

# Role of Patient-Reported Outcomes in Postsurgical Monitoring in Oncology

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Monitoring recovery from oncologic surgery becomes difficult following discharge. The vulnerable time between discharge and first follow up presents an opportunity for symptom management, complication avoidance, and readmission prevention. These goals may be achieved through careful postsurgical symptom monitoring using electronic patient-reported outcomes (ePROs). ePROs can identify patients at risk, provide closer monitoring when needed, and offer a mechanism to identify and treat complications before they progress. Herein, we describe the benefits of ePROs and summarize the literature of ePRO use in surgical oncology.

Improving the patient experience after oncologic surgery relies on symptom management, complication avoidance, and readmission prevention. Although symptoms and complications are carefully managed during initial hospitalization, patients are subsequently discharged—left to experience a gap in clinical care until the next follow-up (often 2-4 weeks later). The vulnerable time between discharge and follow-up offers an opportunity to proactively address and manage symptoms with the intent of avoiding their sequelae (eg, complications, readmissions, urgent care evaluations). One method to facilitate postsurgical symptom monitoring is through ePROs. ePROs can identify patients at risk, provide closer monitoring when needed, and offer a mechanism to identify and treat complications before they progress.

Treatment monitoring through ePROs is not a new concept in oncology. A recent systematic review of ePRO systems used in clinical cancer care identified 33 e-PRO systems, with the majority used in medical oncology clinics (to track chemotherapy-related symptoms) and 40% used in follow-up care.<sup>1</sup> In a study in which medical oncology patients were randomly assigned to receive weekly e-mail prompts between clinic visits, health-related quality of life improved among more patients and worsened among fewer.<sup>2</sup> In addition, resource utilization declined, with patients receiving the ePRO intervention less likely to be admitted to the emergency room or hospitalized. Benefits extended to improved quality-adjusted survival, providing a compelling case for ePRO integration into routine cancer care.

The success of ePROs for treatment monitoring in medical oncology can be extrapolated to surgery. Postsurgical monitoring has known benefits, from better patient satisfaction to increased survival.<sup>3</sup> A postoperative home care intervention (including three home visits and five telephone contacts), improved survival among older late-stage postsurgical patients with cancer. The home care intervention included comprehensive clinical assessments for patients and caregivers, symptom monitoring, teaching, and skills training.<sup>3</sup> Despite its success, implementation has remained a challenge because of resource limitations (eg, at-home nurse visits, telephone contacts). Arguably, resource

limitations could be overcome through ePRO systems, which have the ability to provide similar benefits (symptom monitoring, teaching) while reducing resources. By identifying patients at highest risk through ePRO responses, resources can be allocated efficiently to those in most need.

The concept of risk stratification through symptom monitoring and other patient-reported outcomes can identify threshold events that prompt early intervention. A recent systematic review of telemedicine for postdischarge surgical care noted four intervention studies involving patient-reported outcomes, such as symptoms, medication adherence, and accelerometry.<sup>4</sup> In one study, patients undergoing thoracotomy were randomly assigned to receive at-home symptom monitoring with feedback to clinicians, who could then facilitate postoperative symptom control.<sup>5</sup> Patients who completed at-home monitoring experienced greater reduction in symptom threshold events than did controls (19% v 8%) and a more rapid decline in symptom threshold events. Furthermore, clinicians were responsive, responding to 84% of e-mail alerts. Satisfaction was high among both groups, particularly related to postoperative symptom control. Similar ePRO studies among gynecologic oncology patients demonstrated feasibility and satisfaction approximating 80%.<sup>6,7</sup> The preponderance of current evidence suggests that ePROs can be used to improve the postsurgical patient experience. A recent systematic review of 27 studies<sup>8</sup> drawing from a variety of surgical procedures (from cardiac to orthopedic surgery) demonstrated improved patient-related outcomes compared with usual care, suggesting that postsurgical monitoring through PROs can have significant benefits at a low cost for patients. Beyond patient-related symptoms, postsurgical monitoring could also be implemented to address cancer caregivers' burden and mood. For example, caregivers of patients with advanced lung cancer were randomly assigned to receive a comprehensive health enhancement support system with an embedded coaching system for caregivers. Those who received this intervention reported lower burden and negative mood than those who did not.<sup>9</sup>

