Rapid communication

Attitudes of healthcare workers towards COVID-19 vaccination: a survey in France and French-speaking parts of Belgium and Canada, 2020

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In October and November 2020, we conducted a survey of 2,678 healthcare workers (HCWs) involved in general population immunisation in France, French-speaking Belgium and Quebec, Canada to assess acceptance of future COVID-19 vaccines (i.e. willingness to receive or recommend these) and its determinants. Of the HCWs, 48.6% (n = 1,302) showed high acceptance, 23.0% (n = 616) moderate acceptance and 28.4% (n = 760) hesitancy/reluctance. Hesitancy was mostly driven by vaccine safety concerns. These must be addressed before/during upcoming vaccination campaigns.

To help control the coronavirus disease (COVID-19) pandemic, unprecedented efforts have been made to develop vaccines against this disease. Since December 2020, several vaccines have been authorised in Canada [1] and the European Union [2,3] for use as early as the end of 2020. In October and November 2020, we conducted a survey of healthcare workers (HCWs) involved in general population immunisation to: (i) measure their willingness to accept future COVID-19 vaccines for themselves and recommend them to their patients; and (ii) explore determinants of acceptance among groups of HCWs according to their views (positive, uncertain, or reluctant towards vaccination).

A questionnaire-based survey in France as well as in French-speaking parts of Belgium and Canada

We conducted a cross-sectional questionnaire-based survey in October and November 2020 to collect opinions from general practitioners (GPs) in France and French-speaking parts of Belgium (Brussels, Wallonia), as well as nurses in Quebec, Canada. These professionals were chosen because they are involved in general population immunisation. In Quebec, nurses prescribe and administer almost all vaccines, without GP supervision. These HCWs are also targeted as a priority group for COVID-19 vaccination [4-7]. In France, the survey took place among a national panel of 2,815 private GPs (i.e. non-salaried employment) set up in 2018, representative of age, gender, region, workload, and HCW density in the GPs’ practice zone [8]. Gender was considered in the study, rather than sex, to capture socio-cognitive factors associated with HCWs’ attitudes and practices. In Quebec, we randomly selected 4,000 nurses from the list of the Quebec Order of Nurses and invited those with an available e-mail address (n = 3,973). In Belgium, we invited all GPs practicing in the regions of Brussels and Wallonia (8,412 GPs) through several databases held by different organisations (such as order of GPs or learned societies). Participants were invited to take part online and, in France only, they were contacted by telephone if they had not completed the survey within
### Table 1a

Data on attitudes and opinions of healthcare workers towards future COVID-19 vaccines, in Belgium (Wallonia and Brussels), France (whole country) and Canada (Quebec), October–November 2020 (n = 2,678)

