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**COVID-19 Content**

# Usage Patterns of a Web-Based Palliative Care Content Platform (PalliCOVID) During the COVID-19 Pandemic



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**Abstract**

**Context.** The COVID-19 pandemic has highlighted the essential role of palliative care to support the delivery of compassionate, goal-concordant patient care. We created the Web-based application, PalliCOVID (<https://pallicovid.app/>), in April 2020 to provide all clinicians with convenient access to palliative care resources and support. PalliCOVID features evidence-based clinical guidelines, educational content, and institutional protocols related to palliative care for COVID-19 patients. It is a publicly available resource accessible from any mobile device or desktop computer that provides clinicians with access to palliative care guidance across a variety of care settings, including the emergency department, hospital ward, intensive care unit, and primary care practice.

**Objective.** The primary objective of this study was to evaluate usage patterns of PalliCOVID to understand user behavior in relation to this palliative care content platform during the period of the local peak of COVID-19 infection in Massachusetts.

**Methods.** We retrospectively analyzed deidentified usage data collected by Google Analytics from the first day of PalliCOVID's launch on April 7, 2020, until May 1, 2020, the time period that encompassed the local peak of the COVID-19 surge in Massachusetts. User access data were collected and summarized by using Google Analytics software that had been integrated into the PalliCOVID Web application.

**Results.** A total of 2042 users accessed PalliCOVID and viewed 4637 pages from April 7 to May 1, 2020. Users spent an average of 2 minutes and 6 seconds per session. Eighty-one percent of users were first-time visitors, while the remaining 19% were return visitors. Most users accessed PalliCOVID from the United States (87%), with a large proportion of users coming from Boston and the surrounding cities (32% of overall users).

**Conclusions.** PalliCOVID is one example of a scalable digital health solution that can bring palliative care resources to frontline clinicians. Analysis of PalliCOVID usage patterns has the potential to inform the improvement of the platform to better meet the needs of its user base and guide future dissemination strategies. The quantitative data presented here, although informative about user behavior, should be supplemented with future qualitative research to further define the impact of this tool and extend our ability to deliver clinical care that is compassionate, rational, and well-aligned with patients' values and goals. *J Pain Symptom Manage* 2020;60:e20–e27. © 2020 American Academy of Hospice and Palliative Medicine. Published by Elsevier Inc. All rights reserved.

**Key Words**

*COVID-19 pandemic, coronavirus, palliative care, digital health, progressive web application, mobile health, Google Analytics*

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## Introduction

### Background

The novel coronavirus (COVID-19) pandemic has strained the health-care system beyond its usual capacity to accommodate such a large influx of seriously ill patients.<sup>1,2</sup> This has created the need to bring palliative care medicine practices to the frontline across specialties.<sup>3–6</sup> Many clinicians who have not been specially trained in palliative care do not feel adequately prepared to facilitate difficult conversations with patients or their family members about goals of care.<sup>7</sup> Providing these clinicians with convenient access to focused education, clinical reference materials, and specialist palliative care support may improve end-of-life care for patients.<sup>1</sup>

As the COVID-19 surge approached Boston in April 2020, our interdisciplinary team of emergency physicians, palliative care specialists, and digital health innovators at Partners HealthCare recognized the need to rapidly increase the capacity to deliver primary palliative care at the frontline. Partners HealthCare is a large academic integrated health-care system that was founded by Massachusetts General Hospital and Brigham and Women's Hospital in 1994 and now consists of a core network of 11 hospitals in the New England area. Our goal was to create a centralized resource of information that would support Partners health-care staff to provide goal-concordant care and expert symptom management to patients who were ill with suspected COVID-19 infection.

Given the challenges of distributing and maintaining the quality of up-to-date information in such a fast-changing environment, we sought out a digital solution. We aimed to develop an online, centralized compendium of clinical reference materials, focused educational content, and institutional protocols intended to seamlessly integrate palliative care across a variety of care settings, including the emergency department, hospital ward, intensive care unit, and primary care practice with respect to Partners-specific resources and established protocols.

