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Impact of the health crisis, COVID 19, on compliance with safety rules by type of user:

5 comparative analysis of car drivers and motorcyclists.

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Abstract

This paper looks at the impact of the health crisis, COVID 19, on compliance with road rules among three categories of road user: car drivers, motorcyclists with a cylinder capacity of no more or more than 125 cm³.

15 A questionnaire was designed and distributed to 4,382 car users, motorcyclists with a cylinder capacity of more or no more than 125 cm³., representative of the French population.

The results show an effect of both the type of vehicle and the health crisis on the frequency and number of safety rules respected.

The implications of the findings are discussed.

20

Highlights

- This work confirms the interest of differentiating the road user population by showing the differences between car drivers and motorcyclists.

25 ●—The results show an effect of both the type of vehicle and the health crisis on the frequency and number of safety rules respected.

1. Introduction

30 1.1. Context

In the context of the Covid-19 global pandemic, the French government has implemented a strong health measure: the travel ban, popularised under the name "population lock down", corresponding to stage 3 of the fight against the epidemic. Accompanied by the closure of shops and non-essential public spaces, this ban restricted the mobility to the necessary (food shopping, care, work when
35 teleworking is not possible) and conditioned it with a specific authorization. This strict lock down has been put in place from Tuesday 18 March to Sunday 10 May 2020, with the closure of educational facilities starting on Monday 17 March. From 29 October to 14 December 2020, France experienced a second lockdown, less strict than the first one as schools remained open. Teleworking was compulsory for those professions whose missions allowed it. Travelling was only allowed for
40 shopping, picking up children from school and one hour of out-of-home time per day was allowed.

This ban on travelling had a major impact on the mobility of the French, both in terms of uses of personal vehicles and public transportation. However, some professions have been forced to continue travelling. Compliance with road rules seems to have slackened: the accident rate has not fallen as much as traffic. In France, compared to 2019, during the first lock-down, the number of
45 injury accidents fell by 20% while traffic fell by 75% (ONISR, 2021). Thus, the reduction in traffic congestion, combined with a reduction in the number of roadside checks, has created a climate favorable to speeding (Watson, Atkins, Berning, Robbins, Watson and Anderle, 2020).

The question then arose as to how to manage the exit from lock-down in terms of behaviour on the road. What will be the impact of this particular period on the perception of the rules and their
50 respect when the situation returns to "normal"? Will road users, relieved to be able to move around again, be calmed down or, on the contrary, will they feel more relaxed about the road risk, which seems to be more controllable than the risk of contamination?

Has the fact of having been obliged to work and travel during this period and therefore to be confronted on a daily basis with the risk of contamination, or, on the contrary, of being unemployed
55 and facing the consequences of this crisis, led to a downgrading of road safety in relation to other priorities that seem more urgent?

More generally, we're looking at how people construct their relationship with social and legal rules, how they relate to each other throughout their lives, and the possible interactions between these different rules.

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1.2. Impact of the crisis on the accident rate

The results diverge on the impact of the first containment on the accident rate. Some results show an overall reduction in the number of accidents but an increase in serious accidents, while others show a decrease in this type of accident (Katrakazas, Michelaraki, Sekadakis and Yannis, 2020; Saladie,
65 Bustamante, and Gutierrez, 2020; Shilling and Waetjen, 2020). However, in France, the available evidence shows a reduction in the number of accidents but an increase in serious accidents during the first lock down (ONISR, 2021). Serious accidents are likely to increase by 25% due to an increase in risky behaviour such as overspeeding or drinking and driving (Hughes, Kaffine and Kaffine, 2022). Indeed, during the first lockdown, speeding increased from 10 to 15 miles per hour
70 in California during rush hour (Hughes et al., 2022). Law enforcement officials noted a 200% to 700% increase in speed limit violations over 50 km/h in the United States in March 2020 (Heidenreich, 2020; Chan, 2020). Drinking and driving appears to have increased as well. The number of serious or fatal crashes due to alcohol or drug use increased by more than a quarter in the US during the first lockdown. Vanlaar, Woods-Fry, Barrett, Lyon, Brown, Wicklund and Robertson
75 (2021) asked car drivers about their behaviour before the first lockdown and at the time of the study in September 2020. The vast majority of respondents stated that their behaviour had not changed. However, a minority reported riskier behaviour such as speeding, which was the most common,

followed by drink driving and distraction. The authors go beyond the simple observation and try to explain this by studying the impact of different factors on the reported increase in these risk behaviours. Thus, age and the fact of having been fined more than twice are predictive factors of an increase in the frequency of risk behaviours such as driving at excessive speed, while consuming alcohol or drugs. In contrast, gender and the number of miles driven in a month had no impact.

1.3. Different categories of motorcycle drivers

Vanlaar et al (2021) focus only on car drivers, whereas motorcyclists are a particularly vulnerable population, over-represented in road crashes, more thrill-seeking and therefore more likely to engage in risky behaviour. Even within this population, there are differences according to the type of users (Eyssartier, Meineri and Guéguen, 2017). Although speed is the main accident factor for all types of motorised users, the speed factor is over-represented for drivers with a cylinder capacity of more than 125 cm³ compared to other types of users (moped riders and owners of a vehicle with engine capacity between 50 and 125cm³) (Van Eslande, Fournier and Jaffard, 2011). According to the MAIDS report (2009), among 921 investigated crashes, 32% of motorcyclists with powerful vehicles were travelling at least 10 km/h above the speed limit at the time of the crash.

When considering riding speed according to the type of vehicle, the owners of a sport bike ride, which are vehicles with a cylinder capacity of more than 125cm³, drive more often over the speed limit than the commuters who most often ride a scooter with a capacity of 125cm³ and a 3-year driving licence (Banet & Bellet, 2009; Bellet, et al., 2011). While speeding is one of the three motivations to ride a sport bike (together with the pleasure of riding and acceleration sensations), this element is not found for commuters as a motivational element to ride a scooter (Bellet, Banet, Joshi, Turetschek, Risser, Spyropoulou, Rößger, Hagen, Carvalhais, Noriega, Leden, Rosander, Johanson, Underwood, Roebroek, Delahaye and Lenné, 2011; Bellet & Banet, 2014).