| Survey data | COUNTRY | Area considered | Number of participants (% of total) | p value<sup>a</sup> | Total 2,678 (100%) |
|-------------|---------|-----------------|-------------------------------------|----------------------|---------------------|
|             |         |                 |                                     |                      |                     |
|             |         |                 |                                     |                      |                     |
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|             |         |                 |                                     |                      |                     |
|             |         |                 |                                     |                      |                     |
|             |         |                 |                                     |                      |                     |
| Age in years |         |                 |                                     |                      |                     |
| 18 to 39   | 1,209<sup>c</sup> (45%) | FRANCE Whole country | 147 | 12.16 | 83 | 19.98 | 507 | 48.05 | <0.001 | 920 | 34.37 |
| 40 to 59   | 414<sup>c</sup> (16%) | BELGIUM Wallonia and Brussels | 620 | 51.27 | 128 | 31.05 | 482 | 45.68 | 1,250 | 46.67 |
| ≥ 60       | 442     | CANADA Quebec | 442 | 36.57 | 203 | 48.97 | 66 | 6.27 | 508 | 18.96 |
| Gender<sup>b</sup> |         |                 |                                     |                      |                     |
| Male       | 736     | FRANCE Whole country | 736 | 60.87 | 237 | 57.28 | 121 | 11.50 | <0.001 | 823 | 30.75 |
| Female     | 473     | BELGIUM Wallonia and Brussels | 473 | 39.13 | 237 | 42.72 | 177 | 42.72 | 1,855 | 69.25 |
| If a vaccine against COVID-19 were available, would you be willing to recommend it to your patients? |         |                 |                                     |                      |                     |
| Yes, certainly | 607     | 50.19 | 147 | 12.16 | 169 | 40.73 | 480 | 45.48 | <0.001 | 1,253 | 46.77 |
| Yes, probably | 352     | 29.08 | 620 | 51.27 | 128 | 31.05 | 360 | 34.14 | 879 | 32.83 |
| No, probably not | 63      | 5.24 | 442 | 36.57 | 203 | 48.97 | 20 | 1.17 | 80 | 2.98 |
| No, certainly not | 12      | 0.97 | 442 | 36.57 | 203 | 48.97 | 13 | 1.17 | 30 | 1.13 |
| Do not know | 175     | 14.51 | 442 | 36.57 | 203 | 48.97 | 182 | 17.22 | 436 | 16.29 |
| If a vaccine against COVID-19 were available, would you be willing to be vaccinated yourself? |         |                 |                                     |                      |                     |
| Yes, certainly | 562     | 46.53 | 473 | 39.13 | 164 | 39.50 | 452 | 42.85 | 1,175 | 43.88 |
| Yes, probably | 348     | 28.83 | 473 | 39.13 | 151 | 36.53 | 291 | 27.56 | 764 | 28.52 |
| No, probably not | 74      | 6.09 | 473 | 39.13 | 29 | 7.01 | 69 | 6.55 | 172 | 6.43 |
| No, certainly not | 60      | 4.93 | 473 | 39.13 | 10 | 2.36 | 56 | 5.28 | 134 | 4.99 |
| Do not know | 165     | 13.62 | 473 | 39.13 | 60 | 14.60 | 182 | 17.75 | 433 | 16.18 |
| COVID-19 vaccine acceptance |         |                 |                                     |                      |                     |
| High       | 612     | 50.59 | 1,209 | 45% | 177 | 42.80 | 507 | 45.68 | <0.001 | 1,302 | 48.60 |
| Moderate   | 295     | 24.39 | 1,209 | 45% | 138 | 33.23 | 224 | 21.24 | 616 | 23.02 |
| Hesitancy/reluctance | 302 | 25.02 | 1,209 | 45% | 99 | 23.97 | 324 | 30.69 | 760 | 28.39 |
| Were you vaccinated against seasonal influenza for the winter 2019/20 season? |         |                 |                                     |                      |                     |
| Yes        | 1,031   | 85.30 | 1,209 | 45% | 347 | 83.86 | 636 | 60.27 | <0.001 | 1,876 | 70.06 |
| No/do not know | 178    | 14.70 | 1,209 | 45% | 67 | 16.14 | 419 | 39.73 | 862 | 29.94 |
| Do you sometimes hesitate to recommend some vaccines on the official schedule for your patients, for example, when you have questions about their benefits or risks? |         |                 |                                     |                      |                     |
| For adults (≥ 18 years old) with a chronic disease | Never | 893 | 73.84 | 318 | 76.83 | 505 | 47.86 | <0.001 | 1,561 | 58.28 |
| Sometimes/often/always/do not know | 316 | 26.16 | 318 | 76.83 | 95 | 22.98 | 333 | 31.54 | 783 | 29.23 |
| Does not apply to my practice | 0 | 0.00 | 318 | 76.83 | 1 | 0.19 | 217 | 20.60 | 334 | 12.49 |

COVID-19: coronavirus disease; GP: general practitioner; NA: not applicable.

<sup>a</sup> Data are weighted, unless otherwise specified.

<sup>b</sup> In France (whole country) and Belgium (Brussels and Wallonia) GPs took part in the survey. In Canada (Quebec) nurses took part.

<sup>c</sup> Unweighted figures.

<sup>d</sup> The differences between the three country samples is assessed using a chi-squared test (with Rao–Scott correction).

<sup>e</sup> Weighted percentages (for each country, the percentages were weighted according to age, gender and region).