## Methods

### Development of the Platform

We built a progressive Web application (PWA) called "PalliCOVID" for the purpose of sharing digital content related to the delivery of palliative care during the COVID-19 pandemic. PWAs have previously been noted to have significant untapped potential in the field of health care to improve work efficiency and quality of care.<sup>8</sup> The main advantages of PWAs are that they provide the user with a similar experience to using a native application but are accessed via a Web browser, do not require download from an app

store, can be shared via a URL link, and can be found via a Web search engine. Users around the world can access PalliCOVID via Web browsers on any mobile or desktop device, thus allowing for wide dissemination of the digital content posted by the authors. At the same time, the authors are able to centrally manage the content and make instantaneous updates as needed, which is an important mechanism for quality control considering the rapidly changing information environment of the pandemic.

The clinical guidelines and content featured on PalliCOVID were sourced, produced, and reviewed by palliative care specialists at Brigham and Women's Hospital and Dana-Farber Cancer Institute and emergency physicians from Brigham and Women's Hospital. This interdisciplinary team of nurses, physicians, and physician assistants met weekly to discuss updates to the content. We prioritized the publication of guidelines that were succinct, specific, and commensurate with the best available scientific evidence about the COVID-19 disease process and end-of-life care. We established several key criteria for content posted on PalliCOVID:

- **Accurate:** Content was reviewed by palliative care experts to reflect the best available scientific evidence.
- **Practical:** Recommendations were designed to be useful and implementable by nonpalliative care clinicians in a variety of care settings.
- **Accessible:** Content was presented in a format that was optimized for viewing on both mobile devices and desktop computer screens.
- **Applicable:** Content was specific to the care of patients with confirmed or suspected COVID-19 infection and took into account the need to limit face-to-face interactions because of enhanced infection-control measures and restricted visitor policies.

We have included examples of PalliCOVID resources that respectively address the three major domains of palliative care expertise with regard to symptom management, goals of care discussions, and family support.<sup>6,9</sup> opioid dosing recommendations for the treatment of dyspnea and pain at the end of life (Fig. 1), a conversation guide for rapid code status determination in the peri-intubation setting (Fig. 2), and a tip sheet for responding to difficult questions from family members of dying patients (Fig. 3). Although certain features of PalliCOVID are restricted to users within the Partners HealthCare System, such as one-click access to the hospital paging system, we have made the majority of the content on PalliCOVID open to public access.

### Study Design

The primary objective of this study was to collect and analyze usage data from PalliCOVID as a way to

**DFCI/BWH PalliCOVID Pocket Card**

**PLEASE PAGE DFCI/BWH PALLIATIVE CARE SERVICE AT #42200 WITH QUESTIONS. WE'RE HERE TO HELP 24/7!**

### Using IV Opioids for Dyspnea and Pain

For guidance using PO opioids, visit <http://pinkbook.dpci.org>

**Choose a PRN Dose for Opioid Naïve Patients:\***

NORMAL renal function

- **IV MORPHINE** 2-4mg IV Q2h PRN

ABNORMAL renal function (CrCl<50)

- **IV HYDROMORPHONE** 0.2-0.4mg IV Q2h PRN
- **IV FENTANYL** 25-50 mcg IV Q15 min PRN

**\*Decrease starting dose by 50% for patients >65**

**If pain/dyspnea returns as soon as PRN dose wears off, start an infusion.**

- Add up the past 12-hour IV opioid requirement
- Divide by 12 to reach hourly rate

**ALWAYS USE PRN BOLUSES FOR ACUTE SYMPTOMS**

- PRN bolus dose = 1-2X the drip rate
- If symptoms poorly controlled, bolus can be repeated after 15 mins. If necessary, bolus can then be doubled.

