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# **MOBILE HEALTH: THE PROMISE AND THE PROGRESS**

# Mohawk MEDIC

- not-for-profit applied research facility focused on digital health
- approaching \$20M in digital health Applied R&D since 2007
- working globally, have worked on all continents, in about 12 countries
- have completed over 60 projects in digital health
- worked with small and medium enterprises, start-ups, governments, public-private partnerships, NGOs, etc.
- applied research grant holder with CIHR, NSERC, CFI, FedDev, OCE, etc.
- recognized experts on interoperability and mobile health



Mohawk students win national app contest

www.cbc.ca/hamilton/news/story/2012/06/01/mohawk-students-hamilton-app.html

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## Mohawk students win national app contest

By Conrad Collaco, CBC News Posted: Jun 1, 2012 12:16 PM ET | Last Updated: Jun 1, 2012 4:22 PM ET



Mohawk College students Jerad Godreault (left) and Leo Godreault win the app challenge at the National ehealth conference in Vancouver. (Arun Agrawal/Mohawk College)

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Mohawk College students Leo and Jerad Godreault are doing what they can to make sure the people who need to take medication are doing it on time. And, their bright idea has made them winners of the app challenge at the national ehealth conference.



# 3 attempts at defining mHealth...

***mHealth** is an area of electronic health and it is the provision of health services and information via mobile technologies such as mobile phones and Personal Digital Assistants (PDAs).*

. – World Health Organization, 2009

***mHealth** is the delivery of healthcare services via mobile communication devices.*

. – Foundation for the National Institutes of Health, 2010

***mHealth** is the use of mobile and wireless devices to improve health outcomes, healthcare services and health research.*

– NIH Consensus Group, 2011





m-Health is not a pure science – it is a confluence of forces, including healthcare, technology, consumer demand and public policy

# Relatives of mHealth

- Wireless Medicine, Digital Medicine
  - Eric Topol, Discusses a system of super-convergence
- Personalized Health
  - Individual unique personal attributes (genetics, personal history) used in diagnosis and especially treatment (drug, therapy) selection
- Consumer Health
  - Empowerment and enablement of end-consumers to select diagnose, treat and manage their own health
- Telehealth
  - Some health intervention has a distance component
- eHealth
  - Mostly refers to large jurisdictional or organizational “backoffice” systems
- Social Media / Patient Community Health
  - Patient to patient interactions between individuals in a certain population

Mobile devices - capability and adoption

# **MOBILITY**



# MOBILE COMPUTING CHARACTERISTICS

- Devices are always on, always connected
- Always with the individual, personal
- Convenient
- Data input and output
- Information at your finger tips, from the “cloud”
- Special purpose health “apps”
- In context (e.g. geo-location, patient-specific state via wearables – blood sugar, blood pressure, etc.)
- Highly connected multi-way communications





**IBM mainframe computer, circa 1972**  
(System/370 Model 158-3)

**COST:** ~\$3.5 million (in 1972, \$19M in 2011 dollars)

**PERFORMANCE:** 1 MIPS (million instructions per second)

**MEMORY:** 4 MB max

**STORAGE:** typical 1.5 GB (200 MB/drive)

**Apple smartphone, Christmas 2011**  
(iPhone 4S)

**COST:** \$200-\$400 with 2 year wireless contract

**PERFORMANCE:** 5,000 MIPS (1 GHz dual-core ARM Cortex-A9 processor rated at 2.5 DMIPS/MHz per core)

**MEMORY:** 512 MB standard

**STORAGE:** 16, 32 or 64 GB

**Key Global Telecom Indicators for the World Telecommunication Service Sector in 2011**  
(all figures are estimates)

	Global	Developed nations	Developing nations	Africa	Arab States	Asia & Pacific	CIS	Europe	The Americas
<b>Mobile cellular subscriptions (millions)</b>	5,981	1,461	4,520	433	349	2,897	399	741	969
<b>Per 100 people</b>	86.7%	117.8%	78.8%	53.0%	96.7%	73.9%	143.0%	119.5%	103.3%
<b>Fixed telephone lines (millions)</b>	1,159	494	665	12	35	511	74	242	268
<b>Per 100 people</b>	16.6%	39.8%	11.6%	1.4%	9.7%	13.0%	26.3%	39.1%	28.5%
<b>Active mobile broadband subscriptions (millions)</b>	1,186	701	484	31	48	421	42	336	286
<b>Per 100 people</b>	17.0%	56.5%	8.5%	3.8%	13.3%	10.7%	14.9%	54.1%	30.5%
<b>Fixed broadband subscriptions (millions)</b>	591	319	272	1	8	243	27	160	145
<b>per 100 people</b>	8.5%	25.7%	4.8%	0.2%	2.2%	6.2%	9.6%	25.8%	15.5%

