

DRA Project Biomonitoring Update

August 2008

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Introduction: This package contains the background pieces of the DRA Project’s 2008 update on Biomonitoring & Disparities. In 2006 the DRA Project’s biomonitoring component was completed, with support from the Robert Wood Johnson Foundation. Forecasts were developed for diabetes and cancer, and trends and emerging developments were considered in biomonitoring using blood, breath, saliva and other media or platforms. These were reviewed by an advisory committee and recommendations were developed to make advances disparity reducing rather than disparity increasing. The forecast reports and the final report are available at www.alfutures.com/bfp. Also in 2006, priorities were set and additional reports were developed focusing on [early detection of cancer using blood testing](#), [continuous passive body monitoring](#), [cell phones](#). Networking and advocacy on the recommendations continued. In 2008 this update was done and its pieces included here. A scan was done of developments related to our 2006 forecasts (the DRA Project Biomonitoring Update Scan, pps. 4 to 50 below, an interpretation of that scan by Clem Bezold and Bill Rowley, pp. 2 to 4 below, an overview of Federal HIT & Biomonitoring Activity that relates to the recommendations for Federal agency leadership in some areas of biomonitoring, pp. 51 to 70 below, and an update of cell phone-related developments, pp. 70 and 71 below. At a DRA Project meeting on Biomonitoring & Disparities on July 28, 2008 the material below, additional analysis from Molly Coye and the Health Technology Center, and a discussion among leaders in related fields led to a synthesis and renewed targets. These are reviewed in the summary of the July 28th meeting (DRA Report 8-3).



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2008 Biomonitoring Update Scan – Interpretation by Bezold and Rowley

- Biomonitoring will yield significant advances over the next decade.
- The advances forecast in 2006 are generally on track
- Promise of “Big Wins” remains:
 - Managing chronic diseases esp. CHF, asthma, and Diabetes;
 - Enhanced cancer screening & earlier detection
- Yet the field remains very complex,
- No platforms have dropped off the running. However, to create highly sensitive and specific, reliable and easy to use, will take time
- Promising developments include:
 - Saliva testing has moved forward, including identifying most of the unique proteins in salivary glands.
 - A potentially lower cost nano/bio chip for identifying saliva proteins is being tested in ambulances this summer.
 - Simple blood test to identify Alzheimer’s is in testing
 - The blood test for bipolar disorder could be useful in getting better treatment where many doctors are biased against mental disease.
 - Options for using monitoring to check compliance is also growing (pill box, tagging pills, saliva tests).
- Cancer -- Activity and excitement remain high in the search for biomarkers and biomonitoring for cancer screening, earlier detection, and assisting in treatment. This appears to remain the area with the greatest level of effort. Biomarkers for cancers that are difficult to diagnose early, e.g. ovarian and pancreatic cancers appear to be making progress.



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- An area that showed promise but does not appear to have had successful movement is non-invasive monitoring of blood glucose.
- Biomonitoring, to make a difference, needs to lead to changes – in treatment, in the individual’s behaviors, and/or in the environment.

Conclusion

- Biomonitoring advances will enhance health outcomes – they will reduce disparities only with concerted action

DRA Project Biomonitoring Update Scan

December 16, 2008

A review of developments related to the DRA Project's Biomonitoring Forecasts and Recommendations

www.altfutures.com/DRAProject

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Introduction

In 2006 the DRA Project, with support from the Robert Wood Johnson Foundation issued a [report focusing on the promise of biomonitoring](#) and how advances in that area can be leveraged to reduce disparities. Many promising trends in home monitoring, Personal Health Records (PHR) and Electronic Medical Record (EMR) use, saliva, blood, or other diagnostic tests and other aspects of biomonitoring were chronicled and forecasts and recommendations were developed. Now, two years later, advances in biomonitoring technology and practice have continued. This report is a scan of major developments in these areas, covering biomonitoring and related technology reported between March 2007 and July 2008. Although this scan does not include proprietary information, it represents a thorough review of publicly available information on biomonitoring for the above time period. Reviewing seventy-nine different advances in biomonitoring, this report indicates that the development and use of biomonitoring technology is generally on track with what was forecasted and recommended in 2006. The advances encompass many areas of healthcare, and much progress has been made in the diagnosis and treatment of cancer and heart disease in particular. Below is a chart indicating the distribution of the recent biomonitoring advances in the areas of testing, home and remote monitoring, EHRs and behavior shaping. Whether these advances, as they are proven, contribute to worsening or reducing disparities remains unclear. This reinforces the DRA Project recommendations that would shorten the diffusion time of these advances as they are proven, including ensuring that they are culturally and economically relevant for patients and their providers.

Developments in this July 2008 Biomonitoring Update Scan arrayed by application:

	Cancer	Diabetes	Heart disease	Aging/frailty	Obesity	Mental Health	Infectious disease
Saliva tests	•		•			•	
Blood tests	•					•	
Breath tests	•	•					
Skin tests	•		•				
Urine tests	•						
Home and remote monitoring		•	•	•	•		
EHR/PHR	•						
Imaging tests	•						

Miscellaneous tests	•	•						•
Genetic/nano tech	•							•

Canary Foundation: 2007 Report Card

Canary Foundation accessed February 20, 2008 <http://www.canaryfoundation.org/2007reportcard.cfm>

The Canary Foundation released its 2007 report card in concerning their research advancements. They following areas are relevant to cancer testing:

- The Canary foundation’s goal to obtain blood samples prior to ovarian cancer diagnosis, they have begun to evaluate top candidate blood biomarkers in samples obtained prior to cancer diagnosis and have initiated a new project to assemble resources for further pre-clinical testing
- The canary foundation also aimed to advance ovarian molecular imaging through the development of imaging probes. Dr. Sam Gambhir has identified candidate imaging probes for two of the three targets that will soon be tested in mouse models for their ability to 'light up' ovarian cancer
- The Canary foundation goal to expand the pancreatic cancer program has led to them adding additional research on biomarkers and to add imaging research in the near future. Biomarker research is underway. They are also building resources to validate the use of blood biomarkers in pancreatic cancer research.

Saliva Testing

Testing For Disease Could Be Easy as Spit

Reuters updated March. 25, 2008 accessed March 27, 2008; <http://www.msnbc.msn.com/id/23792553/from/ET/>

Saliva Tests Making Their Way to Routine Care

Alan Mozes, HealthDay, March 22, 2007 accessed March 5, 2008 <http://www.healthday.com/article.asp?AID=602955>

U.S. researchers have identified all 1,116 unique proteins found in human saliva glands, a discovery they hope begins a trend of convenient, spit-based diagnostic tests that do not require blood. Up to 20 percent of the proteins found in saliva can also be found in blood. In order to diagnose disease using saliva, tests must be able to express the saliva proteome, a complete map of proteins; the proteome is otherwise characterized as a listing of which proteins are present in the saliva. While genes provide the instruction manual, proteins carry out the instructions by regulating cellular processes.

Researchers from the following five universities sought to determine the complete set of proteins secreted by the major salivary glands: University of Rochester, The Scripps Research Institute, the University of Southern California, The University of California San Francisco and the University of California Los Angeles.

They collected saliva from 23 healthy men and women of several races. They tested saliva samples using some form of mass spectrometry, which determines the identity of proteins based on measurements of

their mass and charge. They then compared their findings with recent protein maps of human blood and tears. Early analysis has already turned up a number of proteins with known roles in Alzheimer's, Huntington's and Parkinson's diseases; breast, colorectal and pancreatic cancer and diabetes. Most of the proteins were part of signaling pathways, which are key to the body's response to system wide diseases.

Other groups are working on a saliva-based test for breast cancer that would detect a protein fragment from the HER2 protein. Fred Hagan, a researcher at the University of Rochester Medical Center said such tests could eventually replace uncomfortable and costly mammograms.

"We envision in the future spitting in a tube and looking for a marker like this breast cancer marker. It would be much easier to do, potentially at home," Hagen said. In 2004, the U.S. Food and Drug Administration (FDA) approved a saliva-based test for HIV, the virus that causes AIDS.

Dr. David Wong of the University of California Los Angeles say the novel protocol could be available as a standard of care as early as 2011 to screen for a variety of major diseases. Dr. Wong's group is working on oral cancer screenings. Oral cancer has been identified by screening for five specific proteins and four mRNAs that form a unique diagnostic signature in more than 90 percent of cases

A Faster Way to Detect Heart Attacks: a diagnostic chip tests saliva to determine if someone is having a heart attack.

Kristina Grifantini, May 9, 2008 Technology Review; accessed June 4, 2008 <http://www.technologyreview.com/Biotech/20749/>

Researchers at the University of Texas at Austin have developed a saliva-based test to diagnose heart attacks. Saliva is placed on a nano-biochip and an analyzer detects protein patterns that can indicate if a patient is experiencing a heart attack. Currently, EKGs are the most common method of diagnosing heart attacks, but some heart attacks are not detected by EKGs. Blood tests are then used to diagnose a heart attack, but blood takes time to be drawn and analyzed. This saliva test is faster than a blood test and John McDevitt, the principal researcher, reports that researchers detected only sixty-seven percent of heart attacks with EKGs along, but identified ninety seven percent of heart attacks using the new saliva test along with EKGs. With more research, McDevitt hopes to reduce the cost of the disposable nano-biochips to less than \$20 and the machine used to analyze the chips should cost only in the thousands. This equipment should be tested in ambulances this summer, but researchers hope to eventually place this technology in doctors' offices and health centers.

Relevance to Health Disparities

- Because of its relative cheapness, may be available to community health centers as an alternative or supplement to EKGs
 - More accurate than just EKGs and quicker and less expensive than blood tests
 - Could allow quick diagnosis of heart attack for both low-income and non-low-income patients

Blood Testing

Blood Test Detects Ovarian Cancer Early

Reuters updated Feb. 15, 2008; accessed February 27, 2008 <http://www.msnbc.msn.com/id/23188344/>

New Test Detects Early Stage Ovarian Cancer With 99 Percent Accuracy

<http://www.sciencedaily.com/releases/2008/02/080212144500.htm>; accessed February 20, 2008

Researchers have developed what they believe is the first blood test that accurately detects ovarian cancer at an early stage. The test has the ability to recognize almost 100 percent of new ovarian tumors. It will possibly be the standard of care for woman having routine examinations according to Dr. Gil Mor. In 2005, Dr. Gil Mor (senior author) and his team first described a panel of biomarkers that can detect stage I and II ovarian cancer. In the present trial, reported in the medical journal Clinical Cancer Research, the researchers expanded the panel from four proteins to six, and used a sophisticated assay system to measure protein levels in 362 healthy women and 156 patients newly diagnosed with ovarian cancer. Alone, none of the biomarkers could distinguish the cancer patients from the healthy comparison group, the researchers report. When all six biomarkers were measured, however, the test identified 95 percent of the cancer patients. A larger evaluation of the biomarker assay is currently underway.

Relevance to Health Disparities

- If it becomes the new standard of care it will lower death rates for cancer in all women who get routine examinations.
 - Treatment will still be an issue

Blood Test Could Reveal Bipolar Disorder

Steve Mitchell updated Mon., Feb. 25, 2008; accessed February 26, 2008 <http://www.msnbc.msn.com/id/23337532/from/ET/>

A blood test could be used to diagnose and assess the severity of certain mental illnesses, such as bipolar disorder, and could be on the market within 5 years. The test can identify 10 genes when if “turned on” can predict mood. The genes give a better picture of the severity and state of the mental disorder and progress in treatment. The researchers could predict high mood if the score was high (highly active genes) and low mood if the score was low (low activity). When these genes were examined in the initial group of patients, the calculated scores were 85 percent accurate in predicting high mood and 77 percent accurate in predicting low mood, comparable rates to that of genetic cancer testing. Initially the test was being used to track severity of mania and depression in bipolar patients, but has now been used for initial diagnosis.

The test as with all genetic tests comes with ethical issues. The controversy stems from this type of testing being used to screen for job applicants and college applicants. It may also be used for those wanted to purchase guns or high sensitivity jobs such as police officers. There is also a disconnect between the testing and the way the patient feels. A patient can have more positive test results but still feel low.

Detecting Alzheimer's Disease: A blood test that identifies the disorder in its early stages could soon be made available to researchers

Anna Davison May 16, 2008 Technology Review; accessed June 4, 2008 <http://www.technologyreview.com/Biotech/20783/>

Researchers have developed a simple blood test that can identify Alzheimer's disease in its very early stages, approximately two years earlier than clinicians can diagnose the disease. Current methods of diagnosis rely entirely on noting the presence of symptoms like memory loss and language problems and then ruling out other causes of dementia, such as stroke. This diagnosis can then be confirmed by examining the brain after death, but until now there has been no way to definitively diagnose Alzheimer's disease in a living patient. The new blood test identifies particular concentrations of proteins that are associated with Alzheimer's, and has been nearly ninety percent effective in identifying people with mild cognitive impairment that later progressed to Alzheimer's disease. The hope is that with early diagnosis, treatments may be developed to significantly slow or stop the progression of the disease. Satoris, the company that developed the test, hopes to share it with researchers and begin clinical trials in the near future.