These results confirm the need to differentiate motorcycle drivers at least according to their engine power.

105 1.4. *Explanatory factors of risk behaviours*

Sensation-seeking is one of the explanatory factors of risk behaviours that is most frequently found in the literature. Zuckerman (1979) defines sensation seeking as the wish to take physical, social, legal, and financial risks to search for different, complex, and intense sensations and experiences. Sensation seeking and risk taking are correlated and motorcyclists seek more risky situations than
110 other types of road users (Tunnicliff, Watson, White, Hyde, Schonfeld and Wishart, 2012; Eyssartier et al, 2017) .

Comparative optimism is also an explanatory factor for risky behaviour. In the field of road safety, it refers to the belief in a lower probability of occurrence of negative events, such as accidents, for oneself compared to the average driver (Delhomme, 2000). The cognitive explanation is to be found
115 in the superior self-conformity bias (Codol, 1975), so that users consider themselves to be "better drivers" than other users (Cestac et Al., , 2018) either in terms of driving skills (Delhomme, 1991; Delhomme & Meyer, 1995; Svenson, 1981) or in terms of compliance with road safety rules (Delhomme, 1991).

Traffic law enforcement is specifically aimed at enforcing compliance with traffic regulations and
120 norms. It is therefore an external pressure that aims to make users respect the traffic rules. The attitude of users towards this tool will have an impact on its effectiveness, but also on the subjective risk of detection. The subjective risk of detection is the more or less conscious and explicit judgement of drivers about the possibility of being stopped for violations. It results from the user's perception of the intensity of enforcement activities. (Cestac et al., 2018). Although it remains
125 subjective, the actual frequency of enforcement will affect subjective perception.

Tyler (1990) posits the existence of two types of motivations for compliance with the rules. The first type, instrumental motivations, is related to the gains and losses involved in complying with or

breaking the rule. Compliance with the rule is then linked to forces and motivations external to the individual. It is an external regulation of behaviour (Grolnick et al., 1997). Thus, complying with the rule for fear of being punished is clearly an instrumental motivation. The second type, normative motivations, is the result of an internalisation of the rule and a feeling of obligation to conform, in accordance with personal values. The internalisation of the rule, i.e. its inclusion in the individual's personal values, leads to fewer transgressions than instrumental motivations (Tyler, 1990).

1.5. Objective

Initial research on the impact of the health crisis on some risky behaviour shows an increase of such behaviors during the first lockdown (ONISR, 2021 ; Katrakazas, Michelaraki, Sekadakis and Yannis, 2020; Saladie, Bustamante, and Gutierrez, 2020; Shilling and Waetjen, 2020). Our objective is to study the variations of some factors that explain compliance or not with the highway code, according to the time and the type of vehicles. Compliance was measured at three distinct moments: before (1) and after (2) the first lockdown and during the second lockdown (3) in France. In our analysis, we will distinguish between motorcyclists with very powerful vehicle (with a cylinder capacity of more than 125 cm³) (motorcyclists +), car users and motorcyclists with less powerful vehicles (with a cylinder capacity of less than 125cc) (motorcyclists -). The literature is quite unanimous on the issue and shows differences in road behaviour between these three types of users (Van Eslande, Fournier and Jaffard, 2011, MAIDS report, 2009; Banet & Bellet, 2009; Bellet, et al., 2011; Eyssartier, Meineri and Guéguen, 2017).

We assume:

- that the motorcyclists + will less respect the road safety rules than the car drivers and motorcyclists - .
- that we will observe a timing effect, the compliance of road safety rules should be higher before the first lock down than after the first lock down and during the second lock down.

-that some factors will have more impact on compliance with the rules than others according to the type of users. The motorcyclists + will have less internalized road safety rules and should have a more salient relationship to risk than car users.

2. Method

2.1. Sample

The survey was carried out, on line by a French polling institute (IPSOS), between 20 November and 10 December 2020, i.e. during the period of the second lock down. The sample is drawn from the IPSOS Access Panel. The researcher had no access to their personal data and received anonymised data. For participating in the survey, people received remunerations. It is composed of 4,382 users, 3966 exclusive car drivers, 280 exclusive or bi-modal motorcyclists + and 136 exclusive or bi-modal motorcyclists -, representative of the French population aged 18 to 70, using a quota method based on sex, age, socio-professional category and category of agglomeration (see table 1).

Table 1 : Sample

| | N | Age | Male | socio-professional category : workers | agglomeration of more than 100 000 inhabitants |
|-----------------|------|-------|-----------------|---------------------------------------|--|
| Car users | 3966 | 45,25 | 46,6 % (N=1849) | 15,8 % (N=625) | 29,4 % (N=1165) |
| Motorcyclists + | 280 | 45,12 | 70 % (N=210) | 18,4 % (N=51) | 30 % (N=83) |
| Motorcyclists - | 136 | 44,37 | 70 ,6% (N=89) | 27 % (N=34) | 39,5 % (N=49) |

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2.2. Variables

In the first part of the questionnaire, several socio-demographic variables are collected: gender (male/female), and age (in years) .

•—**Social comparison:** we used items from a study on drivers' relationship with the rules, assessed in 2016 (Cestac et al., 2018).

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- Attitudes towards roadside checks** was measured in terms of level of concern, annoyance, perception of their frequency and finally, the degree of agreement with the slogan "Speed cameras = Money pumps".
- General attitude towards legal rules** was measured as the perceived legitimacy of the legal system (Tyler & Jackson, 2014), in 4 items previously used in an international comparison (Granié et al., 2020).
- General relationship to risk.** An indication of the general relationship to risk is given by the participants' answers to two items from the French version of the temporality scale (Apostolidis & Fieulaine, 2004), targeting the fatalistic present and the hedonistic present .
- Perception of the good driver** was measured using two items from Cestac et al. (2018) report. The first item focused on driving performance and the second on compliance with the rules.
- Internalization** was studied using an item that asked respondents whether they would obey the rules of the road if they were no longer mandatory and enforced.
- Compliance with road rules** was measured using two items on a 10-point scale, relating to the number of rules complied with and the frequency of compliance. From these two items, an overall score was calculated, which is the average of the two items mentioned above, at three points in time: before and after the first lock-down and during the second lock-down . These questions were asked during the second lockdown , so respondents were asked to recall their past behaviours (before and after the first lock down) and to report their present behaviour (during the second lock-down).