Source: **International Telecommunication Union (November 2011)**

via: **mobiThinking**

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TECHNOLOGY

## Global smartphone users top 1bn

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Apple Senior Vice President of Worldwide product marketing Phil Schiller announces the new iPhone 5 during an Apple special event at the Yerba Buena Center for the Arts on September 12, 2012 in San Francisco, California. Apple announced the iPhone 5, the latest version of the popular smart phone. Photo/Justin Sullivan/Getty Images/ AFP

By AFP  
Posted Wednesday, October 17 2012 at 18:29

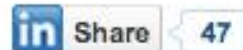
### IN SUMMARY

- US research and consulting firm Strategy Analytics said the number of users topped one billion in the third quarter this year, with one out of every seven people worldwide carrying one of the devices.
- The first smartphone, the Nokia Communicator, came out in 1996, but demand for the devices exploded after the release of Apple's iPhone in 2007.
- The research firm said it expected the number of users to double to two billion in less than three years.



# More People Have Cell Phones Than Toilets, U.N. Study Shows

By Yue Wang | March 25, 2013 | 23 Comments



On the eve of World Water Day last week, the U.N. offered a sobering statistic: according to its recent study, more people on earth have access to cell phones than toilets.

Out of the world's estimated 7 billion people, 6 billion have access to mobile phones. Far fewer — only 4.5 billion people — have access to working toilets. Of the 2.5 billion who don't have proper sanitation, 1.1 billion defecate in the open, according to the study.

U.N. Deputy Secretary-General Jan Eliasson said in a statement that this is a global crisis that people “don't like to talk about.” He said the U.N. is trying to cut in half the number of people without access to clean toilets by 2015 and eliminate by 2025 the practice of open defecation, which is linked to many diseases.



JOSEPH VAN OS / GETTY IMAGES

## RELATED

More people have access to cellphones than toilets *Yahoo*



# MOBILE COMPUTING IN PRACTICE

67% of Canadian family physicians own a smart phone

82% used them for drug references

50% for clinical decision support



30% of physicians now own an iPad, with the majority (62%) using it for professional purposes



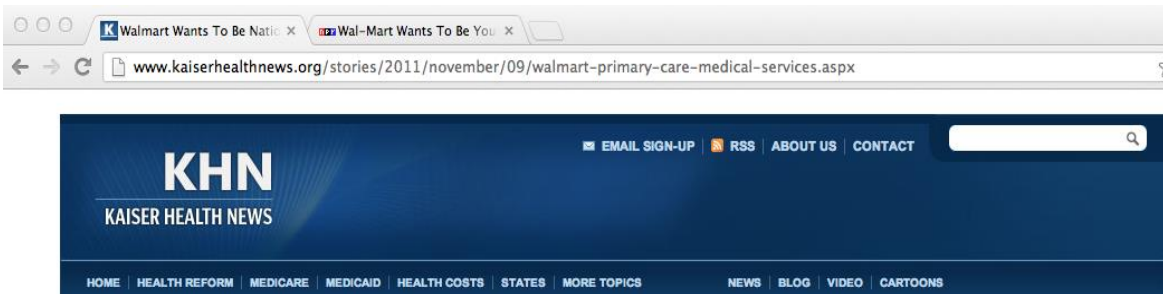


mHealth promises to:

- personalize medicine
- empower patients (“consumers”)
- better equip providers
- increase system capacity
- operationalize best practices

## **THE PROMISE**

# Consumerization of primary care is underway – what effect will this have?



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## Facebook Is Urging Members to Add Organ Donor Status

By MATT RICHTEL and KEVIN SACK  
Published: May 1, 2012 | 262 Comments

Nearly 7,000 people in the United States die each year while waiting for an organ transplant. It is a number that Facebook hopes to lower with its vast network of 161 million members in this country.