New Blood Marker May Predict Prostate Cancer Spread

American Association for Cancer Research February 27, 2008; accessed June 5, 2008 <http://www.aacr.org/home/about-us/news.aspx?d=980>

Researchers have identified a blood biomarker that may predict with up to ninety-eight percent accuracy if prostate cancer will spread to regional lymph nodes. When cancer spreads beyond a solid tumor, it does so at a microscopic level that is not identifiable through CT scans or other imaging techniques. With current methods, doctors are only 89.4 percent accurate in predicting the spread of prostate cancer, while adding the new biomarker, plasma endoglin, increases that accuracy to 97.8 percent. Although more studies are needed to confirm this result, this new biomarker may better identify patients at risk for having their prostate cancer spread, and it may spare patients at low risk from the discomfort and risk of death of an unnecessary lymphadenectomy.

Lab In A Drop: Pocket-sized PCR rapid test including sample preparation

Science Daily May 7, 2008 accessed June 5, 2008 <http://www.sciencedaily.com/releases/2008/05/080506120940.htm>

Researchers at the Institute of Bioengineering and Nanotechnology in Singapore have developed a rapid genetic diagnosis test on a single chip. Polymerase chain reaction (PCR) testing allows gene sequences to be duplicated and identified, but because the sample must pass through a specific series of temperatures this type of testing generally takes several hours. In addition, chip-based testing devices have previously been developed, but generally required that the sample be prepared separately and not on a miniaturized scale. In the newly developed PCR chip, the sample, as small as just a drop of blood, can be prepared directly on a chip, and the entire process takes only minutes to complete. This may eventually allow for immediate on-site genetic testing and reduce the need for expensive, time-consuming laboratory tests.

Relevance to Health Disparities

- Could eventually make genetic testing and diagnosis widely available for a much lower cost, allowing for sophisticated genetic testing in community health centers or even health fair settings

New Test Could Track Tumors in 'Real Time'

Liz Szabo July 2, 2008 USA Today; accessed July 3, 2008 http://www.usatoday.com/news/health/2008-07-02-cancer-cells_N.htm?csp=34

Circulating Tumor Cells Reveal Insights Into Lung Cancers

Amanda Gardner July 3, 2008 HealthDay; accessed July 3, 2008 <http://www.healthday.com/Article.asp?AID=617097>

Researchers at the cancer center at Massachusetts General Hospital have developed a technique for separating and analyzing cancer cells that break off from tumors and travel through the blood. The CTC (Circulating Tumor Cells) chip is a silicon chip about the size of a business card that has 80,000 "columns" coded with an antibody that acts like a "glue" to capture tumor cells. After the tumor cells are captured, they can be genetically analyzed, allowing the doctor to monitor changes in the cancer without multiple biopsies. This can make it possible to better tailor cancer treatments based on the genetic mutations and how tumors are responding. The number of cancer cells in the blood can also indicate if the tumor is growing or shrinking, which would allow doctors to understand the effectiveness of treatment more often than every six to eight weeks when CT scans are done. The technique may also provide doctors with a new way to study and understand metastasis. The technology is still in a very early stage, as it takes a long time to process a single sample, but researchers are looking to reduce that time and planning larger clinical trials.

Breath Testing

Scientists Using Laser Light To Detect Potential Diseases via Breath Samples, Says New Study

Jun Ye jun.ye@colorado.edu, 303-735-3171, University of Colorado at Boulder; accessed February 20, 2008 http://www.eurekalert.org/pub_releases/2008-02/uoca-sul021808.php;

NIST working on "Deathalyzer"

<http://www.networkworld.com/community/node/25185> accessed February 27, 2008

Breathalyzer Can Detect Breast Cancer: Live From DARPA Tech

http://www.popularmechanics.com/blogs/science_news/4220196.html August 8, 2007

The National Institute of Standards and Technology and the University of Colorado at Boulder have found that blasting a person's breath with laser light may be able to detect molecules which are markers for diseases such as asthma and cancer. The research has not yet reached clinical trial stage.

Known as optical frequency comb spectroscopy, the technique is powerful enough to sort through all the molecules in human breath and sensitive enough to distinguish rare molecules that may be biomarkers for specific diseases. Similar to light frequencies, the comb line, also known as the “tooth”, is tuned to a distinct frequency of a particular molecule's vibration or rotation to distinguish the molecule.

As comparable to bad breath being a signal of disease in dentistry, excess methylamine may signal liver and kidney disease, ammonia may be a sign of renal failure, elevated acetone levels may indicate diabetes and nitric oxide levels can be used to diagnose asthma.

While current breath analysis using biomarkers is a noninvasive and low-cost procedure, approaches are limited because the equipment is either not selective enough to detect a diverse set of rare biomarkers or not sensitive enough to detect particular trace amounts of molecules exhaled in human breath

"The new technique has the potential to be low-cost, rapid and reliable, and is sensitive enough to detect a much wider array of biomarkers all at once for a diverse set of diseases.

Relevance to Health Disparities

- Any widely distributed and utilized equipment is years out, but once on the market may be a highly cost effective way to diagnose
- Is not exactly preventative for all diseases, but for CHC's who may see patients closer to higher stages of disease, will be a helpful for proper treatment

Breath Analyzer Monitors Drug Compliance: A new device could lead to better clinical trials

Kristina Grifantini May 2, 2008 Technology Review; accessed June 4, 2008 <http://www.technologyreview.com/Biotech/20710/>

Researchers at the University of Florida have developed a method to use a breath analyzer to monitor medication compliance. By adding an FDA-approved alcohol, 2-butanol, to pills, researchers have simplified measuring medication compliance through breath testing, allowing a simple breath analyzer to detect the presence of this compound, rather than varying and complex drugs. Although results were less reliable when subjects had eaten fatty foods before testing and the system costs around \$1000, researchers are working to combat these problems, making the device more sensitive and shrinking it to bring the cost down to \$200. Recognizing that the device still requires that the patient be compliant and use it, they also plan to incorporate a reminder system that flashes, beeps, or vibrates to remind patients to take medication. Additionally, researchers are planning a study that compares this method to programs in which caregivers watch patients take medication, which is currently considered the best method to ensure medication compliance. However, although this may be useful for more accurate clinical trials, some worry that in a clinical setting the extra step and the implied lack of trust could actually be detrimental rather than helpful.

Skin Testing

Ten-Minute Cancer Test: Researchers are developing a microfluidics device that can identify cancer cells during a routine visit to the doctor's office

Katherine Bourzac August 21, 2007 Technology Review; accessed June 16, 2008

<http://www.technologyreview.com/Biotech/19274/>

Researchers at the University of Texas are developing a microfluidics device that detects oral-cancer cells in as little as 10 minutes and is simple and cheap enough for use in the dentist's office. The acrylic device uses a scraping of tissue from the mouth and cancer cells are then tagged with a fluorescent marker that is visible under a fluorescent microscope. The entire process takes about ten minutes, and any suspicious looking sores could be checked while a patient was still in the dental chair. The test works well on cancer cells grown in a laboratory and researchers are testing its effectiveness on biopsies from oral-cancer patients. Although far from ready for clinical use, the system has the potential to be very cheap, and researchers are exploring the possibility of eliminating the need for an external fluorescence microscope by adding a simplified fluorescence imaging system to the machine.

Mouth May Tell the Tale of Lung Damage Caused By Smoking

Science Daily April 14, 2008 accessed June 5, 2008 <http://www.sciencedaily.com/releases/2008/04/080413183701.htm>

Researchers have found that biomarkers from oral tissue lining the mouth may indicate the presence of lung cancer, reducing the need for more uncomfortable and invasive tests. Comparing the results of tissue samples from brushing the inside of the cheek and from bronchoscopy, there is a strong correlation between early indicators of cancer found in the oral test to those found in the more invasive procedure to check for lung cancer. Ninety-five percent of those with the cancer indicator in the oral test proved to have the cancer indicator in the bronchial test, while only sixty nine percent without indication in the oral test had the cancer biomarker in the bronchial test. In order for this test to be clinically useful, more biomarkers must be identified to better predict those with high risk for lung cancer, but researchers plan to pursue that line of study, and also hope that this method may be expanded to be useful for other types of cancers.

Skin Test Spots Heart Risks in Healthy People

Ed Edelson HealthDay Reporter; ScoutNews, LLC, April 17, 2008. Accessed April 28, 2008; <http://healthday.com/Article.asp?AID=614651>

A cholesterol test that requires no more than a small sample of skin cells scraped off the palm of the hand can measure the risk of heart disease in healthy people, researchers report. The test looks at levels of skin sterol, a molecular relative of blood cholesterol.

In a test on 9,055 people, skin sterol readings correlated closely with levels of good HDL cholesterol and of C-reactive protein, a marker of inflammation that is a risk factor for cardiovascular disease. Dr. Dennis L. Sprecher was expected to report on the findings Thursday (April 17) at the American Heart Association Conference on Arteriosclerosis, Thrombosis and Vascular Biology in Atlanta.

"What happens with this test is that a little plastic device is applied to the surface of the palm of the hand to peel off a layer of dead skin cells," Michael Evelegh, executive vice president of clinical and regulatory affairs with PreMD Inc., said. "The sample is sent to a laboratory, which measures the cholesterol in those cells. It turns out that cholesterol in the skin is associated with the risk of cardiovascular disease."

"A test like this is useful in a setting where you want to test cholesterol without taking a blood sample, as when people are applying for life insurance," Evelegh said. The participants in the study were being screened for life insurance coverage. One advantage of the skin test is that "you don't have to fast," Evelegh said. "It makes no difference what you ate this morning. That has no effect on the test results." Conventional cholesterol tests do require prior fasting.

Urine Testing

New, Non-Invasive Prostate Cancer Test Beats PSA in Detecting Prostate Cancer

American Association for Cancer Research February 1, 2008; accessed June 5, 2008 <http://www.aacr.org/home/about-us/news.aspx?d=981>

An experimental urine test has been developed that more accurately detects prostate cancer than any test currently in use. The current test most commonly used, a PSA blood test, accurately detects prostate cancer, but also leads to many false positives. Even a newer PCA3 test is less accurate than the urine test. The experimental urine test is based on the PCA3 test, but researchers tested for seven biomarkers including PCA3. For this test, researchers took urine samples from 234 men with rising PSA levels who then underwent biopsies to test for prostate cancer. Four biomarkers, including PCA3 proved to be significant in predicting prostate cancer, and together the four biomarkers achieved a specificity and predictive power of seventy-five percent. This is much better than the PSA blood test and five percent better than just the PCA3 urine test. Ultimately, researchers hope to improve the test to entirely eliminate the need for biopsies in ruling prostate cancer out.

Relevance to Health Disparities

- If test could be improved such that it could definitively diagnose prostate cancer without a biopsy, it may help ensure follow-up and proper treatment in CHC settings

Home & Remote Monitoring

Online House Calls Click with Doctors

Daniel Costello Las Angeles Times February 4, 2008 accessed July 16, 2008 <http://articles.latimes.com/2008/feb/04/business/online4>

Although many doctors and patients have recognized the advantages of online doctor's visits for years, the practice has been limited because most insurance companies would not pay for these online visits. However, Aetna Inc. and Cigna Corp. announced in early 2008 that they would begin reimbursement for online doctors visits. The online services are primarily meant for follow-up visits, and treatment for

minor illnesses, but specialists see them as a way to conduct periodic check-ups as well. These services will cost approximately the same amount as a regular doctor's visit. Several companies, such as RelayHealth Inc. or Medem Inc. have created software to help track and bill for these online visits. The trend toward virtual visits could complement the increasing availability and decreasing price of vital sign monitoring equipment and the increasing prevalence of EHRs, making healthcare more home-based.

Some experts do worry that this practice will increase the risk of mistakes and others caution that, if the practice encourages patients to seek care more often, online visits will not save money. Additionally, some smaller insurance companies that were offering this service stopped reimbursing for online consultations, as so few patients were using the service. Aetna and Cigna, however, along with many doctors and patients are optimistic about this change.

Sarnoff and Viocare® to Develop Mobile Phone-Based Food Tracking System

Sarnoff Corporation May 13, 2008 accessed July 15, 2008 <http://www.sarnoff.com/press-room/news/2008/05/13/sarnoff-and-viocare-to-develop-mobile-phone-based-food-tracking-system>

Sarnoff Corporation and Viocare Technologies announced their collaboration in developing a new dietary assessment tool for the National Institutes of Health's Genes Environment and Health Initiative. The tool, called the Mobile Food Intake Visualization and Voice Recognizer (FIVR) is a mobile phone-based system that uses a combination of photographs and speech recognition to estimate a meal's nutritional content. Along with estimating the caloric content of meals, the system will be able to categorize the user's eating habits, using a series of questions to allow for recognition of foods that a user commonly eats, along with habits specific to that food, such as adding butter. This technology will both offer a new, convenient way of allowing users to track what they eat and also make nutritional studies easier by eliminating burdensome questionnaires, food diaries, and a large staff of surveyors.

The Vision of the Future Seen in Bionic Contact Lens

Bryn Nelson updated Mon., Jan. 21, 2008 accessed February 27, 2008 <http://www.msnbc.msn.com/id/22731631>

University of Washington researchers have created a contact lens that includes light-emitting diodes, basic wiring for electronic circuits and even a tiny antenna. The lens creates projected images only the wearer can see.

