,038 individuals have completed the questionnaire. We collected the data and proceeded to its cleaning, and retained 1,016 responses for the analysis.

The rapid assessment and its results are not nationally representative and cannot be extrapolated to the regional or national level. While the assessment is not representative at a larger scale, studying the population's mobility behaviour provides valuable insights and knowledge relevant for interventions and policies in times of crises.

A structured questionnaire with question items was developed to capture relevant information for the purpose of the assessment. The questionnaire used for the survey was kept short, avoiding very detailed questions or questions with long lists of answer choices.

The questionnaire is structured in 5 modules: 1) Background information about respondents, 2) Level of information regarding the COVID-19 pandemic, 3) Mobility before lockdown, 4) Mobility during the lockdown and 5) Perception of post-lockdown mobility. The questionnaire was translated and administered in Arabic and French.

For the empirical analysis, we proceeded in three stages. The first consisted in a descriptive analysis of the data. In the second step, we performed an ordered logistic regression analysis to identify the determinants of the perception of the dangerousness of COVID-19 with different specifications models. We also estimated binary logit for the analysis of the determinants of mobility behaviour: mobility before and during the lockdown per week, mobility before and during the lockdown per day and an ordered logistic regression for the analysis of the determinants of mobility behaviour: degree of change in terms of weekly mobility and degree of change in terms of daily mobility.

Finally, a simulation is done in order to evaluate the risk level on contamination according to the assessment of the post lockdown mobility and the precautions that are taken.

A descriptive analysis highlighted that 46.1% of the respondents were men, while 53.9% of women answered. We also noted that the age varies between 17 and 72 years old, with a mean of 32.5 years.

3- THE ALGERIAN PERCEPTION ON COVID-19

To study the Algerian perception on COVID-19, a focus is made on three principal elements: the disease type, its transmitting mode and its dangerousness. First of all, these elements are analysed separately. Then, the study of their relationship is done. Finally, the dangerousness determinants are put into evidence.

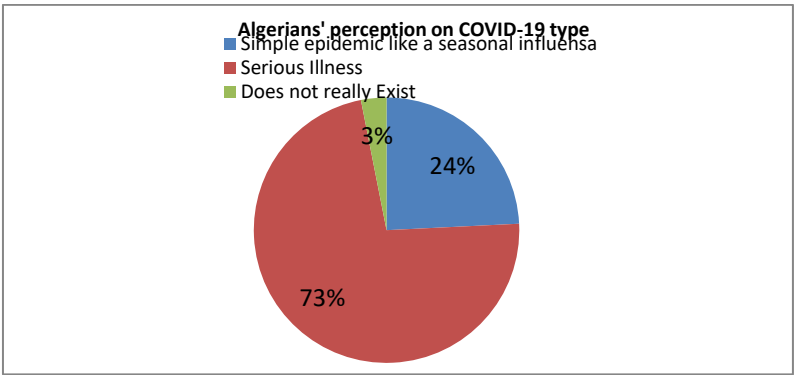
3.1- Perception elements analysis

3.1.1. COVID-19 type

Despite the fact that the viruses causing both seasonal influenza and COVID-19 induce some similar symptoms, they are very different [16]. In addition, only 1 in every 1,000 infected persons by the seasonal influenza dies, against 57 in every 1000 for the COVID-19[1] . In this direction, Algerian people were asked about the COVID-19 type, 72.7% of them consider it as a serious illness, while 24.2% estimate that it is just like the seasonal influenza. Furthermore, 3.1% think that this disease does not really exist (see Figure 4). Moreover, men seem more likely to be assimilating COVID-19 to the seasonal influenza than women.

[1] This rate is calculated using eced.eu.com data until 09/06/2020.

Figure n°4. Algerians' perception on COVID-19 type**.**



Source: survey study on post lockdown mobility in Algeria, CREAD 2020.

3.1.2. Transmitting mode

As mentioned before, the spreading speed plays a major role in the COVID-19 management. In fact facing the lack of epidemiological information, the only way to win time and avoid an oversaturation of the hospitals is to slow down the virus spreading. To do so, it is important to know how SARS-COV2 is transmitted from a person to a person. On the WHO website, the transmitted mode is described as follows,

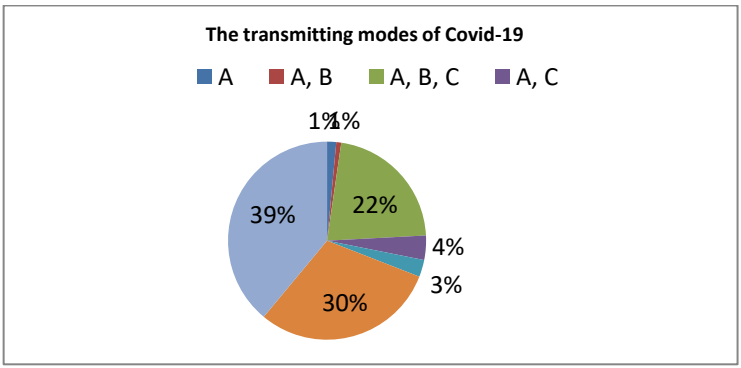
> *"The virus seems to be transmitted mainly via small respiratory droplets through sneezing, coughing, or when people interact with each other for some time in close proximity (usually less than one metre). These droplets can then be inhaled, or they can land on surfaces that others may come into contact with, who can then get infected when they touch their nose, mouth or eyes. The virus can survive on different surfaces from several hours (copper, cardboard) up to a few days (plastic and stainless steel). However, the amount of viable virus declines over time and may not always be present in sufficient numbers to cause infection."*[16].