<sup>f</sup> Weighted for the whole sample (including the three countries).

<sup>g</sup> Gender was considered in the study, rather than sex, to capture socio-cognitive factors associated with healthcare workers’ attitudes and practices.

<sup>h</sup> Strongly or somewhat.

<sup>i</sup> Question asked to participants in France only.

The bold font indicates statistical significance at the p < 0.05 level.
4 weeks of invitation to participate. In all, 2,678 HCWs participated: 1,209 of 2,815 GPs (43%) in France, 414 of 8,412 GPs (5%) in French-speaking Belgium, and 1,055 of 3,973 nurses (27%) in Quebec.

The questionnaire, which was pilot-tested for clarity, length, and face validity in the three countries among a separate group of 144 HCWs not included in the survey, concerned ‘future’ COVID-19 vaccines. In this regard, ‘future’ is with reference to the time/context of the study, which occurred when availability or authorisation of any COVID-19 vaccine was not yet a reality. Two main questions were asked to the participants: (i) their willingness to be vaccinated themselves and (ii) their willingness to recommend the vaccines to their patients, using a five-point scale from ‘no, certainly not’ and ‘no, probably not’ to ‘yes, probably’, and ‘yes, certainly’, with a ‘do not know’ option. The other questions are presented in Table 1.

A score of presumptive acceptance of future COVID-19 vaccines was constructed based on the responses to the two questions in the survey about COVID-19 vaccines. The score was derived from awarding points per participant, depending on the different possible responses given, with 0 point for an answer stating...
‘no certainly not’, one point for ‘no, probably not’, two points for ‘yes, probably’ and three points for ‘yes, certainly’. ‘Do not know’ answers did not get any points and were considered separately. The points obtained for each of the two questions per participant were then summed to obtain the score (Cronbach’s alpha: 0.83; range: 0–6). We then used the score to categorise participants according to their degree of ‘COVID-19 vaccine acceptance’: ‘high acceptance’ (score > 4), ‘moderate acceptance’ (score = 4) and ‘hesitancy or reluctance’ (score < 4 or answers ‘do not know’ to at least one of the two questions). We weighted the samples for age, gender and region. All analyses used two-sided p-values, defined statistical significance as p<0.05, and were performed with Stata 14, R 4.0.1 and SAS 9.4.

**Attitudes and perceptions of healthcare workers towards COVID-19 vaccines**

Among the 2,768 participants, 79.6% (n = 2,132) would certainly or probably recommend a future COVID-19 vaccine to their patients; and 72.4% (n = 1,939) would certainly or probably agree to be vaccinated with it (Table 1).

Pooling the answers to the two questions about willingness of HCWs to get vaccinated with future COVID-19 vaccines and their intention to recommend the vaccines to their patients into the variable ‘COVID-19 vaccine acceptance’ and using the score yielded 48.6% (95% confidence interval (CI): 46.2–51.0) of participants with high acceptance, 23.0% (95% CI: 21.1–25.1) with moderate acceptance, and 28.4% (95% CI: 26.3–30.6) with hesitancy or reluctance. Moreover, 40.9% of participants reported that the safety of vaccines developed in an emergency during an epidemic cannot be guaranteed (Table 1).

**Concerns about the safety of future COVID-19 vaccines: main drivers of hesitancy or reluctance**

A multi-model averaged polytomous logistic regression [9], with high acceptance as the reference, showed that this opinion about the safety of vaccines developed in an emergency was, by far, the most important factor independently associated with hesitancy or reluctance and with moderate acceptance (Table 2); this factor had the highest partial Nagelkerke’s pseudo-R² (17%, Table 3), a statistic computed to measure the contribution of each explicative variable to the dependent variable [10]. The replication of this result in separate analyses for each country (data not shown) suggests that these findings are robust and, above all, transcend background cultural, professional and social factors [11,12]. Moreover, we found minimal but not statistically significant changes in HCWs’ attitudes after press releases about a COVID-19 vaccine’s effectiveness and safety [13].

We also found that distrust in the ministry of health to ensure vaccine safety, was the second factor most strongly associated with lower COVID-19 vaccines acceptance (partial R²: 4%, Table 3).

