Implementing a self-triage web-application for suspected COVID-19 patients' triage: impact on emergency call centers

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Abstract

Background: We developed a self-assessment web-application for COVID-19 symptoms which was launched in France in March 2020, when French health authorities recommended all patients with suspicion of COVID-19 to call an emergency phone number.

Objective: Our objective was to determine if a self-assessment tool could reduce the burden on emergency call centers and help predict increasing burden on hospitals.

Methods: Users were asked questions about underlying conditions, sociodemographic status, Zip code and main COVID-19 symptoms. Participants were advised to call an emergency call center if they reported dyspnea or complete anorexia. Data were collected on COVID-19 related calls from six emergency call centers and on Covid-19 hospitalizations from Santé Publique France and the French Ministry of Health. We examined the change in numbers of emergency calls before and after the launch of the website.

Results: From 17 March to 2 April, 735,419 questionnaires were registered in the study area (figure 1). 121,370 (16.5%) led to a recommendation to call an emergency center. Peak of connections and recommendations to call an emergency center was observed on 22 March 2020. In the 17 days preceding the launch of the website, emergency call centers in the study area registered a total of 66,925 Covid-19 related calls and local hospitals admitted 639 patients for Covid-19, that is a ratio of 104.7 emergency calls for one hospitalization for COVID-19. In the 17 days following the launch of the website, there were 82,347 emergency calls and 6009 new hospitalizations for Covid-19, that is a ratio of 13.7 calls for one hospitalization (Chi-2 test: P<.001) (figure 2).

Conclusions: Self-assessment web-application kick-off was followed by a ten-fold increase in COVID-19 related hospitalizations with only 23% increase in emergency calls. Peak of connections preceded peak of COVID-19 related hospitalizations by five days. While the design of the study does not allow to conclude that the self-assessment tool alone contributed to the alleviation of the emergency call centers, it does suggest that it played a role, and may be used for predicting increasing burden on hospitals. Clinical Trial: NCT04331171

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Key words: COVID-19; self-triage; emergency medical services; emergency call center;

questionnaires; application; web-application; digital health; smartphone; mobile phone.

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Sponsor: (Weprom) designed and conducted the study; collection, management, analysis, and interpretation of the data; approval of the manuscript.

Abstract:

Introduction:

We developed a self-triage web-application for COVID-19 symptoms which was launched in France in March 2020, when French health authorities recommended all patients with suspicion of COVID-19 to call an emergency phone number. Our objective was to determine if a self-triage tool could reduce the burden on emergency call centers and help predict increasing burden on hospitals.

Methods:

Users were asked questions about underlying conditions, sociodemographic status, Zip code and main COVID-19 symptoms. Participants were advised to call an emergency call center if they reported dyspnea or complete anorexia for over 24 hours. Data were collected on COVID-19-related calls from six emergency call centers and on COVID-19 hospitalizations from Santé Publique France and the French Ministry of Health. We examined the change in numbers of emergency calls before and after the launch of the web-application.

Results:

From 17 March to 2 April, 735,419 questionnaires were registered in the study area. 121,370 (16.5%) led to a recommendation to call an emergency center. Peaks of overall questionnaires and of questionnaires leading to recommend calling an emergency center were observed on 22 March 2020. In the 17 days preceding the launch of the web-application, emergency call centers in the study area registered 66,925 COVID-19-related calls and local hospitals admitted 639 patients for COVID-19, that is a ratio of 104.7 emergency calls for one hospitalization for COVID-19. In the 17 days following the launch of the web-application, there were 82,347 emergency calls and 6009 new hospitalizations for COVID-19, that is a ratio of 13.7 calls for one hospitalization (Chi-2 test: $P<.001$).

Discussion:

Self-triage web-application kick-off was followed by a close to ten-fold increase in COVID-19-

related hospitalizations with only 23% increase in emergency calls. Peak of connections preceded peak of COVID-19-related hospitalizations by five days. While the design of the study does not allow to conclude that the self-triage tool alone contributed to the alleviation of the emergency call centers, it does suggest that it played a role, and may be used for predicting increasing burden on hospitals.