In the survey, the following alternatives concerning the transmitting mode were proposed to the asked people, who may choose more than one alternative.

A: through the air,
B: through the contaminated surfaces,
C: through direct contact with an infected person.

Mainly 38.6% of people think that the virus spreads through a direct contact with an infected person, whereas 29.8% of them consider that in addition to a direct contact with an infected person, the virus is also transmitted through the contaminated surfaces. For 21.7% persons, the virus is spread through the three alternatives. A negligible percent of people answered using other combination of these alternatives (see Figure 5).

Figure n°5. The transmitting modes of COVID-19

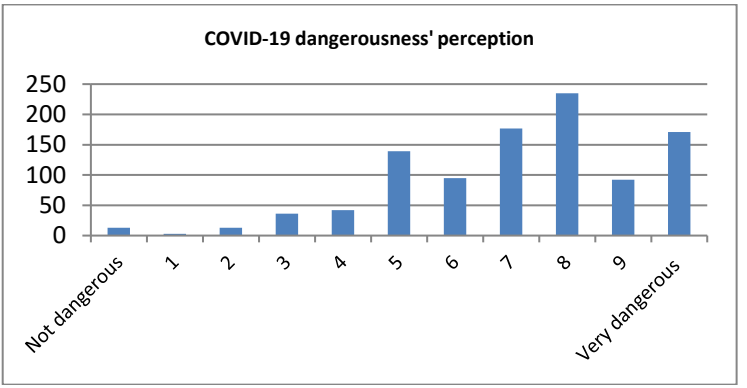


Source: survey study on post lockdown mobility in Algeria, CREAD 2020

3.1.3. Dangerousness

In order to assess the Algerian evaluation of COVID-19 dangerousness, the questioned persons were invited to choose on a scale from 0: not dangerous at all to 10: very dangerous, a mark corresponding to their beliefs. On average, the COVID-19 dangerousness is estimated to 7.11/10. The highest percentage of people (23%) evaluated this danger to 8/10 whereas 24.3% of them allocated an evaluation under the value 5 (see Figure 6).

Figure n°6. COVID-19 dangerousness' perception.



Source: Survey study on post lockdown mobility in Algeria, CREAD 2020

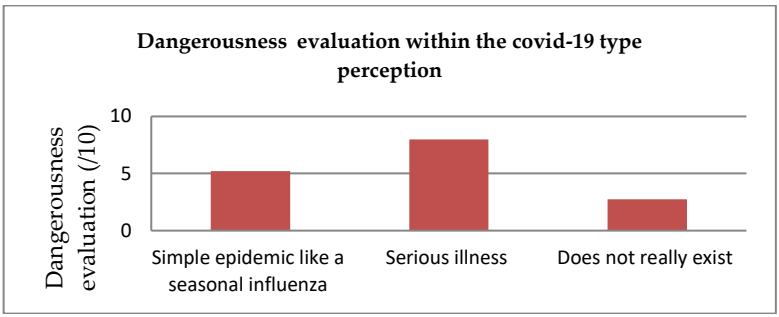
3.2- Perception elements relationships

The aforementioned elements are related. Indeed, the obtained p-values when testing the dependences between the variables of each pair (type, transmitting mode), (type, dangerousness) and (transmitting mode, dangerousness) are equal to 0.000. Furthermore, the most related ones are the type and the dangerousness with a contingency coefficient equals to 0.63, followed by the couple (transmitting mode, dangerousness) with a contingency coefficient equals to 0.52, then comes the couple (type, transmitting mode) with contingency coefficient equals to 0.49.

3.2.1. COVID-19 Type and dangerousness perception

When crossing the type and the dangerousness, it appears that the average evaluation of dangerousness by people who think that COVID-19 is a serious illness is about 7.97/10; while people thinking that COVID-19 is like the seasonal influenza estimated its dangerousness to 5.22/10. Concerning those who deny COVID-19 existence but give a dangerousness evaluation, the average is 2.70/10 (see Figure 7).

