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Original Research

Attitudes and opinions on quarantine and support for a contact-tracing application in France during the COVID-19 outbreak



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ARTICLE INFO

Article history:

Received 18 May 2020

Received in revised form

11 August 2020

Accepted 31 August 2020

Available online 12 October 2020

Keywords:

COVID-19

Quarantine

Risk perception

Contact tracing

Cross-sectional studies

ABSTRACT

Objectives: We aim to identify the factors associated with support and compliance with general quarantine and with the acceptability and potential use of a contact-tracing mobile phone application among French respondents.

Study design: We conducted a cross-sectional study between April 16th and May 7th 2020 using online questionnaires.

Methods: The sample was reweighted to be representative of the French population by age and sex, region and education level. Ordered logistic, logistic and negative binomial regressions were used to estimate the factors associated with quarantine support, with the opinion on quarantine extension, with the number and type of trips outside the quarantine home and with the acceptability and potential use of a contact-tracing application.

Results: After reweighting, full data for regression analyses were available for 1849 respondents. Attitudes and opinions regarding quarantine are correlated with the perceived COVID-19 threat, the perceived benefits of quarantine, trust in the government, well-being during quarantine and risk preferences. Trust in the government, perceived individual health consequences in case of COVID-19 infection and time preferences are associated with the willingness to use a contact-tracing application.

Conclusions: Our analysis indicates that prevention campaigns that stress the individual risk in case of infection or the benefits of quarantine could foster compliance to quarantine protocols. Remote psychological support might also promote quarantine adherence among individuals most distressed by the quarantine. Moreover, public communications should focus on restoring trust among the population as trust is strongly correlated with the willingness to use a contact-tracing application.

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Introduction

Countries relied on non-pharmaceutical interventions (NPIs) to fight the COVID-19 epidemic in early 2020. Among NPIs, quarantine interventions were very effective in reducing COVID-19 transmissions.^{1,2} A modelling study conducted for 11 European countries estimated that general quarantine alone allowed for a reduction of 81% in the number of COVID-19 infections.²

In France, general quarantine was implemented from March 17th to May 11th 2020. Such containment measures can have large social and economic impacts which might reduce their acceptance. Most studies on individual compliance with quarantine measures in epidemic situations were conducted after the outbreaks of Severe Acute Respiratory Syndrome (SARS),^{3–7} H5N1,⁸

H1N1,^{9,10} Middle East Respiratory Syndrome (MERS)¹¹ or Ebola disease.^{12,13} A recent review showed that quarantine adherence is mainly correlated with knowledge about the disease, social norms related to quarantine, perceived benefits of quarantine and perceived risk of the disease.¹⁴ However, while providing useful information, results of previous studies are difficult to transpose to the French COVID-19 general quarantine. Recent surveys on quarantine acceptance were conducted in France. The COCONEL study, conducted in early April 2020, found that 87% of respondents considered the general quarantine as the only effective strategy to fight the COVID-19 epidemic.¹⁵ In this study, quarantine support was found higher among female, older and wealthier respondents.

General quarantine measures were eased in Europe in the past few months. Meanwhile, contact-tracing applications, which can be very effective to control the COVID-19 epidemic if used by enough people,¹⁶ have been developed in numerous countries. However, recent studies conducted in the US, the UK or in European countries

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have shown that data privacy is a major barrier in the use of contact-tracing applications.^{17–22} The willingness to use such applications was also found to be correlated with fear of COVID-19^{17,18} and with risk factors for and personal experience of COVID-19.²¹ Two studies are available regarding the acceptability of a contact-tracing application among the French population. In a study conducted on March 26th and 27th 2020, 80% of French respondents declared being willing to install a contact-tracing application.²³ On pooled data from France, the UK, Italy, Germany and the US, this study also investigates the factors associated with the acceptability of digital contact tracing. Privacy and low government trust appear as barriers to the application adoption while regional COVID-19 mortality rates are unrelated to the willingness to use the application, and the role of COVID-19 risk perceptions is not investigated. In a more recent survey conducted on April 4th and 5th 2020, only 44% of French respondents were willing to use a contact-tracing application with higher acceptability found among men, older respondents and those not able to telework during the quarantine.²⁴ Optimistic results found by Altmann et al.²³ might be linked to their study timing as it was conducted when the epidemic was skyrocketing in France and before digital contact tracing had been widely discussed in French media. In early April 2020, media coverage and associated controversies around the development of a contact-tracing application by the French government greatly increased. Technical features of the forthcoming StopCovid application were only released by the Minister of Health on April 8th 2020.

The objective of this study is twofold. Using an online survey conducted between April 16th and May 7th 2020 among French respondents, we aim to identify the factors associated with (1) support and compliance with the general quarantine and with (2) the acceptability and potential use of a contact-tracing mobile phone application.

Methods

Recruitment of participants

Participants were recruited between April 16th and May 7th 2020 using an online questionnaire posted on generic Facebook groups and on the websites of local newspapers. Participants were presented with an information letter before being asked whether they agreed to participate. The information letter mentioned the strict anonymity of data collected and the following eligibility criteria: to be aged 18 years and older and living in France during the general quarantine.

