

# Psychological symptoms and patterns of mobile application use for young adult cancer survivors

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## KEYWORDS

cancer, cancer survivorship, mHealth, oncology, psycho-oncology, young adult (YA)

## Key Points

### What's already known about this topic?

- Young adult (YA; aged 18–39) cancer survivors report social isolation and unmet needs for social, emotional, and informational support.
- Mobile health applications offer a unique and scalable opportunity to provide access to YA peers and other resources, overcoming geographical distance and financial burden
- App features such as group chats, private messaging and “matching” to peers by age or cancer type serve to build relationships between YA survivors.
- Despite reporting moderately high perceived socioemotional support from their existing networks, YAs with more frequent symptoms of anxiety were the most likely to use the private messaging feature on the app.
- In addition to targeting supportive mobile health apps to YA survivors, assessing the mental health status of users and observing patterns of app usage can be used to tailor and improve uptake and utility.

## 1 | INTRODUCTION

Access to adequate social, emotional and informational support may be limited for young adult (YA; aged 18–39) survivors of cancer, who have psychosocial needs that are unique to their age group and type of cancer.<sup>1</sup> Their same-age peers will rarely share their health concerns and treatment experiences, and fellow YA survivors are often at a geographical distance due to the rarity of cancer at a young age.<sup>2</sup> YA survivors report social isolation, a desire to meet other young survivors, and for some, symptoms of anxiety and depression.<sup>1</sup> Mobile health applications present an opportunity to connect young cancer survivors with one another, and offer a forum for providing emotional and informational support in survivorship.<sup>3</sup>

Recent research indicates that mobile health applications are feasible and acceptable to YAs.<sup>4</sup> Such findings justify the targeting of mobile health applications to the YA survivor age group, but it remains unknown how to tailor such applications to best meet the survivors'

individual needs.<sup>5,6</sup> The present study therefore assesses whether use of specific features on a mobile health application relates to how emotionally supported YAs feel, and whether they have symptoms of anxiety or depression. While YAs who have symptoms of anxiety and depression may stand to benefit most from freely accessible and scalable support through mobile health applications, they may also be less disposed to use such apps if they are perceived to be burdensome.<sup>7</sup> Based on outcomes of studies like the current one, tailoring of mobile health applications for YAs should include features that enhance perceived socioemotional support and reduce psychological symptoms. Our findings could promote successful implementation of future interventions to improve emotional health among YA survivors.

The present study describes patterns of use of a mobile health application offered to YAs registered for a nationwide conference for young cancer survivors (i.e., CancerCon, 2018) as they relate to emotional symptoms and perceived social support. Specifically, we hypothesized that YAs with emotional symptoms of anxiety and

depression (such as nervousness and worry), would be less likely to download the app and that those who did download the app would utilize features such as group chats and one-to-one messaging less frequently.

## 2 | METHODS

YAs in this study were registered for CancerCon, a patient conference and social networking event organized by the nonprofit organization Stupid Cancer. YAs were asked by email to complete an anonymous survey about their mental health and social support network, and to provide feedback on a free mobile application. The app was cocreated by Stupid Cancer and the digital health company GRYT Health. The app was a publicly available, free platform designed for YA survivors to access anonymous peer support through private one-to-one messaging and moderated group chats. Attendees who consented to participate (~47% of those who were sent recruitment materials) were sent a secure link to complete the survey online. The present study of deidentified YA data was approved as exempt research by an Institutional Review Board committee.

Measures collected in the survey include sociodemographic and medical history, measures of emotional support (NIH PROMIS<sup>8</sup>), interpersonal support (ISEL; appraisal subscale<sup>9</sup>), cancer-related self-efficacy (CBI-B<sup>10,11</sup>), and anxiety and depression (PHQ-4<sup>8</sup>), decision to download, and patterns of use of the mobile health application. Patterns of use were assessed with the question, "What prompted you to use the app?" and response options are presented in Figure 1.

The associations between downloading the app and any socio-demographic or psychological symptoms were tested using bivariate logistic regression analysis. Multiple linear regression was used to test the relationship between perceived emotional and interpersonal support, frequency of sending private one-to-one messages, frequency of participating in group chats, and symptoms of anxiety and depression.