Although the feasibility of postsurgical ePROs is becoming clear, understanding the role of ePROs in the postsurgical setting requires additional consideration. Postsurgical ePROs could fill a much-needed gap in clinical care in several ways. First, ePROs can inform the care team when symptoms arise. Second, an ePRO system could provide tailored postsurgical education to the patient on the basis of current symptoms. Third, early recognition of symptoms and appropriate

management through an ePRO system could reduce resource utilization through avoidance of complications, emergency room visits, and readmissions. Among surgical patients, readmissions are most common among elderly patients undergoing major abdominal surgery for cancer.<sup>10,11</sup> High readmission rates may be measurable indicators of preventable complications, such as dehydration, infection, and fever.<sup>11</sup> Patients with increasing symptoms tend to use more resources, an association that is important to health care systems and payers.<sup>12</sup> These complications may be mitigated if they are rapidly identified and addressed by an effective ePRO system, thereby avoiding worsening complications and readmission. ePROs have the added benefit of eliminating geographic barriers. Patients undergoing surgical oncology procedures often travel long distances for care with increasing distance strongly associated with complications and readmissions.<sup>11</sup> By employing the lessons learned from mHealth in largely nononcologic and nonsurgical contexts, careful and systematic design of an ePRO intervention that provides timely feedback to patients and clinicians has the potential to reduce geographic barriers associated with complications and readmissions.

An additional consideration regarding PRO interventions is effective delivery. Examples of delivery systems include electronic surveys, interactive voice response, and wearable patient-generated data. Although this certainly depends on the patient population, several advantages for electronic surveys exist. Most ePRO systems can be accessed through multiple technologies, including laptops, smart phones, tablets, and other computer-based systems. Through an Internet-based platform, ePROs are practical and low-cost, with the potential to enhance the process and outcomes of care and be scalable in large patient populations. According to the Pew Research Center,<sup>13</sup> 87% of American adults use the Internet, 40% to 80% use smartphones, and the use of mobile technology is expected to increase. Among older adults, smartphone and tablet use have been steadily increasing as the population ages. Notably, Internet use among seniors continues to increase steadily, with 59% of seniors currently reporting Internet use, up from 53% the prior year.<sup>14</sup> This is critical, given the older median age of patients with cancer. Interestingly, among a cohort of patients undergoing chemotherapy, benefits of ePROs were greater among participants lacking computer experience.<sup>2</sup> As the adoption of smartphones and capabilities of Internet-based technology increases, the potential for these types of mHealth interventions will expand dramatically.

Despite a compelling argument for ePRO use in post-surgical monitoring, several barriers to effective implementation exist. First, an effective ePRO system will require rigorous development. Future studies should focus on identifying the most actionable symptoms, how often to prompt the user, and defining thresholds for intervention. Identifying important and actionable PROs reduces survey fatigue and increases provider buy-in, thereby facilitating implementation. Developmental challenges can be easily overcome with a thoughtfully designed qualitative study that accounts for patient and provider needs. Second, the ePRO system will require real-time monitoring. Embedding the ePRO system within the electronic health record (EHR) would allow automatic alerts sent to the on-call provider (and/or designated health care professional), thus eliminating concerns regarding access. Embedding the ePRO system within the EHR would also enhance care coordination because information will be

available to the entire care team, including other providers and home health nurses. A conceptual model for tracking symptoms after chemotherapy could be adapted for surgical oncology procedures such as cystectomy and modified to include meaningful PROs for specific procedures, as illustrated in Figure 1.<sup>15</sup> Finally, cost surrounding development and implementation of an ePRO system is not negligible. However, several studies now demonstrate positive downstream effects such as resource utilization, which translates to a cost-favorable approach to postsurgical management.