Figure n°7: Dangerousness evaluation within the COVID-19 type perception



Source: Survey study on post lockdown mobility in Algeria, CREAD 2020

3.2.2. Transmitting mode and dangerousness

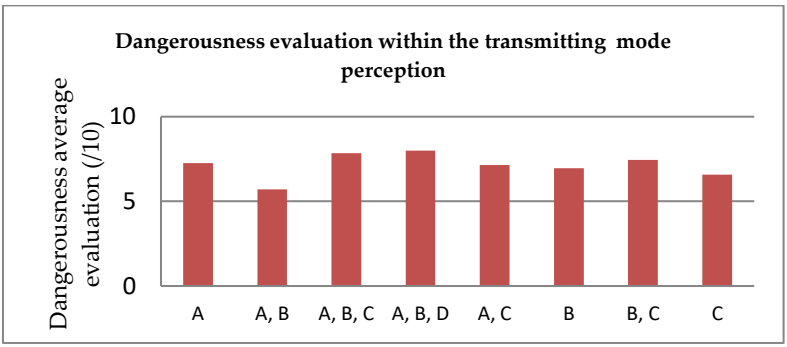
The obtained results when crossing transmitting mode with the dangerousness evaluation show that (see Figure 8):

(i) The people thinking that the SARS-COV 2 is transmitted through the air, the infected surfaces and the direct contact with an infected person (A, B, C) give the highest score to the COVID-19 dangerousness. Indeed the average of dangerousness evaluation in this case is about 7.84/10.

(ii) When the transmitting mode is believed to be through the air and the contaminated surfaces (A, B), the average dangerousness evaluation is the lowest (5.71/10).

(iii) As shown before (see Figure 5) most of interviewed people think that the SARS-COV2 is transmitted only through a direct contact with a contaminated person (C).This belief induces the second lowest score of dangerousness evaluation. Indeed, in this case the average dangerousness evaluation is about 6.58/10. However, for the 59.9% of people who consider other alternatives than the (C) or the (A, B), the score of the dangerousness is upper than **7**.

Figure n°8: Dangerousness evaluation within the transmitting mode perception

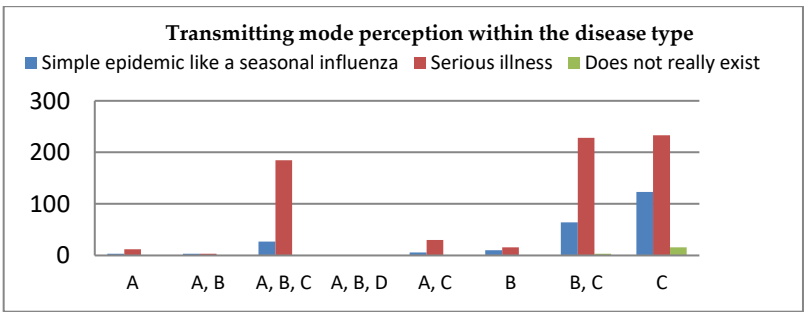


Source: Survey study on post lockdown mobility in Algeria, CREAD 2020

3.2.3. COVID-19 Type and transmitting mode

From Figure **9** one can observe that, when the COVID-19 is assimilated to a seasonal influenza, the prevailing transmitting mode is the alternative (C). However, when it is assimilated to a new serious illness; the believed transmitting mode is mainly split over the alternatives (A, B, C), (A, C) and (C), with no significantly prevailing mode.

Figure n°9. Transmitting mode perception within the disease type



Source: Survey study on post lockdown mobility in Algeria, CREAD 2020

3.3- Dangerousness determinants

To establish the principal parameters that influence the Algerian perception of COVID-19 dangerousness; several statistical tests were

done. In this direction, the dependence between the dangerousness perception and each of the age, gender, educational level, activity sector, whether the person knows a contaminated person or not and finally the taken precautions are analysed.

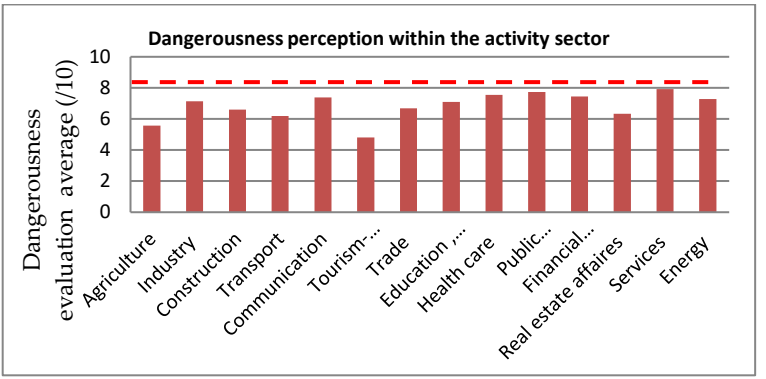
3.3.1. Educational level versus dangerousness

While testing the dependence between the educational level of the questioned persons and their perception of COVID-19 dangerousness, a p-value of 0.083 is obtained. Therefore, these two variables are not dependent. One can explain this result by the fact that since it is a new virus, even the researchers do not master the topic yet. The lack of information induces some confusion and reduces the knowledge to beliefs. This could explain why the educational level seems to have no influence on the dangerousness perception.

3.3.2. Activity sector versus dangerousness

Unlike the educational level, the activity sectors of the interviewed people impact their dangerousness perception. In fact, the obtained p-value when testing the dependence between these two variables is equal to 0.023 with a contingency coefficient equals to 0.43. From Figure 10, one can observe that the people working in the activity sectors: services, public administration and healthcare are those giving the highest score to the COVID-19 dangerousness with average evaluation equals to 7.91/10 respectively, 7.73/10 and 7.54/10.