The lens is being produced for the technology/entertainment market, but Babak Parviz, an assistant professor of electrical engineering at the University of Washington, said the health care field might also benefit from the technology. "How do we constantly monitor someone's health?" he said. "It turns out that a lot of indicators that tell if a person is healthy or not show up on the surface of the eye." A biosensor-equipped lens could provide a non-invasive way of gleaning that information and sending it on to a database or serving as a relay station for data or power from retinal implants designed to correct vision problems.

Relevance to Health Disparities

- Obvious connection to PHR's or EHRs but may not be available to disparate populations right away.

Caregivers Use Technology to Help Faraway Family

BOB MOOS / The Dallas Morning News bmoos@dallasnews.com Sunday, August 19, 2007; accessed March 3, 2008
http://www.dallasnews.com/sharedcontent/dws/dn/latestnews/stories/DN-seniortech_19bus.ART.State.Edition1.35b6b2c.html

Remote Control: Frail Seniors Embrace Home Monitoring

Sue Shellenbarger Work & Family; accessed March 5, 2008;
<http://online.wsj.com/public/article/SB119630438176707457.html>

Today, sensors can collect information about eating, medication use, sleeping, and toilet habits and transmit it to the adult children or professional caregivers via the Web. Other systems detect nighttime wandering and check blood pressure, body temperature and pulse. Bed sensors can even measure whether someone has gained or lost weight. The most common systems use wireless motion or contact sensors on doorways, windows, walls, ceilings, cabinets, refrigerators, appliances or beds to track seniors' movements. Temperature sensors gauge heat and air conditioning. If an elderly person enters the bathroom and doesn't come out, or other typical activity patterns aren't recorded in the home, word can be sent to family members, 24-hour response workers or both. The systems also offer hand-held or wearable "panic buttons."

The systems raise inevitable questions about privacy, but current patients seem to welcome the videoconferences with family and do not mind the cameras in public areas such as living rooms.

Larger corporations who are starting to enter the market include Honeywell International Inc., Intel Corp. and Phillips, but much of the technology has come from entrepreneurs and start-up companies.

The Attentive Care system, developed by Caregiver Technologies Inc. of Oklahoma City, provides a virtual window into seniors' homes. It also lets family members post photos of grandchildren and reminders about doctor appointments on the senior's video screen. Caregiver Technologies charges \$200 for the setup and \$60 a month after that. Another system, Quiet Care is monitored by response workers and the remote caregiver receives email updates several times a day. Costs of other various systems range from \$99 to several thousand dollars to install, plus about \$35 to \$150 a month. Systems range from simple sensors to video cameras and teleconferencing or even a dedicated WebTV channel to post family news (offered by GrandCare Systems, West Bend, Wis.). Other vendors include Alarm.com, McLean, Va. and Community Management Initiative, Green Bay, Wis.

Relevance to Health Disparities

- The monthly fee will not be helpful to disparities but may be an affordable alternative to minor long term care needs

Monitoring the Heart without Missing a Beat

Duncan Graham-Rowe December 6, 2007 MIT Technology Review accessed March 5, 2008

<http://www.technologyreview.com/Infotech/19825/?a=f>

A new wireless cardiac "patch" could allow doctors to continuously monitor patients' hearts and record electrocardiograms (EKGs) while they are on the go. Such highly portable continuous monitors could help doctors treat cardiac patients, and they may soon become crucial tools in diagnosing conditions in otherwise healthy people, say the device's developers

Developed by researchers at the Interuniversity Micro-Electronic Centre (IMEC), an independent nanotechnology research institute in Eindhoven, the Netherlands, the flexible stick-on device is a variation of a Holter monitor, a portable EKG tool currently used by cardiologists to help assess and diagnose their patients. It is similar to Bluetooth and does not contain wires. The new device in contrast to past devices simply sticks onto the patient's chest and wirelessly sends electrical signals detected from the heart to a credit-card-like receiver.

Many hospitals have started installing wireless EKG patient-tracking systems as a way of keeping tabs on their patients and locating them if they get into trouble, says Bert Gyselinckx, the director of IMEC's Wireless Autonomous Transducer Solutions program. But such systems amount to little more than Holter monitors hooked up to a central hospital tracking system that monitors the patients' whereabouts and EKGs.

Monitors Send Heart Data to Doctors

From Patriot-News, The (Harrisburg, PA) (KRT) (August 3, 2007)

<http://www.pharmasentry.com/news/newsletter.cfm?linkID=44697CB9%2D1372%2D54C2%2D61EF235C63FC4584>

Some midstate heart patients won't have to leave their homes or workplaces to have their doctors monitor their condition. Instead, they will be able pass a wand over their heart defibrillators to gather information that will go to a device connected to a telephone line. The data will move over the Internet to a secure Web site that can be viewed by a doctor within minutes. The newest defibrillators have built-in wireless capability and can automatically transmit to the telephone-connected device, said Dr. David Scher of Associated Cardiologists, a Susquehanna Twp.-based practice. Scher said the practice plans to remotely monitor about 700 patients.

Typically, heart patients make four visits to the doctor every year but with the new monitoring, they'll only have to go once, said Scher, who specializes in treating heart rhythm disturbances.

Scher said he was involved in convincing Medicare that it should cover remote monitoring equipment and pay doctors for time spent evaluating the information. The cost of the monitoring equipment is included in the price of the defibrillator, which costs about \$20,000. Medicare pays doctors the same fee it would for an office visit.

Dr. Ginny Galega is vice president for medical policy with Highmark Inc., the state's largest health insurer. She said Highmark has concerns about using remote monitoring for people with life-threatening

heart ailments and won't cover it. However, Highmark will cover the monitoring under its Medicare Advantage plans, she said.

Associated Cardiologists also plans to put the remotely collected information directly into patients' electronic medical records. Electronic medical records are touted as a way to improve the quality of health care and reduce costs. But because of high costs and other drawbacks, the records still aren't widely used. Associated Cardiologists has used electronic medical records for years. For a practice the size of Associated Cardiologists and starting from scratch, it costs \$500,000 or more to switch to electronic medical records, said Allen Glotfelty, executive director of the practice. One obstacle, he said, is no financial reimbursement for such a purchase. Associated Cardiologists has tried to address that issue by putting patients' records on a small disk they can carry while traveling. It charges \$10 for the disk, which must be manually updated. At least 50 patients have them, Glotfelty said. The disks contain information on medical history, medication the patient is taking and test results.

Canadian Researchers Tap Cell Phones To Monitor Patients

iHealth Beat December 18, 2007 accessed March 3, 2008: <http://www.ihealthbeat.org/articles/2007/12/18/Canadian-Researchers-Tap-Cell-Phones-To-Monitor-Patients.aspx?topicID=87>

LG electronics is in the development stages for a sensor device which allows patients to send vital signs to health care professionals. The technology could be useful for seniors with limited mobility or those living in remote areas who might have high blood pressure or need to be monitored when they start new medications. Prototypes are being tested in January at University of Alberta.

Digital Counselor Minds your Meds

Mark Baard, Boston Globe March 26, 2007 accessed March 5, 2008
http://www.boston.com/business/globe/articles/2007/03/26/digital_counselor_minds_your_meds/

A hand-held digital companion which acts as a virtual "relational agent" which displays the animated face of a counselor on a desktop or PDA. The device engages the patient in a casual conversation asking things such as if you've been finding enough time "to relax and cut loose." It may also encourage you not only to take your meds, but to exercise, or cut out trans fats. The PDA agent "talks" to you via a text balloon, to help ensure your privacy in public places according to information science professor Timothy Bickmore. Bickmore is trying to replicate some of the "therapeutic alliance" between patients and doctors and counselors. The relational agent, he says, "is all about reach and availability."

Remote Microscopy: A modular microscope attachment for cell phones could improve the quality of telemedicine.

Kaspar Mossman March 19, 2008 accessed March 20, 2008 <http://www.technologyreview.com/Infotech/20433/?a=f>

Researchers at the University of California, Berkeley, have developed a modular, high-magnification microscope attachment for cell phones which will enable health workers in remote, rural areas to take high-resolution images of a patient's blood cells using a cell-phone camera, and then transmit the photos to experts at medical centers. The researchers hope that the innovation will help patients with blood disorders who live far from medical specialists get more accurately diagnosed and treated. Daniel

Fletcher, a professor of bioengineering at Berkeley and his students integrated a simple arrangement of lenses with the cell-phone camera and transmitted magnified images to a laptop using a Bluetooth attachment to the phone. The researchers say that the cameras in late-model phones are capable of capturing all the details that a doctor would need to identify malaria parasites and cancer cells. "The challenge was to make a low-cost, durable device with a long battery life," says David Breslauer, a graduate student in Fletcher's lab. The total cost of the first prototype, built from off-the-shelf components, was \$75.

Fletcher plans to test the microscope cell phone in Uganda this summer. The researchers also hope to collaborate with a telemedicine program at the University of California, Davis that serves rural California. Leukemia patients in remote areas could use the microscope cell phone to transmit images for white blood cell counts.

InforMedix Dials Up the Med-ePhone

Eric Wicklund, HealthCareIT News, January 01, 2008 accessed March 6, 2008

<http://www.healthcareitnews.com/story.cms?id=8438>

Smart Device Reminds Patients to Take Meds, Notifies Medical Staff if Health Declines

Mobile Enterprise December 7, 2007 accessed March 6, 2008

<http://www.mobileenterprisemag.com/ME2/dirmod.asp?sid=&nm=News&type=news&mod=News&mid=9A02E3B96F2A415ABC72CB5F516B4C10&tier=3&nid=88DDED4CA073459F8F4ED9C70872B42B>

Health and Well-Being - Mind Your Medicine

Imperial Valley News, November 10, 2007 accessed March 6, 2008;

http://www.imperialvalleynews.com/index.php?option=com_content&task=view&id=292&Itemid=9

InforMedix Holdings, Inc., developer of the Med-eMonitor (<http://www.informedix.com/>) an interactive smart pillbox system for medication adherence and health management, is planning to introduce a new device, the Med-ePhone.

Med-ePhone is an automated system that not only reminds people to take their medicine but records and monitors patient information for further clinical uses. "What we've designed is a pretty comprehensive medication adherence system that's interactive," said Bruce A. Kehr, MD, the company's CEO. They expect that the Med-ePhone system will provide a simple, inexpensive method for reminding users to take their medications regularly, and that the device will record and monitor patient medication adherence and health status over mobile phones and landlines. If a dose is missed, the wrong medicine taken or the user's health in decline, the device sends an alert message via e-mail, text message or fax to a caregiver or loved one. Studies show that more than 90 percent of people who use the existing Med-eMonitor "smart pillbox" take their medication as prescribed versus 35-55 percent of people before using it. Dr. Dawn Velligan of the University of Texas says, "I think this device is a significant advance in both monitoring and improving adherence to medication regimens."

Cost is about \$60 per month

Biotech Firm Set to Unveil Pill-Box Monitoring Device

Tamarind Phinisee, San Antonio Business Journal April 6, 2007 accessed March 6, 2008

<http://sanantonio.bizjournals.com/sanantonio/stories/2007/04/09/story10.html>

The device, called MedSignals, is a four-bin pill box that includes a monitoring device that tracks when and how often the lid of each bin is opened. Once connected to a server, the data stored in the device is uploaded and posted to a designated Web site. The information at the Web Site can be accessed remotely by the patient as well as a caregiver or doctor. MedSignals was developed by San Antonio-based LIFETECHniques Inc., which specializes in the research and development of technology designed for the health care industry. The device will cost consumers about \$200 and the service will be anywhere from \$2.50 to \$15 a month.

"Cybertooth" for Patients May Replace Pills

Corinne Heller Reuters Apr 19, 2007 accessed March 20, 2008

<http://www.reuters.com/article/scienceNews/idUSL1929848720070419>

The European Union is funding the Intellidrug project to develop a cybernetic oral device that attaches to a tooth and administers a dosage programmed by a patient's doctor. Researches sat the device may replace pills and injections for those who have a hard time remembering to take their pills. "The device is going to be crucial, first of all for patients who have disabilities in remembering -- like Alzheimer's patients," said Ben Z. Beiski, one of the developers, at Assuta Medical Centre in Tel Aviv.

The device can be fixed in a patient's mouth, either as an attachment, or type of crown, to a tooth or as an implant. The doctor can program the software into a remote control with information such as when the drug should be administered, and the patient's age, weight and medical history. When it is time to administer the medicine, a panel on the device opens and releases the programmed dosage into the back of the patient's mouth, where it would mix with saliva and enter the bloodstream. The device can contain up to several weeks of doses of most drugs and administer more than one type of medicine.

The method has several disadvantages. Any foreign object placed inside the body could be prone to infection. Also, some drugs are incompatible with the device. The device is meant for "slow release medicines but some medicines cannot be packaged or formulated chemically for slow-release. Beiski said he and colleague Andy Wolff, a dentist and expert in oral medicine, are planning to conduct clinical trials, along with scientists in Europe, in three months. They hope to market the device within three years, he said.