Table 2: Factors studied and associated items

| | |
|---|---|
| Social comparison | The questions investigated the comparative judgement of driving skills (from 1 "a worst driver than the others "to 6 "a better driver than others") and accident risk compared to other drivers (from 1 "lower than others" to 6 "highest than others"). |
| Attitudes towards roadside check | The questions investigated the level of concern (from 1 "not concerned at all" to 5 "totally concerned") , annoyance (from 1 "not at all annoyed" to 5 (totally annoyed")), perception of their |

frequency (1“not enough frequent” to 5 “Too frequent”) and finally, the degree of agreement with the slogan "Speed cameras = Money pumps" (from 1 “strongly disagree” to 5 “totally agree”).

General attitude towards legal rules It was measured by the 4 items below (from 1= Strongly disagree to 5= Strongly agree).

- People should do what the law says
- All laws should be strictly observed
- Obeying the law ultimately benefits all members of the community
- There are times when it is acceptable to ignore the law

General relationship to risk. An indication of the general relationship to risk is given by the participants' answers to two items targeting the fatalistic present ("Since what has to happen will happen, it really doesn't matter what I do") and the hedonistic present ("Taking risks prevents my life from becoming boring"), in a Likert format of 1= Totally disagree to 5= Totally agree.

Perception of the good driver The first item focused on driving performance ("A good driver is above all someone who has perfect control of his or her vehicle") and the second on compliance with the rules ("A good driver is above all someone who scrupulously respects the rules of the road"). For each item, respondents were asked to position themselves on a 6-point scale (from 1 strongly disagree to 6 strongly agree).

Internalization Respondents were asked whether they would obey the rules of the road if they were no longer mandatory and enforced. They were asked to choose between two response options: "I would still obey the rules of the road even if they were no longer compulsory" vs. "I would no longer obey the rules of the road since they would no longer be compulsory".

Compliance with road rules **Compliance with road rules** was measured using two items on a 10-point scale, relating to the number of rules complied with, (ranging from 0 "I don't respect any road safety rules" to 10 "I respect all rules of the road") and the frequency of compliance (0 "I never respect the traffic rules" to 10 "I always respect the traffic rules") at three points in time: before and after (In mars 2020 vs in september 2020, how did you respect the traffic rules?) and during the second lock-down (Now, how do you respect the traffic rules).

3 Results

200 We first present descriptive analysis, the differences on compliance with the highway code according to the type of vehicle and the time (before and after the first lock down and during the second one), second, we compare the studied factors (report to the law, considering to be a good drivers, the attitude towards traffic safety cameras, social comparison, general relationship to risk and internalization) according to the type of users and finally, we present the predictive factors of

205 compliance (report to the law, considering to be a good drivers, the attitude towards traffic safety
cameras, social comparison, general relationship to risk and internalization) with the highway safety
rules for each of the populations studied (car users, motorcyclists + and motorcyclists -).

3.1. Descriptive analysis

210 Correlation analyses show a strong link between the four items concerning the law (r between 0.342
and 0.731), and between the four items concerning speed cameras (r between 0.153 and 0.624).
There was also a strong link between the number of rules complied with and the frequency of
compliance before the first lock-down ($r=0.836$), after the first lock-down ($r=0.813$) and during the
second lock-down ($r=0.732$).

Table 3: Reporting Means, Standard Deviations, and Zero-order Correlation Matrix.

| | Means | Standard deviation | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | | | | | | | | | | | | |
|--|----------------------------|--------------------|---|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| 1. Sex | N men=2 147 (49%) | | 1 | -,0 05 | ,00 5 | -,0 02 | -,0 07 | -,0 21 | ,05 0** | ,06 0** | ,05 9** | ,05 8** | -,0 15 | -,0 32* | ,00 2 | -,0 50* | ,04 5** | -,0 83* | -,0 33* | ,05 8** | ,06 8** | ,06 6** | ,06 3** | ,07 5** | ,05 4** |
| 2 Age | 45,18 | 14,23 | | 1 | ,14 1** | ,18 3** | ,14 3** | -,1 * | ,02 3 | ,21 0** | ,16 9** | -,2 * | -,1 * | -,0 21 | ,03 3* | ,00 6 | -,0 * | -,1 * | -,1 * | ,21 0** | ,18 0** | ,21 2** | ,17 4** | ,18 8** | ,14 9** |
| 3. Conformity with the law | 3,84 | 0,97 | | | 1 | ,73 1** | ,68 2** | -,3 83* | ,14 4** | ,37 0** | ,19 9** | -,1 24* | -,2 54* | -,2 16* | -,2 38* | ,05 3** | -,0 69* | -,1 76* | -,1 33* | ,30 7** | ,27 6** | ,29 5** | ,26 4** | ,27 2** | ,23 4** |
| 4. Respect for all laws | 3,65 | 1,05 | | | | 1 | ,63 7** | -,4 03* | ,13 1** | ,36 4** | ,17 2** | -,1 20* | -,2 42* | -,2 18* | -,2 39* | ,07 3** | -,0 43* | -,1 37* | -,0 99* | ,28 2** | ,26 1** | ,27 3** | ,24 1** | ,25 6** | ,22 7** |
| 5. Welfare of others | 3,77 | 1,04 | | | | | 1 | -,3 42* | ,12 6** | ,34 4** | ,18 6** | -,0 97* | -,2 27* | -,1 94* | -,2 40* | ,05 9** | -,0 65* | -,1 22* | -,1 33* | ,28 8** | ,25 9** | ,27 5** | ,25 2** | ,24 5** | ,21 7** |
| 6. Conditionality of the law | 2,86 | 1,22 | | | | | | 1 | -,0 91* | -,2 20* | -,0 56* | ,16 3** | ,23 2** | ,22 9** | ,27 6** | ,02 8 | ,07 6** | ,25 1** | ,22 0** | -,1 74* | -,1 57* | -,1 64* | -,1 51* | -,1 70* | -,1 36* |
| 7. Internalization ¹ | 92,1% (N=4023) | | | | | | | | 1 | ,35 0** | ,04 2** | -,0 48* | -,1 27* | -,1 73* | -,1 69* | ,01 2 | ,02 7 | -,0 49* | -,0 67* | ,21 4** | ,19 9** | ,21 5** | ,19 0** | ,22 3** | ,17 9** |
| 8. Compliance with traffic regulations | 4,73 | 1,24 | | | | | | | | 1 | ,35 5** | -,1 73* | -,2 78* | -,2 71* | -,2 07* | ,11 7** | -,0 61* | -,1 62* | -,1 49* | ,48 3** | ,45 7** | ,49 2** | ,45 9** | ,49 0** | ,41 0** |

