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Short Communication

The Corona Screener: Using Patient-Reported Outcomes for COVID-19 Monitoring

K. Dijke[1*], V.S. Nelson[1*], A.T. van Halteren[2], M. van Genuchten[3], R.S.L. Liem[1,4*]

[1]Leiden University Medical Centre, Leiden, Netherlands

[2]Principal Scientist, Philips Research, Eindhoven/Professor of Health Behaviour Informatics, Vrije Universiteit, Amsterdam, Netherlands

[3]COO Philips Vital Health, Ede, Netherlands

[4]Surgeon, Head of Department of Surgery, Groene Hart Hospital, Gouda, Netherlands

[*]**Corresponding author:** Ronald Liem, Surgeon, Head of Department of Surgery, Groene Hart Hospital, Gouda, Bleulandweg 10, 2801HH Gouda, Netherlands

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The region around the city of Gouda was one of the regions in the Netherlands that had been hit badly during the first wave of the COVID-19 pandemic. On the 25th of March 2020, the Corona Screener was launched in collaboration between the Groene Hart Ziekenhuis (GHZ) in Gouda and Philips VitalHealth. The screener included a digital questionnaire for triaging patients with respiratory symptoms and to monitor these patients during their disease course. In the Netherlands the General Practitioner (GP) functions as gatekeeper for the healthcare system and is the one who decides whether a referral to the hospital is necessary. Unburdening first line-care with limited resources was the primary goal of the screener. The set-up of the GHZ Corona screener made it possible for GPs to focus on essential care and it prevented the throughput of patients to the hospital who had not been triaged. The population of the region around Gouda accounts for 230 thousand people [1]. During this period 637 cases of COVID-19 were confirmed in the region surrounding Gouda [2], of which 163 were admitted to the GHZ, the only hospital in the area. Forty-eight patients were treated in the ICU and 24 people died as a result of COVID-19 [2]. 2252 patients used the Corona screener during a 7-week period, which amounts to 1% of the population in this area.

Corona Screener

The initial concept of the Corona screener originated 3 weeks before launching. A previously existing application of Philips VitalHealth, Questmanager®, was used to develop questionnaires and to act upon their outcome [3]. We conducted the hypothesis that the automated follow-up of patients who did not need immediate care by the screener would reduce the pressure on healthcare workers. The Corona screener was published on the homepage of the hospital and the website of the GPs. The questionnaire was designed based on the prevailing guidelines of the WHO and Dutch National Institute for Public Health (RIVM) at that time. Patient-reported outcome measures, defined as any report of the status of a patient's health condition that comes directly from the patient without interpretation of the patient's response by a clinician or anyone else, provide the ideal means of systematically capturing the patient perspective and experience [4]. The screener was not designed to define whether a patient was infected with COVID-19 but intended for early recognition of a serious course of disease. Based on answers of symptoms, patients were subdivided in different categories: (1) patients without symptoms compatible with COVID-19 who did not need further follow-up, (2) patients with mild symptoms and (3) patients with serious symptoms matching COVID-19. Patients within category 2 were automatically followed-up through questionnaires designed to monitor the disease course and to act upon deterioration of their outcomes when necessary. All patients in the third category were contacted by a call-center staffed by medical students to check upon their symptoms. If patients had severe symptoms matching COVID-19, they were directly assigned to their GP. During the time the screener was live, several amendments were made to optimize the workflow of the screener. In the beginning, the threshold for contact with a GP was too conservatively chosen, whereby the primary goal of the screener defeated its purpose. After revision, the threshold for every category was adjusted and the minimal cut-off point for referring to a GP was increased. Furthermore, questions about cough and shortness of breath were adjusted to a rated slide from 0-10 instead of a yes or no answer, enabling the call-center staff to make a better and standardized estimation of disease symptoms.

Data Analysis from the COVID-19 Screener

We included every patient who filled in the Corona screener and gave permission for their data to be collected in the

data analysis. Double reponses, e.g. patients who took multiple questionnaires within 48 hours, were excluded. Overall, 2252 patients completed the Corona screener within a period of 7 weeks. Data analysis showed that common cold symptoms (such as nasal cold, runny nose, sneezing or a sore throat) were the most frequently reported by patients from the 2nd category. Patients within the 3rd category, however, did more often report a combination of multiple symptoms, but there was no specific symptom that stood out in this category. At the initial screening questionnaire, the mean age of patients within the first category appeared to be higher than those of patients from the 2nd or 3rd category (Figures 1,2). This phenomenon could possibly be explained by the fact that elderly patients have a greater tendency to fill out the Corna screener when experiencing minor to moderate symptoms, while younger patients only make use of the screener when symptoms get more severe. 859/2282 patients (38%) were automatically followed up by an additional questionnaire(s) from the screener and 286/2282 (13%) patients were called by the call-center to verify their symptoms and to complete the follow-up (Table 1). Six patients have been committed to the GHZ because of COVID-19, one of these patients was admitted to the ICU. These six patients have all been called by the call-center before their hospital admission to check upon their symptoms and to refer them to the GP. There were some false-positive results; patients who have been followed up by the call center or referred to the GP, while in retrospect interference from a health-care worker was not per se necessary. However, the method of the Corona screener has prevented multiple unnecessary contacts with the first-line healthcare from happening during the first wave of the COVID-19 pandemic.