Unsurprisingly, history of personal vaccination against seasonal influenza was also independently predictive of HCWs’ acceptance of COVID-19 vaccines (Table 2), as previously found in the influenza A(H1N1)pdm09 pandemic [14]; this suggests the weight of personal habits regarding vaccination in HCWs.

**Ethical statement**

The ethics boards of the University-Hospital-Centre Saint-Pierre (Belgium, CE/20–10–14), the Conseil national de l’information statistique (France, CNIS, avis n°114/H030) and the University-Hospital Centre of Québec–Laval University (Québec, #2021–5286) approved the study protocol and questionnaire.

**Discussion**

For several months now, a number of studies in several countries have indicated negative attitudes towards future vaccines against COVID-19, in proportions of up to or exceeding 30–40% of the general population [15,16]. A principal reason for such attitudes seems to be the concern that the new vaccines will not be safe [16]. Regarding HCWs, past experience with pandemic influenza vaccination suggests that not all of them will agree to be vaccinated against COVID-19 [14]. However, currently, there are only few publications about HCWs’ acceptance to get vaccinated with COVID-19 vaccines and, to our knowledge, none about their intention to recommend these vaccines to their patients. Previous reports suggest that willingness to get vaccinated lies between 60% and 90% among physicians in Greece (February 2020) and France (March–July 2020) [17,18] and between 40% and 60% among nurses in Hong Kong, China (February–March 2020) and France [18,19]. In our study, 72.4% of participating HCWs would be in favour of getting vaccinated with a future COVID-19 vaccine and 79.6% would be willing to recommend it to their patients.