| | Means | Standard deviation | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
|---|-------|--------------------|---|---|---|---|---|---|---|---|---|-------------------------|-------------------------|--------------------|--------------------|--------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| 9. Controls its vehicle | 5,11 | 1,75 | | | | | | | | | 1 | -,154 ⁺ * | -,168 ⁺ * | -,004 | ,055 ^{**} | ,220 ^{**} | -,126 ⁺ * | -,090 ⁺ * | -,065 ⁺ * | ,369 ^{**} | ,345 ^{**} | ,365 ^{**} | ,332 ^{**} | ,350 ^{**} | ,293 ^{**} |
| 10. Concern about traffic safety cameras | 2,35 | 1,2 | | | | | | | | | | 1 | ,624 ^{**} | ,250 ^{**} | ,153 ^{**} | -,024 | ,226 ^{**} | ,155 ^{**} | ,110 ^{**} | -,202 ⁺ * | -,188 ⁺ * | -,205 ⁺ * | -,190 ⁺ * | -,198 ⁺ * | -,153 ⁺ * |
| 11 Irritability due to traffic safety cameras | 2,16 | 1,18 | | | | | | | | | | | 1 | ,377 ^{**} | ,302 ^{**} | ,001 | ,194 ^{**} | ,218 ^{**} | ,186 ^{**} | -,283 ⁺ * | -,261 ⁺ * | -,274 ⁺ * | -,246 ⁺ * | -,257 ⁺ * | -,218 ⁺ * |
| 12 Traffic safety cameras frequency | 3,03 | 1,14 | | | | | | | | | | | | 1 | ,526 ^{**} | ,032 ⁺ | ,137 ^{**} | ,138 ^{**} | ,122 ^{**} | -,173 ⁺ * | -,160 ⁺ * | -,167 ⁺ * | -,157 ⁺ * | -,174 ⁺ * | -,145 ⁺ * |
| 13 Traffic safety cameras money pump? | 3,52 | 1,34 | | | | | | | | | | | | | 1 | ,086 ^{**} | ,059 ^{**} | ,113 ^{**} | ,170 ^{**} | -,106 ⁺ * | -,107 ⁺ * | -,099 ⁺ * | -,101 ⁺ * | -,104 ⁺ * | -,093 ⁺ * |
| 14 Social comparison good driver | 3,55 | 0,74 | | | | | | | | | | | | | | 1 | -,184 ⁺ * | ,030 | -,015 | ,187 ^{**} | ,189 ^{**} | ,194 ^{**} | ,200 ^{**} | ,206 ^{**} | ,178 ^{**} |
| 15. Probability of having an accident | 2,69 | 0,77 | | | | | | | | | | | | | | | 1 | ,106 ^{**} | ,122 ^{**} | -,127 ⁺ * | -,115 ⁺ * | -,134 ⁺ * | -,126 ⁺ * | -,115 ⁺ * | -,106 ⁺ * |
| 16. Hedonism | 2,52 | 1,14 | | | | | | | | | | | | | | | | 1 | ,432 ^{**} | -,178 ⁺ * | -,168 ⁺ * | -,174 ⁺ * | -,155 ⁺ * | -,161 ⁺ * | -,128 ⁺ * |

3.2. Compliance with rules according to the type of user and time (before and after first containment, during second containment)

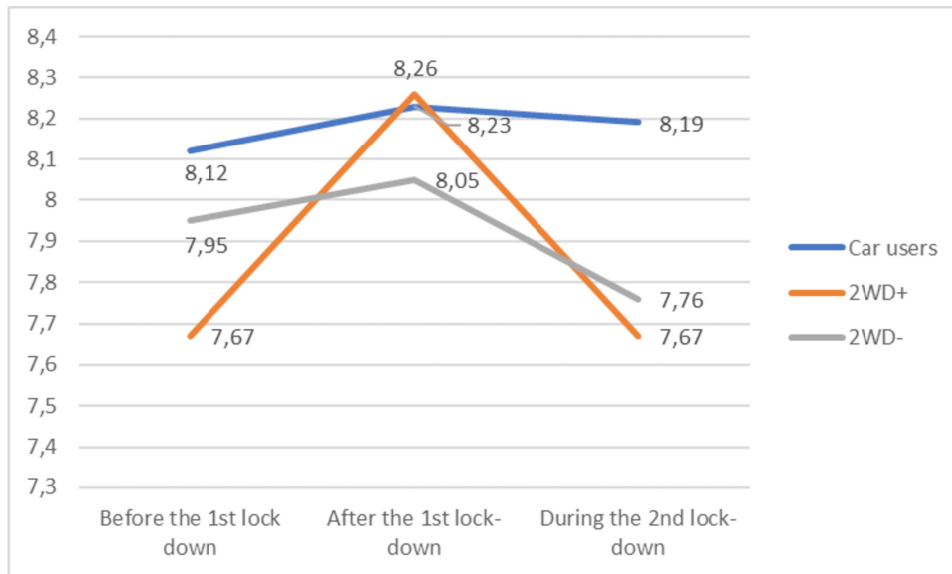
Younger men are over-represented in motorised two-wheeler accidents, with a lower level of compliance with the rules than older men and also than women, who are much less likely than men
225 to drive a motorised two-wheeler. To ensure that these variables do not bias the results, we performed a repeated measure ANCOVA, with gender and age as co-variables (see table 2). The aim of the ANCOVA, carried out using SPSS software, is to test the relationship between the independent variable and the dependent variable (here compliance with the rule) by statistically removing the indirect effect of the covariates (gender and age). The co-variables in the model are
230 evaluated using the following values: SEX-Sex=1.53. AGE-Age=45.59.