**Increase infusion rate** if requiring >3 PRN doses in 6 hours:

- Add up PRN doses and divide by # hours given
- Add this to current infusion rate
- Adjust PRN bolus dose to 1-2x drip rate

### Converting Long-Acting Opioids to IV Infusions

1. Calculate the total long-acting opioid use in 24 hours
2. Convert to IV medication of choice based on conversion table
3. Reduce the dose by 25% for incomplete cross-tolerance, unless symptoms are poorly controlled
4. Divide by 24 to reach the hourly rate
5. Use the guidelines to the left to titrate infusion rates and boluses

#### Opioid Conversion Table

(all doses in chart are equianalgesic)

Drug	PO/PR (mg)	IV/SQ (mg)
Morphine	30	10
Oxycodone	20	N/A
Hydromorphone	7.5	1.5
Fentanyl	N/A	0.1 (100mcg)

Dana-Farber Cancer Institute

Adapted from VitalTalk, University of Washington Medicine, and the MGH Division of Palliative Care and Geriatric Medicine

BRIGHAM HEALTH  
BRIGHAM AND WOMEN'S HOSPITAL

Fig. 1. Opioids for treatment of dyspnea and pain pocket card.

better understand user behavior and gain insights about the population of users accessing this palliative care content platform. The secondary objective was to use the insights derived from user engagement behavior to formulate ideas about future improvements to the platform and future dissemination strategies.

We retrospectively analyzed deidentified usage data that were collected by Google Analytics from the first day of PalliCOVID’s launch on April 7, 2020, through May 1, 2020. Google Analytics is a free tool that provides quantitative data on website usage and has previously been used in health research for process evaluation and quality improvement.<sup>10</sup> This project was undertaken as a Quality Improvement Initiative at Brigham and Women’s Hospital and as such was not formally supervised by the institutional review board per their policies. We followed the SQUIRE guidelines for quality improvement reporting.<sup>11</sup>

### Evaluating Usage

We evaluated usage data using Google Analytics (Google, LLC, Mountain View, CA), which was installed on PalliCOVID and used to track user data from April 7, 2020, through May 1, 2020.<sup>12</sup> This allowed collection of data related to user behavior

emanating from a user’s interaction with the application. The data could come from avenues such as the URLs of the pages the user viewed, the location of the user, and the type of device being used to access the application. Google Analytics also collected information about the nature of the visit such as the content viewed and length of the session. Google Analytics did not collect any personally identifiable information and presented all collected data in aggregate form, thus mitigating the ethical concerns that could arise from user behavior research.<sup>13,14</sup>

We evaluated user engagement by examining “sessions”. A session was defined as a series of interactions by a user that took place within a predetermined time frame (30 minutes), which represented the period of time that the user was actively engaged with the application. The number of returning users referred to the number of sessions visited by the same client ID. A relatively high proportion of returning users has been noted in Web-based mental health intervention research to be a marker of user engagement.<sup>10,15,16</sup>

The number of pages per session refers to the number of webpages within the platform that the user viewed in a single session and the mean session duration referred to the mean duration of time that users spent on the platform (reported in minutes and

ED PERI-INTUBATION CONVERSATION GUIDE	
<p><b>Goal:</b> Make rapid, patient-centered intubation recommendations for patients who may be at high-risk for poor outcomes.</p> <p>After establishing that <u>advance directive does not exist</u>, complete the following steps:</p>	
STEPS	WHAT TO ASK
Ask what they know	I am Dr. _____. I am sorry to meet you this way. Can you tell me your understanding of what is happening with your [mother]?
Warning shot	I am afraid I have serious news. Would it be OK if I share?
Headline	Your [mother's] is not breathing well from [pneumonia/COVID]. With her other health issues, I am worried she could get sicker and even die from this.
Establish urgency & align	We need to <b>work together quickly</b> to make the best decisions for her care.
Baseline function	To decide which treatments might help your [mother] the most, I need to know more about her.  What <b>type of activities</b> was she doing day-to-day before this illness?
Patient's Values (Select appropriate questions)	Has she <b>previously expressed wishes</b> about the kinds of medical care she would or would not want?  If time is short, what is <b>most important to her</b> ?  <b>How much</b> would she be willing to go through for possibility of more time?  What <b>abilities are so crucial</b> to her that she would consider life not worth living if she lost them?  Are there states she would consider <b>worse than dying</b> ?
Summarize	What I heard is _____. Did I get that right?
Make recommendations	We will use all available medical treatments that we think will help your loved one recover from this illness. For her, this means care focused on _____.
Forecast [If they elect ICU care]	In 24 to 48 hours, ICU team will discuss with you how (your mother) is responding to treatment.

