mCollegeHealth: Leveraging Mobile for Healthier Campuses

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Epidemiology of mHealth Access

http://rememberitnow.com/blog/tag/mhealth/
Internet Use by Age, 2000-2010

- **Teens 12-17***: 93%
- **All adults 18 and older**: 79%
- **Adults 18-29**: 95%
- **Adults 30-49**: 87%
- **Adults 50-64**: 78%
- **Adults 65 and older**: 42%

* Teens data is from Sept-09.
### Generational Differences in Online Activities

<table>
<thead>
<tr>
<th>Online Teens^ (12-17)</th>
<th>Gen Y (18-32)</th>
<th>Gen X (33-44)</th>
<th>Younger Boomers (45-54)</th>
<th>Older Boomers (55-63)</th>
<th>Silent Generation (64-72)</th>
<th>G.I. Generation (73+)</th>
<th>All Online Adults^^</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Go online</strong></td>
<td>93%</td>
<td>87%</td>
<td>82%</td>
<td>79%</td>
<td>70%</td>
<td>56%</td>
<td>31%</td>
</tr>
<tr>
<td><strong>Teens and Gen Y are more likely to engage in the following activities compared with older users:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Play games online</td>
<td>78</td>
<td>50</td>
<td>38</td>
<td>26</td>
<td>28</td>
<td>25</td>
<td>18</td>
</tr>
<tr>
<td>Watch videos online</td>
<td>57</td>
<td>72</td>
<td>57</td>
<td>49</td>
<td>30</td>
<td>24</td>
<td>14</td>
</tr>
<tr>
<td>Get info about a job</td>
<td>30</td>
<td>64</td>
<td>55</td>
<td>43</td>
<td>36</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>Send instant messages</td>
<td>68</td>
<td>59</td>
<td>38</td>
<td>28</td>
<td>23</td>
<td>25</td>
<td>18</td>
</tr>
<tr>
<td>Use social networking sites</td>
<td>65</td>
<td>67</td>
<td>36</td>
<td>20</td>
<td>9</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>Download music</td>
<td>59</td>
<td>58</td>
<td>46</td>
<td>22</td>
<td>21</td>
<td>16</td>
<td>5</td>
</tr>
<tr>
<td>Create an SNS profile</td>
<td>55</td>
<td>60</td>
<td>29</td>
<td>16</td>
<td>9</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Read blogs</td>
<td>49</td>
<td>43</td>
<td>34</td>
<td>27</td>
<td>25</td>
<td>23</td>
<td>15</td>
</tr>
<tr>
<td>Create a blog</td>
<td>28</td>
<td>20</td>
<td>10</td>
<td>6</td>
<td>7</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Visit a virtual world</td>
<td>10</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Activities where Gen X users or older generations dominate:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Get health info</td>
<td>28</td>
<td>68</td>
<td>82</td>
<td>74</td>
<td>81</td>
<td>70</td>
<td>67</td>
</tr>
<tr>
<td>Buy something online</td>
<td>38</td>
<td>71</td>
<td>80</td>
<td>68</td>
<td>72</td>
<td>56</td>
<td>47</td>
</tr>
<tr>
<td>Bank online</td>
<td>*</td>
<td>57</td>
<td>65</td>
<td>53</td>
<td>49</td>
<td>45</td>
<td>24</td>
</tr>
<tr>
<td>Visit govt sites</td>
<td>*</td>
<td>55</td>
<td>64</td>
<td>62</td>
<td>63</td>
<td>60</td>
<td>31</td>
</tr>
<tr>
<td>Get religious info</td>
<td>26~</td>
<td>31</td>
<td>38</td>
<td>42</td>
<td>30</td>
<td>30</td>
<td>26</td>
</tr>
</tbody>
</table>

[http://www.pewinternet.org/Infographics/Generational-differences-in-online-activities.aspx](http://www.pewinternet.org/Infographics/Generational-differences-in-online-activities.aspx)
Social Media Use by Age, 2005-2010

Source: Pew Research Center's Internet & American Life Project Surveys, September 2005 – May, 2010. All surveys are of adults 18 and older.
Broadband and Dial-up Adoption, 2000-2010

% of American adults who access the internet via dial-up or broadband, over time.

Source: Pew Internet & American Life Project surveys.