Dependent variables of interest

The level of agreement with the general quarantine was measured on a Likert-type scale ranging from 1 ('strongly disagree') to 5 ('strongly agree'). Participants were asked how many times in the past seven days they went out of their quarantine home by categories of trips. We created two variables; the total number of trips outside the quarantine home over the last 7 days, and a dummy variable coded as 1 if respondents went out for physical activity or brief walk(s) at least once in the past 7 days and 0 otherwise. Respondents were also asked whether general quarantine should be extended beyond May 11th 2020, its official end date at the time of the survey, and if yes by how many weeks. We created a dummy variable for the opinion regarding the need for

quarantine extension and a variable representing the length in weeks the respondents thought the general confinement should last after May 11th 2020.

Respondents were presented with a description of a contact-tracing application: installation would be voluntary and data collected anonymous, the application would run through Bluetooth without recording the precise location of users. The users would be notified if they had a close contact with an infected person during the last 15 or 20 days without the infected person's identity being revealed. Respondents were asked whether they found the use of a contact-tracing application acceptable and whether they would personally install it. Two dummy variables were created and coded as 1 if respondents had a positive opinion about the acceptability ('Rather acceptable' or 'totally acceptable') and use ('I would probably install it' or 'I would definitely install it') of the contact-tracing application and 0 otherwise.

Independent variables of interest

The Health Belief Model^{25,26} was used as a theoretical framework to investigate the factors associated with attitudes and opinions regarding the general quarantine and with the contact-tracing application acceptability and potential use. Fig. 1 provides a graphical representation of the theoretical framework.

The perceived threat related to COVID-19 was measured using three one-item variables: the perceived probability of contracting the disease, the perceived health impacts of the COVID-19 epidemic in France and the individual health consequences in case of infection.

Perceived benefits were measured using two one-item variables: the perceived efficacy of the general quarantine and trust in the government to handle the health crisis. Respondents were asked whether they agreed with two assertions stating that 'the general quarantine is effective to protect the general population from the COVID-19 epidemic' and 'I trust the government to limit the health effects of the COVID-19 epidemic'.

Respondents were also asked how often since the beginning of the quarantine they felt anxious, depressed, isolated or bored on a scale from 1 ('never') to 5 ('always'). These items were reverse-scored and summed to create a well-being index (ranging from 0 to 16) used as a measure of perceived barriers to explain attitudes and opinions regarding the general quarantine ($\alpha = 0.7676$).

Cues to actions were measured using two one-item variables: the experience of COVID-19 symptoms (either personal or among closed ones) and the perceived respect of quarantine rules by the general population. Regarding the latter, respondents were asked whether they agreed with the assertion that 'most people in France respect the general quarantine rules'.

Individual modifying factors include socio-economic and demographic characteristics (gender, age, region, education level, matrimonial status, income, labour market situation since the beginning of the general quarantine), perceived health status, conditions of quarantine (type of housing, size and number of people living in the quarantine home, presence of person(s) aged under 18 and presence of dogs in the quarantine home) and time and risk preferences. For risk preference, respondents were asked to rate themselves on a scale from 0 ('extremely careful') to 10 ('extremely adventurous'). The French-validated 15-item short form of the Barratt Impulsiveness Scale (BIS 15) was used as a measure of present preference.²⁷ Internal consistency of the BIS is acceptable ($\alpha = 0.7688$).

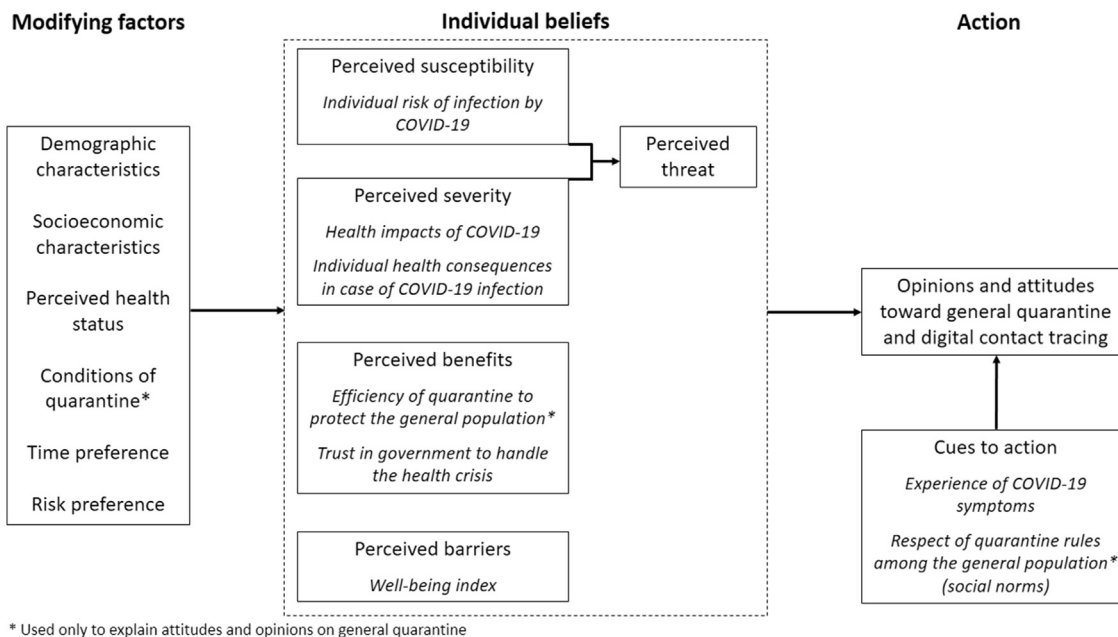


Fig. 1. The Health Belief Model theoretical framework.