The results show an effect of time (before and after the first lockdown, and during the second one) ($F(2; 4211)=90,884; p<0,001$) and of the type of vehicle on the compliance with road safety rule ($F(2; 4211)=5,45; p<0,004$). Thus, the post-hoc tests show that car users differ from motorcyclists + (Diff avg=0.262; $p<0.008$) but not from motorcyclists - (Diff avg=0.182 ns) .

235 Regarding the main effect of the timing of the measure, the results show no difference between compliance before the first lockdown and during the second lockdown ($F; 1; 4212)=2.106$ ns). In contrast, compliance with road safety measures is higher after the first lockdown than before ($F1; 4212)=95.722$ $p<0.0001$) and during the second lockdown ($F1; 4212)=109.47$. $p<0.0001$)

On the other hand, there was an interaction between the time and the type of vehicle ($F=3,23; p=0.024$). Car users comply more with the road safety measures than motorcyclists + before the first
240 lock down and during the second lock down. On the other hand, after the first lock down, there was an increase in compliance with the road safety measures for all three categories of users, with a greater effect for motorcyclists + (see figure 1).

Figure 1 : Rules complied with (average) according to time and type of user



3.3. Comparison of the factors studied according to the type of user

Insofar as we observed an effect of the type of vehicle on the reported compliance with the rules in the previous model, we sought to determine, by means of an ANOVA carried out using SPSS software, whether the factors likely to explain compliance with the rules vary according to the type of road user (motorcyclists -, motorcyclists + and car drivers). The results (see table 3) show a difference between car users and motorcyclists + on the items concerning the frequency of traffic safety cameras on the road and the fact of considering speed cameras as a "money pump". Motorcyclists + find speed cameras too frequent ($F(2;4379) = 10,60; p < 0,001$) and that they are a money-spinner ($F(2;4379) = 5,36; p < 0,01$) compared to car users.

In addition, they are more fatalistic ($F(2;4379)=4,25$; $p<0,05$) and consider themselves better drivers than the majority of drivers ($F(2;4379)=7,03$; $p<0,01$) compared to car users. Less motorcyclists than car users report that they continue to respect the road safety rules even if they were no longer compulsory compared to car users ($\chi^2=6,873$; $p<0,05$; $Eta=0,21$). Car users differed from both motorcyclists + and motorcyclists - on the definition of a good driver, which would refer to a user who respects the rules of the road; their score on this item was higher than that of the one of motorcyclists + and motorcyclists - ($F(2;4379)=14,28$; $p<0,001$). On the other hand, the hedonism score, taking risks to prevent my life from becoming boring, is higher for motorcyclists + and motorcyclists - than for car users ($F(2;4379)=5,36$; $p<0,01$).

Table 4: Comparison between the type of road users on the studied factors

| | Car drivers N=3966 | Motorcyclists + N=277 | Motorcyclists - N=124 | F |
|--|-----------------------|--------------------------|--------------------------|--------------------------------|
| Relationships to the laws | | | | |
| Conformity with the law | 3,85 (0,96) | 3,73 (1,01) | 3,74 (1,03) | 2,43 |
| Respect for all laws | 3,65 (1,04) | 3,55 (1,11) | 3,57 (1,07) | 1,54 |
| Obedying the law for the welfare of others | 3,77 (1,04) | 3,74 (1,07) | 3,72(0,96) | 0,23 |
| Conditionality of the law | 2,85 (1,21) | 3,00 (1,26) | 3,00(1,27) | 2,76 |
| Internalization ² | 92,4% (N=3663) | 88,1% (N=244) | 93,5% (N=116) | $\chi^2=6,873^*$; Eta=0,21 |
| Good drivers | | | | |
| Compliance with traffic regulations | 4,77 (1,22) | 4,39(1,42) | 4,49(1,41) | 14,28*** |
| Controls its vehicle | 5,11 (1,06) | 5,01(1,14) | 5,02(1,18) | 1,75 |
| Traffic safety cameras | | | | |
| Concern about traffic safety cameras | 2,36(1,20) | 2,31(1,28) | 2,33(1,30) | 0,22 |
| Irritability due to traffic safety cameras | 2,15(1,17) | 2,20(1,28) | 2,25(1,27) | 0,68 |
| Traffic safety cameras frequency | 3,01 (1,12) | 3,33 (1,22) | 3,11(1,26) | 10,60*** |
| Traffic safety cameras money pump? | 3,50(1,34) | 3,75(1,34) | 3,69(1,45) | 5,36** |
| Social comparison | | | | |
| Social comparison good driver | 3,54(0,74) | 3,71(0,79) | 3,59(0,84) | 7,03** |
| Probability of having an accident | 2,68(0,77) | 2,78 (0,84) | 2,70 (0,90) | 2,21 |

² This is a dichotomous variable, hence the percentage and not an average.

| General relationship to risk | | | | |
|------------------------------|-------------|-------------|-------------|----------|
| Hedonism | | | | 14,42*** |
| | 2,50 (1,13) | 2,87 (1,13) | 2,56 (1,13) | |
| Fatalism | | | | 4,25* |
| | 2,67 (1,17) | 2,88 (1,24) | 2,66 (1,19) | |

* p<0,05

** p<0,01

***p<0,001

3.4. Compliance with the rules

The third model aims to help us explain the results of the first model by summing up the differences in terms of compliance with the measures during the three periods, but also according to the type of user. To do this, we present above, for each of the populations studied, the factors that explain compliance with safety rules before and after the first lock-down and during the second lock-down.