Manuscript:

Introduction:

From February 2020, France has been hit by a severe COVID-19 epidemic which partly overwhelmed health system capacities. At the beginning of the epidemic, the French Ministry of Health recommended all patients with suspicion of COVID-19 call an emergency call center (Centre 15). As a result, long delays before reaching an operator were experienced by patients, some of them with a condition requiring emergency care. In this context, triage tools pre-selecting patients who should call the emergency call center may be particularly helpful. Web-based self-triage of symptoms is a growing field and has been shown to improve survival in oncology [1,2]. Past data have shown the feasibility of self-triage by parents of children with influenza-like illnesses although specificity was weak [3]. Self-triage symptom checkers have higher levels of appropriate triage when used for emergency care, according to a study on symptoms checkers that are available in Australia [4]. The use of web-based tools for COVID-19 management is currently expanding [5], but little data are available on self-triage and its impact on healthcare use. We sought to develop a web-based self-triage tool to optimize triage of COVID-19 patients in France. A web-application [6] was developed and launched during the growing phase of the COVID-19 epidemic in France in March 2020. Our objective was to determine if a self-triage tool for COVID-19 could reduce the burden on emergency call centers and help predict increasing burden on hospitals.

Methods:

The web-application was launched on March 17, 2020 via national media campaign in France including social media, radio and magazine media. At that time, the French Ministry of Health recommended that all patients with suspicion of COVID-19 call an emergency call center. Recruitment process via the web-application was already detailed in a previous work [7]. Participants were asked about their Zip code, preexisting conditions and potential COVID-19 symptoms (fever defined as body temperature >37.7°C, unusual cough, shortness of breath, sore throat, muscle aches,

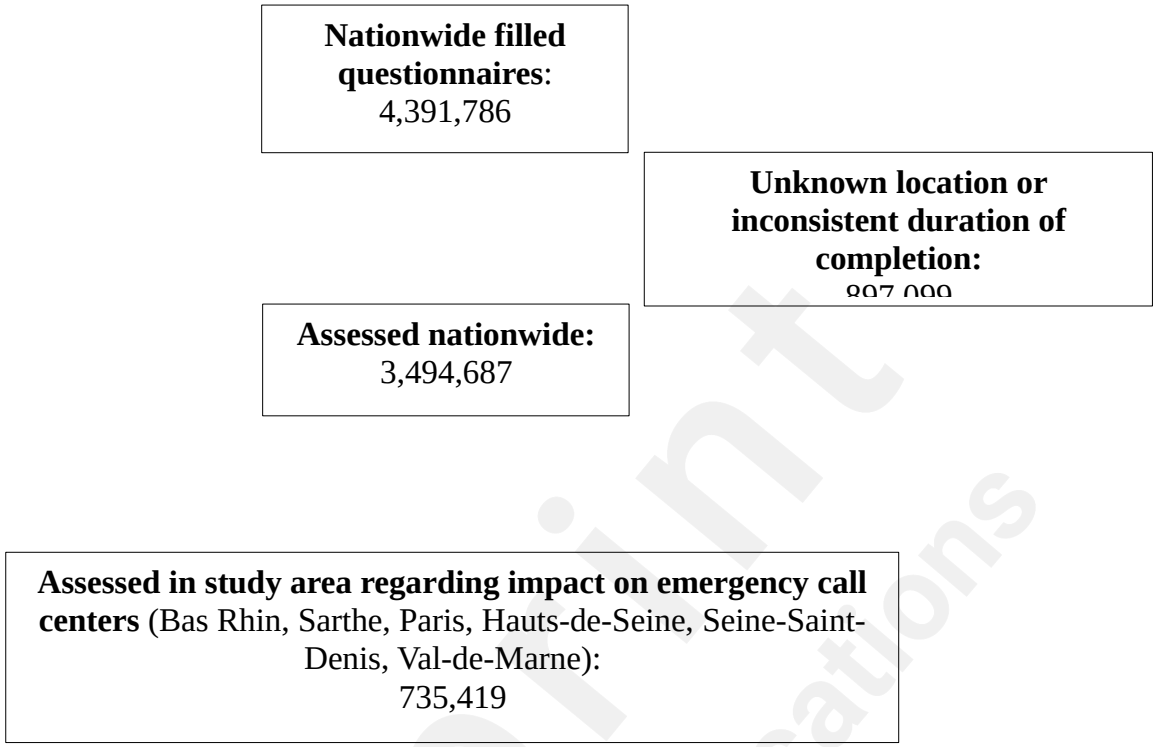
diarrhea, anorexia, fatigue, anosmia and ageusia). Depending on reported symptoms and underlying conditions, the user was recommended either to stay home and re-use the application in case of evolving symptoms (self-monitoring), or to contact a general practitioner (GP), or to call an emergency call center (if they reported shortness of breath or complete anorexia for over 24 hours) [8]. The web-application did not offer monitoring of adherence of the participant to the self-triage recommendation. Access to web-application did not require login nor creating an account. The web-application did not identify participants who responded several times nor any follow-up of participants. Questionnaires were excluded from the analysis if they did not include Zip code or if completion duration was considered inconsistent (below 30 seconds). The study was approved by the French National Health-Data Institute which reviews ethical conduct of human subject's research, data confidentiality and safety.