Figure n°10. Dangerousness perception within the activity sector



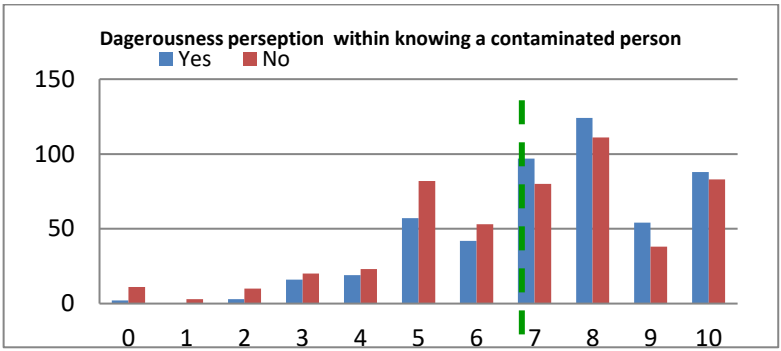
Source: Survey study on post lockdown mobility in Algeria, CREAD 2020

3.3.3. Dangerousness perception versus knowing a contaminated person

The fact to know a contaminated person affects the Algerian perception of COVID-19 dangerousness. Indeed the obtained p-value when testing the dependence between these two variables is equal to 0.004. However this dependence is somehow weak (contingency coefficient= 0.15). Nevertheless, most people evaluating COVID-19 dangerousness under a score of 6/10 do not know a contaminated person. Whereas most people evaluating COVID-19 dangerousness upper than 7/10 know contaminated persons (see Figure 11).

Furthermore, the approximation degree with the contaminated persons has no significant impact on the dangerousness perception. In fact, the obtained p-value when testing the dependence between these two variables is equal to 0.939.

Figure n°11. Dangerousness perception within knowing a contaminated person



Source: Survey study on post lockdown mobility in Algeria, CREAD 2020

3.3.4. The dangerousness perception impact on security measures

In the survey, people were asked to choose among the following precautions, the ones they respect:

A: Social distancing.
B: Wearing a medical mask.
C: Use of a hydro alcoholic gel.
D: Regular wash of the hands.
E: None of them.
F: Other.

As result, 43% of them take the four precautions (A, B, C, D), whereas 11% observe only the A, B and C. 2.2% do not observe any precaution while the rest take different combinations of these precautions at an insignificant percentage.

When testing the dependence between the taken precautions and the dangerousness score, the obtained p-value equals to 0.000 with a contingency coefficient equals to 0.482. Furthermore, people respecting the four precautions give an average dangerousness evaluation of 7/10.

3.4-. Determinants of the perception of the dangerousness of COVID-19

In order to confirm the above results, we analyze the determinants of the perception of the dangerousness of COVID-19, using ordered logit model. For the explanatory variables, we introduced three

categories: 1) demographic characteristics such as the gender, the age and the educational level. 2) The situation with respect to the job, and 3) COVID-19 information such as if the interviewee knows people infected with COVID-19, if the population is sufficiently informed of the precautions to take, if the person plan or not to come back to work after lockdown.

In ordered logit, an underlying score is estimated as a linear function of the independent variables and a set of cutpoints. The probability of observing outcome i corresponds to the probability that the estimated linear function, plus a random error, is within the range of the cutpoints estimated for the outcome:

$$\Pr(\text{outcome}_j = i) = \Pr(\kappa_{i-1} < \beta_1 x_{1j} + \beta_2 x_{2j} + \cdots + \beta_k x_{kj} + u_j \leq \kappa_i)$$

u_j is assumed to be logistically distributed in ordered logit. In either case, we estimate the coefficients β_1, β_2, . . . , β_k together with the cutpoints κ_1, κ_2, . . . , κ_{k-1}, where k is the number of possible outcomes. κ_0 is taken as $-\infty$, and κ_k is taken as $+\infty$. All of this is a direct generalization of the ordinary two-outcome logit model.

The outcome variable take the value from 0 (COVID-19 is not dangerous at all) to 10 (COVID-19 very dangerous). All control variables are expressed in dummy variables.

The results of the estimations show that men (compared to women) are more likely to believe that COVID-19 is less dangerous. The first model shows a linear relationship between age and the perception of dangerousness of COVID-19 (age square is not significant). This means that older people are more likely to think that COVID-19 is dangerous compared to the youth. It seems that the level of education does not have a significant effect on the perception of dangerousness of COVID-19. That means that individuals have different perceptions of dangerousness of COVID-19 regardless of their level of education. In the second model, it appears that the unemployed (unlike the occupied) think that the COVID-19 is potentially dangerous.

We checked the situation of individuals on the labour market, combining the individual situation (employed, unemployed, inactive) and the sector of activity in which the person exercises. Two dummy variables are significant, the services sector and the public

administration sector with positive effects, which means that people who work in these two sectors find that COVID-19 is dangerous compared to people in a situation of inactivity.

Knowing someone infected with the disease increases the perception of COVID-19 dangerousness. This result seems consistent. A person's behaviour also depends on the behaviour of other people. Indeed, the results show that when a person thinks that other people are sufficiently informed of the precautions to take to protect themselves from COVID-19 will decrease their perceptions of the dangerousness of the pandemic and vice versa. Note that the probability of perceiving dangerousness decreases from the modality 'fully inform' to the modality 'partially inform'.