Center for Future Health Awarded Funding for Proactive Self-Care Technology

University of Rochester Center for Future Health March 20,2008 accessed March 20, 2008

<http://www.futurehealth.rochester.edu/news/>

The Robert Wood Johnson Foundation (RWJF) has awarded nearly \$1.2 million to the Center for Future Health at the University of Rochester to lead a project in proactive self-care technology. RWJF has supported the project during the exploratory phase and has continued support through its Pioneer Portfolio for the current research phase. The current phase is expected to take 12 months and supports

the engineering of a system for cardiac monitoring. The system incorporates ambient/mobile technology which can look at motion, activity, the sounds of voice and breathing, and examines how they all intersect. To deal with the large amounts of data needed to successfully utilize the technology, researchers obtained aid and consultation from IT companies specializing in product design, user-friendly interfacing, automation, and human factor design. In designing health-monitoring devices, turning large amounts of raw data into usable, meaningful information becomes a challenge. Recognizing trends in a big body of data, according to Bocko, is a big field in itself. The researchers brought in companies for this and other areas of niche expertise such as product design, user-friendly interfacing, automation, and human factor design.

The Networked Pill: A new information system records what pills do to the body.

Michael Chorost March 20, 2008 accessed March 24, 2008 <http://www.technologyreview.com/Biotech/20434/>

A system that monitors pill taking and its effects is being engineered by a Silicon Valley startup, Proteus Biomedical, of Redwood City, CA. The technology consists of pills that report when they've been taken, and sensors that monitor the body's responses. The company behind the product calls its technology the Raisin system. In the Raisin system, each pill contains an "ingestible event marker" (IEM). The IEM consists of a sand-grain-size microchip with a thin-film battery that is activated on ingestion, as it is exposed to water. The battery, Proteus says, is nontoxic because it is made from materials similar to those in a vitamin pill. Once swallowed, the IEM sends through the body's tissues a high-frequency electrical current that's modulated in such a way that it provides a unique marker of the pill. It's not an RFID technology: it uses the conductive tissues of the body to conduct the signal, rather than a radio, and the signal is confined within the body.

The electrical current is picked up and logged by a receiver on a patch placed on the patient's chest or abdomen, or placed underneath the skin as a subcutaneous insert. The receiver also contains sensors that monitor physiological parameters such as heart rate, respiration, and bodily movement. Heart rate is monitored by detecting the electrical activity of the heart; respiration is monitored by detecting changes in the impedance of the electrodes as the chest expands and contracts; activity is monitored with a miniature accelerometer, similar to the ones in iPhones. Combining the parameters can reveal behavioral measures such as sleep patterns. Monitoring chemistry-based parameters such as blood glucose with subcutaneously implanted chips is possible in principle although it's more challenging to do technologically. For the present, the company is focusing on biophysical parameters that can be measured on top of the skin. Once collected, the data are uploaded to a server via a cell phone or a PC for a caregiver's scrutiny. The patient can then be advised to adjust dosages or change medications.

Mark Zdeblick, the company's CTO, says that the IEMs could cost less than a penny each when manufactured in volume. Similar technologies are being developed elsewhere. For example, the MagneTrace system, designed by engineers at the Georgia Institute of Technology, records when magnetized pills pass through a patient's esophagus and sends the information to a computer. The Raisin system takes the additional step of incorporating on- and in-body sensors that correlate pill taking with the body's physiological responses.

So far, Proteus has raised \$60 million from investors including the Carlyle Group and Kaiser Permanente Ventures, and it has filed more than 250 patents. Clinical trials with human users began earlier this year, to test the functionality of the IEM and sensors. The company hopes to have the system on the market in 2011.

Remote Monitoring Improves Heart Failure Patients' Health, May Reduce Hospital Readmissions

American Heart Association News Releases May 1, 2008 accessed June 3, 2008
<http://americanheart.mediaroom.com/index.php?s=43&item=405>

Remote Monitoring Saves Lives Of Heart Patients, Research Shows

Science Daily April 23, 2007 accessed June 4, 2008
<http://www.sciencedaily.com/releases/2007/04/070420133738.htm>

Two recent studies indicate that remote monitoring of heart failure patients may reduce hospital admissions and morbidity. The first study, released in 2007, finds that remote monitoring of blood pressure, weight and ECG and oxygen details for heart failure patients, either through structured telephone support or more sophisticated telemonitoring, reduced hospital admissions and all cause mortality by twenty percent. Dr. Finlay McAlister, University of Alberta researcher, noted that “such an approach could help deal with the increasing number of patients with chronic heart failure that cannot be accommodated in existing specialty clinics due to access issues related to geography, lack of resources or infirmity.”

A 2008 study by the Center for Connected Health comparing sixty-eight heart failure patients receiving usual care to forty-two patients using a remote monitoring system also found positive results. Patients using the remote monitoring system used telemonitoring equipment to record pulse, blood pressure, and heart rate, weighed themselves daily, and answered a set of questions about symptoms daily. This information was transferred to a nurse, who monitored the data and called patients weekly and when the data indicated a possible problem. After three months, patients receiving remote monitoring experienced fewer hospital readmissions than non-participants and those receiving usual follow-up care, along with heart-failure related readmissions and fewer emergency room visits.

These results and patient satisfaction—all participants said the equipment was easy to use and their health improved and ninety-five percent of participants expressed overall satisfaction and indicated that the program helped them monitor their condition and stay out of the hospital—have caused the Center for Connected Health to expand the program into Connected Cardiac Care (<http://www.connected-health.org/programs/cardiac-care/center-for-connected-health-models-of-care/connected-cardiac-care.aspx>), which includes telemonitoring equipment and training and regular monitoring and necessary home visits by a nurse. The program is offered to referred Partners Healthcare patients at no cost.

Relevance to Health Disparities

- Less expensive than frequent hospital readmissions

- If insurance companies could, like Partners Healthcare, make the program free or low-cost, based on its relative cost effectiveness, could be of great benefit to low-income and rural heart failure patients

Clothes That Monitor Health: A new patch tracks electrolyte levels in sweat

Kristina Grifantini April 17, 2008 Technology Review; accessed June 4, 2008 <http://www.technologyreview.com/Biotech/20642/>

A new patch, developed by Biotex, is designed to be worn as part of clothing and analyze sweat samples for electrolyte levels. This patch goes beyond typical monitoring of heart rate and body temperature to testing biochemical properties of sweat. Capillary actions of fabric are used to direct sweat to the sensor, which can then analyze electrolytes, pH, pulse, sweat conductivity, and oxygen saturation to monitor health indicators such as exertion, stress, and metabolic changes. The shirt is washable and shirt and electronics are both reusable. The only non-reusable portion of the device is the chemical patch. Along with helping with self-monitoring, the patch could help doctors monitor and collect data on patients.

Biotex expects that the patch may be particularly useful for diabetics and obese children, providing continuous monitoring for metabolic changes or problems. Biotex plans to test the system on ten subjects in the next few weeks. Currently, the system is wired only to a computer that the physician monitors, but researchers expect to have to incorporate a display for the user, perhaps using cell phones as a platform.

Reduced Emergency Room Visits for Elderly Patients Attributed To 'Virtual' Health Care Team Approach

Science Daily May 1, 2008 accessed June 5, 2008 <http://www.sciencedaily.com/releases/2008/05/080501125446.htm>

Patients With Chronic Illness Benefit from Telehealth Intervention

Science Daily May 9, 2008 accessed June 5, 2008 <http://www.sciencedaily.com/releases/2008/05/080507175000.htm>

Pulmonary Rehab On Call: TELEHEALTH Offers Dial-up Help For The Rural And Remote

Science Daily May 19, 2008 accessed June 9, 2008 <http://www.sciencedaily.com/releases/2008/05/080519170204.htm>

The “Virtual Integrated Practice” pilot project, coordinating doctors, pharmacists, social workers, nurses, dieticians, and elderly patients through fax, email, and other virtual means seems to have resulted in fewer emergency room visits among these patients than among those who were not part of the pilot project. A relatively low-tech form of medical home monitoring, the practice updates the way that medical professionals communicate with each other and with the patient, creating a team-based approach without necessitating more office visits or other face-to-face contact. The program focused on high-risk diabetes patients and found that those in the program made fewer emergency room visits over two years than did those not in the program. In addition to providing a virtual platform for integrated medical teams, this may be a useful system to combine with continuous passive biomonitors.

Further research indicates that telehealth programs, providing virtual communication between doctors and patients may also reduce hospital readmission and improve health outcomes. Canada’s Capital

Health implemented the TELEHEALTH Pulmonary Rehabilitation program to expand services to patients with chronic lung disease into remote areas where traditional programs are unavailable. TELEHEALTH patients engaged have the ability to consult with pulmonologists and respiratory therapists through video and communications technologies. In addition, the program allowed patients to attend informational sessions and engage in guided exercise under a pulmonologist or respiratory therapist through virtual means, at local community and health centers. Comparing the results of 113 patients in the TELEHEALTH program to the results of patients in local programs, researchers found that the TELEHEALTH program produced results that were very encouraging and similar to the results found in local programs. Additionally, researchers at the University of Missouri found that telehealth interventions from care providers significantly reduced hospital readmission rates among patients who had recently been hospitalized for heart failure.

Relevance to Health Disparities

- Proven success and overall cost reductions of telehealth and home monitoring programs may induce government and private insurance to cover such programs, allowing for better, more continuous care for all
- Effectively improves access to quality medical care to rural patients

More Than 25 Percent Of Pediatric 'Emergency' Visits Could Be Conducted Online, Study Suggests

Science Daily May 7, 2008 accessed June 5, 2008 <http://www.sciencedaily.com/releases/2008/05/080506074451.htm>

Researchers conducting a community-wide study in New York have found that almost twenty-eight percent of pediatric emergency room visits could have been replaced with more cost-effective telemedicine. The researchers also direct the Health-e-access program, a program providing interactive internet-based telemedicine from primary care doctors to nineteen schools and child care centers. For this study, they categorized possible diagnoses into those that would be almost always appropriate for treatment through telemedicine, those that are usually but not always appropriate for treatment through telemedicine, and those that usually not appropriate for such treatment. Analyzing data from all 2006 pediatric visits to the largest emergency department in Rochester, more than 22,000 emergency department visits, researchers concluded that almost twenty-eight percent of visits fell into the first category, those conditions that are almost always treatable through telemedicine. Additionally, researchers then compared two groups of families, those with access to telemedicine and those without, and determined that, although those with access to telemedicine accessed care almost twenty-three percent more often than those without access to telemedicine, their rate of emergency department visits was also twenty-four percent lower than those without access to telemedicine. Because emergency department visits cost seven times what a doctor's visit or telemedicine visit costs, despite accessing medical care more often overall, telemedicine would save insurers more than \$14 per child per year in that particular community. Additional advantages of the system are convenience for parents and the ability to consult with the child's regular primary care physician—on average the child's own family pediatrician handles eighty-seven percent of these telemedicine visits.

High Blood Pressure Patients Advised To Use Home Monitors

Science Daily May 26, 2008 accessed June 9, 2008 <http://www.sciencedaily.com/releases/2008/05/080522181538.htm>

The American Heart Association, American Society of Hypertension and the Preventive Cardiovascular Nurses' Association have recommended that patients with high blood pressure regularly monitor their blood pressure at home to assist in managing their condition. For the first time, the American Heart Association has not only recommended the use of home monitors, but issued specific guidelines for their use. The use of home monitors is being recommended because blood pressure is variable, meaning that a single blood pressure reading every few months in the doctor's office will give only an incomplete picture. Regular home monitoring of blood pressure may assist doctors and patients in creating treatment plans and confirm initial diagnoses of hypertension. The statement expressed hope that this practice may also encourage patients to take their medications and meet goals and may indicate more quickly the efficacy of treatments. The guidelines recommend use of an oscillometric monitors with an upper arm cuff, which often cost less than \$100. The use of a wrist monitor is not recommended.

Virtual Health Care Worker Could Save Patient Time And Nursing Resources

Science Daily May 27, 2008 accessed June 9, 2008 <http://www.sciencedaily.com/releases/2008/05/080523162954.htm>

Japanese Researchers have developed a three part system for remote healthcare, combining aspects of continuous passive biomonitors with less sophisticated telehealth systems in hopes of eventually improving healthcare access in remote areas. The system combines video and voice communications systems with remote monitoring vital signs and remote monitoring of drip infusions for medications or nutrients administered by local caregivers. While current circumstances preclude those in remote locations or small towns from having access to sophisticated medical care, the new system uses internet or cellular phone technology for video conferencing and brings this together with the uploading and referencing of data on vital signs and progress of a drip infusion. This allows remote nursing staff to relay required care or changes to local caregivers. Although there have been successful field trials of this system, some aspects need to be improved before the system is widely adopted, specifically delays in videoconferencing, the accuracy of remote diagnosis, and accuracy of predicting drip infusion finishing time.