We collected data on COVID-19-related calls from six emergency call centers who cover some of the most severely COVID-19 affected areas in France (Bas-Rhin, Paris, Hauts-de-Seine, Seine-Saint-Denis, Val-de-Marne) where burden was expected to be highest on emergency call centers, and one area where the web-application was advertised through local papers few days before nationwide communication, allowing for an earlier evaluation of impact (Sarthe). Data include calls made before the web-application kick-off, from the day the first COVID-19-related hospitalization following an emergency room (ER) consultation was reported in the study area. That period covers the 17 days preceding web-application kick-off, starting 29 February 2020. All of the territories covered in the study area had reported their first hospitalization following ER consultation for COVID-19 by 3 March 2020. We collected the same data in the 17 days following web-application kick-off. Data of daily hospitalizations for COVID-19 following evaluation at an ER in the study area were provided by Santé Publique France and the French Ministry of Health. We compared the ratio of daily emergency center calls reported by emergency call centers on daily hospitalizations for COVID-19 before and after the launch of the web-application using a Chi-2 test.

Results:

From 17 March to 2 April 2020, there were nationwide 4,391,786 filled questionnaires (figure 1). 897,099 questionnaires were excluded from analysis for unavailable Zip code or inconsistent completion duration. The number of assessed questionnaires represent the number of assessments and not individuals. Among the 3,494,687 assessed questionnaires, 558,236 (16.0%) led to recommend calling an emergency call center. In the study area, 735,419 questionnaires were assessed, among which 121,370 (16.5%) led to a recommendation of calling an emergency call center. Both peaks of overall questionnaires and of questionnaires leading to a recommendation of calling an emergency center were observed on 22 March 2020 and were 155,415 and 23,952, respectively (figure 2).

Figure 1: Flowchart of self-triage web-application respondents



The first hospitalization for COVID-19 following an ER consultation in the study area was reported on 29 February. Peak of hospitalizations was observed on 27 March with 553 hospitalizations (figure 2).

In the 17 days preceding web-application launch, emergency call centers in the study area registered 66,925 COVID-19-related calls and local hospitals admitted 639 patients for COVID-19, that is a ratio of 104.7 calls associated with one hospitalization. In the 17 days following application kick-off, there were 82,347 COVID-19-related emergency calls (a 23% increase from the previous period) and 6009 new hospitalizations for COVID-19 (a 9.4-fold increase from the previous period), that is 13.7 calls associated with one hospitalization (Chi-2 test: $P<.001$) (Figure 2).