Jim Wilson/The New York Times

B. J. Fogg of Stanford said the feature would get more people to consider organ donation.

Enlarge This Image



The company announced a plan on Tuesday morning to encourage everyone on Facebook to start advertising their donor status on their pages, along with their birth dates and schools — a move that it hopes will create peer pressure to nudge more people to add their names to the rolls of registered organ donors.

It is a rare foray by Facebook into social engineering from social networking, and one with a potentially profound effect, according to experts in the field of organ donation.

They say people declaring on Facebook that they are organ donors could spur others to sign up at motor vehicle departments or online registries. But these experts say Facebook could create an informal alternative to such registries that could, even though it carries less legal weight, lead to more organ donations.

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## Walmart Wants To Be Nation's Biggest Primary Care Provider

TOPICS: DELIVERY OF CARE, MARKETPLACE

By Julie Appleby and Sarah Varney  
NOV 09, 2011

This story is part of a reporting partnership that includes NPR and Kaiser Health News.

This story was updated at 3:10 p.m. on Nov. 9.

Walmart — the nation's largest retailer and biggest private employer — now wants to dominate a growing part of the health care market, offering a range of medical services from basic prevention to management of chronic conditions like diabetes and heart disease, according to a document obtained by NPR and Kaiser Health News.



(Illustration by KHN after photo by Walmart via Flickr)

In the same week in late October that Walmart announced it would stop offering health insurance benefits to new part-time employees, the retailer sent out a request for information seeking partners to help it "dramatically ... lower the cost of healthcare ... by becoming the largest provider of primary healthcare services in the nation."

On Tuesday, Walmart spokeswoman Tara Raddohl confirmed the proposal but declined to elaborate on specifics, calling it simply an effort to determine "strategic next steps."

But by midafternoon Wednesday, the retailer issued a statement saying its own request for information was "overwritten and incorrect." The firm is "not building a national, integrated low-cost primary health care platform," says the statement by Dr. John Agwunobi, a senior vice president.

The information request begins with the exact wording that Agwunobi says is incorrect, saying Walmart "intends to build a national, integrated, low-cost primary care healthcare platform." The request goes on to ask firms to spell out their expertise in a wide variety of areas, including managing and monitoring patients with chronic, costly health conditions. The goal it says is for Walmart to become "the largest provider of primary healthcare services in the nation."

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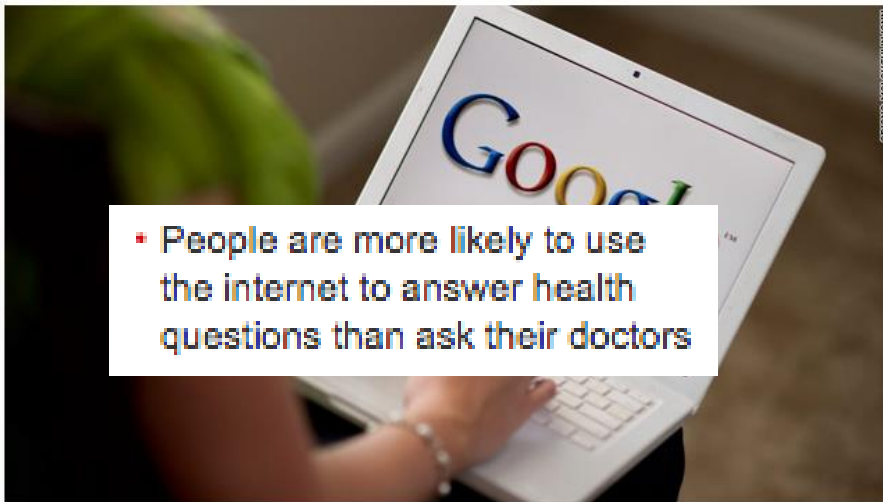
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ELIZABETH COHEN

## Your top health searches, asked and answered

By **Elizabeth Cohen**, Senior Medical Correspondent

October 21, 2010 8:07 a.m. EDT



According to Pew, 83 percent of web users have used the internet to look for health information.