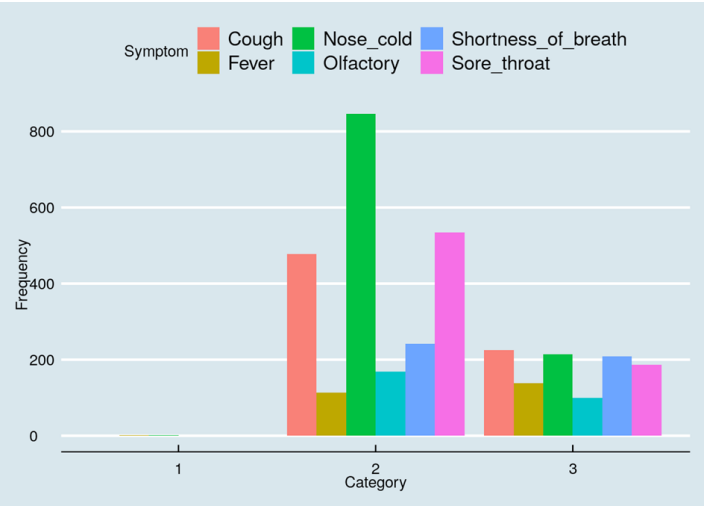

Figure 1: Frequency of symptoms per category. Category 1: Patients without COVID-19 symptoms. Category 2: Patients with mild symptoms. Category 3: Patients with serious symptoms.

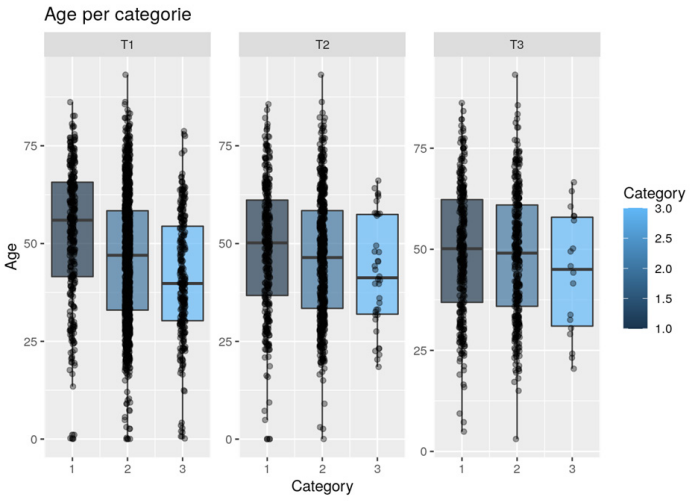

Figure 2: Boxplot of distribution of age per questionnaire disaggregated in category. T1= Initial screener. T2= First follow-up questionnaire. T3= Second follow-up questionnaire.

Questionnaire COVID-19
Do you have a fever (>38 ˚C)
To what extent do you experience coughing? (Rating slide 0-10)
To what extent do you experience shortness of breath? (Rating slide 0-10)
Do you have a sore throat?
Do you have a nose cold?
Did you recently lose your sense of smell, without nasal congestion?
Since how many days do you experience symptoms?
Are you above 70 years of age?
Are you under 70 years of age and did you receive a call this year to get vaccinated for the flu because of pre-existent disease?

Table 1: Corona screener questionnaire. Rating slide for coughing: 0: no cough at all and 10: most severe cough. Rating slide for dyspnoea: 0: no dyspnoea and 10: most severe dyspnoea, comparable to a visual analogue scale [5].

GHZ COVID-19 Screener vs. OLVG Corona Check: A Comparison

Besides the GHZ Corona screener, another comparable screening application was introduced in the Netherlands by the Onze Lieve Vrouwe Gasthuis (OLVG) in Amsterdam during the first wave of the pandemic. This screening application was called the "OLVG corona check" and had comparable objectives to the GHZ Corona screener. However, the two screening applications did differ significantly in their methods. The GHZ Corona screener

was restricted to first-line-care in the Netherlands and the GP always kept in control of the care for their patients. In the OLVG, however, patients were followed-up by doctors from the hospital. In contrast to the OLVG corona check, the follow-up of the GHZ Corona screener is partly automated. Follow-up questionnaires were sent automatically to patients with mild or moderate symptoms. Therefore, the call-center attached to the screener had to employ only two medical students for each shift at the most, while the OLVG corona check had a much bigger team of health-care workers working on their screener application. Moreover, the GHZ Corona screener used closed-loop surveillance. Patients with severe symptoms were actively follow-up within 1 hour by the call-center and, if necessary, directly referred to the GP. This differs significantly from the OLVG corona check, which did not have an automated follow-up and in which the patients were called within 24 hours after filling in the questionnaire.

Conclusion

While the first wave of the COVID-19 pandemic threatened to overwhelm the Dutch health-care system, there was a high need for a tool to redirect the care for patients with COVID-like symptoms in the first-line-care. The Corona screener tool enabled us to automatically follow-up the majority of these patients without any interference from the GP or the call-center. Patients who were categorized with severe symptoms were contacted by the call center within one hour and, if necessary, directly referred to the GP. Although some surveys turned out to be false-positive (e.g. categorized as severe symptoms while the symptoms were moderate), many unnecessary contacts with first-line-care workers have been prevented. Hence, the GHZ Corona screener was a valuable tool to lower the burden for the (first-line) healthcare in the region of Gouda during the first wave of the COVID-19 pandemic. Self-triage through digital surveys could be a valuable asset during times of crisis when medical resources are limited and the treatment capacity of the healthcare is at risk to be exceeded. Future research should determine whether self-triage screening tools could also be applied within other fields of medicine, for example in the follow-up of patients with chronic diseases.

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