# Cellphone Use by US Adults

<table>
<thead>
<tr>
<th>Topic</th>
<th>Dec 2005</th>
<th>Dec 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wireless subscribers</td>
<td>208M</td>
<td>303M</td>
</tr>
<tr>
<td>Wireless penetration</td>
<td>69%</td>
<td>96%</td>
</tr>
<tr>
<td>Wireless only households</td>
<td>8%</td>
<td>27%</td>
</tr>
<tr>
<td>Minutes of use</td>
<td>1.5T</td>
<td>2.2T</td>
</tr>
<tr>
<td>Annual text messages</td>
<td>81B</td>
<td>2.1T</td>
</tr>
</tbody>
</table>

http://www.ctia.org/advocacy/research/index.cfm/AID/10378
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Take a picture</td>
<td>91</td>
<td>83</td>
<td>78</td>
<td>60</td>
<td>50</td>
<td>16</td>
<td>76</td>
</tr>
<tr>
<td>Send or receive text messages</td>
<td>94</td>
<td>83</td>
<td>68</td>
<td>49</td>
<td>27</td>
<td>9</td>
<td>72</td>
</tr>
<tr>
<td>Access the internet</td>
<td>63</td>
<td>42</td>
<td>25</td>
<td>15</td>
<td>17</td>
<td>2</td>
<td>38</td>
</tr>
<tr>
<td>Play a game</td>
<td>57</td>
<td>37</td>
<td>25</td>
<td>11</td>
<td>10</td>
<td>7</td>
<td>34</td>
</tr>
<tr>
<td>Record a video</td>
<td>57</td>
<td>39</td>
<td>23</td>
<td>11</td>
<td>7</td>
<td>4</td>
<td>34</td>
</tr>
<tr>
<td>Send or receive email</td>
<td>52</td>
<td>35</td>
<td>26</td>
<td>22</td>
<td>14</td>
<td>7</td>
<td>34</td>
</tr>
<tr>
<td>Play music</td>
<td>61</td>
<td>36</td>
<td>18</td>
<td>10</td>
<td>7</td>
<td>5</td>
<td>33</td>
</tr>
<tr>
<td>Send or receive instant messages</td>
<td>46</td>
<td>35</td>
<td>22</td>
<td>15</td>
<td>13</td>
<td>6</td>
<td>30</td>
</tr>
</tbody>
</table>

# Mobile-Only Household Health

<table>
<thead>
<tr>
<th>Category</th>
<th>Land-line Households</th>
<th>Cellphone-only Households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Had five or more alcoholic drinks in one day in the past year</td>
<td>17.2%</td>
<td>37.7%</td>
</tr>
<tr>
<td>Current smoker</td>
<td>18.4%</td>
<td>30.2%</td>
</tr>
<tr>
<td>Flu shot in the past year</td>
<td>35.7%</td>
<td>19.2%</td>
</tr>
<tr>
<td>Tested for HIV</td>
<td>35.8%</td>
<td>49.3%</td>
</tr>
<tr>
<td>Has a usual place to go for medical care</td>
<td>87.5%</td>
<td>69.9%</td>
</tr>
<tr>
<td>Failed to get medical care in the last year because of cost</td>
<td>6.5%</td>
<td>14.0%</td>
</tr>
<tr>
<td>Currently uninsured</td>
<td>13.6%</td>
<td>28.3%</td>
</tr>
</tbody>
</table>

mHealth Dynamic Growth
ROCK REPORTS

35 digital health companies have received $2M+ in 2011

Digital Health companies receiving $2M+ in financing in 2011
Source: Capital IQ + CrunchBase

@jaybernhardt
Largest Deals of 2011

**eghc**
software for healthcare and insurance delivery
$61M from Camden Partners and Kleiner Perkins Caufield & Byers

**lumosity**
software for cognitive enhancement
$32.5M from Menlo Ventures, FirstMark Capital, Harrison Metal Capital, Norwest

**ABILITY**
connecting providers and Medicare
$27M from Bain Capital Ventures and Lemhi Ventures

**practice fusion**
web-based EMR
$23M from Founders Fund, Artis Capital Management, Glynn Capital, Morgenthaler, Felicis
Adoption of mHealth Initiatives and Phases, Globally

Source: mHealth. New horizons for health through mobile technologies, WHO, June 2011

mHealth > SMS

SMS or MMS
Voice (human, recorded, IVR)
Email or Instant Message
Audio file (MP3, etc.)

