Examining Patient Portal Messages and their Association with Hormonal Therapy Medication Discontinuation

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Introduction

Hormonal therapy is an adjuvant therapy that can help reduce breast cancer recurrence and mortality rates. However, it is estimated that approximate 50% of breast cancer patients are unable to complete the prescribed five-year treatment protocol. While studies have shown that patient portal messages were associated with hormonal therapy medication discontinuation, few studies investigated the patterns of such back-and-forth message threads and their association with medication discontinuation. In this study, we applied text mining and regression analysis to characterize message thread patterns and examine the extent to which they were associated with medication discontinuation.

Materials and Methods

We focused on a study cohort of 1,991 breast cancer patients with cancer stage I, II (early stage, encoded as 0) and III (advanced stage, encoded as 1) and who sent patient portal messages in Vanderbilt University Medical Center (VUMC) between 2005 and 2017. These patients had ages between 22 and 89 and generated a total of 51,477 message threads. Among these patients, 1,107 of them discontinued medications. Once obtaining the study cohort, we first examined the communication patterns of these patients based on the number of messages, the response delay, namely, the time a patient or a healthcare provider takes to respond back to the last message in that specific message thread, and who initiated and closed a message thread. Next, we relied on non-negative matrix factorization (NMF) to extract the topics conveyed in these messages. Finally, we applied survival analysis to infer the association between message thread patterns and medication discontinuation.

Results and Discussion

Our findings are listed as follows: 1) The number of breast cancer patients being treated at VUMC based on the age and year of diagnosis, stratified by their cancer stage. We found that the age range of 49-59 was the most vulnerable in our study cohort. We also observed a steady increase in the number of patients over the years from 2005 to 2017. 2) The average number of messages sent per patient (Figure 1). We found that patients diagnosed with an advanced stage of cancer tended to have greater number of messages than patients with early cancer stage. After applying NMF on the messages, we found that seeking information was the top priority of all the patients when communicating with healthcare providers. We also found that patients frequently expressed their appreciation to healthcare professionals;

3) Response delay (Figure 2). Although there was no notable response delay during weekends as compared to weekdays, there was a significant delay during nighttime (from 6:00PM to 8:00AM) as compared to that during the daytime (8:00AM to 6:00PM). Particularly, such delay was approximate 40 hours on average, which was much larger than the expected 14 hours' gap due to the definitions of nighttime and daytime;

4) Survival analysis (Figure 3). We found that patients who experienced higher message response delay from healthcare providers and sent more messages during daytime had an increased risk of discontinuing hormonal therapy medications. Message threads initialized and closed by a patient suggested an active engagement in online communication by the patient. This might further indicate that the patient was more involved in their health. Such patients were more likely to complete their treatment protocol. Our study suggested that communication patterns between patients and healthcare providers were associated with medication discontinuation.