


# It Took a Global Pandemic to Demonstrate the Value of Using Technology to Routinely Collect and Use Patient-Reported Outcomes

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## Keywords

COVID-19, patient-reported outcomes, patient-reported outcome measures, PROs, PROMs, value-based health care, orthopedic surgery, patient engagement

## Introduction

When the coronavirus disease 2019 (COVID-19) global pandemic first began, there was a great deal of confusion among health care professionals, government officials, and those simply going about their daily routines (1). Indeed, physicians were unaware initially of the severity of the novel constellation of systemic and respiratory symptoms being appreciated in numerous patients. Similarly, patients were unsure of how concerned to be about a reported new virus spreading rapidly across the globe. However, it quickly became evident that this was a concerning situation that would not be alleviated in the short term.

The initial days, weeks, and months of the COVID-19 global pandemic saw an exponential growth of cases and a high death rates for those infected (2). In response, recommendations on when to seek care shifted as the health system became overwhelmed, with many suggesting avoiding the emergency room or doctors' offices unless symptoms became severe. The sad reality of this well-intentioned guidance was that sick, infected patients arrived to the hospital too late for any treatment to be successful. Thus, significant effort and resources across the health care landscape coalesced around creating large-scale public health initiatives to limit new cases, while also safely triaging infected patients. Ultimately, routine collection and use of patient-reported outcomes (PROs) through innovative software programs were the answers to this "Catch-22"-type scenario.

In this perspective, we aim to describe the software program behind the routine collection and use of PROs to screen and triage patients—and monitor employee symptoms as well—during the COVID-19 global pandemic at a single, large,

urban academic health center in the United States. Further, we discuss how similar collection and use of PROs can assist in the care of patients with a wide range of medical conditions, not just in the time of a global health crisis.

## What Is a Chatbot and How Did It Help Collect and Use PROs During the COVID-19 Global Pandemic?

Chatbots are computer software programs used to conduct an online chat conversation via text to answer a wide range of questions in lieu of direct conversation with a live person. Chatbots, which may use natural language processing and automated artificial intelligence programming, are not new and have been available for years. Most common household examples include Siri, Alexa, and Google. During the ongoing COVID-19 pandemic, many chatbot programs

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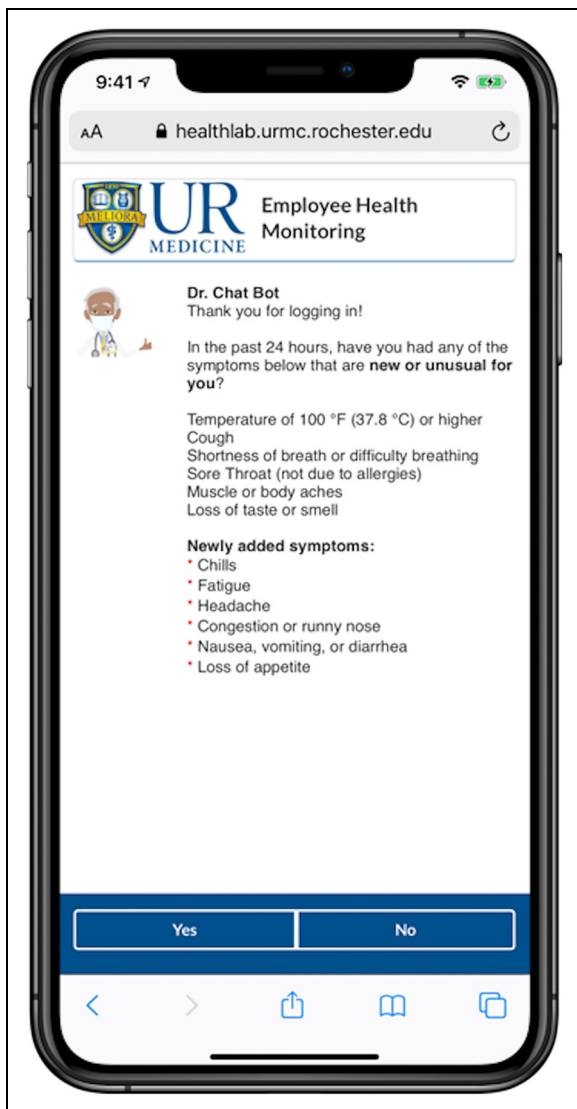
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were constructed throughout the United States, including at the U.S. Centers for Disease Control and Prevention (CDC), Northwell Health, University of Pennsylvania, University of California - San Francisco, and University of North Carolina (3–6). These automated programs were used to answer commonly asked COVID-19-related questions and aid in directing patients to resources (3,4). The tool can also ask patients directly how they are feeling and functioning if ill or concerned about exposure. The evaluated and monitored symptoms are targeted to those most commonly seen with COVID-19 (e.g., cough, fever, shortness of breath). Ultimately, patients' answers via the chatbot platforms can be assessed and imported into a decision-making algorithm overseen by seasoned health professionals to triage overwhelming numbers of patients and better guide care, which helps to reduce the burden faced by many health systems and their emergency departments.