Video file (M4V, etc.)
Mobile Web Monitoring
Custom application program ("apps")

mHealth market 2015: 500m people will be using healthcare smartphone applications

Smartphone user base in 2015 (million)

- Total: 1.400
- mHealth: 500

30% of total smartphone users will have used mHealth applications by 2015

Share of mHealth revenue sources of total mHealth market opportunity in 2010-2015 (%)

- Transaction: 8%
- Advertisement: 1%
- Paid downloads: 14%
- Device sales: 30%
- Services: 46%

Those mHealth users will mainly pay for services and devices

Smartphone applications will become the killer applications for mobile health solutions.

Text Messaging as a Tool for Behavior Change in Disease Prevention and Management

Heather Cole-Lewis* and Trace Kershaw

*Correspondence to Heather Cole-Lewis, Yale University School of Epidemiology and Public Health, PO. Box 206034, New Haven, CT 06520-0340 (e-mail: heather cole-lewis@yale.edu).

Accepted for publication January 25, 2010.

Mobile phone text messaging is a potentially powerful tool for behavior change because it is widely available, inexpensive, and instant. This systematic review provides an overview of behavior change interventions for disease management and prevention delivered through text messaging. Evidence on behavior change and clinical outcomes was compiled from randomized or quasi-experimental controlled trials of text message interventions published in peer-reviewed journals by June 2009. Only those interventions using text message as the primary mode of communication were included. Study quality was assessed by using a standardized measure. Seventeen articles representing 10 studies (5 disease prevention and 7 disease management) were included. Intervention length ranged from 3 months to 12 months, none had long-term follow-up, and message frequency varied. Of 9 sufficiently powered studies, 8 found evidence to support text messaging as a tool for behavior change. Effects exist across age, minority status, and nationality. Nine countries are represented in this review, but it is problematic that only one is a developing country, given potential benefits of such a widely accessible, relatively inexpensive tool for health behavior change. Methodological issues and gaps in the literature are highlighted, and recommendations for future studies are provided.

cellular phone; health behavior; intervention studies; review

Abbreviations: HIV, human immunodeficiency virus; mHealth, mobile health.
What works in mHealth?

• Hundreds of pilots = Limited evidence base
• Conducted a “review of systematic reviews”
  – Google Scholar search for ‘review’ and terms: mHealth, mobile, SMS, cell phone, wireless
• Found 6 full-text systematic-reviews
  – Broad topics: Healthcare, Health services, Maternal and Child Health, Behavior change,
  – Narrow topics: Diabetes management, Chronic pain, Hospital appointments
  – Mobile channels: Voice, SMS, email, etc.

- mHealth interventions taxonomy:
  - Improve diagnosis, treatment, monitoring
  - Deliver treatment or disease management, health promotion, improve treatment compliance
  - Improve processes, attendance, reminders

- Clinical decision support systems (diagnosis & disease management)
- Medical education
- Disease monitoring
- Data collection tools
- Medical records
- Test results notification
- Appointment reminders
- Treatment programs
- Chronic disease management
- Medication adherence
- Health behavior change
- Acute disease management
- Untargeted mass health promotion

- Reviewed 12 studies (17 articles) using SMS
  - Intervention length ranged from 3-12 months
  - Sample sizes (n=16-126, + 1,705)
  - Disease management: Diabetes, Asthma
  - Disease prevention: Medication adherence, Weight loss, Physical activity, Smoking cessation
  - 8 of 9 powered studies found evidence of significant behavior change

- 21 studies reviewed from 2010 and 2011
- Interventions:
  - Diary/log, Reminders, Education
- Significant outcomes:
  - Self-efficacy, HbA1c, Self-management behaviors
- Limitations:
  - Small samples (n=6-100)
  - Short durations (2 weeks - 1 year)
  - Technical issues (67% of studies)

- 25 studies conducted in 13 countries
- Interventions: SMS, voice, email, or combination
- Message frequency: 5x day – 1x week
- Significant Improvements (60% of measures):
  - Processes: Appointment attendance, Diagnosis and treatment time, Improved teaching and training.
  - Clinical outcomes: Adherence, Asthma, HbA1C, Stress levels, Smoking quit rates, Self-efficacy.
  - Limited data on cost/benefit