### STORY HIGHLIGHTS

- People are more likely to use the internet to answer health questions than ask their doctors
- 17 percent of cell owners have used their phones to look up health information
- Three out of the five most popular health searches on cell phones have to do with sex

**(CNN)** -- One day, Google's chief health strategist, Dr. Roni Zeiger, had an epiphany: On any given day, more people are posing health questions to Google than posing health questions to their doctors.

"What amazes me is how much and how many people are looking for health information, and how important their questions are," says Zeiger, who's an internist. "As a physician it's overwhelming and incredibly motivating."

According to the Pew Internet & American Life Project, 83 percent of Internet users have looked online for health information. **New data released by Pew this week show many people are now using cell phones to search for health information -- 29 percent of cell phone owners age 18 to 29, and 17 percent of cell owners overall. It's the**

# Efficiencies and Quality



**25%**

costs in elderly care can be reduced by mhealth solutions \*

Maternal and pre-natal mortality can be reduced by

**30%** \*\*



**2x**

rural patients can be reached per doctor

Costs related to data collection can be reduced by

**24%**



Source: [x]cube LABS Infographic, <http://www.xcubelabs.com/mhealth-infographics.php>, Boston Consulting Group (BCG)

\* through visit avoidance and longer independent living

\*\* in under-developed nations



# Projected Savings From Remote Monitoring

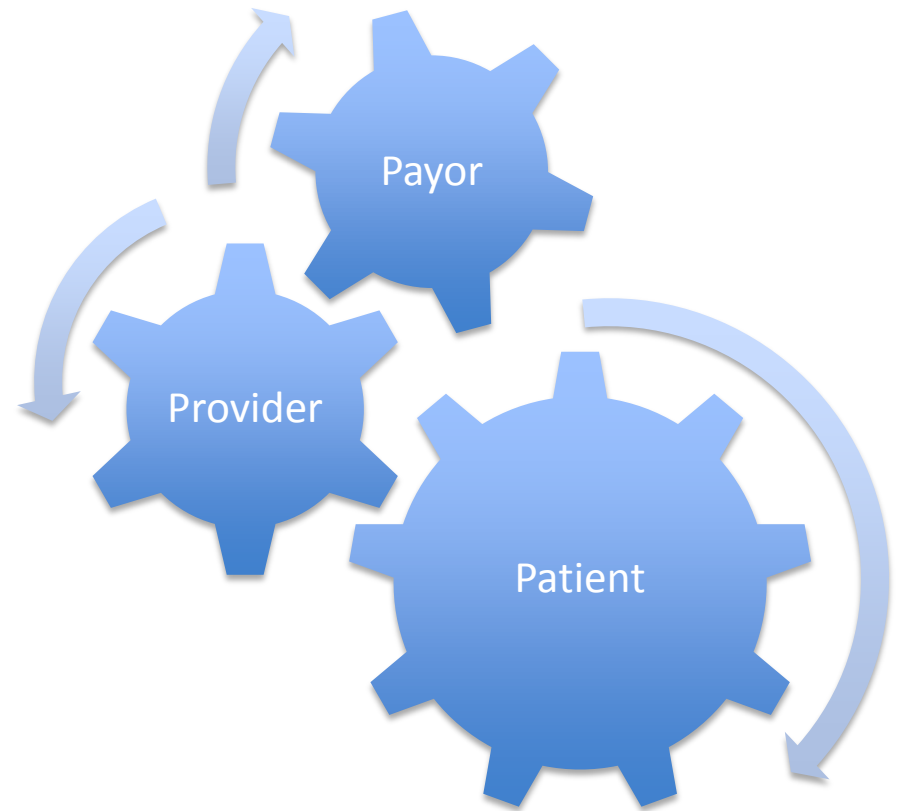
Disease	Emergency Care	Hospitalization	Nursing Home	Total Savings
<i>Congestive Heart Failure</i>	\$50 M	\$7.4 B	\$2.7 B	\$10.1 Billion
<i>Diabetes</i>	\$100 M	\$3.5 B	\$2.5 B	\$6.1 Billion
<i>Chronic Obstructive Pulmonary Disease</i>	\$200 M	\$2.9 B	\$1.8 B	\$4.9 Billion



**\$197 billion savings to US health care system over 25 years if remote patient monitoring is effectively put in place**