Fig. 2. Rapid code status determination conversation guide for use in peri-intubation situations in the emergency department.



What they might say	Rationale	What you might say
How much longer do you think she has?	Clarify that time is what the person wants to know. <b>Speak in ranges.</b>	<i>It sounds like having a sense of how much time would be helpful? [Yes] My sense is that she has hours to a few days.</i>
Shouldn't we give her some IV fluid?	Evidence does not support that hydration improves quality or length of life in dying patients. <b>Explore emotion and talk about what you are doing.</b>	<i>I can imagine it's so hard seeing her like this. I worry extra fluid won't help her live longer or better at this point. We are going to do all we can to ensure she's comfortable.</i>
Do you think she is in pain? (patient appears comfortable)	May come from a fear of not being able to help their loved one. Tell them how you are assessing the patient.	<i>I see how deeply you care about her. When I'm looking at her face and body, she appears calm and comfortable. We are going to keep monitoring closely.</i>
Can she still hear us?	Encourage family (even if by phone) to talk with patient as they normally would.	<i>We think so, and many believe that hearing is the last sense people retain. I'd encourage you to talk to her as you normally would.</i>

Fig. 3. Common questions from family members of imminently dying patients.

seconds). This kind of user traffic data provide an approximation of the degree of exposure that users had to the content being hosted on the platform.<sup>10</sup>

Graphics demonstrating the geographic distribution of users were created by Google Analytics. Tables demonstrating the distribution of sessions, visits, most viewed pages, and device types were created using Microsoft Excel, version 16.36 (Microsoft Corporation, Seattle, WA).

**Results**

*Characteristics of User Behavior*

There was a total of 2042 users and 4637 page views during the period of April 7, 2020, to May 1, 2020. Eighty-one percent of users were first-time visitors to the application, with the remaining 19% representing return visitors (Fig. 4). Seventy-five percent of sessions were accessed by first-time or second-time visitors to the application (Table 1). Users spent an average of 2 minutes and 6 seconds per session on PalliCOVID, with 77% of sessions lasting less than one minute (Table 2).

*Platform Improvement*

The most viewed page was the home page (96.5% of total page views), followed by Quick Guides to

Symptom Management (an example of which is included as Fig. 1), the page with indexed links to [COVIDprotocols.org](https://www.covidprotocols.org), the section on Emergency Department resources, and the collection of videos simulating different types of difficult conversations

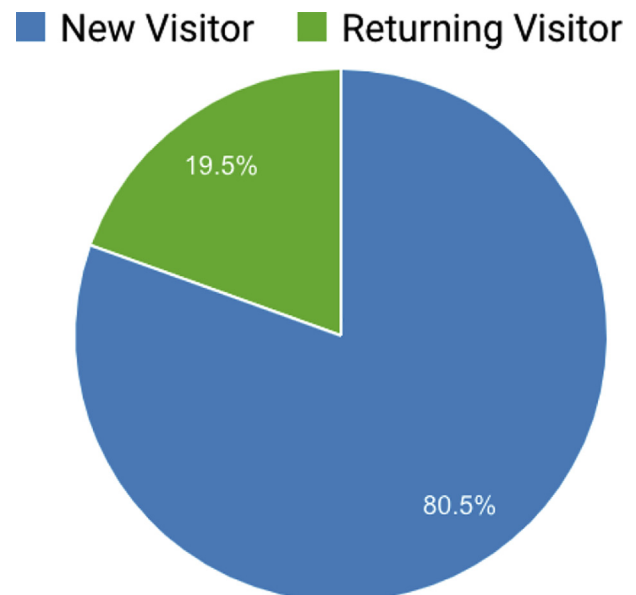


Fig. 4. Proportion of new users vs. returning users.