**Figure 1.** A visual representation of the University of Rochester Medical Center (URMC) Dr. Chat Bot “Welcome Screen” on a smart phone screen.

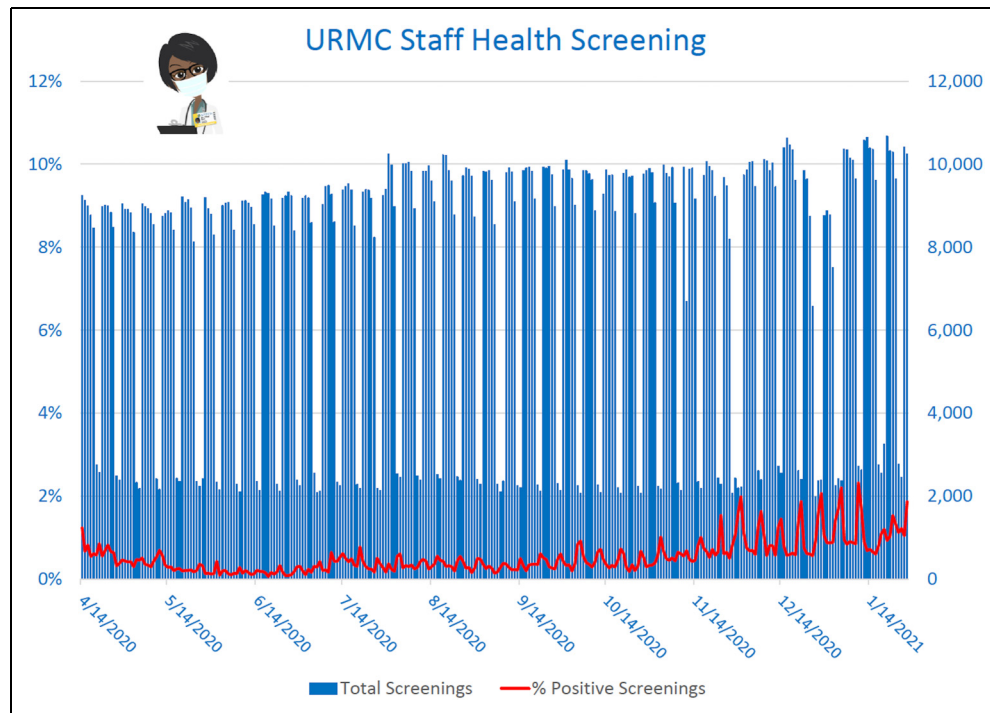
### *University of Rochester Medical Center’s Dr. Chat Bot Experience*

Beginning March 18, 2020, the University of Rochester Medical Center (URMC), the largest employer in the Upstate New York region, launched Dr. Chat Bot, our institution’s health-related chatbot, on a patient-facing URMC COVID-19 website. Dr. Chat Bot, is an innovative product of the URMC HealthLab and Employee Health Team. During the initial height of the pandemic, the tool aided in the triage of patients seeking COVID-19 resources, as the clinical COVID-19 phone hotline was getting overwhelmed with calls from worried asymptomatic patients. It appropriately guided patients with symptoms to medical care professionals, and all others were given links to the CDC website for informational updates. Dr. Chat Bot served its purpose well. Upon implementation, the call volume to the hotline dropped approximately 50% in 1 week.