# MOTIVATIONS IN MHEALTH

- Trichotomy in healthcare, not typical in other sectors
- Patient, Provider, Payor dynamics
- We are seeing mHealth development by and for each of these groups

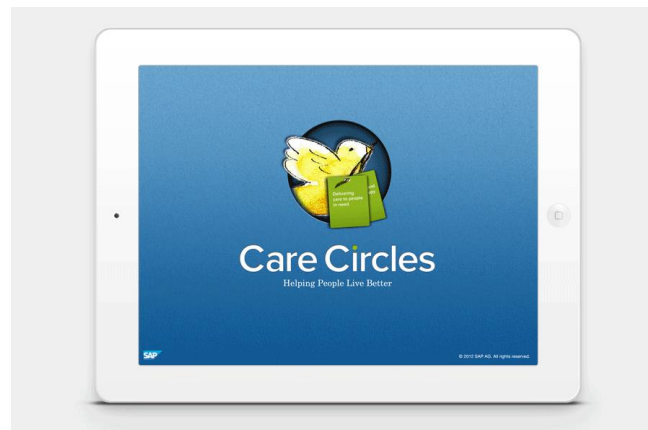
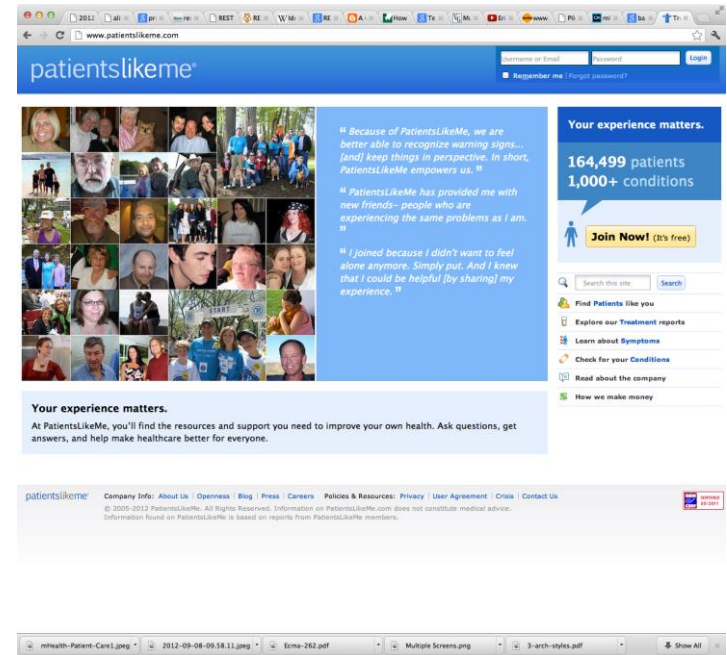




# EXAMPLES OF M-HEALTH APPLICATIONS AND SERVICES

# PATIENT MOTIVATIONS AND DESIRES

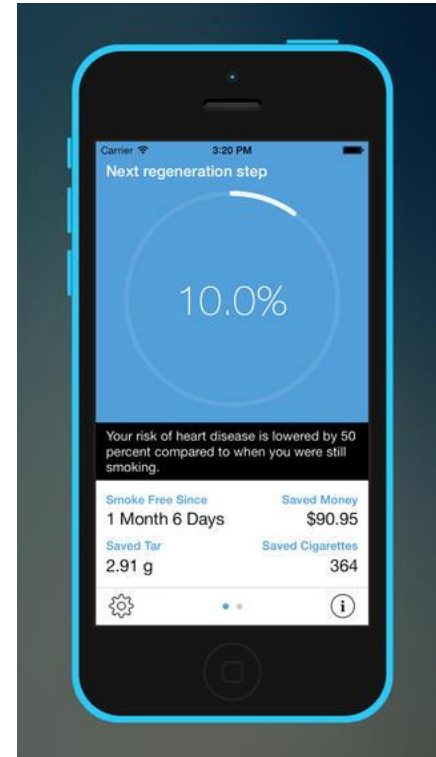
- Better health, especially for loved ones
- More control/empowerment
  - Access to records
  - Condition tracking
  - Access to reliable health related information sources
  - Better communication with providers
- Social/community engagement