## 3 | RESULTS

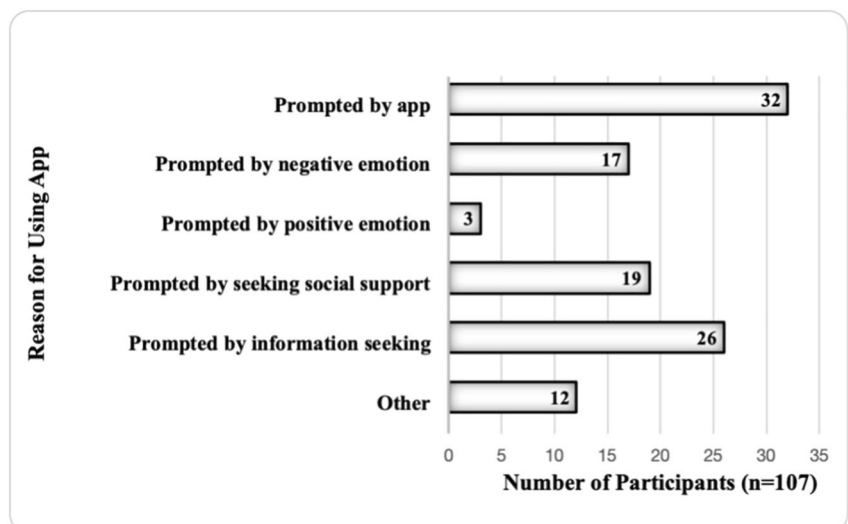
One hundred eighty participants consented to the research study and began the survey measures. Participants reported minimal symptoms of depression and anxiety (PHQ-9;  $M = 2.09$ ,  $SD = 0.80$ ), and moderately high levels of perceived emotional support (PROMIS Emotional Support;  $M = 3.92$ ,  $SD = 0.86$ ) and moderately positive evaluations of the support they were receiving from close others when appraising their cancer (ISEL, Appraisal Subscale;  $M = 1.75$ ,  $SD = 0.66$ ). They felt moderately efficacious in coping with cancer (CBI-B;  $M = 88.3$ ,  $SD = 24.6$ ).

One hundred seven participants (59.1%) had downloaded the application at time of survey. Contrary to hypotheses, bivariate logistic regression analysis indicated no significant differences in sociodemographics or psychological symptoms between those who did and did not download the Stupid Cancer app.

Around one-third of participants had sent a one-on-one message to prescribed matches (37%) or had sent private messages once a month or more frequently (27%). While more than half (56%) had not joined group chats, 24.1% had participated in them and 19.5% had joined without participating actively.

Greater emotional support was negatively correlated with frequency of symptoms of anxiety ( $r(135) = -0.32$ ,  $p > 0.01$ ). Neither perceived emotional support nor interpersonal support were significantly correlated with frequency of sending one-to-one messages to other app users ( $p > 0.05$ ). There was a significant positive correlation between greater frequency of anxiety symptoms and more frequent use of the private messaging feature ( $r(27) = 0.45$ ,  $p = 0.015$ ).

Among participants who had sent private messages to their matches ( $n = 29$ ), greater interpersonal support for appraisals of one's ability to cope with cancer and higher frequency of sending messages to a peer on the app were associated with more frequent symptoms of anxiety ( $F(2,26) = 8.649$ ,  $p = 0.001$ ),  $R^2 = 0.4$ . Greater perceived emotional support and higher frequency of sending private messages were significantly related to higher anxiety symptoms