A very important finding, the perception of the dangerousness of COVID-19 has a direct effect on the decision of individuals to return to work. This means that the population needs more insurance to come back to work. The government must take this into account when preparing measures to be taken after lockdown. Finally, we asked a question about what people think about lifting the confinement after June 13th. It turns out that people who have a perception of the COVID-19 as dangerous do not agree to lift the confinement. These results are summarized in Table N°5 (see Annexe).

4- THE COVID-19 IMPACT ON ALGERIAN MOBILITY

In order to capture the COVID-19 impact on the Algerian mobility, questions about their usual mobility before and during the lockdown are asked. The main idea behind these questions is then to evaluate whether the lockdown reduces this mobility or not. Moreover, an ordered logit model is used in order to analyze the determinants of mobility behaviour.

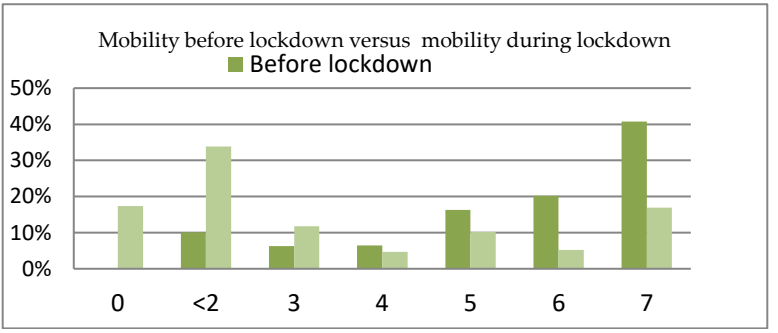
4.1- Mobility behaviour analysis

To study the mobility behaviour, two mobility kinds are defined:

- Weekly mobility that concerns the number of days per week that the people go out.
- Daily mobility that concerns the number of daily displacements usually done by people.

Asked about their weekly mobility before the lockdown, 40.7% of people go out every day (7 days per week) whereas only 10.1% go out less than two days a week. However, during the lockdown 17.3% of people did not go out at all, 33.9% went out less than two days a week and only 16.9% continued to go out every day (see Figure 12).

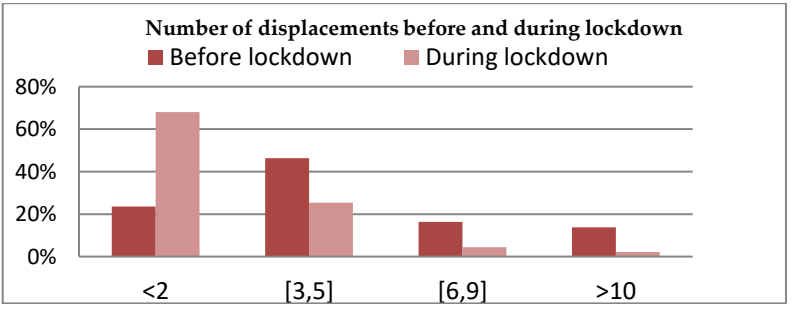
Figure n° 12. Mobility before lockdown versus mobility during lockdown



Source: Survey study on post lockdown mobility in Algeria, CREAD 2020

Concerning the daily mobility before the lockdown, 46.4% of people make between 3 and 5 displacements per day whereas 23.5% of them make less than two displacements per day. During the lockdown, the percentage of people making less than two displacements per day increases to 68% while the percentage of people making between 3 and 5 displacements per day decreases to 25.4% (see Figure 13).

Figure n°13. Number of displacements before and during lockdown



Source: Survey study on post lockdown mobility in Algeria, CREAD 2020

To better understand these behaviours, the following variables are introduced:

- Let us consider the variables N_{wb} , N_{wd}, N_{db} and N_{dd} such that,
- N_{wb} represents the number of days that people go out before the lockdown,
- N_{wd} represents the number of days that people go out during the lockdown,
- N_{db} represents the number of displacements that people do per day before the lockdown,
- N_{dd} represents the number of displacements that people do per day during the lockdown.
- For each mobility kind, two types of variables are defined using the variables N_{wb} , N_{wd}, N_{db} and N_{dd}.
- Weekly mobility variables

Let $DifMS$ be a binary variable such that,

$$\begin{cases} DifMS = 1, & if\ N_{wb} \neq N_{wd} \\ DifMS = 0, & otherwise. \end{cases}$$

The variable $DifMS$ allows us to know whether the people change their mobility behaviour during the lockdown or not. However, it does not quantify the mobility variation. Hence to capture this variation the variable $LdifMS$ is defined as follows,

$$LdifMS = N_{wb} - N_{wd}$$

- Daily variables

As for the weekly variables, the variables $DifMJ$ and $LdifMJ$ are defined as follows:

$$\begin{cases} DifMJ = 1, & if\ N_{db} \neq N_{dd} \\ DifMJ = 0, & otherwise. \end{cases}$$