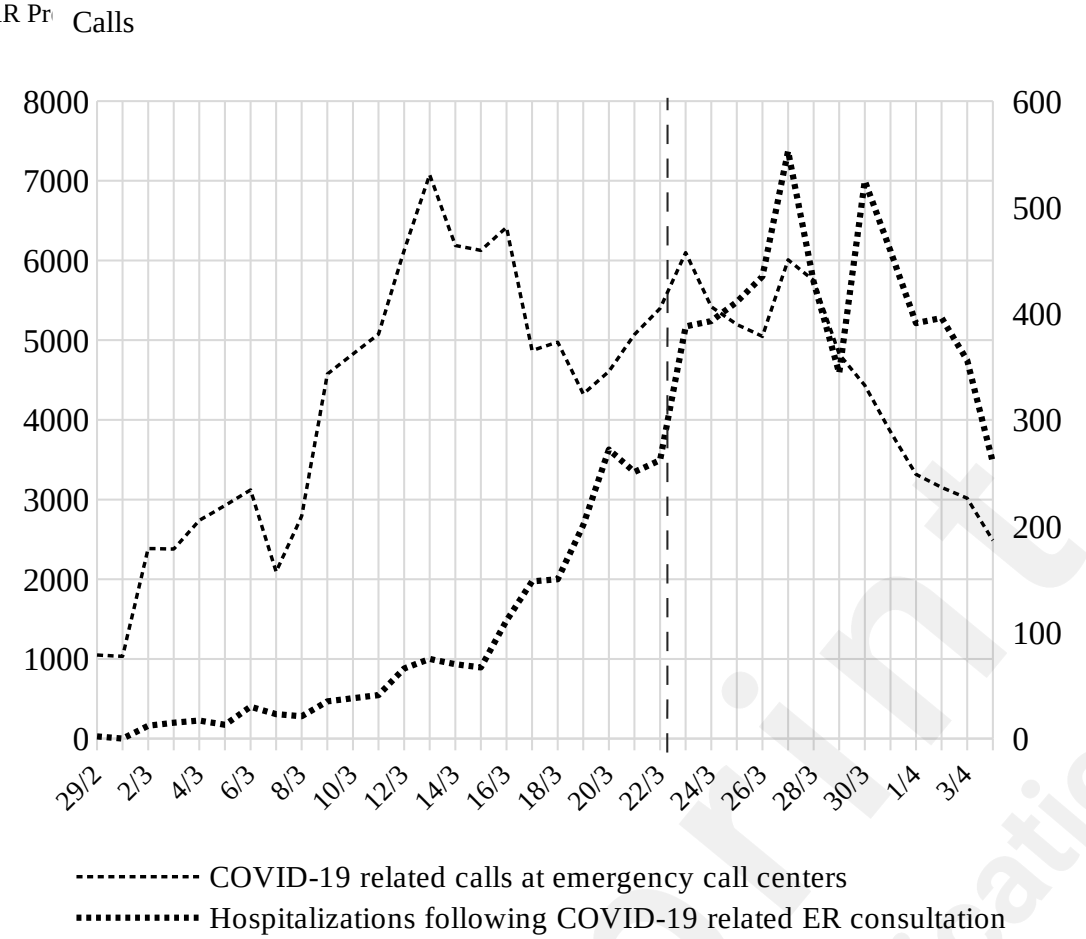
Figure 2:

Data from the study area (raw numbers):

A: COVID-19-related calls to emergency call centers, hospitalizations following a COVID-19-related emergency room consultation

B: Overall assessed questionnaires and among those assessed questionnaires with recommendation to call an emergency center (web-application launch 17 March 2020)

A



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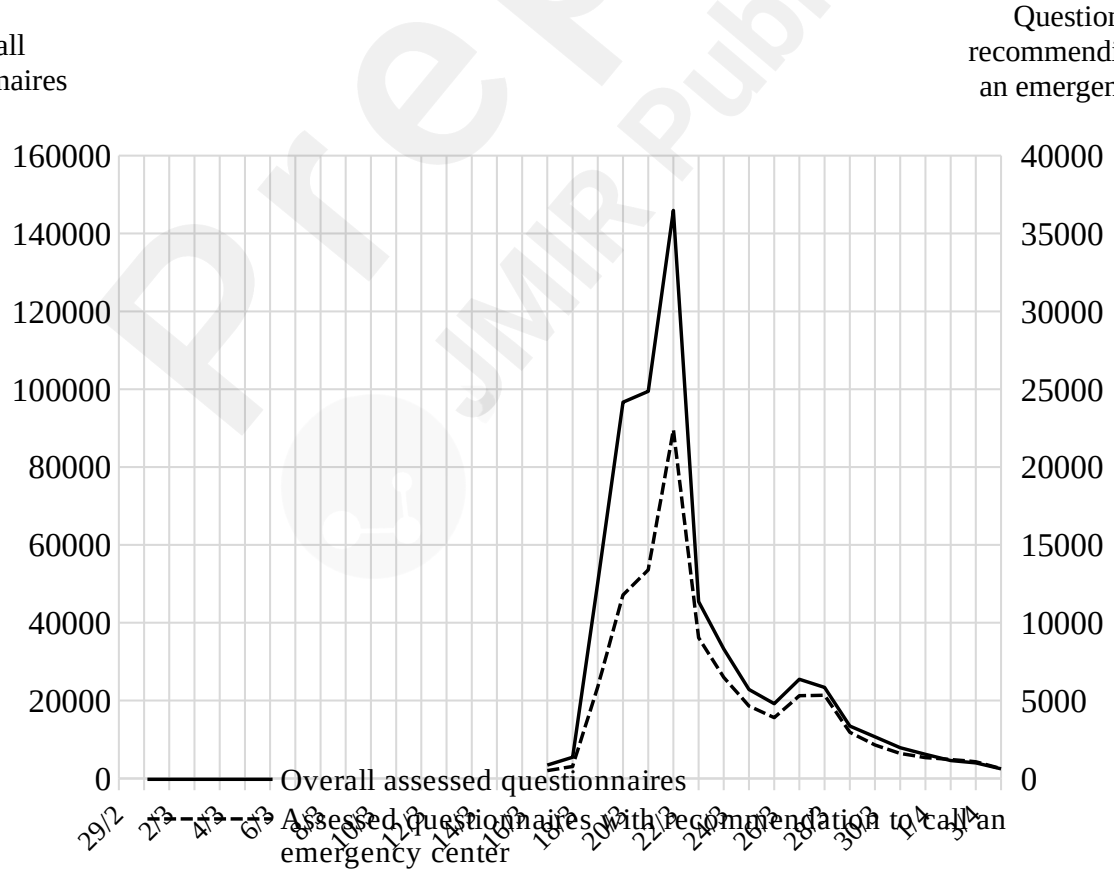