Data analysis

To reduce bias due to sample selection, regression analyses were conducted on a reweighted sample representative of the 20- to 74-year-old mainland French population by age and sex, region and education level. Appendix A provides details regarding the reweighting procedure.

Factors associated with the level of agreement with the general quarantine were estimated using an ordered logistic model. Regression analyses for the opinion on whether quarantine should be extended, for the dummy variable on physical activity or brief walking trips, and for the acceptability and potential use of the contact-tracing application were run using logit models. The number of trips outside the quarantine home in the last seven days and the opinion on the number of additional weeks of quarantine required were estimated using negative binomial regressions, given evidence of overdispersion. All regression analyses were run using Stata®, version 15.

Descriptive statistics

We collected 2751 questionnaires. Full data were available for 1909 respondents. The response rate is 69%, and almost half of partially completed questionnaires were stopped before completing the first part on socio-economic and demographic characteristics. Only respondents aged between 20 and 74 years old could be retained in the reweighting analysis to match the age categories of the French National Institute for Statistical and Economic Studies. A total of 1849 observations were then used in regression analyses.

Table 1 provides the key summary statistics before reweighting. Among respondents, 15% rather or totally disagreed with the general quarantine while 11.2% neither agreed nor disagreed. During the last 7 days, the mean number of trips was 4.98 and less than half of respondents (44.8%) went out for brief walk(s) or physical activity. More than half (53%) of the respondents thought the general quarantine should have been extended beyond May 11th 2020. On average, respondents thought the general quarantine

should have been extended by 1.78 week. Regarding the contact-tracing application, 42.1% of the respondents found it rather or totally acceptable and only 38.4% declared they would probably or definitely install it.

Fig. 2 presents the evolution of the mean values for attitudes and opinions regarding quarantine between April 16th and April 30th 2020, when 95% of survey responses were collected. The general quarantine agreement level and the number of additional weeks of quarantine needed decreased over time. Meanwhile, the mean number of trips in the last seven days and the share of respondents who went out for brief walk(s) or physical activity increased. Between April 16th and 30th, two major governmental media interventions occurred: the Prime and Health Ministers held an epidemic situation update on April 19th and the Prime Minister publicly presented the national reopening strategy on April 28th. No change in attitudes or opinions regarding quarantine is noticed around these two interventions.

Regression analyses on opinions and attitudes regarding the general quarantine

Table 2 presents the regression analysis results for the opinions (panel A) and attitudes (panel B) regarding the general quarantine. Female and older respondents tend to be less in favour of a quarantine extension (column 2) while they tend to declare a higher number of trips (column 4). Older respondents are also more likely to go out for physical activity or walks (column 5). No clear pattern emerges regarding the region of residency. Respondents from Île-de-France and Grand Est, which were the most affected regions, do not support neither the quarantine nor its extension to a greater extent and are not less likely to go out. More educated respondents express lower support for a quarantine extension (columns 2 and 3) while they tend to go out more often, either in general (column 4) or for physical activity or walks (column 5).

We find positive correlations between the perceived health impacts of COVID-19 in France and the quarantine agreement level (column 1), the opinion on quarantine extension (column 2) and its length of extension (column 3). On the contrary, a negative

Table 1
Descriptive statistics.

	Mean (standard deviation)	N (%)
Sex		
Male		443 (24.0%)
Female		1406 (76.0%)
Age		
20–29		650 (35.2%)
30–39		346 (18.7%)
40–49		310 (16.8%)
50–59		303 (16.4%)
60–74		240 (13.0%)
Region		
Auvergne-Rhône-Alpes		84 (4.5%)
Bourgogne-Franche-Comté		14 (0.8%)
Bretagne		215 (11.6%)
Centre-Val de Loire		30 (1.6%)
Grand Est		244 (13.2%)
Hauts-de-France		38 (2.1%)
Île-de-France		148 (8.0%)
Normandie		26 (1.4%)
Nouvelle-Aquitaine		28 (1.5%)
Occitanie		899 (48.6%)
Pays de la Loire		58 (3.1%)
Provence-Alpes-Côte d'Azur		65 (3.5%)
Level of education		
< A level		120 (6.5%)
A level		266 (14.4%)
Two-year university diploma		263 (14.2%)
> Two-year university diploma		1200 (64.9%)
Matrimonial status		
Single		522 (28.2%)
In a relationship, civil union or married		1122 (60.7%)
Divorced or separated		180 (9.7%)
Widowed		25 (1.4%)
Monthly income		
<1000 euros		332 (18.0%)
1000–2000 euros		736 (39.8%)
2000–4000 euros		567 (30.7%)
>4000 euros		135 (7.3%)
Not applicable or not wishing to answer		79 (4.3%)
Work situation during general quarantine		
Teleworking		639 (34.6%)
Working at usual working place		273 (14.8%)
Not working but usually works		391 (21.1%)
Not working, unemployed before general quarantine		134 (7.2%)
Not working, student before general quarantine		179 (9.7%)
Not working, inactive or retired before general quarantine		233 (12.6%)
Perceived health status		
Poor or very poor		76 (4.1%)
Fair		397 (21.5%)
Good		882 (47.7%)
Very good		494 (26.7%)
Type of housing during general quarantine		
House		882 (47.7%)
Flat with exterior space		750 (40.6%)
Flat without exterior space		217 (11.7%)
Size of general quarantine home (m²)		
	90.50 (51.06)	
Household number(s) during general quarantine		
1		368 (19.9%)
2		731 (39.5%)
3		343 (18.6%)
4		277 (15.0%)
5 or more		130 (7.0%)
Presence of <18 in general quarantine home		
No		975 (52.7%)
Yes		874 (47.3%)
Presence of dog(s) in general quarantine home		
No		1529 (82.7%)
Yes		320 (17.3%)
General quarantine agreement		
Totally disagree		108 (5.8%)
Rather disagree		170 (9.2%)
Neither agree nor disagree		208 (11.2%)
Rather agree		779 (42.1%)
Totally agree		584 (31.6%)
Number of trips in the last 7 days		
	4.98 (5.52)	