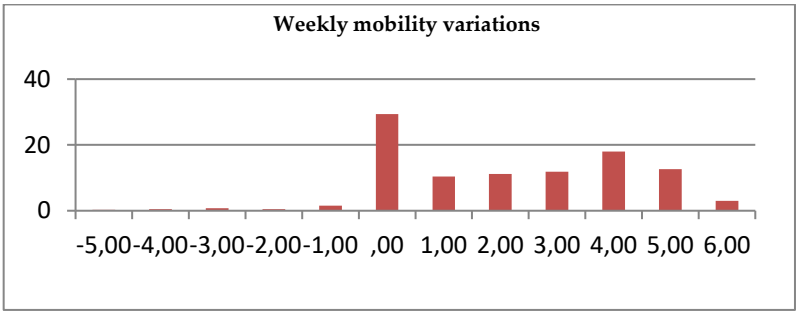
and,

$$LdifMJ = N_{db} - N_{dd}$$

When analyzing the obtained answers, one can observe that 69.3% of people have changed their weekly behaviours whereas 52.4% have changed their daily ones. Furthermore, 44.83% of the people who changed their weekly behaviours have also changed their daily ones.

More detailed analyses on these variations show that the variable $LdifMS$ varies between the values -5 and 6. In other words, there are people who increased their mobility during the lockdown (negative values) and others who decreased it (positive values). Furthermore, the maximum increase is made by 5 days a week (value -5) and the maximum decrease is about 6 days a week (value 6), these results are summarized in Figure 14.

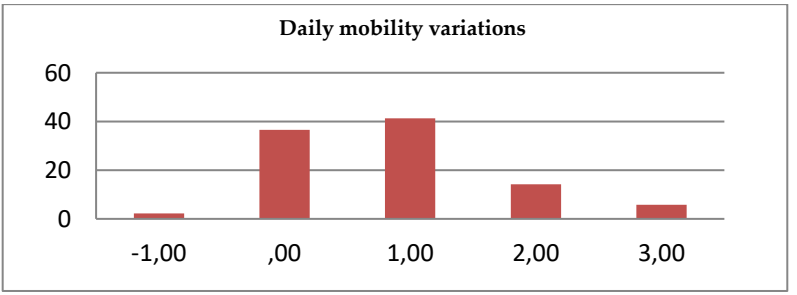
Figure n°14. Weekly mobility variations



Source: Survey study on post lockdown mobility in Algeria, CREAD 2020

Regarding the daily variations, the variable $LdifMJ$ varies between the values -1 and 3. That is to say, there are people who increased their daily mobility (negative values) and others who decreased it (positive values). Moreover, the maximum increase is about one displacement per day and the maximum decrease is about three displacements per day (see Figure 15).

Figure n°15. Daily mobility variations



Source: Survey study on post lockdown mobility in Algeria, CREAD 2020

4.2- The proposed ordered logit model

4.2.1. Difference between mobility before and during containment

We analyze the determinants of mobility behaviour, using binary logistic regression. Mobility behaviour can be formalized by a discrete choice structure $DifMti$ = 1 if individual "i" changed their mobility behaviour and $DifMti$ = 0 if not. t=S, J (S=week, J= day).

$$P(\text{DifMti} = 1) = \frac{e^{\beta' x}}{1 + e^{\beta' x}}$$

$$P(\text{DifMti} = 0) = \frac{1}{1 + e^{\beta' x}}$$

Variables DifMS and DifMJ are defined in the previous section. For the explanatory variables, we introduced socio-demographic characteristics (sex, age, level of education), situation in the profession, the means of transport used and information related to COVID-19. All control variables are expressed in dummy variables.

4.2.2. Assessment of the degree of change in terms of weekly and daily mobility

We analyze the determinants of mobility behaviour, using ordered logit model. The outcome variable LdifMS takes a value from -5 to 6 and the outcome variable LdifMJ takes a value from -1 to 3. We used the same control variables used in the previous model.

Our variable of interest is the Dangerousness of COVID-19 (variable takes a value from 0 (COVID-19 not at all dangerous) to 10 (COVID-19 very dangerous). It appears that this variable has no effect on the change in mobility behaviour except for the LdifMJ model when it is combined with sex (gender). The results are summarized in Table N°1.

Table n°1. The determinants of mobility behaviour before vs after lockdown

	LdifMS	**LdifMj**	**DifMS**	**DifMJ**
Dangerousness of COVID-19	NS	NS	NS	NS
Dangerousness of COVID-19 * Sex	NS	-	NS	NS
Sex included	✓	✓	✓	✓
Age & Age squared included	✓	✓	✓	✓
Educational Attainment included	✓	✓	✓	✓

Situation in the profession included	✓	✓	✓	✓
The means of transport used included	✓	✓	✓	✓
Information about COVID-19	✓	✓	✓	✓

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Source: Survey study on post lockdown mobility in Algeria, CREAD 2020

5- RISK SIMULATION

As shown in the previous sections, the dangerousness perception does not really affect the mobility behaviour of the Algerians. However, the mobility plays an important role in the SARS-COV 2 spreading. Indeed, more is the mobility the more is the contamination risk. That is why a too impulsive lockdown break can worsen the situation. Even if the lockdown break is done progressively, the situation can get worse if the people do not respect sufficiently the security precautions.