Relevance to Health Disparities

- May significantly improve access to healthcare for those in rural areas

Market for Patient Monitoring Systems To Double by 2012

iHealthBeat April 11, 2008 accessed June 10, 2008 <http://www.ihealthbeat.org/articles/2008/4/11/Market-for-Patient-Monitoring-Systems-To-Double-by-2012.aspx?topicID=52>

Market for patient monitoring devices could reach \$8 billion by 2012

Richard Pizzi April 11, 2008 Healthcare IT News accessed June 10, 2008
<http://www.healthcareitnews.com/story.cms?id=9061>

A report by life sciences research firm Kalorama Information indicates that expenditures on patient monitoring systems, at \$3.9 billion in 2007, will double by 2012. These systems include monitoring of vital signs and other data, wireless communication and web interfacing, and data processing systems.

The report suggests that the expected increase in spending is a result of an aging population and a shortage of healthcare workers. The spending on patient monitoring devices is focused in those with chronic conditions such as asthma, heart failure and diabetes. One advantage to these systems is that they may allow patients to spend less time in the hospital, reducing costs. According to Kalorama, the most useful of these systems are those with automatic data processing that alerts healthcare workers when measurements are outside a specified range. This reduces the burden on healthcare workers while still effectively monitoring the patient.

In-Body Sensors Could Warn Doctors: Sci-Fi-Like Idea Could Easily Become Future of Medicine

Ashley Phillips May 12, 2008 ABC News accessed June 10, 2008 <http://abcnews.go.com/print?id=4835631>

A report released in the United Kingdom suggests that “in-body” networks (internal biomonitors systems), along with similar “on-body” networks, may one day be available. These networks will combine wearable devices that monitor vital signs with implantable devices with similar purposes. These networks would then not only monitor a patient’s vital signs, but also transmit information to a doctor or to the nearest emergency center if the patient is having a heart attack or a stroke. There are certainly concerns regarding the security of the transmitted information and regarding infrastructure, and particularly the possibility of overwhelming both communication and health systems with these networks. Decisions would need to be made about where such transmissions would go, and a system would need to be put in place to handle all of the alerts that this system may generate. However, this may eventually be an alternative to external biomonitors devices for high-risk patients.

High-Tech Devices Keep Elderly Safe From Afar

Elizabeth Olson May 25 2008 New York Times accessed June 10, 2008 http://www.nytimes.com/2008/05/25/us/25aging.html?_r=1&oref=slogin

According to the New York Times, there has been an increasing trend toward the use of remote monitoring systems to keep elderly relatives or patients safe but still independent. These monitoring systems may include not only traditional emergency response buttons or typical biomonitors of vital signs, but also motion sensors to check for appropriate levels of movement or even whether or not a patient has stopped at his medication dispenser. More technology is also being developed: for example, “memory bracelets” that vibrate to remind patients to take medication and carpets with sensors to monitor gait. However, although this technology will be helpful for many elderly patients, particularly as demand overwhelms assisted living facilities, a system with motion sensors costs between \$50 and \$85 per month and there is little government or insurance support. This is beginning to change, though. NewCourtland Elder Services implemented a pilot project in Philadelphia in 2006 and is working with health insurance companies to expand the trial. Private companies are also investing large sums of money in developing this technology and the European Union recently committed \$1.5 billion to this research. According to Dr. Jeremy Nobel, a Harvard professor of public health, significant increases in the use of these systems is only two to five years away, and within ten years these systems will be widespread. Additionally, he notes that insurance coverage of these systems is still evolving, as the area is still very new.

Intel's In-Home Health Device Gets FDA Nod

Holly Jackson July 10, 2008 CNet News accessed July 11, 2008 http://news.cnet.com/8301-11386_3-9988328-76.html?hhTest=1

FDA Approves Intel Home-Care Tools

Wall Street Journal July 10, 2008 accessed July 11, 2008

Intel Corp. announced on July 10, 2008 that the new Intel Health Guide passed its first review by the Food and Drug Administration. Aimed at patients with chronic health conditions, such as diabetes and congestive heart failure, the eight pound in-home gadget manages collection of vital signs, remote interactions between patients and providers, and patient reminders and provides educational content and motivational messages. The system attaches to blood-pressure monitors, glucose meters, weight scales, and other medical devices to monitor vital signs and connects to the internet to relay this information to health care providers. The system also includes a touch screen monitor and the Intel Health Care Management Suite software to help patients and doctors monitor health as well as providing video conferencing services. Although this is not the first device of its kind, Intel believes that it is unique in its focus on closely involving patients in their own care. Pilot studies have already been conducted in the UK and the US, and Intel expects the system to be available by the end of 2008 or the beginning of 2009. They have not yet stated a price for the system.

New Robots Can Provide Elder Care For Aging Baby Boomers

Robotics Trends July 7, 2008 accessed July 14, 2008

http://www.roboticstrends.com/home/features/new_robots_can_provide_elder_care_for_aging_baby_boomers/

Researchers at the University of Massachusetts Amherst have developed a robotic assistant that can provide monitoring and care the elderly. This robot, with camera, microphone and LCD touch screen, Segway-like wheels, and an array of sensors as its "eyes and ears," provides a unique monitoring and interface system. The robot can be programmed to dial 911 in case of emergencies, remind clients to take their medication, help with grocery shopping and even allow a client to talk to loved ones and health care providers. The wheels allow it to navigate around the house looking for the patient, and the robot can recognize normal human activities, such as walking and sitting, and abnormal events, such as falls, and notify caregivers accordingly. It may be programmed to recognize when paths are blocked and remove obstructions and it can lift up to 2.2 pounds, potentially allowing it to assist with light household tasks. The communication interface also allows for remote face-to-face communication with family, friends, and caregivers. Researchers hope and expect this technology to reduce the burden of the expected retirement of over 77 million Americans in the next 30 years.

Bringing Second Life To Life: Researchers create character with reasoning abilities of a child

Science Daily March 10, 2008 accessed July 16, 2008 <http://www.sciencedaily.com/releases/2008/05/080530074313.htm>

A group of researchers from Rensselaer Polytechnic Institute has developed an avatar in Second Life that can reason about his own beliefs at a level that matches the reasoning of a four year old child. In order to do this, researchers had to combine logic-based artificial intelligence with cognitive modeling techniques based on the theory of the mind. Selmer Bringsjord, leader of the project, notes that "Truly

convincing autonomous synthetic characters must possess memories; believe things, want things, remember things." It is this set of beliefs and understanding of the beliefs of others that researchers have been able to replicate on a limited scale in Second Life.

EHR/PHR

Web-Based System May Improve Mammography Rates

Reuters Health, March 27, 2007 accessed March 5, 2008 <http://www.reuters.com/article/idUSFLE77374420070327>

A Web-based reminder system created by Dr. Rajeev Chaudry and colleagues, from the Mayo Clinic in Rochester, Minnesota, provides a list of women who are due for mammographic screening within the next 3 months, Chaudry and associates report in the Archives of Internal Medicine. The secretary then sends a letter to all patients who have not scheduled screening yet, asking them to call for an appointment. If the patient does not call, a second letter is sent and if the patient still does not respond, a phone call is made. "The breast cancer screening rate improved significantly with the practice redesign of having appointment secretaries proactively manage breast cancer screening needs," the authors conclude. "Many preventive screening services can be delivered without involvement of physicians or physician visits, and office staff can manage the preventive service needs of patients, which should also decrease the costs incurred by practices, patients, and insurers."

HHS Selects 12 Communities for Medicare EHR Incentive Project

iHealthBeat June 11, 2008 accessed June 12, 2008 <http://www.ihealthbeat.org/articles/2008/6/11/HHS-Selects-12-Communities-for-Medicare-EHR-Incentive-Project.aspx?topicID=54>

HHS officials selected twelve communities to take part in a five year Medicaid project to provide doctors with financial incentives to use electronic health records. The program is designed to test the effectiveness of incentives in increasing the use of EHRs in small- and medium-sized practices. Incentives will be distributed based on how well participating physicians meet benchmarks established by Centers for Medicare and Medicaid Services (CMS), starting with effective use of EHRs, then, in following years, moving on to national quality measures and the use of EHRs to improve care. Participating communities will recruit up to 200 physician practices, half of which will be offered incentives and the other half of which will serve as a control group. Participating practices are required to use EHR systems approved by the Certification Commission for Health IT to ensure that they meet interoperability and security standards. Although the program will cost \$150 million if the maximum amount in incentives is claimed, CMS expects the program to be budget-neutral, as the costs will be offset by savings achieved through EHR use.

Google Health Heads to the Hospital: A new partnership at a Boston hospital could forecast future success

Lissa Harris May 28, 2008 Technology Review; accessed June 17, 2008 <http://www.technologyreview.com/Infotech/20823/?a=f>

Google Health Launches: Security concerns are already surfacing

Emily Singer May 19, 2008 Technology Review; accessed June 17, 2008
<http://www.technologyreview.com/blog/editors/22074/>

On May 19, Google launched its new medical database service, allowing users to store medical histories and test results, compile prescriptions, and search for doctors or medical information. Because the database is user-driven and all information is entered by the user, HIPAA regulations do not apply, leading to concerns regarding security. Additionally, although permission is required for Google to allow access to a user's profile, there is no way to allow partial access to a Google Health profile. Despite these qualms, however, many big names have partnered with Google, including Walgreens, CVS, Quest Diagnostics, and the Cleveland Clinic. Large networked hospitals like Beth Israel Deaconess Medical Center, who announced a partnership with Google Health on May 20th, may also benefit from the service, linking their own EHR systems to Google's PHR system. According to John Halamka of Beth Israel Deaconess, this could hopefully allow patients to "build a secure, seamless lifetime record of their medical information." However, that hope depends on whether or not people ultimately decide to trust Google with their medical information.

Access To Electronic Medical Records Significantly Increases Efficiency Of Emergency Care

Science Daily May 30, 2008 accessed June 9, 2008 <http://www.sciencedaily.com/releases/2008/05/080530074313.htm>

A new study carried out by Christiana Care Health System indicates that, in the event of a mass casualty incident, the use of Electronic Health Records connected to an implantable microchip may lead to better care and decreased costs. Researchers studied the Verichip system, a product that combines an implantable microchip with a secure online database where emergency medical staff can quickly access a patient's information. The chip costs \$200-\$300 for insertion and there is a yearly fee of \$80 or \$20 depending on the level of information kept available. This allows for access to identification and important medical information even if a patient is unconscious or incoherent, reducing the time medical staff spend on identification and reducing the likelihood of errors in treatment. In the case of a prospective mass casualty scenario, researchers estimate that widespread use of this system could lead to an average savings of \$685.67 per patient simply in avoiding extraneous tests.

Imaging Tests

A Fuller Picture of Your Lungs: A cheap MRI machine images lung function more realistically

Katherine Bourzac April 10, 2008 Technology Review Accessed June 4, 2008
<http://www.technologyreview.com/Biotech/20548/>

Scientists at Harvard have created a new MRI machine that is able to better image lung functioning than traditional MRIs, can be used with the patient sitting or standing, and is much cheaper than traditional MRI machines. While traditional MRI machines use a very strong magnet to polarize water for its imaging, the new Harvard MRI uses a much weaker magnet to image already-polarized helium gas. The

patient inhales the pre-polarized helium gas and holds his breath for thirty seconds, as the MRI completes its imaging. Because the lungs are not filled with water, this creates a better image of the lungs than traditional MRIs and is also much cheaper and simpler. It also allows patients to be in any position during the imaging and, because oxygen molecules influence the spin of the polarized helium, the Harvard system can also indicate the concentration of oxygen in different parts of the lung. At less than \$100,000—compared with \$1 million dollars for conventional MRI machines—researchers believe that this system may be simple and inexpensive enough to be used in pulmonologists' offices. As a drawback, the system does require patients to hold their breaths and stay still for thirty seconds, which may be difficult for patients with compromised lung function, but researchers are working on shortening the time required for the imaging.

Relevance to Health Disparities

- Only relevant to lung conditions, but will make high quality imaging more widely accessible and affordable

Peering into the Heart, Safely: An emerging technology could offer clearer pictures of the heart

Tim Barribeau April 7, 2008 Technology Review; Accessed June 4, 2008 <http://www.technologyreview.com/Biotech/20523/>

Two US companies are working individually to improve current optical coherence tomography (OCT) imaging technology for the heart to make scans faster and safer. Current technology for OCT, an imaging system that relies on several exposures of light to create a complete picture, takes thirty seconds to complete and requires that the artery be clear of blood. A special balloon is used during the procedure to block incoming blood, but this is dangerous and may damage tissue. Thus, despite the high resolution provided by OCT scans, useful in checking stents, monitoring healing, identifying small plaque deposits, or targeting biopsies, the technology's use is only limited. The new system uses a mathematical formula to analyze complex data, allowing multiple wavelengths of data to be collected simultaneously rather than sequentially, reducing the time required for a scan from thirty seconds to two seconds. One of the companies developing this technology expects it to be available by the end of 2009 at the latest, and researchers speculate that these advances may prove to be useful not only for heart imaging but also for the gastrointestinal track or the bladder.