Table 1 (continued)

	Mean (standard deviation)	N (%)
Physical activity or walking trips		
No		1021 (55.2%)
Yes		828 (44.8%)
Opinion on general quarantine extension		
No		982 (53.1%)
Yes		867 (46.9%)
Opinion on general quarantine extension length (weeks)	1.78 (2.45)	
Acceptability of the contact-tracing application		
Not acceptable or without opinion		1071 (57.9%)
Rather or totally acceptable		778 (42.1%)
Use of the contact-tracing application		
I would not install it or without opinion		1115 (61.6%)
I would probably or definitively install it		696 (38.4%)
Not concerned (I don't have a smartphone)		38 (2.1%)
Health impacts of COVID-19 in France		
Not or moderately serious		378 (20.4%)
Rather serious		934 (50.5%)
Very serious		537 (29.0%)
Individual risk of infection by COVID-19		
Low or very low		912 (49.3%)
Intermediate		594 (32.1%)
High or very high		343 (18.6%)
Individual health consequences in case of infection COVID-19		
Low or very low		583 (31.5%)
Intermediate		880 (47.6%)
High or very high		386 (20.9%)
Efficacy of general quarantine to protect the general population		
Totally or rather disagree		271 (14.7%)
Neither agree nor disagree		234 (12.7%)
Rather or totally agree		1344 (72.7%)
Trust in government to handle the health crisis		
Totally or rather disagree		821 (44.4%)
Neither agree nor disagree		459 (24.8%)
Rather or totally agree		569 (30.8%)
Well-being index	9.91 (3.49)	
Experience of COVID-19 symptoms		
Neither had symptoms or knew someone with symptoms		835 (45.2%)
Personally experienced symptoms		185 (10.0%)
Household member(s) experienced symptoms		53 (2.9%)
Acquaintances experienced symptoms		776 (42.0%)
Respect of general quarantine rules among the general population		
Totally or rather disagree		566 (30.6%)
Neither agree nor disagree		584 (31.6%)
Rather or totally agree		699 (37.8%)
General risk preference	4.21 (2.16)	
Present preference (BIS 15 impulsivity scale)	29.07 (5.84)	
Observations	1849	1849

BIS, Barratt Impulsiveness Scale.

correlation is found between perceived COVID-19 health impacts and physical activity or walking trips (column 5).

Respondents with a high or very high perceived risk of infection express higher support for the general quarantine (column 1). An intermediate perceived risk of infection is also associated with a higher number of trips (column 4) and a higher probability of physical activity or walking trips (column 5). These surprising results could be explained by a reverse effect of the number of trips on the perceived risk of infection with respondents going out more often being aware of their higher risk of infection.

The perceived health consequences in case of infection are positively correlated with the quarantine agreement level (column 1) and with the length of quarantine extension (column 3). This variable is also negatively correlated with trips for physical activity or walks (column 5). The perceived efficacy of the general quarantine is positively correlated with the quarantine agreement level (column 1) and with the number of additional weeks of quarantine required (column 3).

Trust in the government to handle the health crisis is positively correlated with the quarantine agreement level (column 1) and negatively correlated with the opinions on its extension (columns 2 and 3) which indicates a greater support for the official epidemic control strategy among respondents who trust the government. Trust in the government is also positively correlated with the number of trips (column 4) and with trips for physical activity or walks (column 5). French general quarantine rules were less strict than those applied in other highly affected countries, and the mandatory certificate of movement included a rather large number of reasons for trips outside the quarantine home (e.g. trips for individual physical activity were authorised once a day). Respondents trusting the government might have felt more confident in taking authorised trips during the quarantine, which might explain the correlations we find between trust in the government and trips out of the quarantine home.

The well-being index is positively correlated with the quarantine agreement level (column 1), the opinion that quarantine should be extended (column 2) and the length of this extension

