Artificial-Intelligence Smartphone App Significantly Reduced Severity of Cancer Patients’ Pain and Hospital Admissions

This summary includes updated data not in the abstract
For immediate release
November 13, 2018

Contact
Julianne Lee
571-483-1381
julianne.lee@asco.org

Expert Perspective

“The vast majority of people with cancer experience pain at some point, and we need better tools to track and report it,” said Joshua Adam Jones, MD, MA, Chair, 2018 Palliative and Supportive Care in Oncology Symposium News Planning Team. “My hope is that these findings will pave the way for more widespread use of apps among patients who are experiencing pain, so that they can get the support they need.”

ALEXANDRIA, Va. – A study of 112 people with metastatic solid tumors found that the use of an artificial intelligence (AI)-based smartphone app reduced both the severity of patients’ reported pain and hospital admissions. After an eight-week period, patients who used the AI-powered app to monitor and address pain experienced a 20% reduction in the severity of pain and had nearly 70% lower risk of pain-related hospital admissions than patients not using the app. These findings will be presented at the upcoming 2018 Palliative and Supportive Care in Oncology Symposium in San Diego, California.

“There is a significant shortage of palliative care providers, which will only worsen in the future as our population ages,” said lead study author Mihir M. Kamdar, MD, Associate Director of the Division of Palliative Care and an interventional pain physician at Massachusetts General Hospital, Boston, Massachusetts. “This is one of the reasons why technology solutions to help manage palliative care challenges, such as cancer pain, are so important.”

Research shows that up to 90% of patients with advanced cancer experience pain due to the
disease, directly affecting their quality of life. According to the researchers, this is one of the first mobile apps to utilize both patient-reported outcomes and AI clinical algorithms to significantly decrease pain and reduce overall inpatient hospitalizations in patients with cancer-related pain.

**About the Study**

The app, named ePAL, was designed and studied as part of a collaboration between Partners HealthCare Pivot Labs, the Massachusetts General Hospital Division of Palliative Care, and the Massachusetts General Hospital Cancer Center. Fifty-six patients in the study were assigned to use the ePAL app, while an equal number were assigned to usual care. Patients using ePAL received alerts on their smartphones with daily pain management tips and were prompted to submit their pain levels three days a week. The AI in ePAL was able to distinguish urgent from non-urgent pain and provide appropriate patient-facing education in real time. If cancer pain was severe or worsening, the app connected patients to their clinicians for care.

Pain was reported on a scale of 0 to 10, where 10 is the worst pain imaginable. A drop of one point in self-reported pain was considered a significant reduction. If the pain level was severe, the app alerted a nurse who responded within an hour. If the pain was moderate, the app asked the patient about their pain and then electronically gave the patient tailored educational feedback, such as information on how to better manage bothersome medication side effects.

Questionnaires were given to all participants at the start, midpoint, and end of the eight-week trial to assess attitudes about each patient’s overall treatment and their general anxiety.

**Key Findings**

All patients had similar pain scores at the start of the study. The average pain level of about 4 did not change from the beginning to the end of the trial for people receiving usual care. For patients using the app, however, pain levels decreased by 20% to 2.99 at the end of eight weeks.

In addition, there were far fewer pain-related inpatient hospital admissions for ePAL users compared to patients not using the app (4 vs. 20). Per patient, this resulted in a 69% reduction in risk of having a pain-related admission during the study for those who used the app.

“It’s significant that patients who used the app had significantly fewer hospital admissions without an associated increase in outpatient clinical burden,” said Kamal Jethwani, MD, Senior Director of Pivot Labs at Partners Healthcare and a senior investigator on the study. “These findings suggest that integrating innovations like mobile technology and AI could have a real impact on patient well-being, resource utilization, and cost of care.”

Anxiety scores for people using the app increased from 6.67 to 7.68 (out of 21) while decreasing
slightly in the usual care group (from 5.9 to 5.03). The researchers believe that simply asking about pain may induce anxiety in some people. On the other hand, people reporting pain via the app more than twice a week did not experience an increase in anxiety (the anxiety level was 6.6 at both the beginning and end of the trial).

Next Steps

As a next step, the authors plan to develop an even more robust AI-telehealth platform and study it in other clinical settings.

“We’re especially interested to see if this type of novel technology can be helpful in areas where access to palliative care is limited,” said Dr. Kamdar. “Our hope is to use innovation and technology to extend the reach of palliative care to those who need it most.”

This study was funded by a grant from the McKesson Foundation.

2018 Palliative and Supportive Care in Oncology Symposium News Planning Team

- Chair: Joshua Adam Jones, MD, MA (ASCO)
- Joseph Rotella, MD, MBA, HMDC, FAAHPM (AAHPM)
- Tracy Balboni, MD, MPH (ASTRO)
- Mario E. Lacouture, MD (MASCC)

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### Abstract 76: A randomized controlled trial of a novel artificial-intelligence based smartphone application to optimize the management of cancer-related pain.