The aim of the regression carried out using SPSS software, is to specify, for each category of user, the factors that explain compliance with the measure before and after the first confinement but also during the second confinement. We have performed a stepwise regression so that factors that make no contribution to the model are discarded.

3.4.1. Car drivers

The model explains 30,5% of the variance before the first lock down (R^2 adj=0.305 F(10; 3955)=175,18 p<0.0001), 34,2% of the variance after the first lock down (R^2 adj=0,342; F(10;3955)=429,58 p<0.0001) and 34,3% of the variance after the second lock down (R^2 adj=0.343 F(10;3955)=208,354; p<0.0001).

Being older, being a woman, considering that a « good driver » is the one who respects the rules of the road and also considering that a “good driver” is the one who controls his vehicle have a positive effect on the reported compliance with the road safety measures at the three times studied (Table 4). There is also a positive link between considering oneself a better driver than the average French driver and compliance with road rules during the three periods studied. Similarly, respondents are more likely to comply with road safety rules, if they have internalized them , in other words if they would tend to comply them if they were no longer mandatory and controlled,

for the three period of times (Before and after the first lock-down and during the second
310 one).During the same periods, respondents are more likely to obey the rules if they believe that
people should do what the law says and if, in their opinion, obeying the law helps preserve the
other.

On the other hand, being irritated by the presence of speed cameras and declaring taking risks in order
not to be bored are negatively related to compliance with road safety rules on the three times studied.
315 However, the effect of some variables varied according to the moment, before or after the first lock-
down and during the second lock-down. Thus, after the first lockdown, the likelihood of having an
accident compared to other drivers is linked to compliance with the rules .

320 Table 5 : : Hierarchical multiple regression on compliance with traffic rules before and after the 1st lock down and during the 2nd lock down for car users .

| | Before the first lock down | | After the 1st lock down September 2020 | | During the 2nd lock down | |
|--|----------------------------|-------|--|-------|----------------------------|-------|
| | R ² adj=0,30*** | | R ² adj=0,34* ** | | R ² adj=0,34*** | |
| | β | VIF | β | VIF | β | VIF |
| Socio-demographic variables | | | | | | |
| Sex | ,040** | 1,02 | ,033* | 1,02 | ,032* | 1,02 |
| Age | ,056** | 1,09 | 0,068*** | 1,09 | 0,069*** | 1,09 |
| Relationship to the laws | | | | | | |
| Conformity with the traffic rules | 0,039* | 1,99 | 0,052** | 2 | 0,060** | 1,99 |
| Respect for all laws | -0.016 | 2,37 | -0.004 | 2.37 | 0.011 | 2.365 |
| Obeying the law for the welfare of others | 0,038* | 1,93 | 0,052** | 1,93 | ,058** | 1,93 |
| Conditionality of the law | -0.006 | 1.28 | 0.008 | 1.28 | 0.006 | 1.279 |
| Internalization | 0,062*** | 1,15 | 0,060*** | 1,15 | 0,066*** | 1,15 |
| Good drivers | | | | | | |
| Compliance with traffic regulations | ,304*** | 1,53 | ,300*** | 1,531 | ,285*** | 1,53 |
| Controls its vehicle | ,159*** | 1,23 | ,171*** | 1,24 | ,186*** | 1,23 |
| Traffic safety cameras | | | | | | |
| Concern about traffic safety cameras | -0.017 | 1,72 | -0.028 | 1.745 | -0.014 | 1.721 |
| Irritability due to traffic safety cameras | - | 1,17 | -0,109*** | 1,2 | -,116*** | 1,17 |
| | 0,104*** | | | | | |
| Traffic safety cameras frequency | -0,02 | 1.246 | 0.003 | 1.259 | -0.009 | 1.246 |
| Traffic safety cameras money pump? | 0.001 | 1.218 | 0.021 | 1.220 | 0.009 | 1.218 |
| Social comparison | | | | | | |
| Social comparison good driver | 0,132*** | 1,07 | 0,135*** | 1,1 | ,121*** | 1,07 |
| Probability of having an accident | -0.015 | 1.097 | -0,03* | 1,1 | -0.019 | 1.097 |
| General relationship to risk | | | | | | |
| Hedonism | -0,042** | 1,11 | -0,054*** | 1,11 | -,059*** | 1,11 |
| Fatalism | 0.004 | 1.25 | 0.009 | 1.257 | -0.011 | 1.250 |

* p<0.05

** p<.01

***p<.001

3.4.2 *Motorcyclists with very powerful vehicle (with a cylinder capacity of more than 125 cm³) (motorcyclists +).*

330 For the rules followed before the first lock down the model explains 36% of the explained variance ($R^2_{adj}=0,36$ $F(5;271)=32,61$ $p<0.0001$), 32% of the explained variance after the first lock down ($R^2_{adj}=0,32$ $F(3;273)=44.14$; $p<0.0001$) and 25,8 % after the second lock down ($R^2_{adj}=0,26$; $F(17;262)=6,54$; $p<0.0001$).

For motorcyclists with a vehicle with a cylinder capacity of more than 125 cm³ (motorcyclists +),
335 finding it acceptable sometimes to ignore the law is negatively related whereas defining the good driver as the one respecting the rules of the road and control his vehicle is positively related to the compliance with traffic rules . (Table 5). The results presented below concern the three moments studied, before and after the 1st lock down, and during the 2nd.

With regard to the differences observed concerning the moment studied, respondents are more
340 likely to comply with road safety rules, if they think the probability of having an accident is lowest for them than for other drivers, and, as they would tend to comply with them if they were no longer compulsory and therefore only checked before the first lock-down.