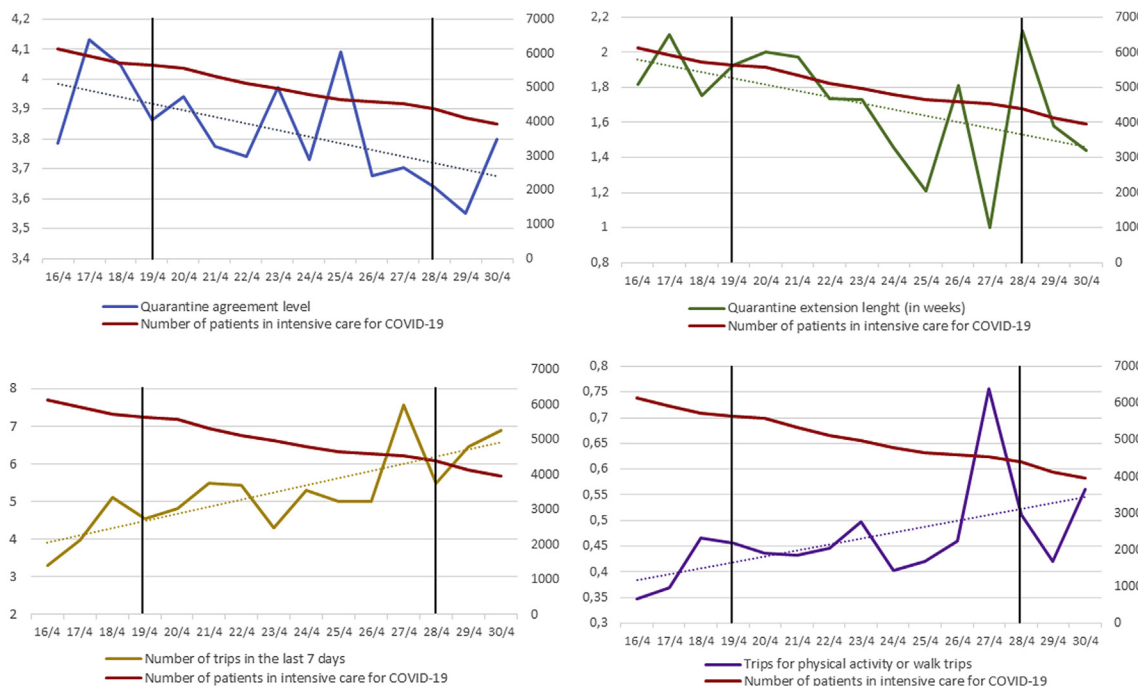


Fig. 2. Evolution of the mean values for attitudes and opinions regarding quarantine between April 16th and April 30th 2020.

(column 3). We also find a negative correlation between the well-being index and the probability of physical activity or walking trips (column 5).

The belief that quarantine rules are broadly respected is negatively correlated with the opinion that quarantine should be extended (column 2) and the length of this extension (column 3). Respondents perceiving a higher level of compliance with the quarantine rules might be more likely to think that the first quarantine period was effective in controlling the epidemic and that its extension is unneeded.

The risk preference measure is negatively correlated with the opinion on quarantine extension (column 2) and with the number of additional weeks of quarantine required (column 3) while it is positively correlated with the number of trips (column 4) and with trips for physical activity or walks (column 5). Risk adverse respondents also tend to be less in favour of a general quarantine extension, maybe because such extension is perceived as a source of economic or social risk. Interestingly, respondents scoring higher on the impulsivity scale tend to favour an extension of the quarantine (column 2) and to support a longer extension (column 3). One explanation could be that impulsive respondents express higher support for a quarantine extension as a commitment strategy to reduce their risk of infection in the near future.

Regression analyses on the acceptability and potential use of the contact-tracing application

Table 3 presents the results of the regression analyses for the acceptability (column 1) and the potential use (column 2) of the contact-tracing application.

Compared with those aged 20–29 years, respondents aged between 40 and 49 years tend to find the contact-tracing application less acceptable and are less likely to use it (columns 1 and 2). The acceptability and the potential use of the tracing application appear

higher in some (Île-de-France) but not in all (Grand Est) highly affected regions (columns 1 and 2).

A positive correlation is found between the perceived health consequences in case of COVID-19 infection and the willingness to use the tracing application (column 2). Trust in the government to handle the health crisis is strongly and positively correlated with the acceptability and the potential use of the contact-tracing application (columns 1 and 2). Finally, impulsivity is negatively correlated with the potential use of the contact-tracing application (column 2). Then, respondents who are less future oriented express a lower willingness to use the contact-tracing application.

Discussion

Consistent with the theoretical framework provided by the Health Belief Model, attitudes and opinions regarding the general quarantine are associated with the perceived threat related to COVID-19, the perceived benefits of quarantine, trust in the government and individual modifying factors. Perceived health impacts of COVID-19 in France are strongly correlated with the quarantine agreement level, with the opinions on its extension and with trips for physical activity and walks. Perceived health consequences in case of infection are positively correlated with the opinion on the number of additional weeks of quarantine needed and negatively correlated with trips for physical activity and walks. The perceived efficacy of quarantine is positively correlated with the support for the quarantine and its extension. Trust in the government is associated with more support for the epidemic control strategy. Well-being during the general quarantine is also positively correlated with the support for the quarantine and its extension. Finally, risk preference is correlated with more trips and with less support for the quarantine extension.

In line with the available literature,^{3,5,6,10,12,14} our results confirm the importance of the perceived disease risk, the perceived benefits of quarantine and trust in the government in support and

Table 2
Results of regression analyses on opinions and attitudes regarding the general quarantine.