A Unique View of Disease: Researchers use unique molecular signatures to visualize the body

Courtney Humphries April 1, 2008 Technology Review; accessed June 4, 2008 <http://www.technologyreview.com/Biotech/20493/>

A new imaging technique using nanotechnology may allow researchers to better visualize molecular structures and changes within the body. Using nanoparticles attached to dye molecules, researchers can target these nanoparticles to particular locations in the body, types of tissues, or proteins and use a technique called Raman spectroscopy to create an image. This method has not yet been tested in humans, but if found to be safe and effective, may have several advantages over traditional imaging techniques, like PET testing and others. The Raman spectroscopy technique has very good sensitivity would be cheaper than PET testing, and, unlike PET testing, does not use radioactivity. Its major

advantage, however, is the power to image several things at once. By using several different nanoparticles researchers can distinguish between these particles, giving them a better understanding of the molecular processes. However, as with many optical imaging techniques, the Raman spectroscopy method is limited in its ability to penetrate deep into tissue, and may be more useful for tumors close to the surface of the skin.

Imaging the Genetic Profile of a Tumor: MRI scans could be used to determine which drug will work best against a brain tumor

Katherine Bourzac March 25, 2008 Technology Review Accessed June 4, 2008
<http://www.technologyreview.com/Biotech/20462/>

Researchers at UCSD have found evidence that the genomic profiles of some cancerous brain tumors may be identifiable through MRIs. Glioblastoma tumors, the most common form of brain cancer, may have very different genetic makeups and respond differently to treatments. However, although expensive gene-expression studies can be performed on biopsies, these tests are expensive and not widely used. MRI scans, though, are standard, and researchers have linked characteristics of tumors on MRI scans with seven genetic profiles, indicating blood-vessel growth, cell proliferation, or other characteristics of cancer biology that existing drugs target. While the study was very small, larger studies are underway to confirm this finding. If larger studies support these results, then brain cancer could be treated in a more effective, targeted way simply using existing standard imaging technologies. Additionally, related researchers published a study last year indicating a similar relationship between characteristics of liver tumors in CT scans and gene-expression patterns, and other researchers believe that this method may prove to be useful for other cancers and perhaps other diseases.

Relevance to Health Disparities

- May make targeted cancer therapies widely available despite the high cost and low usage of gene-expression studies

Chip Advances Lift Ultrasound Market, Help Save Lives

Riva Richmond March 20, 2008 Wall Street Journal

Seimens AG has created a portable ultrasound device the size of a Game Boy that could make ultrasound imaging available for diagnosis in emergency rooms, clinics, and in the field. Advances in technology, including smaller, faster, cheaper chips that are less power-hungry have allowed for advancements in imaging technology as well computers and cell phones. Although technologies for portable devices still do not provide color imaging, making it less useful for some conditions, and have a relatively short battery life, these technologies are still improving and sales of portable ultrasound devices are climbing.

Relevance to Health Disparities

- Cheap, portable ultrasound devices such as these make ultrasound imaging and diagnosis available to community health centers and even health fairs, improving access

Remote Control for Pill Cameras: Capsule-sized camera can be steered through the digestive system

Kate Baggott June 19, 2008 Technology Review; accessed June 19, 2008 <http://www.technologyreview.com/Biotech/20909/>

Researchers at the Fraunhofer Institute for Biomedical Engineering in Germany have developed a magnetic device that can guide a camera within the body. This advance could replace the much more uncomfortable endoscopy. While pill or capsule cameras have been used for about five years, doctors' lack of ability to control them made them useful only for the intestines and colon, as they pass through the esophagus and stomach very quickly. In a single experiment, however, the research team was able to keep the magnetically-controlled pill camera in the esophagus for ten minutes, with no reported unpleasant effects. The controller can also turn the camera and adjust its angle as needed. With the ability to control such capsules, it may also be possible to deliver therapeutic treatments in specific areas as well.

Miscellaneous Testing Advances

New Toys Read Brain Waves

Rachel Konrad The Associated Press April 30, 2007 accessed March 21, 2008 <http://abcnews.go.com/Technology/wireStory?id=3097954>

Engineers at NeuroSky Inc are developing a mask, modeled after Darth Vader's mask and light saber, with sensors that touch the user's forehead and reads the brain's electrical signals, then sends them to a wireless receiver inside the saber, which lights up when the user is concentrating. The player maintains focus by channeling thoughts on any fixed mental image, or thinking specifically about keeping the light sword on. When the mind wanders, the wand goes dark.

Engineers at NeuroSky Inc. have big plans for brain wave-reading toys and video games. They say the simple Darth Vader game a relatively crude biofeedback device cloaked in gimmicky garb portends the coming of more sophisticated devices that could revolutionize the way people play. "Most physical games are really mental games," said Koo Hyoung Lee, a NeuroSky co-founder from South Korea. "You must maintain attention at very high levels to succeed. This technology makes toys and video games more lifelike." Boosters say toys with even the most basic brain wave-reading technology scheduled to debut later this year could boost mental focus and help kids with attention deficit hyperactivity disorder, autism and mood disorders.

The price and size of EEG hardware is shrinking. NeuroSky's "dry-active" sensors don't require gel, are the size of a thumbnail, and could be put into a headset that retails for as little as \$20, said NeuroSky CEO Stanley Yang. Researchers at NeuroSky and other startups are also building prototypes of toys that use electromyography (EMG), which records twitches and other muscular movements, and electrooculography (EOG), which measures changes in the retina. While NeuroSky's headset has one electrode, Emotiv Systems Inc. has developed a gel-free headset with 18 sensors. Besides monitoring basic changes in mood and focus, Emotiv's bulkier headset detects brain waves indicating smiles, blinks, laughter, even conscious thoughts and unconscious emotions. Players could kick or punch their video game opponent without a joystick or mouse.

STMicro's Chip Shoots At Bird Flu

James McKeigue, March 24, 2008 accessed March 24, 2008 http://www.forbes.com/markets/equities/2008/03/24/stmicro-bird-flu-markets-equity-cx_jm_0324markets25.html

The Franco-Italian chipmaker has developed a new portable chip which it says can detect bird flu, and other forms of influenza, in humans. The VereFlu chip can screen multiple classes of pathogens and genes in a single test and yield results within hours--a massive improvement on the current chip technology that can only test one strain at a time and can need days, or even weeks, to yield results.

Ultra-Fast, Ultra-Intense Laser has Clean-Cut Advantage

Physprg.com, University of Missouri-Columbia March 13, 2008 accessed April 21, 2008 <http://www.physorg.com/news124635494.html>

The ultra-fast, ultra-intense laser, or UUL, with laser pulse durations of one quadrillionth of a second, otherwise known as one femtosecond, could change cancer treatments, dentistry procedures, precision metal cutting, and joint implant surgeries.

"The femtosecond laser has now entered the era of applications. It used to be a novelty, a fantasy," said University of Missouri researcher Robert Tzou, the James C. Dowell professor and chairman of the department of Mechanical and Aerospace Engineering. "We are currently targeting the areas of life-science and bio-medicine."

What makes the femtosecond laser different from other lasers is its unique capacity to interact with its target without transferring heat to the area surrounding its mark. Results are clean cuts, strong welds and precision destruction of very small targets, such as cancer cells, with no injury to surrounding materials. ***Tzou hopes that the laser would essentially eliminate the need for harmful chemical therapy used in cancer treatments.***

"If we have a way to use the lasers to kill cancer cells without even touching the surrounding healthy cells, that is a tremendous benefit to the patient," Tzou said. "Basically, the patient leaves the clinic immediately after treatment with no side effects or damage. The high precision and high efficiency of the UUL allows for immediate results."

Practical applications of this type of laser also include, but aren't limited to, the ability to create super-clean channels in a silicon chip. That process can allow doctors to analyze blood one cell at a time as cells flow through the channel. The laser can be used in surgery to make more precise incisions that heal faster and cause less collateral tissue damage. In dentistry, the laser can treat tooth decay without harming the rest of the tooth structure.

PC Beats Doctor in Scan Tests

Wellcome Trust Centre for Neuroimaging at University College London; accessed Tuesday February 26, 2008 <http://news.bbc.co.uk/2/hi/science/nature/7257730.stm>;

A diagnostic test for Alzheimer's using a standard computer may soon enter the clinical market. The computer was trained in how to diagnose the disease by scanning the brain of an Alzheimer's patient and the brain of a patient with no signs of disease. It has a 96% accuracy rate as compared to an 85% rate with provider conducted standard scans, blood tests, and interviews.

Relevance to Health Disparities

- The improved accuracy will decrease the need for follow-up tests and reduce the cost of care.
- The test's ability to improve progressive monitoring of the disease will allow more accurate and relevant pharmaceutical research and treatment
- Can better stage the degenerative disease/dementia
- Use of standard computer is more cost effective and can easily trickle down to community health centers and low income clinics

DIY Lab Scanner Made from Standard CD Drive

Tom Simonite September 25, 2007 NewScientist.com; accessed March 3, 2008

http://technology.newscientist.com/article.ns?id=dn12688&feedId=online-news_rss20

A normal CD or DVD drive can be transformed into a highly accurate scanner for chemical or medical tests by fixing it two additional light sensors.

Normally, the machines used for light detection are expensive, normally costing between 30,000 and 60,000 Euros (\$47,000 – \$95,000 USD). Angel Maquieira, of the Polytechnic University of Valencia, Spain and colleagues found that an off-the-shelf CD drive can be modified to do the same job. While a laboratory machine has to precisely scan samples with light and record the results, a CD player uses similar precision to read the tiny pits that encode music or data on a disk.

"The main advantages of using a CD reader are versatility, simplicity, ease of operation, and portability for point-of-need applications," Maquieira told New Scientist. It has also been noted that future disk drives may be even more useful with technologies such as Blu-ray and HD-DVD which use shorter wavelength lasers that are closer to those found inside laboratory machines.

Lab-on-a-Chip Made of Paper: Paper-based microfluidic devices could yield cheap, disposable diagnostic tests

Kristina Grifantini May 14, 2008 Technology Review; accessed June 4, 2008 <http://www.technologyreview.com/Biotech/20771/>

Talking Up A New Role For Cell Phones In Telemedicine

Science Daily May 6, 2008 accessed June 6, 2008 <http://www.sciencedaily.com/releases/2008/05/080505120705.htm>

Researchers from Harvard's Whitesides Research Group have created a small paper microfluidics device that may be used for cheap, portable, easily disposable diagnostics tests that require only very small amounts of fluids. Unlike conventional microfluidics chips made from expensive plastic, glass, or silicon and using tiny pumps and valves to move fluid, the new, cheaper paper-based device uses the natural capillary action of paper to direct samples to particular parts of the of the device. Different chemical reagents for testing for different conditions or symptoms are placed on various parts of the paper, allowing for simultaneous performance of several tests and the small size of the device allows for very small sample sizes, eliminating the need for syringes.

Although the limited pumping action of the paper may preclude more complex chemical reactions, the test may be used to screen blood or urine for glucose levels, proteins, or signs of kidney failure or

infectious disease. The creators also envision combining these paper tests with the use of cell phones for off-site diagnosis, minimizing the level of on-site expertise needed to use the tests.

Relevance to Health Disparities

- May significantly expand availability of diagnostics for various conditions to rural and low-income people around the world
 - Expands ability to diagnose at mobile health fairs or clinics

More-Accurate Radiation Therapy: Small, implantable devices could measure radiation from within tumors themselves

Courtney Humphries April 24, 2008 Technology Review; accessed June 4, 2008
<http://www.technologyreview.com/Biotech/20672/>

A new, wireless device, small enough to be implanted into tumors using a large syringe, may help doctors more precisely target radiation therapy to tumors and measure the actual dosage of radiation received by the tumor. Because it may be difficult to direct radiation precisely to the tumor, avoiding healthy tissue, and particularly because the patient's anatomy may shift over time, it is impossible to know with certainty the radiation dosage that is hitting the tumor. The developers of this device are now working to make the device smaller and to combine it with a magnetic tracking device that could also provide doctors with information about the location of the tumor.

Perfecting An Artificial Pancreas: Specialized polymer is key to insulin-regulating device

Bethany Halford May 5, 2008 Chemical and Engineering News; accessed June 6, 2008
<http://pubs.acs.org/cen/science/86/8618sci4.html>

No More Needles: Toward An Artificial Pancreas For Fighting Diabetes

Science Daily May 6, 2008 accessed June 6, 2008 <http://www.sciencedaily.com/releases/2008/05/080505093226.htm>

Joseph P. Kennedy and his colleagues at the University of Akron, in Ohio, have created an artificial pancreas that has shown preliminary success in animal trials. The new bioartificial pancreas is made up of a small metal mesh tube, seven centimeters long, coated with a special semipermeable polymer membrane. All of the materials are biocompatible. The tube is then filled with a suspension of pig islets-pancreatic cells responsible for detecting glucose and releasing insulin. The polymer then allows for free movement of glucose and insulin but restricts access of immune cells to the islets and any viruses from the islets to the body; the polymer also allows the device to sequester oxygen to nourish the islet cells. One of the project collaborators notes that the device is "biocompatible, flexible, transparent, autoclavable... easily synthesized and relatively inexpensive." This device would allow patients to monitor and correct glucose levels in real time, rather than a few times per day, and would ultimately not require sophisticated electronic monitoring systems or repeated finger sticks. Researchers expect the main market for the device to be patients with type 1 diabetes, but believe that it may also be helpful for those with type 2 diabetes who now control their blood sugar with insulin injections. The team is now working on more advanced animal trials before moving on to human trials.