Discussion:

Self-triage web-application kick-off was followed by a close to ten-fold increase in COVID-19-related hospitalizations with only 23% increase in emergency calls, whereas overall filled questionnaires on the self-triage web-application quickly surged, including questionnaires leading to a recommendation to call an emergency center, indicating an appropriate use of the tool. Both peaks of overall questionnaires and of questionnaires leading to recommend calling an emergency center happened five days after lockdown started in France on 17 March. This is compatible with a maximum incidence rate of SARS-CoV-2 infections one day before lockdown, considering a mean 5-day incubation period for COVID-19 [9,10]. There was a further delay of five days between the peaks of questionnaires to the peak of COVID-19-related hospitalizations, consistent with a mean duration between infection and hospitalization for severe forms of disease of 10 days, as previously described [11]. It is unknown how many questionnaires were filled by people with actual COVID-19. However, nationwide daily incidence immediately lockdown onset on 17 March 2020 has been estimated between 180,000 and 490,000 in a study by Salje *et al.* [12]. Positive predictive value of general symptoms such as dyspnea or anorexia increases in such a high incidence setting, suggesting a significant share of people reporting emergency warning signs during the surge peaking on 22 March actually had COVID-19 (although more precise evaluation is impossible). It indicates that the self-triage tool could help predict rises in severe cases and burden on hospitals. This hypothesis needs confirmation would a new surge in COVID-19 cases and related hospitalizations occur.

There are little data regarding the impact of self-triage tools on healthcare use. A recent systematic review of self-triage symptom checkers for urgent health problems suggests they lead to less frequent healthcare use [13]. Verzantvoort *et al.* reported 67% of patients receiving a self-care advice intended to follow the advice [14]. In COVID-19, Judson *et al.* described a dedicated self-triage tool that recommended self-care to 40% of symptomatic patients, which was mostly followed as only 8% of them had an in-person visit in the following 48 hours, suggesting effective reduction in unnecessary

GP or ER visits [15].

The design of the present study does not allow to conclude that the self-triage tool alone contributed to the alleviation of the emergency call centers. Other interventions such as the creation of an information hotline for non-urgent COVID-19-related questions happened little after web-application kick-off and may have contributed to relieve burden on emergency call centers. The sudden drop in overall questionnaires following the peak may be related to the drop in infections after the lockdown, but may also indicate the influence of media campaigns which promoted the use of the web-application. Interpretation of peaks in website use should therefore be cautious and take into account those campaigns. Altogether, we think that a self-triage tool can be useful in periods of high incidence of COVID-19, when healthcare use quickly surges and healthcare providers such as emergency call centers endure a rapidly increasing burden. Helping predict increasing burden on hospitals may also help policymakers and healthcare providers anticipate their response.

