Digital Technologies for Interventions in Cancer Survivors

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Digital Technology

• What is it?
  • Electronic
  • Mobile
  • Wearables
  • Social media

• Cancer survivor use

• Potential for intervention in cancer survivor population
Global digital snapshot

- Total Population: 7.476 Billion
- Internet Users: 3.773 Billion
- Active Social Media Users: 2.789 Billion
- Unique Mobile Users: 4.917 Billion
- Active Mobile Social Media Users: 2.549 Billion

Data: Hootsuite
A minute on the Internet

- 87,000+ hours video streamed on Netflix
- 320+ new accounts on Twitter
- 12,000+ new ads posted on Craigslist
- 510,040 comments made on Facebook

- 2 million minutes of voice calls on Skype
- 6,600+ new pictures uploaded on Flickr
- 100+ new accounts on LinkedIn
- 13,000+ iPhone apps downloaded

- 168 million emails sent
- 50+ downloads from WordPress
- 1,500+ new blog posts
- 20,000+ new posts on Tumblr

- 500,000 tweets on Twitter
- 695,000+ status updates on Facebook
- 70+ domains registered
- 1,600+ reads on Scribd

- 350,000 tweets on Twitter
- 1,700+ downloads of the Firefox browser
- 600+ new videos posted on YouTube
- 79,364 wall posts on Facebook

- 4 million search queries on Google
- 6,600+ new pictures uploaded on Flickr
- 2 million minutes of voice calls on Skype
- 20,000+ new posts on Tumblr

- 87,000+ hours video streamed on Netflix
- 320+ new accounts on Twitter
- 12,000+ new ads posted on Craigslist
- 510,040 comments made on Facebook

Data: Go-Globe.com
Cancer Survivor Population

• 16.9 million cancer survivors; 5% of US population
• 21.7 M by 2029
• 67% have survived > 5 y; 45% > 10 y; 18% > 20 y
• 64% are over age 65 y
• Female breast (23%, 3.6 million), prostate (21%, 3.3 million), colorectal (9%, 1.5 million), gynecologic (8%, 1.3 million) and melanoma (8%, 1.2 million)

Cancer Survivorship Population in WHI

- Number of cancer survivors alive by age at first cancer diagnosis from March 31, 2018 data release.
- Includes all reported and discovered (NDI) death information and cases determined from the cause of death information only
- Cancer survivor sample overall and stratified at age 65 y

<table>
<thead>
<tr>
<th>Age at first cancer diagnosis</th>
<th>Any Cancer</th>
<th>Invasive Breast Cancer</th>
<th>Colorectal Cancer</th>
<th>Lung Cancer</th>
<th>Endometrial Cancer</th>
<th>Ovarian Cancer</th>
<th>Melanoma Skin Cancer</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;65 Years</td>
<td>3136 (62.0%)</td>
<td>1486 (72.0%)</td>
<td>201 (54.3%)</td>
<td>47 (13.6%)</td>
<td>230 (74.9%)</td>
<td>61 (33.0%)</td>
<td>296 (85.3%)</td>
</tr>
<tr>
<td>&gt;=65 Years</td>
<td>12,806 (45.6%)</td>
<td>5334 (60.6%)</td>
<td>1264 (44.4%)</td>
<td>669 (18.6%)</td>
<td>844 (57.3%)</td>
<td>237 (22.5%)</td>
<td>1525 (73.2%)</td>
</tr>
</tbody>
</table>
Cancer survivors perceived needs re: eHealth

- Survey of 212 cancer survivors – online panel
- 66% physical care
- 54% healthy lifestyle
- 43% social care
- 38% psychological care
- However, eHealth interest assoc with younger age, greater education, in active treatment, chemo, and prostate cancer (male vs female), lower QOL

Jansen F, Supp Care Cancer, 2015
Advantages of Technology-centric Interventions in Cancer Survivors

• Expanded reach
  • Rural
  • Diverse age, race/ethnicity

• Removes barriers to participation: travel, mobility, costs

• Consistency in intervention delivery; centralized

• Tailoring for individual; adaptive response

• Managing participant burden; self-directed/paced

• Software-driven, routine fidelity monitoring

• Variety of EB interventions
Disadvantages / Current State of Evidence

• Select measures cannot be collected without in-person methods
• Recruitment bias?
• Home-grown versus robustly developed interventions and delivery approaches
  • Mixed method research with active survivor input
  • Adequate adaptation of existing non-cancer programs
• Differential engagement – various technologies, dose/frequency
• Limited number of studies with effectiveness outcomes in cancer survivors
Technology Use among WHI Women

- Form 156; 2014-15
- Limited data set:
  - Do you own a cell phone?
  - Do you use text messaging?
  - Do you own a computer?
  - Do you use email?
  - Do you use the internet?
  - Do you use smartphone or ipad for email or internet?
  - Do you use the internet for health information?