**FIGURE 1** Reasons for using Stupid Cancer app. Participants were permitted to choose as many reasons as they wished

TABLE 1 Participant demographics and background variables

Variable	Mean (SD)	Min-max
Current age	31.74 (7.06)	19–57
Age at diagnosis	24.65 (8.77)	3–48
Variable	N (%)	
<b>Treatment status</b>		
In treatment	13 (7.2)	
Completed treatment	82 (45.6)	
On-going therapies (hormonal, immunotherapy, etc)	25 (13.9)	
Chronic disease (in/out of treatment)	11 (6.1)	
Not yet started treatment	2 (1.1)	
No response	47 (26.1)	
<b>Gender</b>		
Female	113 (62.8)	
Male	21 (11.7)	
Transgender, nonbinary, third gender	1 (0.5)	
No response	45 (25.0)	
<b>Race</b>		
White or Caucasian	116 (64.4)	
Black or African American	4 (2.2)	
Asian or Asian American	9 (5.0)	
American Indian or Alaskan Native	0 (0.0)	
Native Hawaiian or other Pacific Islander	0 (0.0)	
More than one race	2 (1.1)	
Prefer not to answer	4 (2.2)	
No response	45 (25.0)	
<b>Ethnicity</b>		
Hispanic or Latino/a	10 (5.6)	
Non-Hispanic or non-Latino/a	115 (63.9)	
Prefer not to Answer	7 (3.9)	
No response	48 (26.7)	
<b>Relationship status</b>		
Married/domestic partnership/civil union	47 (26.1)	
Single, but cohabitating with a significant other	11 (6.1)	
Single, never married	71 (39.4)	
Divorced or separated	4 (2.2)	
Widowed	0 (0.0)	
Prefer not to answer	2 (1.1)	
No response	45 (25.0)	
<b>Education</b>		
Some high school, but no degree	0 (0.0)	
High school degree	2 (1.1)	
Vocational training, other than college	4 (2.2)	

TABLE 1 (Continued)

Variable	N (%)
Some college, but no degree	22 (12.2)
College degree	52 (28.9)
Postgraduate degree	55 (30.6)
Prefer not to answer	0 (0.0)
No response	45 (25)
Healthcare access	
Yes	121 (67.2)
No	7 (3.9)
No response	52 (28.9)

( $F(2,26) = 7.094$ ),  $p = 0.003$ ),  $R^2 = 0.353$ . Depression and cancer-related self-efficacy were not found to significantly relate to either type of app usage (Table 1).

## 4 | DISCUSSION

This study represents preliminary findings about the socioemotional correlates of mobile health application usage among a sample of YA cancer survivors. Specifically, we investigated how frequency of symptoms of depression and anxiety were related to perceived emotional and interpersonal support and usage of app features. It was found that the decision to download the Stupid Cancer app at CancerCon was unrelated to socio-demographic factors or psychological symptoms, which provides evidence that access to support through a mobile application was not limited by socioeconomic or other disparities in this sample. While features such as group chats and private messaging were only utilized by a minority of those who downloaded the app, those who used messaging were also significantly more likely to report symptoms of anxiety despite perceiving interpersonal and emotional support in their existing networks. Therefore, those who were most anxious were also most interested in using private messaging to access a fellow YA cancer survivor.

Interpretation of these findings is limited due to its cross-sectional nature. The direction of the relationships between anxiety, perceived social support, and mobile application use cannot be determined conclusively. For example, it is possible that app usage or private messaging with a peer may contribute to symptoms of anxiety if informational resources are inadequate, or interacting with another survivor might incur distress among those who already have symptoms of anxiety. Frequently messaging another survivor may also signify an excessive self-monitoring, a possible symptom of anxiety. To best explore the benefits and potential unintended consequences of an application designed to support YA survivors, apps in the future may elect to integrate experimental methods that track individual differences in emotional symptoms in real time, such as ecological momentary assessment. Longitudinal methods of study might also capture the effects of depression, which may have a

delayed impact on app usage. Further study may benefit from a more inclusive sample; conference attendees may have been a population of survivors already seeking further emotional support, and the survey responders were largely homogenous in gender and race.

Despite these limitations, the study has implications for the development of mobile health applications and for clinical practice with YA cancer survivors. Although the app utilized for the present study was targeted to a YA group, it was not tailored to individual needs. Apps developed in the future should consider taking mental health factors such as anxiety into account. For example, knowing that some users have symptoms of depression or anxiety may promote the design of apps with more features of structured, evidence based interventions that address mental health challenges and supplement support from peers. Clinically, it is worthwhile to consider that despite reporting adequate emotional and interpersonal support, YAs in this sample with symptoms of anxiety still sought the opportunity to send private messages to their peers. It may be inferred that they prefer support from fellow YA survivors to their extant social networks. With increasing awareness of mobile health applications, support providers may consider recommending and increasing support for the download and usage of apps for tailored support.

## CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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**How to cite this article:** Ahmad ZN, Benedict C, Hotchkiss M, Ford JS. Psychological symptoms and patterns of mobile application use for young adult cancer survivors. *Psycho-Oncology*. 2021;30:1178–1182. <https://doi.org/10.1002/pon.5662>