In summary, novel strategies for postsurgical monitoring that incorporate ePROs have the potential to reduce postsurgical readmissions and resource utilization, with dramatic public health impact. Although a limited number of ePRO systems have been proposed in the surgical setting, a rigorously developed electronic, Internet-based mHealth intervention is needed, which prospectively

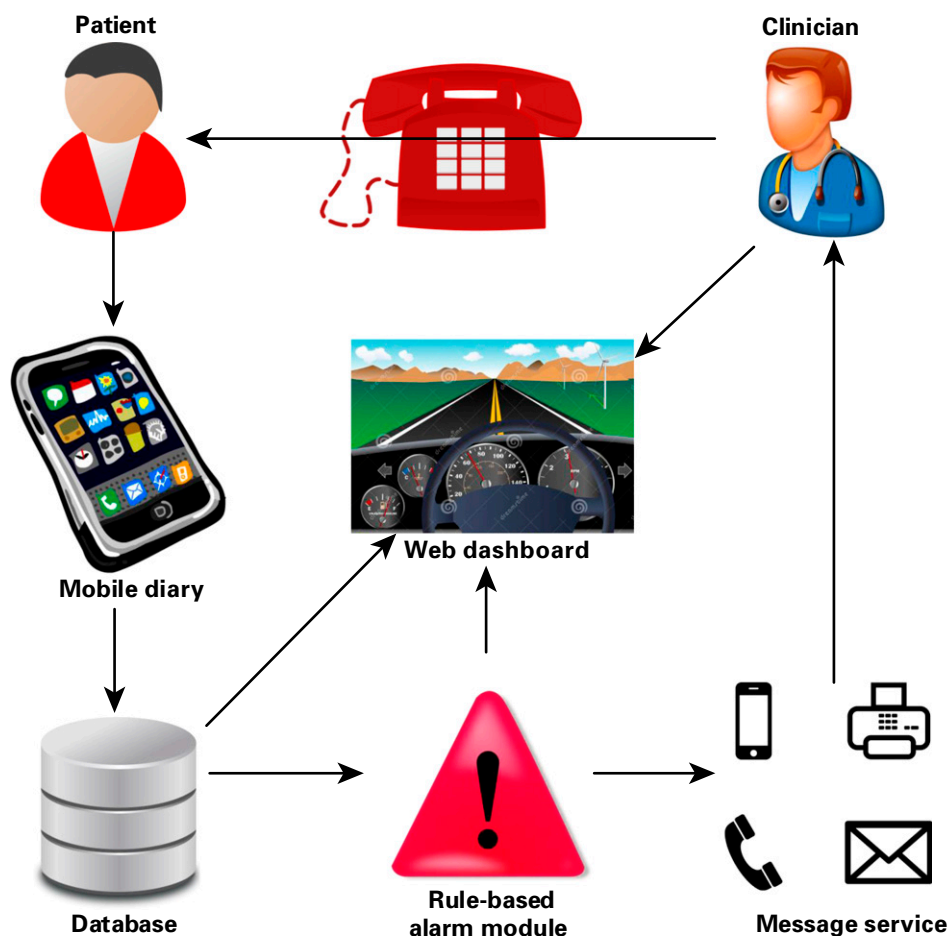


Fig 1. Conceptual model of home monitoring for a patient with cancer. Adapted from Galligioni et al.<sup>15</sup>

collects patient-reported outcomes data while providing timely feedback to patients and clinicians. ePRO systems can be adapted to other surgical procedures for cancer, incorporated into the EHR, modified for specific populations of patients with cancer, and tailored to future technologies. Postsurgical monitoring with ePROs has the great potential to address the vulnerable time between surgical discharge and follow-up, rapidly addressing and managing complications and ultimately closing this critical gap in clinical care.

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## **AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST**

### **Role of Patient-Reported Outcomes in Postsurgical Monitoring in Oncology**

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