![Bar chart showing technology use among WHI women](chart.png)
Does Not Own Cell Phone by Race/Ethnicity

Percent (%)

- White
- Black
- Hispanic
- American Indian
- Asian/Pacific Islander
- Unknown
Sends or Receives Text Messages by Age

Percent (%)

Age at Start of Extension 2010-2015
Technology Use in Older Cancer Survivors

• U.S. National Health and Aging Trends Survey
• Cancer survivors > age 64y (n =1411)
• Use of information and communication technology

<table>
<thead>
<tr>
<th>ICT Use</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of email or text messaging</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No/rarely</td>
<td>443</td>
<td>57.8</td>
</tr>
<tr>
<td>Some days</td>
<td>93</td>
<td>16.1</td>
</tr>
<tr>
<td>Most Days</td>
<td>147</td>
<td>26.1</td>
</tr>
<tr>
<td>Internet use for health matters</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>131</td>
<td>23.3</td>
</tr>
<tr>
<td>No</td>
<td>552</td>
<td>76.7</td>
</tr>
</tbody>
</table>

• Frequent ICT use was associated with higher mental and physical well-being

Lee, Kim and Sharatt, *Qual Life Res*, 2018
## WHISH Technology Use

<table>
<thead>
<tr>
<th>Method</th>
<th>Fall 2016 (no. participants)</th>
<th>Fall 2017 (no. participants)</th>
<th>Fall 2018 (no. participants)</th>
<th>Current (date)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly IVR Inbound contacts (IVR PA tracking system)</td>
<td>930 (6.7%)</td>
<td>1591 (7.3%)</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Tracked PA in IVR</td>
<td>NA</td>
<td>874 (4.0%)</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Monthly IVR Outbound (Adriana Motivational Calls)</td>
<td>21,023</td>
<td>19,300</td>
<td>18,217</td>
<td>17,928 (Apr 2019)</td>
</tr>
<tr>
<td>Website Usage - Pre- upgrade</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Logged into website tracking system</td>
<td>877 (6.3%)</td>
<td>1252 (5.8%)</td>
<td>1333 (6.2%)</td>
<td>NA</td>
</tr>
<tr>
<td>Tracked PA on the website</td>
<td>NA</td>
<td>938 (4.3%)</td>
<td>980 (4.5%)</td>
<td>NA</td>
</tr>
</tbody>
</table>
## Smartphone Usage

**WHISH Survey #3** (data collection July 2017-March 2018)

### Do You Use A Smartphone

<table>
<thead>
<tr>
<th></th>
<th>N = 12,620 responders to Survey #3</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did not answer</td>
<td>620</td>
<td>4.9</td>
</tr>
<tr>
<td>No</td>
<td>5652</td>
<td>44.8</td>
</tr>
<tr>
<td>Yes</td>
<td>6348</td>
<td>50.3</td>
</tr>
</tbody>
</table>

### If Yes, what type of smartphone?

<table>
<thead>
<tr>
<th>Type</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>iPhone</td>
<td>4476</td>
<td>70.5</td>
</tr>
<tr>
<td>Other</td>
<td>1414</td>
<td>22.3</td>
</tr>
<tr>
<td>Did no answer</td>
<td>458</td>
<td>7.2</td>
</tr>
</tbody>
</table>
**WHISH Website Spring 2016**

**WHISH Website Upgrade Oct-Nov. 2018**

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**WEBISTE**

We have exciting news! For those of you who use the Internet, you can now track your physical activity on the WHISH activity-tracking website. If you are a visual person, the website is a great way to see your progress. Our user-friendly site offers a lot of great features:

- An easy way to set your goals and track your physical activity
- Access to all of the WHISHful Actions you’ve received in the mail
- The ability to log on as often as you like
- Instant feedback that highlights your progress
- Access to the goodThe book and the WHISH calendar

Following your progression over time can be a strong motivator to help you stick to your physical activity routine. Plus, seeing your progress on a graph can be both rewarding and fun! We encourage you to log on and enter your physical activity data from the WHISH calendar on the website. See the “Steps to Log On” and give it a try!

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## WHISH Website Use Post-Upgrade November 2018 Launch to Present

### Average number of visits to WHISH homepage: (Nov. 2018-Feb. 2019)

<table>
<thead>
<tr>
<th>Percentage of Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,724 *</td>
</tr>
<tr>
<td>*Use peaks immediately following quarterly newsletter mailings</td>
</tr>
</tbody>
</table>

### Devices Used by Users Visiting WHISH Website

<table>
<thead>
<tr>
<th>Device</th>
<th>Percentage of Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desktop</td>
<td>75.34%</td>
</tr>
<tr>
<td>Tablet</td>
<td>14.22%</td>
</tr>
<tr>
<td>Mobile</td>
<td>10.43%</td>
</tr>
</tbody>
</table>

### Name of System

<table>
<thead>
<tr>
<th>System</th>
<th>Percentage of Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows</td>
<td>54.81%</td>
</tr>
<tr>
<td>iOS</td>
<td>19.14%</td>
</tr>
<tr>
<td>Macintosh</td>
<td>16.4%</td>
</tr>
<tr>
<td>Android</td>
<td>5.17%</td>
</tr>
</tbody>
</table>
Monthly Motivational Email Campaign

April 2019: That’s your cue!

