




Letter to the Editor

Can the implementation of electronic surveys with quick response (QR) codes be useful in the COVID-19 era?

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The world is facing a health crisis with the outbreak of a novel coronavirus-caused respiratory disease (COVID-19). Strong measures (e.g. lockdown) and restrictions to limit the spread of infection have been adopted worldwide. Hand washing, maintaining physical distance (1–2 m) and using protective masks are the main measures recommended by the World Health Organization (WHO)¹ and seem to be effective,² but they cannot be maintained forever.

Self-administered electronic surveys are an important data collection tool in clinical practice and epidemiology. Being less resource-intensive than other data collection methods, they are ideal for achieving wide geographical population coverage and for dealing with sensitive topics. Electronic surveys can be administered in various ways. E-mail-based surveys have existed since 1986³ and website-based surveys since the early 1990s,⁴ but both have limitations and low response rates. Email-based surveys require users to have an email address, and users may ignore e-mails flagged as spam or be reluctant to complete surveys received via e-mail. For website-based surveys, people may have trouble finding the correct website and be unlikely to remember and correctly enter a long web address.

In recent years, technology advances have allowed electronic surveys to be implemented using mobile apps on smartphones or tablets. However, to use these tools, people must remember the name of the app and be familiar with using the app store.

Quick response (QR) codes can also be used to implement electronic surveys and may prove useful in the COVID-19 era. A QR code is a two-dimensional barcode that can be read by the camera of smartphones or tablets

to connect instantly to websites, including surveys⁵ (see [Supplementary material](#), available as [Supplementary data](#) at *IJE* online). QR codes solve the challenges related to app/website/e-mail surveys by directing the person to the correct electronic survey without any need for URL entry, app store/web searching or mental recollection.

Creating a QR code survey is simple. The finalized online questionnaire is associated with a link that is convertible into a QR code through a free online application. Quick access to the online survey is then granted to the user by scanning the QR code with a smartphone or tablet camera. Although many other machine-readable codes (e.g. barcodes) exist, QR codes are more appropriate in health care settings because people can use them without needing to download specific scanning apps or to purchase a barcode scanner.

QR code technology is not yet widespread in the medical world, but it is gaining attention. Mira *et al.* showed that an app able to transform the QR codes on medication packaging into verbal instructions can improve elderly patients' compliance with pharmacological therapy.⁶

It is crucial to distinguish between 'open' electronic surveys, which are open to anyone to complete, and 'targeted' surveys, which are issued to specific people and automatically linked to each person's identity. Targeted surveys are sometimes conducted by giving the user a unique number or text code; another element that must be remembered and entered correctly. This problem can be solved by QR code technology, as the QR code can either direct everyone to an open survey or be unique to a specific user for a targeted survey.

During the COVID-19 pandemic, we believe that QR code-based surveys could be especially helpful to conduct large medical cross-sectional studies and to simplify clinical practice. Following are three potential applications of this technology in the COVID-19 era.

To limit physical contact and interaction time between doctor and patient

During this pandemic, all health care workers must wear personal protective equipment, which complicates interactions with patients. Collecting patients' information and medical history requires a longer time and use of tools (i.e. pen and paper) that could facilitate infection. As already experienced at the Hospital Universitario Gonzalez (Mexico),⁷ the use of a survey accessible via QR code could reduce doctor–patient interaction time. Posters containing a QR code linked to a survey that collects patients' data (e.g. symptoms, risk factors and medical history) can be placed in the waiting rooms of emergency services and general practitioners' clinics. This would provide immediate information about the patient before the medical examination, allowing the staff to quickly prioritize patients' needs. The exposure of health care workers to potentially infected patients, and vice versa, is also reduced.

To monitor clinical symptoms of patients with COVID-19 who are managed at home and of frail patients with chronic disease

The WHO prioritizes COVID-19 patients with the highest probability of poor outcomes for treatment in health care facilities, stressing that patients with mild disease and no risk factors should be managed at home. In this context, communication between health care providers and patients should be established until symptoms have completely resolved.⁸ To avoid unnecessary risks for both frail patients and health care workers, telemedicine services should be implemented as much as possible.⁹

In Italy, this patient–healthcare service communication is guaranteed by daily phone calls—a time-consuming and poorly scalable process, given the many patients affected. From a logistical point of view, the use of QR code-based targeted surveys collecting general (e.g. oxygen saturation, respiratory rate, body temperature, symptoms) and specific (e.g. depending on comorbidities) clinical data could automate the procedure. This approach would require relatively little time for trained staff to prepare and manage the survey, allowing more frequent and complete assessment of patients. To make this process efficient, the survey's QR code could be printed on the discharge letter.

As comorbidities such as respiratory and cardiovascular disease could be risk factors for developing severe COVID-

19 infection,¹⁰ the frailest patients must be protected by limiting non-essential access to health care facilities and implementing the use of telemedicine. Targeted QR code-based surveys that allow close monitoring of patients' symptoms could be useful for early identification of patients who urgently need medical care and to avoid unnecessary medical visits. Using QR codes to reference video, audio or text messages giving information about patients' therapy could also help to guarantee the best clinical care.⁶

To collect large-scale clinical and public health data

The COVID-19 pandemic is demonstrating the complexity of using an empirical approach toward a new disease about which we know little. Without large-scale data collection, it will be impossible to draw evidence-based conclusions. The efforts of the health care system should therefore be focused on collecting population clinical data. An intuitive and cheap method, such as open-to-everybody QR code surveys, could prove valuable and convenient for this. Implementing QR code access to open surveys maximizes the scalability, reliability and speed of data collection, while reducing cost.

In conclusion, to avoid the spread of the virus and rebound infections, we need to limit personal interactions. We strongly believe that digital technology could help us deal with the COVID-19 pandemic. As an efficient and serious telemedicine programme cannot be structured overnight, a simple, inexpensive and easily diffusible method, which would allow rapid optimization of scarce health care resources, could be useful. The use of QR code-based surveys has the potential to be a highly beneficial strategy in the COVID-19 era.

Supplementary Data

Supplementary data are available at *IJE* online.

Author Contributions

A.F. and S.C. developed the idea of the Letter, reviewed the literature, drafted and critically revised the manuscript.

Conflict of Interest

The authors declare they have no conflict of interest.

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