It is often mistakenly believed that HCWs’ attitudes must be positive towards vaccines because they have scientific and medical training. Nevertheless, HCWs are not a homogenous group and most are not experts in the field of vaccination [20]. Immunisation is moreover not an important part of their initial training [21], and professionals attracted by a further education in this field tend to be those already ‘convinced’ about the benefits of vaccines. Numerous studies indicate that vaccine hesitancy exists among HCWs, at prevalence and intensity levels that vary inversely with their level of training on this topic [11,22-24]. In our work, the perception that vaccines developed in an emergency cannot be guaranteed safe, appeared to play an important role on acceptance of COVID-19 vaccines. Analyses restricted to French GPs even suggest that despite reassuring evidence from phase 2 clinical trials [25], the perception of these vaccines’ hypothetical risks is more influential than the perception of the
| Factors                                                                                                                                  | COVID-19 vaccine acceptance<sup>b</sup> (ref.: high acceptance<sup>c</sup>) | Moderate acceptance | Hesitancy/reluctance |
|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|---------------------|-----------------------|
|                                                                          | aOR          | 95% CI  | aOR          | 95% CI   |
| **Healthcare worker characteristics**                                                                                                 |                                                                         |                     |           |
| **Age in years**                                                            |                                                                         |                     |           |
| 18 to 39                                                                   | Ref.         | Ref.    | Ref.         | Ref.     |
| 40 to 59                                                                   | 0.74         | 0.58–0.94 | 0.57         | 0.43–0.74 |
| 60 and over                                                                | 0.74         | 0.41–0.76 | 0.35         | 0.24–0.50 |
| **Gender**<sup>d</sup>                                                        |                                                                         |                     |           |
| Male                                                                       | Ref.         | Ref.    | Ref.         | Ref.     |
| Female                                                                     | 1.22         | 0.96–1.55 | 1.89         | 1.44–2.49 |
| **Country and type of healthcare worker**                                    |                                                                         |                     |           |
| France (whole country), GPs                                                | Ref.         | Ref.    | Ref.         | Ref.     |
| Belgium (Brussels and Wallonia), GPs                                       | 1.48         | 1.09–2.02 | 1.64         | 1.14–2.35 |
| Canada (Quebec), nurses                                                    | 0.53         | 0.40–0.71 | 0.58         | 0.42–0.80 |
| **Personal vaccination: were you vaccinated against seasonal influenza for the winter 2019/20 season?**                               |                                                                         |                     |           |
| No/non-response                                                             | Ref.         | Ref.    | Ref.         | Ref.     |
| Yes                                                                        | 0.66         | 0.49–0.88 | 0.37         | 0.28–0.50 |
| **Vaccine recommendation: hesitancy to recommend vaccines to at-risk patients**                                                  |                                                                         |                     |           |
| None                                                                       | Ref.         | Ref.    | Ref.         | Ref.     |
| Yes                                                                        | 1.36         | 1.09–1.70 | 1.58         | 1.25–2.01 |
| **Perceived risks of new vaccines in emergencies: the safety of a vaccine developed in an emergency, during an epidemic, cannot be considered guaranteed** |                                                                         |                     |           |
| Disagree                                                                   | Ref.         | Ref.    | Ref.         | Ref.     |
| Agree                                                                      | 3.01         | 2.38–3.79 | 12.93        | 9.65–17.33 |
| Do not know                                                                | 1.89         | 1.39–2.56 | 5.81         | 4.06–8.31 |
| **Perceived utility of vaccines: it is preferable to acquire immunity against infectious diseases naturally (by having the disease) than by vaccination** |                                                                         |                     |           |
| Disagree                                                                   | Ref.         | Ref.    | Ref.         | Ref.     |
| Agree/do not know/non-response                                              | 1.57         | 1.05–2.36 | 1.74         | 1.15–2.63 |
| **Trust in science and in the ministry of health**                           |                                                                         |                     |           |
| I trust science to develop safe effective new vaccines                      |                                                                         |                     |           |
| Disagree/do not know/non-response                                          | Ref.         | Ref.    | Ref.         | Ref.     |
| Agree                                                                      | 0.81         | 0.45–1.46 | 0.38         | 0.22–0.65 |
| I trust the ministry of health to ensure that vaccines are safe             |                                                                         |                     |           |
| Disagree                                                                   | Ref.         | Ref.    | Ref.         | Ref.     |
| Agree                                                                      | 0.82         | 0.58–1.16 | 0.34         | 0.24–0.47 |
| Do not know/no response                                                    | 1.10         | 0.61–1.97 | 1.25         | 0.73–2.13 |
| **Period of questionnaire completion**                                      |                                                                         |                     |           |
| Before 10 November 2020<sup>e</sup>                                        | Ref.         | Ref.    | Ref.         | Ref.     |
| From 10 November 2020 onwards                                              | 0.97         | 0.73–1.29 | 0.84         | 0.62–1.15 |

<sup>a</sup> aOR: adjusted odds ratios; CI: confidence interval; COVID-19: coronavirus disease; GP: general practitioner; Ref.: reference.
<sup>b</sup> The three country samples were merged. 255 observations were excluded because vaccine recommendation did not apply to some participants’ practices (these exclusions do not significantly change the results).
<sup>c</sup> The COVID-19 vaccine acceptance variable was based on the results of two questions: (i) willingness to recommend the COVID-19 vaccines to patients, (ii) willingness to get vaccinated against COVID-19. ‘High acceptance’ indicates certainty of willingness to get vaccinated and to recommend vaccinations to patients, ‘moderate acceptance’ indicates the participant’s intention to probably self-vaccinate and recommend the vaccine to patients, and ‘hesitancy/reluctance’ refers to uncertainty (‘do not know’ responses) or reluctance to be self-vaccinated or to recommend COVID-19 vaccines to patients.
<sup>d</sup> Gender was considered in the study, rather than sex, to capture socio-cognitive factors associated with healthcare workers’ attitudes and practices.
<sup>e</sup> Date of European media coverage of the press release about a COVID-19 vaccine’s effectiveness and safety [13]. Terms in bold indicate statistical significance at the p < 0.05 level.
harm potentially resulting from the pandemic (ranked fifth, data not shown). Yet, the consequences of the pandemic are widely documented and experienced individually by most GPs in their daily practice.