- Reviewed 14 studies (4 = prevention; 10 = care)
  - Intervention length: 6 weeks to 1 year
  - Sample sizes: 10-1705
  - 4 of 14 used theory-based intervention
- 13 of 14 found positive behavior change outcomes
- Most effective SMS interventions:
  - SMS dialogue initiation
  - Tailored SMS content
  - Interactive SMS exchanges

- Reviewed 29 studies with 33 interventions
  - Study sizes: n=325-2864
  - Study durations: 2-7 months
- 32 of 33 interventions showed benefits of sending patient reminders prior to appointments
  - Manual calls more effective than automated reminders (39% vs. 29%) but higher cost
  - No differences on reminder timing
Tamrat & Kachnowski (2011) Special Delivery: An analysis of mHealth in maternal and newborn health programs and their outcomes around the world. *MCHJ*.

• Reviewed 34 articles in developing countries
  – Topics: Emergency medical response, point-of-care support, health promotion, data collection

• Most studies showed positive benefits
  – Minimize time barriers and facilitate urgent are
  – Address low coverage and professional isolation
  – SMS messages/reminders for health promotion
  – Data collection and interoperability
mHealth Review of Reviews: Summary

• SMS-based interventions can be effective for:
  – Simple behaviors (e.g., reminders, appointments)
  – Short-term complex behaviors (e.g., adherence, smoking cessation, disease self-management) if:
    • SMS messages are individually-tailored
    • SMS messages facilitate interactive dialogue

• More research and evaluation are needed:
  – Larger samples, longer durations, more cost data
  – mHealth beyond SMS (voice, IVR, mWeb, apps)
Selected mHealth Examples: Adult and College Health
Don’t forget your multivitamin! Baby’s spine and brain are developing now. Getting 400 micrograms of folic acid daily is key to help prevent birth defects.

http://text4baby.org
Text2Quit is an invitation only subscription service. Once you have your invitation code, click on Subscribe button above to enroll into the program and receive Text2Quit Alert Text Messages.

MaXimize your chances of QUITTING
Join Text2Quit today

Welcome to Text2Quit

About Text2Quit
Text2Quit is a personalized mobile coach that guides you through the quitting process. Designed by experts from The George Washington University School of Public Health and Health Services, Text2Quit combines evidence-based smoking cessation techniques with cutting edge technology.

Supported Browsers
Text2Quit users web technology not supported by older browsers. Supported browsers are as follows:

http://voxiva.com
FrontlineSMS: Using mobile technology to promote positive social change

* New FrontlineSMS website layout: Find out more and share your views [here](#)

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@jaybernhardt
Location Based mHealth Programs

Know your HIV status?
Text: Your Zip Code
To: KnowIt or 866948
To find HIV Test Centers near you.
www.hivtest.org

SAMHSA Treatment Locator
Mobile Web
Top mHealth Apps for College Students

- MyFitnessPal
- Period Tracker
- Triage
Quantified Self

http://nike.com
http://fitbit.com
http://www.diabetesmine.com
http://sleepzine.com
Go Viral to Improve Health: IOM-NAE Health Data Collegiate Challenge

College and university students can participate in an exciting initiative to transform health data into effective, innovative new applications (apps) that take on the nation's pressing health issues.

http://challenge.gov
Top mHealth Apps for College Students

http://www.watblog.com
http://www.gadgetsdna.com
http://hireheathervilla.com
mHealth Overview

mHealth Applications:
• Call Centers
• Emergency Alerts
• Appointment Reminders
• Patient Records
• Health Surveys
• Monitoring & Surveillance
• Treatment Adherence
• Health Promotion
• Mobile Telemedicine
• Community Mobilization
• Decision Support Systems

mHealth Channels:
• SMS or MMS
• Voice (human, recorded, IVR)
• Email or IMs
• Audio files
• Video files
• Mobile Web
• Monitoring
• Custom apps
College mHealth Summary

• Many positives for mHealth interventions
  – Increased & Sustained Reach
  – Audience Relevance, Involvement, and Engagement
  – Scalable and Affordable Interventions
  – Facilitates Measurement and Program Evaluation
  – Early evidence-base for SMS interventions is promising

• Many challenges remain for mHealth
  – Limited expertise and resources among professionals
  – More research and evaluation with sustained programs
THANK YOU

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