*Table 1*  
Proportion of Total Sessions Grouped by Number of Visits to PalliCOVID

Visits	Number of Sessions (%)
1	1992 (61.2)
2	460 (14.1)
3	215 (6.6)
4	122 (3.8)
5–8	234 (7.2)
9–14	111 (3.4)
15–25	83 (2.6)
26–50	38 (1.2)

(Table 3). Almost all users used either mobile devices (56%) or desktop computers (42%) to access the application (Table 4). Only 2% of users accessed PalliCOVID by tablet device. Most users (87%) accessed PalliCOVID from the United States, with 32% of all users located in Boston and the surrounding cities (Fig. 5). The remainder of users accessed PalliCOVID from 29 other countries outside of the United States.

## Discussion

In the response to the large influx of seriously ill patients during the peak period of the COVID-19 pandemic in Boston, PalliCOVID was created as a scalable digital solution to increase access to palliative care educational resources and specialist support. Analyzing user engagement behavior, we found that three-quarters of sessions (75%) consisted of first-time and second-time visitors to the application. The remaining 25% of sessions represented usage by “frequent users,” defined as those who have visited the application three or more times. A previous study on usage patterns of a mobile palliative care application found that a small subset of users (13% of users) comprised the majority of all activities in the application (66% of activity).<sup>15</sup> One possible explanation for this distribution is frequent users coming back to the application as a “just in time” clinical reference tool, whereas infrequent users access the application for more passive educational purposes.<sup>15</sup> PalliCOVID content features both types of information: “just in time” clinical reference material such as medication dosing recommendations as well as focused educational content such as difficult conversation

*Table 2*  
Sessions Categorized by Duration of Time Spent on PalliCOVID

Session Duration	Number of Sessions (%)
≤1 minute	2499 (77)
1–3 minutes	324 (10)
3–10 minutes	234 (7)
>10 minutes	198 (6)

*Table 3*  
The Top Five Most Viewed Pages Based on Number of Page Views ( $N = 4637$ )

Page	Page Views (%)
Home page	4474 (96.5)
Quick Guides to Symptom Management	23 (0.5)
COVIDprotocols.org	22 (0.5)
Emergency Department Resources	20 (0.4)
Video Simulations of Difficult Conversations	16 (0.4)

simulation videos, which may explain the different distribution of frequent vs. infrequent users. Furthermore, we limited our data-collection period to less than four weeks of operation, which may not be enough time to observe trends in users returning to the application.

Average duration of sessions on PalliCOVID was short, at less than 2 minutes per session for mobile users and less than 3 minutes per session for desktop users. Some may interpret the short session duration to indicate a degree of user disengagement, but an alternative explanation may be that users were able to quickly find what they were looking for. Sessions in which users access the link to the hospital paging directory from the PalliCOVID home page, for example, would cause the user to exit the application and end the session relatively quickly. In that case, a short session duration would have indicated that PalliCOVID had successfully carried out a function that it was designed to perform.

The platform can be improved based on user behavior. Future iterations of the application will focus on improving user engagement with the content pages for “Nursing Resources” and “Hospice Care Referrals”, which did not rank among the top five most-viewed pages. The lower ranking of these pages may be a reflection of the original dissemination strategy, which focused more heavily on reaching physicians and advanced practice providers rather than the nursing staff. Future dissemination strategies should specifically target nurses or have product design specifications to specific user populations as well. Population and user-specific design may be critical as different roles such as nursing spend the majority of their time at patients’ bedsides and are more likely to be aware of patients’ specific symptoms and end-

*Table 4*  
Type of Device Used to Access PalliCOVID

Device	Number of Sessions (%)	Pages Viewed per Session (n)	Mean Session Duration
Mobile	1835 (56)	1.44	1 minute, 49 seconds
Desktop	1355 (42)	1.42	2 minutes, 30 seconds
Tablet	65 (2)	1.14	1 minute, 29 seconds