345 Table 6 :: Hierarchical multiple regression on compliance with traffic rules before and after the 1st lock down and during the 2nd lock down for motorcyclists +

| | Before the 1st lock down | | After the 1st lock down : September 2020 | | During the 2nd lock down | |
|--|-----------------------------|-------|--|-------|-----------------------------|-------|
| | R ² adj=0,364*** | | R ² adj=0,32*** | | R ² adj=0,258*** | |
| | β | VIF | β | VIF | β | VIF |
| Socio-demographic variables | | | | | | |
| Sex | -0.041 | 1.015 | -0.029 | 1.009 | -0.058 | 1.009 |
| Age | 0.038 | 1.106 | 0.072 | 1.083 | 0.033 | 1.083 |
| Relationship to the laws | | | | | | |
| Conformity with the laws | 0.096 | 1.380 | 0.063 | 1.352 | 0.068 | 1.352 |
| Respect for all laws | -0.003 | 1.445 | 0.015 | 1.423 | 0.017 | 1.423 |
| Obedying the law for the welfare of others | -0.057 | 1.322 | -0.022 | 1.320 | -0.031 | 1.32 |
| Conditionality of the law | -,167** | 1,07 | -,161** | 1,06 | -,186** | 1,06 |
| Internalization | 0,146* | 1,12 | 0.106 | 1.200 | 0.102 | 1.200 |
| Good drivers | | | | | | |
| Compliance with traffic regulations | ,392*** | 1,32 | ,456*** | 1.038 | ,305*** | 1,12 |
| Controls its vehicle | 0,142** | 1,07 | ,161** | 1,12 | ,201*** | 1,05 |
| Traffic safety cameras | | | | | | |
| Concern about traffic safety cameras | -0.002 | 1.118 | -0.008 | 1,05 | -0.054 | 1.038 |
| Irritability due to traffic safety cameras | 0.033 | 1.195 | -0.009 | 1.087 | -0.092 | 1.087 |
| Traffic safety cameras frequency | -0.008 | 1.267 | -0.021 | 1.225 | -0.028 | 1.225 |
| Traffic safety cameras money pump? | 0.006 | 1.348 | -0.022 | 1.338 | -0.002 | 1.338 |
| Social comparison | | | | | | |
| Social comparison good driver | 0.094 | 1.104 | 0.026 | 1.094 | 0.053 | 1.094 |
| Probability of having an accident | - | 1,02 | -0.096 | 1.012 | -0.092 | 1.012 |
| | 0,173** | | | | | |
| | * | | | | | |
| General relationship to risk | | | | | | |
| Hedonism | 0.007 | 1.034 | 0.023 | 1.010 | -0.010 | 1.010 |
| Fatalism | 0.016 | 1.056 | 0.080 | 1.050 | 0.033 | 1.050 |

* p<0,05

** p<0,01

***p<0,001

355

3.4.3 *Motorcyclists with very powerful vehicle (with a cylinder capacity of no more than 125 cm³) (motorcyclists -).*

For the rules followed before the first lock down the model explains 27,4 % of the explained variance (R^2 adj=0,27 $F(3;120)=16,48$ $p<0.0001$), 34,5 % of the explained variance after the first
360 lock down (R^2 adj=0,34 $F(4;119)=17,19$; $p<0.0001$) and 32,7% after the second lock down (R^2 adj=0,38 ; $F(3;120)=4,386$; $p<0.0001$).

For motorcyclists driving a vehicle with a cylinder capacity of no more than 125 cm³, defining the good driver as compliant with highway code and feeling like a better driver than others is linked to compliance with traffic rules before and after the first containment but also during the second one
365 (Table 6).

There was a negative relationship between concern about passing speed cameras and the rules complied with after the first lock-down and during the second one. Women are more likely than men to comply with the rules of the road after the first confinement than before the first confinement and during the second one. In addition, the notion that a good driver is one who is in
370 control of his vehicle is only associated with compliance after the first confinement.

Table 7 : Hierarchical multiple regression on compliance with traffic rules before and after the 1st lock down and during the 2nd lock down for 2WD -

| | Before the 1st lock down | | September 2020 After the 1st lock down | | During the 2nd lock down | |
|--|----------------------------|-------|---|-------|-----------------------------|-------|
| | R ² adj=0,27*** | | R ² adj=0,34*** | | R ² adj=0,327*** | |
| | β | VIF | β | VIF | β | VIF |
| Socio-demographic variables | | | | | | |
| Sex | 0.089 | 1.017 | 0,153* | 1,03 | 0.095 | 1.025 |
| Age | -0.073 | 1.135 | -0.071 | 1.147 | -0.038 | 1.141 |
| Relationship to the laws | | | | | | |
| Conformity with the law | 0.027 | 1.086 | 0.002 | 1.147 | 0.017 | 1.082 |
| Respect for all laws | 0.002 | 1.028 | -0.065 | 1.138 | -0.037 | 1.028 |
| Obeying the law for the welfare of others | 0.083 | 1.068 | 0.052 | 1.054 | 0.098 | 1.068 |
| Conditionality of the law | 0.020 | 1.061 | 0.004 | 1.093 | 0.002 | 1.049 |
| Internalisation | 0.091 | 1.158 | 0.109 | 1.069 | 0.110 | 1.209 |
| Good drivers | | | | | | |
| Compliance with traffic regulations | 0,342** * | 1,27 | ,353*** | 1.228 | 0,370*** | 1,14 |
| Controls its vehicle | 0,186* | 1,31 | 0.136 | 1.315 | 0.131 | 1.315 |
| Traffic safety cameras | | | | | | |
| Concern about traffic safety cameras | -0.162 | 1.205 | -0,277** | 1,21 | -0,221** | 1,2 |
| Irritability due to traffic safety cameras | 0.000 | 1.189 | 0.110 | 1.886 | 0.106 | 1.833 |
| Traffic safety cameras frequency | -0.004 | 1.039 | -0.059 | 1.178 | -0.003 | 1.174 |
| Traffic safety cameras money pump? | 0.068 | 1.059 | -0.049 | 1.075 | 0.019 | 1.063 |
| Social comparison | | | | | | |
| Social comparison good driver | 0,212** * | 1,05 | 0,201** | 1,09 | 0,228** | 1,08 |
| Probability of having an accident | -0.085 | 1.107 | -0.087 | 1.120 | -0.075 | 1.117 |
| General relationship to risk | | | | | | |
| Hedonism | -0.082 | 1.002 | -0.067 | 1.107 | -0.046 | 1.073 |
| Fatalism | -0.078 | 1.075 | -0.119 | 1.141 | -0.120 | 1.119 |