	Panel A: Opinions regarding the general quarantine			Panel B: Attitudes regarding the general quarantine	
	1	2	3	4	5
	General quarantine agreement	Quarantine extension (Yes/No)	Quarantine extension length	Trips in the last 7 days	Physical activity or walking trips
	Odd ratio (90% CI)	Odd ratio (90% CI)	Incidence rate ratio (90% CI)	Incidence rate ratio (90% CI)	Odd ratio (90% CI)
Female (Ref: Male)	0.789 (0.471,1.321)	0.470* (0.245,0.900)	1.073 (0.752,1.532)	0.853* (0.728,0.999)	1.110 (0.637,1.936)
Age (Ref: 20–29 years)					
30–39	0.735 (0.299,1.802)	0.312** (0.120,0.808)	0.704 (0.458,1.083)	1.089 (0.805,1.473)	1.996 (0.830,4.800)
40–49	0.818 (0.226,2.963)	0.344 (0.110,1.081)	0.848 (0.523,1.375)	1.469* (1.054,2.047)	5.032** (1.784,14.197)
50–59	0.622 (0.188,2.057)	0.183** (0.058,0.577)	1.021 (0.619,1.685)	1.573** (1.117,2.215)	3.937** (1.387,11.173)
60–74	1.908 (0.478,7.614)	0.112*** (0.030,0.421)	0.865 (0.414,1.809)	1.276 (0.844,1.931)	7.035** (1.388,35.672)
Region (Ref: Auvergne-Rhône-Alpes)					
Bourgogne-Franche-Comté	5.114 (0.623,42.010)	16.33** (2.191,121.643)	6.601*** (2.105,20.699)	1.330 (0.832,2.128)	3.402 (0.572,20.218)
Bretagne	0.450 (0.089,2.278)	0.214* (0.049,0.943)	0.872 (0.406,1.876)	2.289*** (1.415,3.703)	20.75*** (3.782,113.854)
Centre-Val de Loire	0.489 (0.093,2.583)	1.732 (0.309,9.693)	1.005 (0.493,2.048)	1.459 (0.909,2.340)	0.266 (0.036,1.988)
Grand Est	1.024 (0.208,5.046)	1.165 (0.316,4.295)	0.895 (0.547,1.465)	1.966*** (1.381,2.801)	1.799 (0.440,7.350)
Hauts-de-France	1.470 (0.412,5.243)	0.873 (0.235,3.237)	1.491 (0.767,2.901)	1.392 (0.960,2.019)	0.776 (0.218,2.760)
Île-de-France	1.792 (0.592,5.429)	1.005 (0.314,3.222)	1.187 (0.652,2.159)	1.356 (0.947,1.941)	2.041 (0.608,6.848)
Normandie	2.522 (0.583,10.910)	3.076 (0.561,16.862)	1.454 (0.736,2.874)	2.420*** (1.588,3.688)	1.388 (0.278,6.928)
Nouvelle-Aquitaine	1.966 (0.723,5.350)	0.695 (0.182,2.659)	1.356 (0.698,2.631)	1.448* (1.003,2.089)	2.098 (0.554,7.946)
Occitanie	0.350 (0.096,1.279)	0.292* (0.092,0.924)	1.084 (0.635,1.850)	1.910*** (1.377,2.649)	5.088** (1.509,17.161)
Pays de la Loire	1.704 (0.525,5.534)	0.910 (0.230,3.604)	1.148 (0.638,2.066)	2.574*** (1.809,3.661)	4.468* (1.005,19.852)
Provence-Alpes-Côte d'Azur	2.390 (0.386,14.812)	0.857 (0.173,4.240)	0.802 (0.343,1.879)	0.747 (0.457,1.219)	1.952 (0.265,14.368)
Education level (Ref: < A level)					
A level	0.544 (0.230,1.289)	0.431 (0.156,1.188)	1.234 (0.734,2.075)	0.992 (0.749,1.314)	2.862* (1.118,7.329)
Two-year university diploma	0.393* (0.157,0.981)	0.175*** (0.058,0.529)	0.488** (0.279,0.852)	1.057 (0.802,1.395)	5.133*** (1.976,13.333)
> Two-year university diploma	0.639 (0.270,1.512)	0.107*** (0.038,0.305)	0.690 (0.392,1.215)	1.417** (1.074,1.870)	5.944*** (2.332,15.153)
Health impacts of COVID-19 in France (Ref: Not serious at all or not very serious)					
Moderately serious	2.169** (1.156,4.068)	6.066*** (2.883,12.766)	2.078*** (1.392,3.102)	1.003 (0.790,1.272)	0.264*** (0.123,0.569)
Rather or very serious	3.256*** (1.568,6.765)	5.915*** (2.523,13.867)	2.540*** (1.628,3.963)	1.025 (0.792,1.326)	0.411* (0.180,0.941)

(continued on next page)

Table 2 (continued)