Hello %%First Name%%!

Need an additional cue to get up and move? Set a timer as a reminder. When the timer goes off, get up and move, stretch, or start a household chore. Move any way you can and have fun with it!

Click the image below for more examples of how to include aerobic, strength, and balance activities into your day!

Link to Move Your Way “Tips for Busy Days” video

https://www.youtube.com/watch?time_continue=7&v=61p1OIO20wk

Visit the WHISH website for more videos, news, and research on physical activity

Your WHISH ID for logging on to the website is: %%WHISH ID%%
LIVES

• 1205 stage II-IV ovarian cancer
• NRG/ GOG 0225
• 24 month intervention with 33 calls
• Telehealth coaching using MI
• Delivered by nutrition science students; oversight by RDNs
• Option technologies: SMS, email, blogging
Tech Use: LIVES Ovarian Cancer Survivors

- Telecoaching – 10,993 coaching calls to date; 21 minutes average length
- 148/600 (25%) used MyFitnessPal over 5 y
- 420/~600 FitBit (70%); only 48 friended their coach to exchange communications
- Blog – 60 set-up own login information to access blog; 156 used generic log in; average of 56 visitors/year with 45 views per visitor
- Emails – 850 of 1205 eligible selected to use email for study communications.
Influence of age on SMS use during study

<table>
<thead>
<tr>
<th>Age</th>
<th>ALL pts</th>
<th>SMS Users</th>
<th>% SMS Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30</td>
<td>3</td>
<td>3</td>
<td>100%</td>
</tr>
<tr>
<td>30-39</td>
<td>21</td>
<td>15</td>
<td>71%</td>
</tr>
<tr>
<td>40-49</td>
<td>150</td>
<td>98</td>
<td>65%</td>
</tr>
<tr>
<td>50-59</td>
<td>340</td>
<td>207</td>
<td>61%</td>
</tr>
<tr>
<td>60-69</td>
<td>363</td>
<td>190</td>
<td>52%</td>
</tr>
<tr>
<td>70-79</td>
<td>128</td>
<td>46</td>
<td>36%</td>
</tr>
<tr>
<td>80-89</td>
<td>7</td>
<td>2</td>
<td>29%</td>
</tr>
<tr>
<td>89+</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
Summary of Technology Use in Cancer Survivors

• Limited data

• Wearable activity monitors, feasibility during and after cancer therapy demonstrated (not age specific)

• Telehealth coaching has demonstrated effectiveness in changing diet, medication adherence, physical activity, screening and psychosocial symptoms, etc

• Gaps: SMS and/or App effectiveness, multi-modal and multi-behavioral, aging survivors, diverse race/ethnicity, and cost-effectiveness

Delivery options, proof of effectiveness needed

Mail/print education

Digital health or Multimodal coaching

Telephonic counseling

Onsite 1:1 and Group counseling

Increasing Touch: Required for Effectiveness?

Application stack

1. Customer views a page on your website.

2. Customer clicks on a "Call me!" button, which runs a server-side script in your web application.

3. Your application POSTs a call request to the Twilio API.

4. Twilio asks your application for an action to take after calling the customer.

5. Twilio calls the customer's phone.

6. Twilio asks your application for an action to take after connecting the customer service agent(s). The first one to pick up is informed of the context of the call (example: which product the customer is viewing).

7. "You have a customer interested in the Apple MacBook Pro. Connecting you now..."

8. "Hi, I understand you have a question about the MacBook Pro. How can I help?"

9. "We're connecting you now..."
LIVES software

Follow-up and Reminder E-mails

Text Messages

Forums

LivesCoordinatingCenterCoaching
Calls: 33 Intervention
22 Usual Care

Newsletters

Birthday Cards

Ovarianlives.org
Participant Feedback re: Technology-centric programs / interventions

• Burden of time
• Ease of use
• Fun
• Technology support
• Tailoring
• Avoid repetitiveness, predictability in messages
• Build rapport, perceived support
• Manage expectations
• Program fatigue
WHI, Technology and Cancer Survivorship

• Analyze existing data to determine if technology is associated with health behaviors, outcomes
• LLS2 –collect additional data
  • Technology in home
  • Expand on wearable data collection
• Qualitative research on barriers and facilitators to use with advanced age
• Interventions with relevant aging-related outcomes
Future Research - Targeted Outcomes

Cancer survivors
- Screening behaviors
- Chronic disease self-management
- Diet
- Physical activity
- Sleep
- Ostomy care
- Symptoms/ symptom management
  - Anxiety
  - Depression
  - Pain
  - Cognition
  - Fatigue
- Body weight
- Falls prevention
- ADLs; physical function
THANK YOU

cthomson@email.Arizona.edu