Our survey also found that distrust in the ministry of health to ensure vaccine safety also seemed to play a role in lower COVID-19 vaccines’ acceptance. Trust in the institutions through which information about vaccines is delivered is an essential driver of vaccine acceptance not only for the general population but also for HCWs, as long as social context shapes how information is interpreted and used [11,22]. This trust has been tested since the pandemic began by a number of controversies (e.g. effectiveness of masks and specific old or new drugs). The minimal changes in HCWs’ attitudes after the press releases about a COVID-19 vaccine’s effectiveness and safety [13] raises concerns that these attitudes might not be easily amenable to change in some healthcare professionals, especially also given the relatively low trust of HCWs in the pharmaceutical industry [20]. It is essential to regularly monitor the attitudes and practices of healthcare professionals toward COVID-19 vaccines in the period ahead, not only because of their role in vaccination campaigns, but also, of course, because they are involved in patient care.

Strengths and limitations

Although participation rates in France and Quebec were high for online surveys, generalisation of the results presented here requires caution, and confirmation in other countries is warranted. Reporting biases, especially social desirability biases are possible. These could potentially lead to over-reporting high COVID-19 vaccine acceptance, which would not change our conclusions. Causal inferences cannot be drawn from this cross-sectional and observational study. However, the model averaging approach enabled us to obtain robust estimates and rank the explicative factors.

Conclusion

Because HCWs should be among the first to receive the vaccines, their concerns about the safety of these vaccines must be addressed as early as possible [26]. Building trust will require that independent committees and trusted bodies (such as national immunisation committees and professional associations) provide HCWs with credible information about these vaccines’ safety and efficacy. In this respect, the monitoring of side effects of authorised vaccines and regular and reactive feedback to healthcare professionals are essential to ensure trust in both COVID-19 vaccines and health authorities. We also need a framework, guidelines, approaches and tools that have proven their effectiveness in addressing HCWs’ vaccination concerns that may persist. The upcoming vaccination campaign offers an unprecedented opportunity to develop and evaluate effective interventions targeting HCWs to address their general and specific vaccine hesitancy.

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Table 3

| Factors                                                                 | Global Ranka | Importance Weightb | Partial R²c (%) |
|------------------------------------------------------------------------|--------------|--------------------|----------------|
| The safety of a vaccine developed in an emergency, during an epidemic, cannot be considered guaranteed | 1            | 1.00               | 17.0           |
| I trust the ministry of health to ensure that vaccines are safe         | 2            | 1.00               | 4.0            |
| Personal vaccination against seasonal influenza                         | 3            | 1.00               | 2.0            |
| I trust science to develop safe effective new vaccines                  | 4            | 1.00               | 1.0            |
| Score of hesitancy about recommending vaccines to at-risk patients      | 5            | 1.00               | 1.0            |
| It is preferable to acquire immunity against infectious diseases naturally (by having the disease) than by vaccination | 6            | 0.88               | 0.0            |
| Period of questionnaire completiond                                     | 7            | 0.20               | 0.0            |
| Total Nagelkerke Pseudo-R²                                             | NA           | NA                 | 30.0           |

COVID-19: coronavirus disease; NA: not applicable.

a The ranking of the explanatory variables according to their importance in the model, in terms of strength of association, can be derived from the values of the importance weights: 0.00 to <0.50, no association; 0.50 to <0.75, weak association; 0.75 to ≤0.95, positive association; 0.95 to <0.99, strong association; 0.99 to ≤1.00, very strong association.

b Importance of the explanatory variables in the model.

c Part of the dependent variable variance explained by the explanatory variable: the sum of all partial R² gives the Nagelkerke Pseudo-R² (a statistic comparable to R² in linear regressions).

d Before 10 November (date of European media coverage of the Pfizer press release about a COVID-19 vaccine’s effectiveness and safety) and on and after this date [13].
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Conflict of interest
ND is an unpaid consultant for MSD Belgium on the topic of vaccine pharma-economics.

Authors’ contributions
PV, KA, AG and ED designed the questionnaire. PV, ND, CG and ED coordinated the surveys in their own countries. DS and ED coordinated the surveys in their own countries. DS, PV, KA, AG and ED designed the questionnaire. PV, ND, CG and ED reviewed the manuscript.

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