	Panel A: Opinions regarding the general quarantine			Panel B: Attitudes regarding the general quarantine	
	1	2	3	4	5
	General quarantine agreement	Quarantine extension (Yes/No)	Quarantine extension length	Trips in the last 7 days	Physical activity or walking trips
	Odd ratio (90% CI)	Odd ratio (90% CI)	Incidence rate ratio (90% CI)	Incidence rate ratio (90% CI)	Odd ratio (90% CI)
Individual risk of infection by COVID-19					
(Ref: Low or very low)					
Intermediate	1.682 (0.918,3.080)	0.756 (0.397,1.443)	1.007 (0.742,1.368)	1.257* (1.024,1.542)	2.159* (1.100,4.237)
High or very high	2.398* (1.009,5.699)	2.055 (0.921,4.587)	1.219 (0.873,1.703)	0.799 (0.638,1.001)	1.515 (0.622,3.689)
Individual health consequences in case of infection by COVID-19 (Ref: Low or very low)					
Intermediate	1.965* (1.045,3.695)	1.981 (0.928,4.232)	1.507* (1.056,2.151)	0.935 (0.758,1.154)	0.361** (0.173,0.755)
High or very high	1.072 (0.282,4.073)	2.520 (0.954,6.656)	1.677** (1.145,2.456)	0.862 (0.661,1.124)	0.167*** (0.068,0.410)
Efficacy of the general quarantine					
(Ref: Totally or rather disagree)					
Neither agree nor disagree	1.260 (0.549,2.890)	5.337** (1.663,17.127)	2.191** (1.270,3.779)	0.785 (0.573,1.075)	1.657 (0.564,4.861)
Rather or totally agree	8.200*** (3.131,21.476)	1.972 (0.820,4.747)	1.522* (1.042,2.223)	0.809 (0.601,1.089)	0.615 (0.264,1.432)
Trust in the government to handle the health crisis (Ref: Totally or rather disagree)					
Neither agree nor disagree	0.811 (0.409,1.606)	0.724 (0.324,1.617)	0.597** (0.406,0.877)	1.219 (0.980,1.515)	1.954 (0.986,3.873)
Rather or totally agree	2.831** (1.291,6.209)	0.295*** (0.140,0.620)	0.467*** (0.318,0.685)	1.288* (1.033,1.606)	2.390* (1.097,5.208)
Well-being index during the general quarantine					
Symptoms of COVID-19 (Ref: Neither had them or know someone who had them)	1.096** (1.023,1.173)	1.193*** (1.100,1.293)	1.052* (1.005,1.100)	0.998 (0.973,1.024)	0.916* (0.842,0.997)
Personally experienced symptoms	0.682 (0.296,1.572)	1.095 (0.431,2.781)	1.204 (0.725,2.001)	1.123 (0.818,1.540)	0.435 (0.162,1.166)
Household member(s) experienced symptoms	0.760 (0.201,2.865)	57.71*** (4.672,712.859)	2.572** (1.171,5.649)	1.564 (0.997,2.452)	0.793 (0.198,3.175)
Acquaintance(s) experienced symptoms	1.267 (0.646,2.484)	1.414 (0.749,2.667)	1.079 (0.810,1.436)	1.121 (0.915,1.374)	0.865 (0.451,1.659)
Respect of the general quarantine rules by most people (Ref: Totally or rather disagree)					
Neither agree nor disagree	1.095 (0.559,2.146)	0.740 (0.341,1.603)	0.754 (0.549,1.036)	0.930 (0.738,1.171)	0.616 (0.305,1.243)
Rather or totally agree	0.758 (0.292,1.969)	0.365** (0.183,0.730)	0.482*** (0.335,0.693)	1.021 (0.824,1.265)	1.184 (0.623,2.247)
General risk preference					
	0.931 (0.813,1.065)	0.769*** (0.672,0.879)	0.859*** (0.808,0.913)	1.073*** (1.029,1.119)	1.188** (1.051,1.343)
Present preference (BIS 15 impulsivity scale)					
	1.028 (0.986,1.072)	1.133*** (1.071,1.198)	1.061*** (1.038,1.085)	1.008 (0.994,1.022)	1.044 (0.994,1.096)
Observations	1849	1849	1849	1849	1849

All regressions include controls for socio-economic and demographic characteristics (gender, age, matrimonial status, education level, income, labour market situation since the general quarantine and self-rated health status) and controls for the conditions of quarantine (type of housing, size and number of people living in the quarantine home, presence of person(s) aged under 18 and presence of dogs in the quarantine home).

An odd ratio or an incidence rate ratio between 0 and 1 indicates a negative correlation. An odd ratio or an incidence rate ratio greater than 1 indicates a positive correlation. * $P < 0.10$, ** $P < 0.05$, *** $P < 0.01$. BIS, Barratt Impulsiveness Scale.

Table 3
Results of regression analyses on the acceptability and potential use of the contact-tracing application.