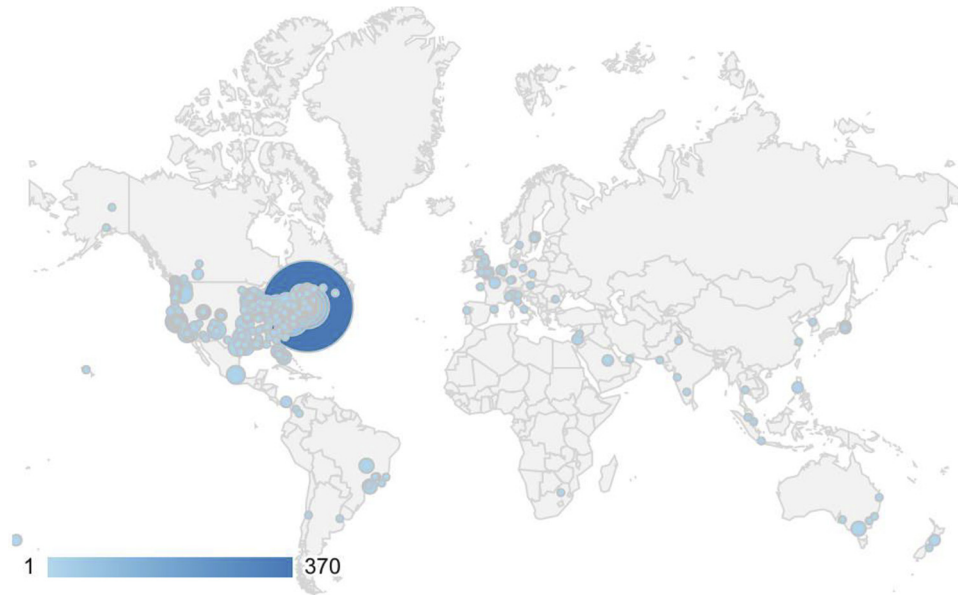


Fig. 5. Geographic distribution of user density by city.

of-life needs than perhaps physicians or advanced practice providers.

There was an overall even split in device types between mobile and desktop, arguing against a stronger user preference for one type of device over the other. As we add future content to the platform, we should continue to optimize viewing for both smaller screens and larger screens with vector graphics, responsive Web design, and screen size flexibility.

When observing the location of the users, 32% of users were found to be from Boston and surrounding cities. This finding aligns with our implementation science focus on engaging users about the platform primarily within the Partners institutions. In addition, a subset of the content was Partners institution specific, and paging directory access was restricted to members of the Partners network. Future reorganization of the content into internal- and external-facing sections may make the application more inviting to users outside of the Partners enterprise. The majority of the clinical content contained within the guides would be applicable to patient care regardless of the particular institution, so future improvements to the platform may include better sign-posting of content as broadly applicable and not Partners specific.

### Limitations

Although Google Analytics has provided promising data about the usage patterns of PalliCOVID, the data should be interpreted cautiously. Google Analytics collects and presents data with a marketing and e-commerce framework for understanding Web-based behavior, rather than a health research frame.

Aggregation of the data, in addition to potential discrepancies in how users are counted when users delete browser cookies, switch devices, or create a new client ID by changing browsers, creates bias in the data. Nonetheless, we believe there is still value in tracking overall engagement numbers and observing trends in usage over time to continually evaluate and improve the performance of the platform.

As the volume of patients with COVID-19 infection rises and falls through different phases of the pandemic, the need for a digital solution such as PalliCOVID may also fluctuate over time.<sup>10,17</sup> Because our team focused our efforts on the development of a resource that would be maximally useful to clinicians within the Partners HealthCare System, the sample size was limited to its distribution within this institution and geographic area. We considered uptake of the resource outside of the Partners enterprise to be a secondary benefit. Future studies should include a more detailed analysis of longitudinal user data or a mixed-method assessment with focus groups, surveys, or in-depth interviews, to supplement Google Analytics data and allow for a more comprehensive quality-improvement study.

### Conclusion

This study described usage patterns of a Web-based palliative care content platform over its first month of operation in April 2020. We have demonstrated that, even in the midst of a global pandemic, it is possible to rapidly design and implement a digital solution in response to an unprecedented health-care challenge.



We have also demonstrated the use of a free, open-access tool such as Google Analytics to evaluate patterns of user behavior, consequences of the dissemination strategy, and aspects of the platform that may be amenable to future improvements. Quantitative data should be combined with qualitative research to provide more accurate interpretations of user behavior. We hope that clinicians who access the content on PalliCOVID may feel empowered to deliver care that is focused on dignity, symptom control, and avoidance of unnecessarily invasive or nonbeneficial interventions whenever possible.

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