# Popular Health and Wellness Apps



Carrot Fit  
Weightloss



SmokeFree  
Smoking Cessation



Glow  
Fertility Tracking



# PROVIDER MOTIVATIONS AND DESIRES

- Better outcomes through better information
  - Patient data recording & communications
  - Diagnostic assistance
  - Decision support, etc.
- Increased capacity & quality, primarily through unnecessary visit avoidance
- Electronic interactions acknowledged in some fee schedules



# PROVIDER MHEALTH EXAMPLES

Epocrates, MIT eye catra, Bant, Vital Hub, AliveCor



# PAYOR MOTIVATIONS AND DESIRES

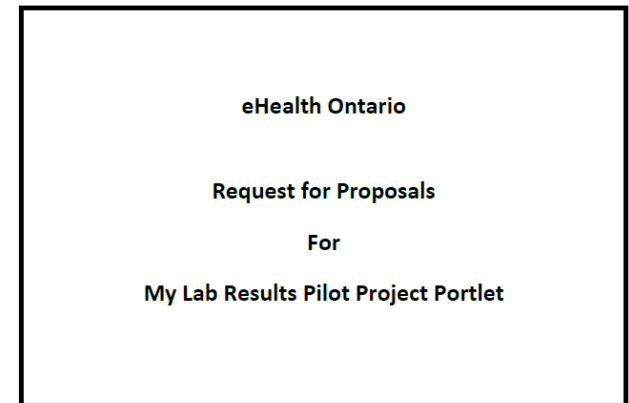
- Reduced risk / cost avoidance through population health
- Cost avoidance through customer retention (in private models)
- Visibility, communication channel into network (analytics)
- Faster movement to less expensive care (hospital->home) (eg SmartView)



MINISTRY OF HEALTH AND LONG-TERM CARE

# PAYOR MHEALTH EXAMPLES

iTriage, OTN, OLIS myLabs Pilot, myEHealth, Qualcomm 2Net



*my*ehealth

*Providing BC patients with secure access to their lab results*

Through *my ehealth*, British Columbian patients now have the same secure Internet access to their lab results that Excelleris has been providing to more than 5800 BC physicians for over a decade -- at no charge.

- Regulation
- Clinical efficacy
- Liability
- Incentives
- Standardization
- Device limitations

## **CHALLENGES**



U.S. Department of Health & Human Services

**FDA U.S. Food and Drug Administration**  
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OSEL Guidance

Radiation-Emitting Products Guidance

## Draft Guidance for Industry and Food and Drug Administration Staff - Mobile Medical Applications

### DRAFT GUIDANCE

Document Issued on: July 21, 2011

This guidance document is being distributed for comment purposes only.

You should submit comments and suggestions regarding this draft document with the *Federal Register* of the notice announcing the availability of the draft guidance to the Division of Dockets Management (HFA-305), Food and Drug Administration, Rockville, MD 20852. Submit electronic comments to <http://www.regulations.gov> docket number listed in the notice of availability that publishes in the *Federal Register*.

For questions regarding this document, contact Bakul Patel at 301-796-5528 or [Bakul.Patel@fda.hhs.gov](mailto:Bakul.Patel@fda.hhs.gov). For questions regarding this document concerning contact the Office of Communication, Outreach and Development (OCOD), by calling 1-800-338-1800.



U.S. Department of Health and Human Services  
Food and Drug Administration  
Center for Devices and Radiological Health  
Center for Biologics Evaluation and Research

### Preface Additional Copies CDRH

Additional copies are available from the Internet. You may also send an e-mail to receive an electronic copy of the guidance or send a fax request to 301-827-4100. Please use the document number (1741) to identify the guidance you are requesting.

### CBER

Additional copies of this draft guidance are available from the Office of Communication, Outreach and Development (OCOD) (HFM-40), 1401 Rockville Pike, Suite 200N, Rockville, MD 20852, 800-835-4709 or 301-827-1800, or from the Internet at <http://www.fda.gov/BiologicsBloodVaccines/GuidanceComplianceRegulatoryInformation>.