Given the success of the original patient-facing Dr. Chat Bot, it was quickly modified to push out to health system employees on their own devices (Figure 1). A new algorithm for health system employees was constructed, and as might be expected, changed multiple times (33 to be specific at the time of this article) as knowledge improved, regulations changed, and treatments evolved. The Dr. Chat Bot “symptom checker” initiative resulted in improved employee screening, monitoring, and patient care through decreased virus exposure with decreased emergency department visits, decreased hospitalizations, and improved allocation of limited health care resources (Figure 2). Dr. Chat Bot provided guidance regarding testing, quarantine recommendations, isolation, work readiness, and advice for additional health care services. This guidance was shared with local and regional health system employees, students, faculty, research participants in COVID-19 vaccine trials, and even community outreach employees. However, this is where the story at the URMC differs from others and offers insight into what could, and should, be the future of PROs outside of the COVID-19 narrative.

### *Chatbots and PROs Beyond the COVID-19 Global Pandemic*

The collection of PROs in a standardized, routine, and validated way to measure symptoms and general patient health is not new to the URMC (7). Since 2015, the institution has been collecting PROs—namely the U.S. National Institutes of Health–funded Patient Reported Outcomes Measurement Information System assessments—at the site of service to aid in clinical care, shared clinical decision-making, and patient engagement across the health care system. The culture and familiarity of PROs collection at the URMC by patients, the community, and health care professionals proved invaluable when pivoting to address the pandemic. Indeed, such an approach was already the “norm,” so the local barriers to at least the implementation



**Figure 2.** An illustration of the overall total symptom screens completed and total symptom screens completed that were positive by employees reporting to work at the University of Rochester Medical Center (URMC) from April 14, 2020, to January 14, 2021.

of the initiative were limited. However, the use of PROs was much more robust during COVID-19. Thus, we might ask: if we can collect information on symptoms (PROs) for COVID-19 and positively influence medical care in real time by more appropriately guiding treatment, why can we not do this with other conditions? *We can.*

There are numerous research publications across a variety of health care conditions demonstrating the value of collecting and utilizing PROs (8–10). Basch et al (8) randomized patients undergoing cancer treatments to usual clinician care symptom monitoring or a computerized, at home, elective symptom monitoring program. With the flexible, home monitoring approach, patients self-reported their symptoms when it was most important to them at their own pace. The system was monitored by clinicians who could respond to this information with care changes in real time as needed. This crucial data added previously unknown vital health information that led to actionable steps to improve patient care. Ultimately, this resulted in decreased emergency department visits and hospital admissions. However, most importantly, monitoring at home via the computerized elective symptom capture program found patients were able to stay on chemotherapy longer and had improved health-related quality of life.

The clinical translation of research projects using PROs to standard of care site-of-service collection and use requires support. In a recent survey by the NEJM Catalyst Insights Council published prior to the pandemic, 50% of executives, clinician leaders, and clinicians were not sure the effort to collect, process, or implement PRO measures was worth

the effort (11). However, the COVID-19 global pandemic has changed many aspects of health care delivery and may have shifted opinions of health care leaders on the value and importance of PROs as well. Indeed, support has likely grown from clinicians who have, during the pandemic, been willing to collect data in a busy clinic setting, as well as view, share, and utilize the data to improve patient care, because the pandemic forced them to do so. Health care leadership, including health systems and payors (both public entities and private insurers), needs to allocate information technology and other resources, including personnel and financial, to benefit. However, this may pose a challenge, and discussions regarding return on investment will need to be had among stakeholders. Importantly, the COVID-19 global pandemic has demonstrated that patients have become committed to sharing their symptoms whenever and wherever they feel the need and are gaining confidence that this information is being examined closely.

## Conclusions

Because of the COVID-19 global pandemic, changes within health care systems and attitudes of health care professionals and the public have brought us great advances in health care, especially as it relates to health care delivery and technology. While many may reflect on the boom of telehealth due to this public health crisis, we must not discount the importance of the advances in symptom monitoring and shared clinical decision-making made possible through technological

advancements like Dr. Chat Bot. It is not a substitute for an in-person evaluation by a physician, but the technology can certainly play a vital role as an aid in helping to provide more holistic, patient-centered care. We need to continue to move forward, not fall back into old, familiar, archaic ways postpandemic, and recognize that PROs are a form of validated symptom monitoring that can positively influence the care we provide for our patients.

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