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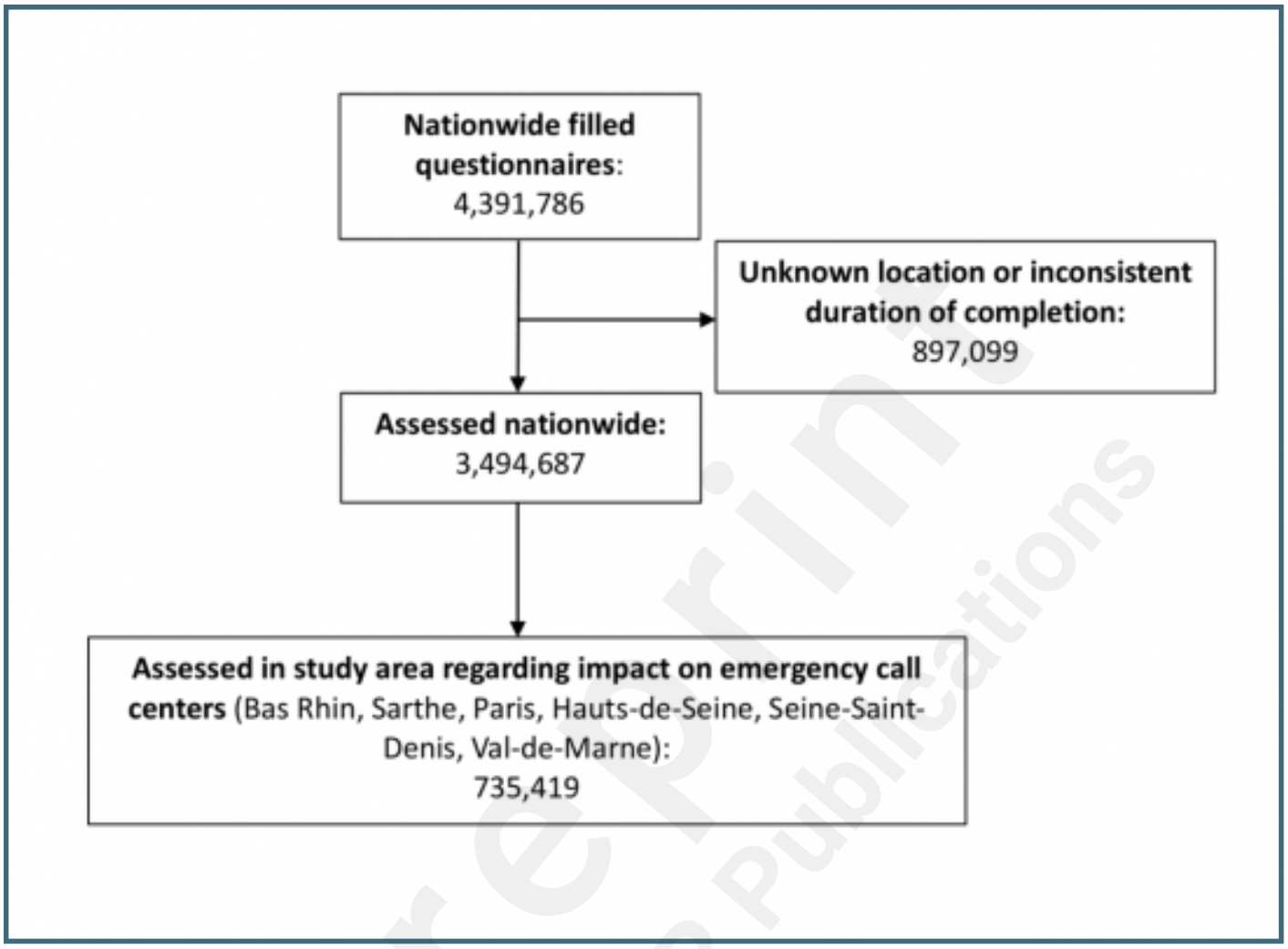
Supplementary Files

Figures

Flowchart of self-assessment web-application respondents.



Data from the study area (raw numbers): A: COVID-19-related calls to emergency call centers, hospitalizations following a COVID-19-related emergency room consultation B: Overall assessed questionnaires and among those assessed questionnaires with recommendation to call an emergency center (web-application launch 17 March 2020).