Relevance to Health Disparities

- Simpler than electronic closed-loop insulin pumps and monitors and created from relatively inexpensive materials, may eventually be a relatively inexpensive, long-term tool for managing diabetes
 - Still far from clinically applicable

'New Wave' In Health Care Provision Signalled By Innovative Antennae

Medical News Today May 16, 2008 accessed June 19, 2008 <http://www.medicalnewstoday.com/articles/107597.php>

Researchers at Queen's University Belfast have developed a new type of antenna that could revolutionize continuous passive biomonitoring, making biosensors more wearable and convenient. Although the use of wearable biosensors to monitor health is not new, properties of traditional antennas have limited the use of biomonitoring. With traditional antennas, most of the signal is directed either outward, or into the body, which weakens the signal. The rest of the signal "creeps" around the body, close to the skin, to transmit to the control unit. Because of the small amount of the signal that creeps around the body, the overall signal strength has to be increased, either requiring an inconveniently large antenna or compromising battery life. The new antenna developed at Queen's University directs most of its signal out of the side of the antenna, into these creeping waves that effectively transmit the signal. The result is an antenna 50 times more efficient than previous on-body antennas, allowing researchers to reduce antenna size significantly. This will increase the convenience of wearability of biomonitoring devices, perhaps ultimately increasing their use.

Genetic/Nano – Testing

Salmonella Bacteria Turned Into Cancer Fighting Robots

Newswise, University of Massachusetts Amherst February 29, 2008 accessed April 14, 2008;
<http://www.newswise.com/articles/view/538237/>; <http://www.sciencedaily.com/releases/2008/02/080229171124.htm>

Neil Forbes of the University of Massachusetts Amherst has received a four-year grant of more than \$1 million from the National Institutes of Health to research killing cancer tumors with Salmonella bacteria. Salmonella bacteria can be turned into tiny terminator robots that use their own flagella to venture deep into cancerous tumors where conventional chemotherapy can't reach. Once in place, the bacteria manufacture drugs that destroy cancer cells. This could translate chemotherapy that is more specific, more effective and easier on patients.

"When we get the Salmonella bacteria into the part of the tumor where we want them to be, we've programmed them to go ape," says Forbes. "We have the bacteria release a drug to trigger a receptor in cancer cells called the "death receptor," which induces cancer cells to kill themselves. We've already done this in the lab. We've done this successfully in cancerous mice, and it dramatically increases their survival rate." Normally, mice with tumors all die within 30 days. After receiving this bacterial system and getting a dose of radiation, all the mice in Forbes' lab tests survived beyond the 30 days, which could potentially translate into many months or years in people.

The basic problem being addressed by Forbes is that some regions in any cancer tumor are impossible to reach with current chemotherapy drugs. Drug access to the tissue in any tumor is limited by the distribution of its blood vessels. Tissue located farthest from its surrounding blood vessels is the hardest for drugs to reach because the vessels act as their chemical highways into the tumor. Every tumor has a different distribution of blood vessels, depending on the nature of the tumor and the patient's genetic makeup.

'Tumour Factory' to Accelerate Cancer Drug Development

Colin Barras, March 17, 2008 Journal reference: Biomedical Microdevices (DOI: 10.1007/s10544-007-9125-8 accessed April 21, 2008; <http://www.newscientist.com/channel/health/cancer/dn13489-tumour-factory-to-accelerate-cancer-drug-development.html>

A machine that churns out three-dimensional artificial tumours could help improve anti-cancer drug testing, researchers say. The "tumour factory" offers a better alternative to the flat cultured cells currently used to test new anticancer drugs.

In a real cancer, different parts of a tumour are fed different amounts of oxygen. Cells growing in a flat monolayer all receive the same amounts of oxygen are all exposed to an equal quantities of nutrients. "Testing anticancer drugs on these models may be very inaccurate," says Maria Teresa Santini of the Istituto Superiore di Sanità in Rome, Italy. Small clumps of cells known as 3D tumour spheroids provide a better model. But, until now, spheroids have had to be made one at a time in a process that produces different sizes each time. Luke Lee's group at the University of California in Berkeley, US, has developed a technique to quickly generate spheroids of a standard size at low cost. The breast cancer drug Taxol has already been shown half as effective on spheroids as it is on 2D cell cultures.

At the heart of the Berkeley team's device is an array of U-shaped traps each 35 micrometers across and 50 micrometers deep, which are made from polydimethylsiloxane (PDMS), a silicon-based organic polymer. The array is held inside a chamber through which flows breast cancer cells suspended in growth solution. Cells that flow into the microscopic traps cannot flow out again, although the growth solution can escape from a small gap underneath the trap too large for a cell. Over the course of a few hours, empty traps become filled with cells and, over about 7 hours, they attach to one another and form tumour spheroids containing 9-11 cells inside each trap. Solution constantly supplies the outer layer of the spheroids with fresh nutrients and oxygen, and removes waste excretions. The PDMS polymer also allows oxygen to reach the cells.

UCLA Researchers Design Nanomachine That Kills Cancer Cells

PhysOrg.com, University of California - Los Angeles, March 31, 2008 accessed April 21, 2008; <http://newsroom.ucla.edu/portal/ucla/researchers-at-ucla-have-designed-46388.aspx>

Researchers from the Nano Machine Center at the California NanoSystems Institute at UCLA have developed a novel type of nanomachine that can capture and store anticancer drugs inside tiny pores and release them into cancer cells in response to light. Known as a "nanoimpeller," the device is the first light-powered nanomachine that operates inside a living cell, a development that has strong implications for cancer treatment. UCLA researchers reported the synthesis and operation of nanoparticles containing nanoimpellers that can deliver anticancer drugs March 31 in the online edition of the nanoscience journal Small.

The study was conducted jointly by Jeffrey Zink, UCLA professor of chemistry and biochemistry, and Fuyu Tamanoi, UCLA professor of microbiology, immunology and molecular genetics and director of the signal transduction and therapeutics program at UCLA's Jonsson Comprehensive Cancer Center. Tamanoi and Zink are two of the co-directors for the Nano Machine Center for Targeted Delivery and On-Demand Release at the California NanoSystems Institute.

The pores of the particles can be loaded with cargo molecules, such as dyes or anticancer drugs. In response to light exposure, a wagging motion occurs, causing the cargo molecules to escape from the pores and attack the cell. Confocal microscopic images showed that the impeller operation can be regulated precisely by the intensity of the light, the excitation time and the specific wavelength. "The nanomachines are positioned in molecular-sized pores inside of spherical particles and function in aqueous and biological environments" says Zink.

"This system has potential applications for precise drug delivery and might be the next generation for novel platform for the treatment of cancers such as colon and stomach cancer," Zink and Tamanoi said. "The fact that one can operate the mechanism by remote control means that one can administer repeated small-dosage releases to achieve greater control of the drug's effect."

Bugs Provoke the Immune System into Fighting Cancer

New Scientist, April 2, 2008 accessed April 28, 2008; <http://www.newscientist.com/channel/health/cancer/mg19726494.900-bugs-provoke-the-immune-system-into-fighting-cancer.html>

Disease-causing bugs could play a valuable role in the treatment of cancer. Deliberately infecting people with the bacteria that cause listeriosis could increase their ability to destroy tumours. The goal is to kick-start the body's immune system by "provoking" it with the bacteria, which are modified to trigger an attack on the cancer. US vaccine company Advaxis chose *Listeria monocytogenes* because of its ability to stow away in immune cells called antigen-presenting cells (APCs). These cells prime the rest of the immune system to attack a given strain of microbe, say, by showing fragments of antigen from that microbe to the appropriate cells.

In a preliminary trial on 13 women with advanced cervical cancer, four of those injected with the bacteria responded. One is tumour-free more than two years after the treatment, and tumours in the other three shrank by 20 per cent. Seven of the women have died from the cancer. Advaxis hopes to begin a trial on 180 patients with less advanced cervical cancer. John Stanford of University College London, whose team has had recent success treating cancer patients with dead *Mycobacterium vaccae*, says that Advaxis may need to give booster doses to sustain the therapeutic effect.

Targeted Delivery for Nanoparticles

Kevin Bullis Technology Review, April 10, 2008 accessed April 28, 2008; <http://www.technologyreview.com/Nanotech/20547/>

Microcontainers could improve cancer treatment by carrying nanoparticles directly to tumors. Nanotechnology-based methods to deliver chemotherapy drugs only to cancerous cells have shown promise, but they don't work for all cancers. Now a handful of research groups are developing more-complex approaches that use microscopic carriers to deliver a variety of particles--including drugs, molecular tags that target tumors, and imaging agents to monitor and destroy cancer cells. In theory,

these microscopic delivery vehicles would evade the body's defenses and target blood vessels near a tumor, then release their payload.

While the technology is still in its early stages, researchers at the University of Texas in Houston have taken a first step by engineering tiny discs of porous silicon that can be used to deliver two types of nanoparticles simultaneously. Others are already trying a similar approach--using targeting molecules attached to nanoparticles--and, in some cases, are about to begin clinical trials. But unlike liposomes, which can carry significant drug payloads, these nanoparticles only carry a relatively small amount of drug on their surface. What's more, many of the particles can be trapped or destroyed by the body's defenses, making it difficult to deliver an effective dose. In Ferrari's approach, the microscopic silicon carrier would protect the nanoparticles and deliver them in large numbers to the vicinity of the tumor, increasing the chances that the drugs will reach the cancer cells in large amounts.

If successful, the relatively large microscopic carrier particles could be used as a generic transport for a variety of combinations of drugs and nanoparticles selected for specific types of tumors.

Blocking the Effect of Inflammation: causing cells lowered prostate cancer cell invasion

Sylvia Wrobel, Federation of American Societies for Experimental Biology Physorg.com, April 8, 2008 accessed April 28, 2008; <http://www.physorg.com/news126888371.html>

Recent studies have suggested an association between chronic inflammation and cancers of the prostate, colon, stomach and liver. Now scientists at Northwestern University Feinberg School of Medicine report success in blocking an early step in metastasis of prostate cancer cells by interrupting the communication between the cancer cells and other cells that promote inflammation. Their success suggests new ways to control cancer spread and metastasis. The findings also provide an impetus to look more closely at existing inflammation-controlling drugs including non-steroidal anti-inflammatory drugs, cyclooxygenase inhibitors, antioxidants and statins. It is possible, says Dr. Paul Lindholm, that these widely available drugs could be used to control aggressive cancer cell growth and spread for these and other inflammation-associated cancers.

The researchers now plan to study the effects of macrophages and inflammation and NF-kappaB inhibiting treatments in vivo, in a specially designed mouse model of invasive prostate cancer. They also plan to extend these experiments to include drugs currently used in humans to control inflammation. If anti-inflammatory drugs block cancer cell NF-kappaB activity and spreading movement, as the researchers hope, these drugs may prove useful for patients whose cancers are discovered early but who are at risk for cancer spread. The results also could help identify biomarkers of early cancer, before it can be detected by current technology, and to monitor response to treatments designed to prevent cancer spread.

New Tests Spot Infectious Bugs More Quickly

By Shirley S. Wang, The Wall Street Journal Last update: Feb. 5, 2008; accessed March 3, 2008 <http://www.marketwatch.com/News/Story/Story.aspx?guid=%7B8A055F80-8F28-45B5-B153-025C3975EF7E%7D&siteid=nwhpf&lsn=15>

Hospitals are increasingly deploying a new breed of diagnostic tests; ones that promise results in hours not days and are particularly effective in detecting deadly antibiotic-resistant "superbugs."

This new generation of tests identifies organisms using genetic information rather than growing them in a dish and examining them under the microscope. They can detect not only what strain of a bug is present more quickly than traditional tests, but also whether it is resistant to one antibiotic or vulnerable to another. The tests may even be able to identify some strains that can't be grown, and therefore couldn't be detected under the microscope.

UMass Amherst Scientists Create Nano Nose With Aim of Sniffing Out Diseased Cells

Vince Rotello, UMass Amherst, April 23, 2007 accessed March 15, 2008

<http://www.umass.edu/newsoffice/newsreleases/articles/51484.php>

A team of scientists from the University of Massachusetts Amherst has created a kind of molecular nose that uses nanoparticle-based sensors to sniff out and identify proteins. The sensors, which can be trained to detect a wide variety of proteins, could eventually serve as a medical diagnostic tool by sniffing out the proteins made by sickly cells. "The goal is to make a sensor that works like the cancer-sniffing dogs we have been hearing about in the news," says UMass Amherst chemist Vincent Rotello. Rotello's team used six different kinds of nanoparticles to sense for seven different proteins, some of which were intentionally very similar. Ninety-four percent of the time the sensors correctly identified the given protein. The scientists also worked out a technique for dealing with varying protein concentrations, which can sometimes confuse analyses. And by combining their raw data with statistical analyses, the researchers were able to correctly identify 56 randomly selected proteins with 96 percent accuracy. The chemical nose approach provides a distinct method of sensing that has the potential to be more reliable (fewer false negatives and false positives) and **cheaper than current technology**, says Rotello.