	Digital contact tracing acceptability	Digital contact tracing potential use
	Odd ratio (90% CI)	Odd ratio (90% CI)
Female (Ref: Male)	0.822 (0.484,1.396)	0.775 (0.440,1.364)
Age (Ref: 20–29 years)		
30–39	0.517 (0.214,1.248)	0.829 (0.330,2.082)
40–49	0.250** (0.097,0.646)	0.172*** (0.067,0.441)
50–59	0.771 (0.293,2.029)	0.970 (0.342,2.756)
60–74	0.341 (0.110,1.052)	0.623 (0.188,2.066)
Region (Ref: Auvergne-Rhône-Alpes)		
Bourgogne-Franche-Comté	1.042 (0.205,5.308)	1.444 (0.359,5.810)
Bretagne	12.91*** (3.180,52.440)	17.20*** (4.003,73.878)
Centre-Val de Loire	0.653 (0.139,3.071)	1.035 (0.220,4.874)
Grand Est	2.389 (0.597,9.563)	1.506 (0.366,6.202)
Hauts-de-France	4.395** (1.269,15.221)	6.699** (1.930,23.259)
Île-de-France	4.901** (1.583,15.168)	7.592*** (2.438,23.645)
Normandie	0.880 (0.171,4.535)	0.602 (0.064,5.652)
Nouvelle-Aquitaine	1.715 (0.475,6.184)	4.048* (1.056,15.521)
Occitanie	9.064*** (2.965,27.710)	16.21*** (4.934,53.248)
Pays de la Loire	3.854* (1.039,14.294)	1.534 (0.379,6.204)
Provence-Alpes-Côte d'Azur	10.19** (2.263,45.852)	26.03*** (4.964,136.547)
Education level (Ref: < A level)		
A level	11.61*** (4.784,28.187)	13.12*** (5.226,32.918)
Two-year university diploma	3.946** (1.584,9.834)	1.937 (0.693,5.415)
> Two-year university diploma	2.429* (1.025,5.756)	1.918 (0.756,4.868)
Health impacts of COVID-19 in France (Ref: Not serious at all or not very serious)		
Moderately serious	0.812 (0.405,1.625)	0.846 (0.390,1.835)
Rather or very serious	0.920 (0.458,1.850)	1.136 (0.514,2.510)
Individual risk of infection by COVID-19 (Ref: Low or very low)		
Intermediate	0.936 (0.520,1.685)	0.549 (0.298,1.013)
High or very high	1.593 (0.731,3.471)	1.598 (0.713,3.581)
Individual health consequences in case of infection by COVID-19 (Ref: Low or very low)		
Intermediate	1.064 (0.556,2.035)	1.501 (0.773,2.917)
High or very high	2.149 (0.907,5.090)	2.962** (1.254,6.995)
Trust in the government to handle the health crisis (Ref: Totally or rather disagree)		
Neither agree nor disagree	2.524** (1.210,5.264)	2.701** (1.278,5.709)
Rather or totally agree	4.522*** (2.283,8.955)	5.853*** (2.869,11.941)
Symptoms of COVID-19 (Ref: Neither had them or know someone who had them)		
Personally experienced symptoms	1.659 (0.741,3.715)	1.852 (0.800,4.289)
Household member(s) experienced symptoms	0.808 (0.253,2.579)	0.179 (0.030,1.069)
Acquaintance(s) experienced symptoms	0.632 (0.333,1.198)	0.542 (0.294,1.001)

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Table 3 (continued)

	Digital contact tracing acceptability	Digital contact tracing potential use
	Odd ratio (90% CI)	Odd ratio (90% CI)
General risk preference	0.961 (0.860,1.073)	0.896 (0.794,1.011)
Present preference (BIS 15 impulsivity scale)	0.966 (0.922,1.012)	0.932** (0.883,0.983)
Observations	1849	1811 ^a

All regressions include controls for socio-economic and demographic characteristics (gender, age, matrimonial status, education level, income, labour market situation since the general quarantine and self-rated health status).

An odd ratio between 0 and 1 indicates a negative correlation. An odd ratio greater than 1 indicates a positive correlation. *P < 0.10, **P < 0.05, ***P < 0.01. BIS, Barratt Impulsiveness Scale.

^a Thirty-eight respondents who declared not having a smartphone were excluded from the analysis.

compliance with quarantine. Our analysis also complements previous analyses by investigating the role of well-being during quarantine and risk preferences on attitudes and opinions regarding the quarantine and shows that both factors are strongly correlated with support and compliance with quarantine.

We find lower willingness to use a contact-tracing application among our respondents than among those of earlier studies conducted in France. It might indicate a decrease in the acceptability of digital contact tracing as the public debate around the StopCovid application moved forward in France. While a two-phase study conducted between March and April 2020 on representative samples of the French population showed a deterioration of the trust in the government over time,²⁸ our results, as those of Altmann et al.,²³ underline that trust in the government is of the utmost importance in the willingness to use the contact-tracing application. Compared with previous studies, our results also show that willingness to use a contact-tracing application is positively correlated with the perceived health consequences in case of COVID-19 infection. While the role of time preference was never explored, we also find that impulsivity (i.e. low future preference) is negatively correlated with the willingness to use a contact-tracing application.

The main limitations of our study lie in the data used in the analysis. First, given our recruitment process, our sample is not representative of the French population. We then conducted regression analyses on a sample that was reweighted to be representative of the French population by age and sex, region and education level. Nevertheless, our recruitment process might also have led to the self-selection of respondents more concerned with COVID-19 than the general population. Moreover, the cross-sectional design used in our study also makes conclusions about causal effects difficult. Our regression results might have alternative interpretations in case of reverse causality or if unobserved factors affect both our dependent and independent variables. We nonetheless included multiple socio-economic and demographic characteristics as control variables to limit the omitted variable concern.

Despite these limitations, our results provide new information that might help guide future communication strategies during infectious disease outbreaks in France. For example, our analysis indicates that prevention campaigns stressing out the individual consequences in case of infection, the nationwide health consequences of the epidemic or the benefits of quarantine could foster compliance with quarantine measures. The positive correlations we find between the well-being index and attitudes or opinions regarding the general quarantine also indicate that remote psychological support might promote quarantine adherence among individuals most emotionally distressed by the quarantine. In parallel to other NPIs, digital contact tracing might be useful to help

prevent a new general quarantine in case of a second wave of COVID-19 infections in fall 2020. However, the StopCovid application has only reached 2.3 million downloads since its release in June 2020. Our results indicate that public communications should focus on restoring trust among the population as trust is of prominent importance in the willingness to use the contact-tracing application. Our analysis also indicates that stressing out the individual consequences in case of COVID-19 infection or the short-term benefits of using the StopCovid application could be useful to promote its adoption among the French population.

Author statements

Ethical approval

Not required given strict anonymity of participants.

Funding

None.

Competing interests

None declared.

Data availability

The data underlying this article will be shared on reasonable request to the corresponding author.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.puhe.2020.08.026>.

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