**Authors:** Mihir M. Kamdar, Amanda Jayne Centi, Nils Fischer, Kamal Jethwani; Massachusetts General Hospital, Boston, MA; Partners HealthCare Pivot Labs, Boston, MA
**Topic Selection:** Integration and Delivery of Palliative and Supportive Care - Integration and Delivery of Palliative and Supportive Care

**Background:** Cancer pain affects 70-90% of advanced malignancy patients, resulting in impaired quality of life and increased healthcare utilization. Novel care delivery models are needed to optimize care for patients dealing with cancer-related pain in between clinic visits. ePAL is a smartphone application (app) that regularly monitors pain and uses artificial intelligence (AI) to differentiate urgent from non-urgent issues to intercede in real time. The purpose of this randomized controlled trial was to determine ePAL's impact on pain severity, attitudes toward cancer treatment, and healthcare utilization in patients with cancer pain. **Methods:** MGH Palliative Care Clinic Patients with pain from metastatic, solid-organ cancer (n=112) were recruited and randomized to either a control group (n=56) that received usual care or an intervention group (n=56) that used the ePAL app in addition to usual care for 8 weeks. The app assessed pain 3 times/week and questionnaires about pain (BPI), attitudes towards cancer treatment (BQ-II), and general anxiety (GAD-7) were given at 0, 4, and 8 weeks. A repeated measures mixed model approach assessed how outcome measures changed over time. Models controlled for baseline differences at enrollment and random slopes in addition to baseline depression score, age and sex (alpha=0.05). **Results:** Pain severity (BPI) and negative attitudes toward cancer pain treatment (BQ-II) decreased significantly for those using the app compared to controls (coeff. -0.09, 95% CI: -0.17, -0.007, p=0.034 and coeff. -0.037, 95% CI: -0.072, -0.001, p=0.042 respectively). Anxiety scores increased for those using ePAL compared to controls (coeff. 0.21, 95% CI: 0.039, 0.37, p=0.015). Over 8-weeks, ePAL users had 40% fewer inpatient hospital admissions compared to controls (n=15 vs. n=25, p=0.048). **Conclusions:** To our knowledge, this is the first mobile app to utilize AI and clinical algorithms to significantly decrease pain and reduce overall inpatient hospitalizations in patients with cancer-related pain.

**Disclosures:** Mihir M. Kamdar, MD: Stock and other ownership interests with Amorsa Therapeutics, Consulting or advisory role with Amorsa Therapeutics.

**About ASCO:**

Founded in 1964, the American Society of Clinical Oncology, Inc. (ASCO®) is committed to making a world of difference in cancer care. As the world’s leading organization of its kind, ASCO represents nearly 45,000 oncology professionals who care for people living with cancer. Through research, education, and promotion of the highest-quality patient care, ASCO works to conquer cancer and create a world where cancer is prevented or cured, and every survivor is healthy. ASCO is supported by its affiliate organization, the Conquer Cancer Foundation. Learn more at [www.ASCO.org](http://www.ASCO.org)
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The American Academy of Hospice and Palliative Medicine’s (AAHPM) is the professional organization dedicated to advancing hospice and palliative care and improving the care of patients with serious illness. Our activities focus on professional education and training, development of a specialist workforce, support for clinical practice standards, research, and public policy advocacy.

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The American Society for Radiation Oncology (ASTRO) is the premier radiation oncology society in the world, with more than 10,000 members who are physicians, nurses, biologist, physicists, radiation therapists, dosimetrists and other health care professionals that specialize in treating patients with radiation therapies. As the leading organization in radiation oncology, the Society is dedicated to improving patient care through professional education and training, support for clinical practice and health policy standards, advancement of science and research, and advocacy. ASTRO publishes three medical journals, International Journal of Radiation Oncology, Biology, Physics, Practical Radiation Oncology, and Advances in Radiation Oncology, developed and maintains an extensive patient website; and created the Radiation Oncology Institute, a non-profit foundation to support research and education efforts around the world that enhance and confirm the critical role of radiation therapy in improving cancer treatment.

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The Multinational Association of Supportive Care in Cancer (MASCC) is an international, multidisciplinary organization with members from six continents and nearly 70 countries. It operates in collaboration with the International Society of Oral Oncology (ISOO). Founded in 1990, MASCC is dedicated to research and education in all areas of supportive care for patients with cancer, regardless of the stage of the disease. MASCC promotes professional expertise in supportive care through research and the scientific exchange of ideas. A focus on supportive care leads to better treatment outcomes and greater quality of life for people with cancer.