* p<0,05

** p<0,01

***p<0,001

4. Discussion

The aim of this study was to investigate the impact of the health crisis on compliance with road safety rules in France, by comparing three types of user: motorists and drivers of heavy and light motorcycles. We hypothesized that drivers of heavy motorcycles would comply less with road rules than the other two types of user, and that compliance would tend to decline after periods of confinement. In line with the first hypothesis, the results show lower compliance than for heavy motorcycle riders. Contrary to the second hypothesis, declared compliance with the rules of the road did not decrease after the two periods of confinement. More precisely, declared compliance increases for all 3 types of user after the first confinement, particularly for heavy motorcycle drivers, then returns to its initial level during the second confinement. More generally, the study of factors associated with compliance in the three collection periods shows that the perception of the good driver as complying with the rules is the most important factor in compliance, for all three types of user.

Regarding the items relating to the relationship with the law, our results are in line with recent studies thus show more broadly the positive effect of the general relationship to the laws on road users compliance with traffic rules (Granié, Thévenet, Evennou, Lyon and Vanlaar, 2020). The importance of respecting the law emerges from the analysis at the three times, before and after the first lock down and during the second ones for car drivers. Thus, for these respondents, laws must be respected because they protect others. For motorcyclists +, the conditionality of the road safety measures has a negative relationship with compliance. This result is stable over time.

This result is consistent with the literature, which shows that motorcyclists have a more flexible relationship with the highway code, particularly when it comes to speeding. Such a result may be explained by a particularly strong sense of control. Another possibility would be the knowledge that, in France, speed cameras mainly flash from the front, while license plates are at the rear, which prevents any penalties.

The results on the question of speed cameras show that motorcyclists who are less concerned about the presence of speed cameras are not necessarily more likely to obey the rules of the road. There is even a negative relationship between the two variables. Such a result could be explained by the fact
410 that those who respect the rules of the road respect them for reasons other than fear of punishment (for example, because they consider themselves to be good drivers, and good drivers respect the rules of the road), whereas those who generally don't respect them, when they do respect them, are doing so for external reasons, in this case fear of punishment.

The impact of the health crisis is mirrored in the question of the internalization of rules. For
415 motorcyclists +, internalization is linked to compliance with the rules of the highway code before the first confinement, but such a link is not found after the first confinement or during the second. For car users, on the other hand, internalization is a significant factor at all three times. However, for this latter category of users, although the betat valuers are significant, they are still very weak. We can therefore conclude that the health context had a different impact on motorcyclists + and car
420 users. Thus, for the former, the internalisation is no longer a determining factor in compliance with road safety rules after the lockdown. It is as if since the beginning of the health crisis, they have been questioning the necessity to respect the rules even if they were not mandatory. The relationship with the internalization was therefore impacted by the health crisis and this had an effect on compliance with the legal rules of the road and health, and very probably other rules (Granié et al.,
425 2022).

The theory of action identification (Wallacher and Wegner, 1987) provides theoretical support for our remarks. According to this theory, the same action can be identified at different levels ranging from an operational (very practical) level to an abstract level. The higher the level, the greater the number of actions it encompasses.
430 The link between compliance with road safety rules and a public health measure (wearing a mask) during a health crisis has been studied (Granié et al. 2022). First of all, the authors highlight the high rate of mask wearing even in the absence of obligation and control: over two-thirds of

participants seem to have internalized this new rule (N=3367/4999). The results, that are statistically significant, show, however, an important link between the internalization of mask wearing and the internalization of compliance with road rules: a large majority of individuals internalized both mask wearing and compliance with road rules (64,21%; N=3210/4999), while very few individuals showed internalization of mask wearing with non-internalization of road rules (3,1%; N=157/4999). These results would be in line with the findings of Nucci and Nucci (1982) concerning the relationship between categorizations of social rules. The results of Granié et al (2022) seem to show that the categorization of a new public health rule in different social domains could be linked to the categorization of other rules, such as the rules of the highway code, which are already socially and individually anchored, notably in terms of the perceived usefulness of the behavior for oneself and others, and personal positioning with regard to the legal system as a whole. It thus seems that the internalization of the wearing of a mask is linked to the perception of the legitimacy of the rule (Varet et al., 2021), to the perception of other rules like road safety measures and to confidence in the legal system

These different results show that the health context and periods of lock-down had a different impact on car drivers and heavy motorcycle riders, in terms of rule perception and compliance. They also show that the factors explaining compliance with the rules seem to vary according to the mode of travel used. This result deserves to be confirmed and explored in further studies. More generally, theoretical reflection on the construction of the relationship to social and legal rules, their links in individuals throughout their lives and their possible interactions needs to be pursued. In applied terms, these results confirm the value of differentiating the road-user population by showing the differences between motorists and motorcyclists, which are not due solely to the mode of travel used. In terms of road safety policies, they show the importance of proposing prevention campaigns targeting different modes of travel, and taking into account the specificities of their users in terms of their perception of rules and the factors involved in their observance.

Limits

460 In this research, we do not have measures collected before the health crisis, the aim was to ask respondents to recall their past behaviour. Moreover, it would be interesting to have another measure now, i.e. at a time when we have returned to a normal situation of mobility. In short, has the relationship to the rule been permanently modified by the health crisis or have we returned to the same relationship to the law as before COVID 19? The importance of respecting health laws
465 was highlighted by the particular health context, but now that the concerns are of a different order (global warming) will we return to a previous situation?

Another limitation concerns the heterogeneity of car sizes. The sample of car users is much larger than that of motorcyclists - and motorcyclists +.

470 Conclusion

The objective of this work was to study the impact of the health crisis in France at three moments, before and after the first lock down, and during the second one, on compliance with road safety rules, taking into account the type of user. It confirms the interest of differentiating the road user population by showing the differences between car drivers and motorcyclists. It also allows for
475 theoretical reflection on the construction of the relationship to social and legal rules and the links between them in individuals throughout their lives and on their possible interactions.

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