In this section, a basic simulation is done in order to establish the relationship between the number of security precautions taken and the risk of new contamination, based on the obtained data from our survey.

5**.1- Simulation assumptions**

To simulate the risk of contamination based on the number of the taken precautions, people are classified into three categories:

- Not careful: in this category the people take at most one precaution.
- Careful: herein people take two or three precautions.
- Very careful: concerns people who take more than three precautions.

When a careful person goes out, the risk to be contaminated or to contaminate (if he is infected) is assumed to be low. The other situations of the contamination risk level when two persons interact are summarized in Table N°2.

Table n°2. Risk level according to the persons care

	Very careful	Careful	Not careful
Very careful	Low risk	Low risk	Low risk
Careful	Low risk	Medium risk	High risk
Not careful	Low risk	High risk	Very high risk

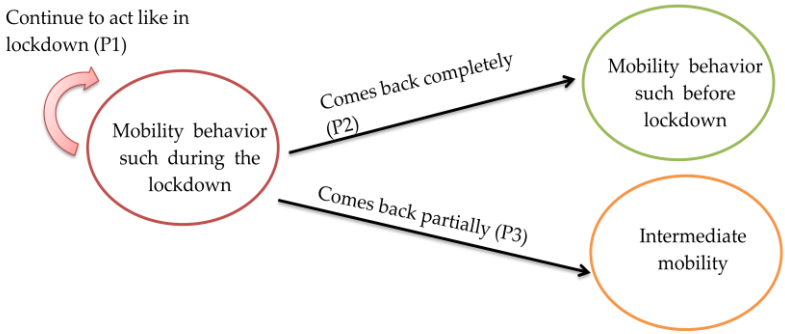
5.2- Simulation inputs

To simulate the Algerians mobility after the lockdown the obtained data of our survey are used. In this direction, three probabilities are defined:

- Probability (P1) that a person continues to act like during the lockdown,
- Probability (P2) that a person comes back completely to his usual mobility,
- Probability (P3) that a person comes back partially to his usual mobility.

One can summarize these possibilities in the following scheme:

Figure n°16. Recapitulative scheme on post-lockdown mobility assessment



5.3- Simulation results

The simulation was executed following several configurations. In the first one (initial configuration), the number of precautions taken is kept as the one obtained during the lockdown. The other configurations are given in Table 3.

Table n°3. Configuration data

		Number of precautions				
		0	1	2	3	4
Number of persons within each configuration	Initial configuration	22	43	56	256	441
	Configuration 1	22	**87**	56	256	**397**
	Configuration 2	**50**	43	**28**	**476**	**221**

	Configuration 3	22	43	56	**300**	**397**
	Configuration 4	22	**68**	56	**231**	441
	Configuration 5	278	**43**	497	**0**	0

The obtained results for each configuration are given in the Table N°4.

Table n°4. The obtained results

	Low risk	Meduim risk	High risk	Very high risk
Initial configuration	65.73%	23.39%	9.85%	1.00%
Configuration 1	60.49%	21.69%	15.15%	2.66%
Configuration 2	34.96%	46.78%	16.70%	1.54%
Configuration 3	61.68%	28.05%	9.51%	0.74%
Configuration 4	65.86%	20.40%	11.98%	1.75%
Configuration 5	0.00%	37.52%	**47.37%**	**15.10%**

Source: Survey study on post lockdown mobility in Algeria, CREAD 2020

5.4- Discussion

From these results, one can observe that if the Algerians continue to be as careful as during the lockdown, the risk of contamination is low in 65.73% of cases. However, if 61% of people are careful and 26% are very careful, the risk of contamination is medium in 46.78% of cases (configuration 2). The worst situation would be the configuration 5, where 39.24% of people are not careful and 60.75% are careful. Indeed, in this situation, the risk is high in 47.37% of cases and very high in 15.10% of cases.

Due to the absence of correlation between COVID-19 dangerousness perception and Algerians mobility on the one hand, and the simulation results on the other hand, the Algerian authorities must focus on the sensitization about the security measures that people must respect upon stopping the lockdown. In fact, each person must respect at least two security measures to avoid a high risk of new contamination.

It is worth to highlight that this recommendation was cited by the respondents to the open question 'Do you want comment the Post Lockdown Mobility". Furthermore, other recommendations were suggested, among them, vigilance and caution are the most important (34%) followed by reducing mobility (23%). These security measures taken for the containment of contagion during the lockdown should

continue according to them. On the other hand, (15%) recommend increasing both the number of buses and the frequencies of public transport and limiting the number of seats. 10% think that we must continue to raise awareness.

CONCLUSION

The purpose of this paper is to analyse the impact of the COVID-19 pandemic on Algerians' mobility. We study the mobility behaviour before and during the lockdown and the perception of post-lockdown mobility. The collected data modelling and analysis allow us to assert that mainly, the Algerians whatever their level of education assess the covid-19 as a serious illness with some differences in the perception between men and women. Indeed, women have a higher perception of Covid-19 dangerousness compared to men. The most important parameter that influences their perception on covid-19 dangerousness is transmitting mode and also the fact to know an individual infected by SARS CoV-2 whatever the relation with this person is.