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May 5, 2009  
**WARNING LETTER**  
**CERTIFIED MAIL**  
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Refer to MIN 09-18  
Ken Powell  
Chairman of the Board and CEO  
General Mills  
One General Mills Boulevard  
Minneapolis, Minnesota 55426  
Dear Mr. Powell:  
The Food and Drug Administration (FDA) has reviewed the label and labeling of your Cheerios® Toasted Whole Grain Oat Cereal. FDA's review found serious violations of the Federal Food, Drug, and Cosmetic Act (the Act) and the applicable regulations in Title 21, Code of Federal Regulations (21 CFR). You can find copies of the Act and these regulations through links in FDA's home page at <http://www.fda.gov>.  
**Unapproved New Drug**  
Based on claims made on your product's label, we have determined that your Cheerios® Toasted Whole Grain Oat Cereal is promoted for conditions that cause it to be a drug because the product is intended for use in the prevention, mitigation, and treatment of disease. Specifically, your Cheerios® product bears the following claims on its label:  
\* "You can Lower Your Cholesterol 4% in 6 weeks"  
\* "Did you know that in just 6 weeks Cheerios can reduce bad cholesterol by an average of 4 percent? Cheerios is ... clinically proven to lower cholesterol. A clinical study showed that eating two 1 1/2 cup servings daily of Cheerios cereal reduced bad cholesterol when eaten as part of a diet low in saturated fat and cholesterol."  
These claims indicate that Cheerios® is intended for use in lowering cholesterol, and therefore in preventing, mitigating, and treating the disease hypercholesterolemia. Additionally, the claims indicate that Cheerios® is intended for use in the treatment, mitigation, and prevention of coronary heart disease through lowering total and "bad" (LDL) cholesterol. Elevated levels of total and LDL cholesterol are a risk factor for coronary heart disease and can be a sign of coronary heart disease. Because of these intended uses, the product is a drug within the meaning of section 201(g)(1)(B) of the Act [21 U.S.C. § 321 (g)(1)(B)]. The product is also a new drug

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Study |

## Diagnostic Inaccuracy of Smartphone Applications for Melanoma Detection

Joel A. Wolf, BA; Jacqueline F. Moreau, BA; Oleg Akilov, MD; Timothy Patton, DO; Joseph C. English, MD; Jonhan Ho, MD; Laura K. Ferris, MD, PhD

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Reliance on these applications, which are not subject to regulatory oversight, in lieu of medical consultation can delay the diagnosis of melanoma and harm users.

Article Tables References Comments

### ABSTRACT

ABSTRACT | METHODS | RESULTS | COMMENT | AUTHOR INFORMATION | REFERENCES

**Objective** To measure the performance of smartphone applications that evaluate photographs of skin lesions and provide the user with feedback about the likelihood of malignancy.

**Design** Case-control diagnostic accuracy study.

**Setting** Academic dermatology department.

**Participants and Materials** Digital clinical images of pigmented cutaneous lesions (60 melanoma and 128 benign control lesions) with a histologic diagnosis rendered by a board-certified dermatopathologist, obtained before biopsy from patients undergoing lesion removal as a part of routine care.

**Main Outcome Measures** Sensitivity, specificity, and positive and negative predictive values of 4 smartphone applications designed to aid nonclinician users in determining whether their skin lesion is benign or malignant.

**Results** Sensitivity of the 4 tested applications ranged from 6.8% to 98.1%; specificity, 30.4% to 93.7%; positive predictive value, 33.3% to 42.1%; and negative predictive value, 65.4% to 97.0%. The highest sensitivity for melanoma diagnosis was observed for an application that sends the image directly to a board-certified dermatologist for analysis; the lowest, for applications that use automated algorithms to analyze images.

**Conclusions** The performance of smartphone applications in assessing melanoma risk is highly variable, and 3 of 4 smartphone applications incorrectly classified 30% or more of melanomas as un concerning. Reliance on these applications, which are not subject to regulatory oversight, in lieu of medical consultation can delay the diagnosis of melanoma and harm users.

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 Morning*

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 AN HALF TONE BACK GROUND MUST APPEAR IN THE MIDDLE.  
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Withings	Blood Pressure
bant	Diabetes
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UK (Cambridge Healthcare): "Europe's First Health-App Store" developing certification process for apps it sells.

US (Happtique): market-leader in health apps published set of standards to certify apps operability, privacy, security, content reliability





Thanks!

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 **MOHAWK**  
COLLEGE

“The future is already here — it's just not very evenly distributed.” – William Gibson