Concerning Algerian mobility one can notice that despite the fact that their mobility behaviour has changed, the covid-19 dangerousness has not influenced these changes; it seems like the Algerians do not really understand the relationship between the virus spreading and the mobility. That's why more sensitization is needed before any lockdown break.

Also, it is important to focus on the precautions that should be taken after the lockdown especially with the results of simulation which show that even with 61% of careful people the situation could turn worst.

These results showed the principal relationship between the Algerians' perception of COVID-19 and their mobility, as well as the security measures needed upon lifting lockdown to avoid a high risk of new spreading. In further works, it would be interesting to integrate other indicators such that the economic impact in the study.

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Annexe

Table n°5. The determinants of the dangerousness of COVID-19

	Model 1	Model 2	Model 3	Model 4
Sex (ref: women)	-0.666***	-0.667***	-0.427***	-0.424***
Men	(0.114)	(0.115)	(0.120)	(0.127)
	0.0565*	0.0635	0.0473	0.0396
Age	(0.0322)	(0.0417)	(0.0422)	(0.0434)
	-0.000424	-0.000447	-0.000334	-0.000233
Age squared	(0.000412)	(0.000517)	(0.000524)	(0.000536)
Educational Attainment (ref: less than university)				
	0.266	0.242	0.262	0.185
University	(0.182)	(0.185)	(0.186)	(0.195)
Situation in the profession (ref: occupied)				
		0.476*	0.373	-
Unemployed	-	(0.285)	(0.283)	
		0.112	-0.0390	-
Student	-	(0.190)	(0.194)	
		-0.223	-0.193	-
Inactive	-	(0.304)	(0.302)	
Individual situation (ref: Inactive)				
				-1.077
Agriculture	-	-	-	(0.858)
				0.301
Industry-craft	-	-	-	(0.372)
				0.151
Construction	-	-	-	(0.379)
				-0.365
Transport	-	-	-	(0.449)
				0.525
Communication	-	-	-	(0.398)
				-0.805
Hotels-cafes-restaurants	-	-	-	(0.976)
				0.00448
Trade	-	-	-	(0.376)
Education - Professional				0.0799
training	-	-	-	(0.326)
				0.203
Health	-	-	-	(0.340)
				0.676*
Public administration	-	-	-	(0.407)

Financial Institutions - Insurance	-	-	-	0.520 (0.401)
Real Estate Affairs	-	-	-	-0.137 (1.066)
Services	-	-	-	1.313*** (0.439)
Energy	-	-	-	0.524 (0.526)
Unemployed	-	-	-	0.604 (0.404)
Student	-	-	-	0.187 (0.338)
Do you know people infected with COVID-19 (ref No)				
Yes	-	-	0.222* (0.114)	0.248** (0.116)
Population is sufficiently informed of the precautions to take (ref : No)				
Yes, totally	-	-	-0.428** (0.174)	-0.409** (0.178)
Yes, partially	-	-	-0.300** (0.149)	-0.267* (0.151)
Do you think that the population will respect the measures imposed by the authorities (ref: No)				
Yes	-	-	0.00509 (0.174)	0.00751 (0.177)
I do not know	-	-	-0.191 (0.148)	-0.170 (0.149)
Com back to your usual activities after lockdown is lifted (ref: No)				
Yes, totally	-	-	-0.746*** (0.197)	-0.740*** (0.199)
Yes, partially	-	-	-0.385** (0.153)	-0.378** (0.155)
Do you think lockdown should be lifted from June 13, 2020 (ref:Yes) No	-	-	1.013*** (0.125)	0.996*** (0.126)

	-3.145***	-2.942***	-2.613***	-2.658***
Constant cut1	(0.677)	(0.883)	(0.926)	(0.913)
	-2.934***	-2.730***	-2.466***	-2.498***
Constant cut2	(0.666)	(0.874)	(0.921)	(0.906)
	-2.322***	-2.118**	-1.857**	-1.851**
Constant cut3	(0.645)	(0.858)	(0.905)	(0.888)
	-1.468**	-1.264	-0.947	-0.948
Constant cut4	(0.631)	(0.847)	(0.893)	(0.876)
	-0.915	-0.711	-0.362	-0.351
Constant cut5	(0.627)	(0.844)	(0.889)	(0.872)
	0.106	0.311	0.722	0.764
Constant cut6	(0.624)	(0.842)	(0.888)	(0.871)
	0.577	0.783	1.238	1.284
Constant cut7	(0.625)	(0.843)	(0.888)	(0.872)
	1.322**	1.530*	2.055**	2.108**
Constant cut8	(0.626)	(0.844)	(0.890)	(0.873)
	2.365***	2.575***	3.194***	3.270***
Constant cut9	(0.628)	(0.846)	(0.893)	(0.876)
	2.923***	3.134***	3.784***	3.861***
Constant cut10	(0.630)	(0.848)	(0.895)	(0.878)
Observations	**1,016**	**1,016**	**1,006**	**992**

*Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1*