Matching Tumors to Drug: A clinical trial offers a first step toward personalizing cancer treatments

Courtney Humphries May 27, 2008 Technology Review; accessed June 4, 2008

<http://www.technologyreview.com/Biotech/20822/>

Researchers led by Lecia Sequist of Harvard recently released a study indicating that cancer treatment can successfully be customized to the genetic profile of the patient's tumor. Sequist screened the genetic profile of lung cancer tumors to identify patients whose tumors would be likely to respond to a targeted therapy, rather than typical chemotherapy. This therapy, targeting a specific molecule in cancer cells (EGFR), was not previously found to be successful at increasing survival and is now used only after chemotherapy; however, Sequist's team genetically screened tumors for EGFR mutations that may indicate that the tumor would be receptive to this alternative treatment. Patients were then offered the choice of receiving the EGFR inhibitor rather than typical chemotherapy. Of the thirty-one patients who received the alternative treatment fifty-five percent had their tumors shrink noticeably in a CAT scan and all but two had tumors that either shrank or did not grow for at least a month. The median

time that these patients went without their cancer progressing was nine months. This is in comparison to response rates of twenty to thirty percent and survival advantages of about four months with typical chemotherapy. Additionally, the EGFR inhibitor is a daily oral pill, and does not induce the same side effects as chemotherapy. While this study does not compare patients with EGFR mutations on chemotherapy to those using the EGFR inhibitor, a study in Spain is currently underway comparing results of these two treatments in patients with genetically similar tumors. Although this does not provide a definitive blueprint for using personalized cancer treatments, it represents an important first attempt to genetically screen cancer patients to determine appropriate treatments.

A Tiny Sensor Simply Made: A nanoscale biosensor that can detect minute amounts of pathogens could come to market this year.

Brittany Sauser June 5, 2008 Technology Review; accessed June 5, 2008 <http://www.technologyreview.com/Biotech/20860/>

NASA researchers have developed a nanotechnology-based biosensor capable of detecting many different microorganisms quickly and simultaneously. NASA plans to use the carbon-based biosensors, fabricated in a process similar to that used to make computer chips, to detect life on other planets, it has licensed the company Early Warning, a company that develops systems to monitor biohazards. Early Warning plans to first use the sensor as a water-quality monitor. Because the biomonitors use microfluidics technology and are based on detecting electrical signals, there is no need to take samples to a lab for results and contaminated water can be identified in as little as thirty minutes, rather than forty-eight hours. Although this is the first planned use of this technology, it is projected that this may be used to detect pathogens in air or food and in medical diagnostics.

Combined Physical and Genetic Map Finds Cancer's 'Ignition Key'

Science Daily May 8, 2008 accessed June 6, 2008 <http://www.sciencedaily.com/releases/2008/05/080505125617.htm>

Using a technique called whole organ histologic and genetic mapping, researchers have combined genetic and molecular to gain an understanding of the molecular progression from normal cells to invasive cancers. In the process, researchers also identified a new category of “forerunner genes” that are shut down early in the development of cancer, when it is still unidentifiable by traditional means. The identification of these new “forerunner genes” create opportunities for the development of new biomarkers to identify cancer in its very earliest stages. Although the technique has, to date, only been used to study bladder cancer, researcher believe that this method may be used to study other cancers and ultimately to improve identification, prevention, and management for them as well.

Gene Chemicals 'Cancer Warning'

BBC News June 10, 2008 accessed June 17, 2008 <http://news.bbc.co.uk/2/hi/health/7445651.stm>

A team from the UK Institute of Food Research has found slight abnormalities in the chemical “tags” of apparently normal cells taken from cancer patients. Normal cells taken from the intestines of bowel cancer patients were found to have slightly different epigenetic codes, which scientists think could indicate a warning that cancer is more likely. Researchers posit the poor diet and lifestyle may cause these changes, preparing these chemicals to activate cancer-causing genes. Some of these differences may also occur along with normal aging, but researchers wonder if diet and exercise could affect the

rate of this change. While this newly identified biomarker may eventually be a very early warning sign for cancer, much more research is necessary to determine its exact progression and limitations.

Novel Protein Nanoparticles 'Shape' The Future Of Disease

Medical News Today May 19, 2008 accessed June 19, 2008 <http://www.medicalnewstoday.com/articles/107756.php>

Researchers at the University of South Carolina Chapel Hill have developed a new protein particle fabrication method and granted an exclusive license for it to Liquidia Technologies. Proteins, large organic molecules that perform complex functions in the body, are ideal for diagnosing and treating diseases, but are difficult to use in practice because of issues with solubility, stability and concentration. The new nanofabrication process called PRINT[®] (Particle Replication in Non-Wetting Templates) creates proteins to a pre-specified size and shape, optimizing the usually difficult characteristics of solubility, stability and concentration. Researchers have used this method to create particles of pure insulin and albumin as well as albumin particles containing therapeutics. While more research is still necessary, this may be an important step toward the use of proteins for diagnosis and treatment.

Microfiltering Sepsis

Jennifer Chu May 23, 2008 Technology Review; accessed July 15, 2008 <http://www.technologyreview.com/Biotech/20816/>

Researchers at Children's Hospital Boston are developing a miniature filtration device to rapidly clear blood of infectious agents, for use as a first-line treatment for sepsis. Sepsis occurs when a body overreacts to infection, causing inflammation to spread and organs to shut down, and sometimes leading to death. Antibiotics are the most common treatment for sepsis, as dialysis systems cannot remove large molecules like pathogens. However, antibiotics take time to work, and in the meantime, inflammation continues to spread. The new filtration device can clear blood of pathogens quickly, by sending the blood through a microfluidics device that uses a magnetic field to pull pathogens out of the blood into a saline-based solution. Researchers have effectively filtered the amount of blood found in a premature baby in approximately two hours and are working to increase the capacity and efficiency of the device.

xCELLigence - Online-Measurement of Cell Activities without Labelling

Genetic Engineering & Biotechnology News July 7, 2008 accessed July 16, 2008 <http://www.genengnews.com/news/bnitem.aspx?name=38441998>

Roche and ACEA have announced the launch of their new xCELLigence system for analyzing cells. The system needs only fifteen seconds to analyze one of its disposable 96 well microtiter E-Plates. Micro-electric biosensors in each well of the E-plate can monitor changes in cell status, such as cell adhesion, cytotoxicity, cell proliferation, cell - cell interactions, and morphological changes by measuring changes in electrical impedance. This system has many advantages, including the fact that it can monitor cells without chemical labeling and it can provide real-time, uninterrupted monitoring.

Biomonitoring: Related Behavior Shaping Tools

The Health Buddy System

Health Hero Network accessed July 10, 2008, https://www.healthhero.com/products_services/products_services.html

The Health Buddy System is an appliance that interacts with the patient in his/her home by collecting measurements from a variety of medical devices via infrared technology and asking questions about vital signs, symptoms and behaviors. This information is communicated back to health providers to allowing them to monitor patients with chronic disease. The information can either be transmitted via Ethernet or traditional phone line. The device also provides education, reinforcement and points of action for the patient upon the completion of the session.

Health Buddy Improves Asthma Outcomes in Randomized Trial

https://www.healthhero.com/press/press_releases/pr_03_20_02.html, accessed July 14, 2008

The Health Buddy System was tested in a randomized controlled trial to determine whether it had a beneficial impact on children with asthma. The Children's Hospital of Oakland published a study in the Archives of Pediatrics & Adolescent Medicine in 2002 that showed that use of the Health Buddy System decreased urgent hospital visits due to asthma in children, decreased the odds of limitation in activity by 48% and lowered the odds of dangerous peak flow levels.

Mercy Health Center Improves the Health Status of Underserved Border Residents Through the Use of Health Hero's Technology Platform

https://www.healthhero.com/press/press_releases/pr_10_11_01.html, accessed July 14, 2008

A 1999-2000 program sponsored by Mercy Health Center in Laredo, Texas aimed to improve the health status of indigent border residents with chronic diseases (specifically congestive heart failure and diabetes mellitus) through the use of telemedicine technology. Patients used the Health Buddy to answer questions (in English or Spanish) about their disease symptoms, knowledge, and medication compliance. The CHF sample included 57 patients (36 female, 21 male, median ages 68 and 61, respectively). The diabetes sample included 169 patients (130 female, 39 male, average age 53). A comparative standard care sample for each disease was included in the study to assess changes in care utilization among the group using the Health Hero technology. For the CHF test, results indicated a 41% reduction in CHF-related hospitalizations among the patients enrolled in the telemedicine disease management program, and a reduction in total charges of \$13,159 per person per year. The diabetes test showed a 32% drop in hospitalizations related to diabetes, and charge reductions of \$747 PPPY. Significantly, both studies recorded very high levels of patient satisfaction with the Health Buddy (95%) and ease of use (88%).

Relevance to health disparities

- The Health Buddy system from Health Hero has been shown to enable low income, Hispanic populations to better manage their diabetes and low-income youth to better manage their asthma. It is a system that allows the patients to easily and inexpensively communicate with their health providers as well as receive coaching, feedback, action points and education related to their chronic health issue. The Health Buddy is one of several home monitoring systems used in the VA's pilots.

“Patient Safety and Quality: An evidence-based handbook for nurses Vol. 3: Chapter 48 - patient safety, telenursing and telehealth”

Loretta Schlachta-Fairchild, Victoria Elfrink and Andrea Deickman, May 2008, AHRQ; accessed July 12, 2008

http://www.ahrq.gov/qual/nursesfdbk/docs/SchlachtaL_PSTT.pdf.

There is a new handbook out through AHRQ: “Patient Safety and Quality: An Evidence-Based Handbook for Nurses: Vol. 3” which contains a chapter, “chapter 48 Patient Safety, Telenursing, and Telehealth” authored by Loretta Schlachta-Fairchild, Victoria Elfrink and Andrea Deickman. It was released in May 2008 and is available at: <http://www.ahrq.gov/qual/nursesfdbk/>. Chapter 48 is available at: http://www.ahrq.gov/qual/nursesfdbk/docs/SchlachtaL_PSTT.pdf. Chapter 48 gives a review of the evidence base for telehealth and behavior shaping tools. The authors show that telehealth using two way video or audio has been an effective way to offer education and counseling. This technology has been used to improve patient compliance and nurse productivity. The chapter also discusses a variety of behavior shaping tools that have been effective in improving patient compliance, decreasing adverse events and urgent hospital care. These include devices such as glucoboy, health buddy, and internet-based programs to monitor symptoms and compliance and provide feedback, education and action points. They also discuss the relevance of telehealth to providing emotional support and psychosocial therapy, as well as being used effectively to monitor the elderly in their homes, delaying the need for nursing home care. The authors point out the need to continue to find ways to protect the patient’s privacy and confidentiality and the need for further research regarding patient safety related to the use of telehealth.

A sample of some of the interventions reviewed in this chapter include the following.

- Internet based store and forward video monitoring system for patients aged 6-17 with asthma and follow-up with virtual visits via the internet compared to in person office visits. Results: Emergency room visits were avoided, rescue therapy was infrequent. The system was well accepted by families and children.
- Telementoring using a platform called @home to monitor adherence to drug regimens for diagnosed schizophrenic outpatients. The system provides clinicians with early warning signs of impending nonadherence along with adherence patterns. Results: Showed a reduction in emergency room visits and medical appointments. Additionally, there was an improvement in the Global Clinical Impression Scale.
- Home service that automatically transmits blood pressure data via telephone and provides weekly reports to both the health care provider and the patient. Results: Showed reductions in mean arterial pressure of patients with established essential hypertension.
- Telephone therapy intervention with children aged 7-18 who have type I diabetes. Results: HbA1c levels decreased.
- Telecare management via an internet-based home messaging device used with chronically ill veterans. Results: Significant reduction in hospital admission and emergency room visits. Pre-post testing.

- Telehealth obesity treatment program with US Navy and Army personnel. Results: Successful weight management
- Glucoboy gaming device used to monitor sugar levels in children. Results of pre-/post- testing: Improved testing compliance by 200%. HbA1c levels were lowered.

This is just a sampling of the interventions reviewed.

Relevance to health disparities

- Some of the interventions reviewed were specific to rural or low-income populations as they made medical care more accessible and were relatively inexpensive or utilized technology such as the telephones, which are ubiquitous throughout the United States. Others, such as glucoboy and internet based programs present obstacles to use with low-income populations due to the financial burden of accessing the internet or purchasing equipment such as a nintendo gaming system. The manual is a good resource reviewing many telehealth technologies providing an evidence base for what works.

Glucoboy

<http://www.glucoboy.com/?page=about>, accessed July 10, 2008

Glucoboy is a blood glucose meter made especially for kids and adolescents. It is a glucometer that can be used with the Nintendo Game Boy Advanced System or the GRiP incentive-based web community. It is part of an integrated network that works on an incentive basis for testing compliance and good health management. More information can be found at: <http://www.glucoboy.com/?page=about>. AHRQ points out in chapter 48 of the newly released manual "Patient Safety and Quality: An Evidence-Based Handbook for Nurses Vol. 3" that the cost of this system could be a problem. However an article on the effectiveness of the device published in 2005 by Slater in Home Health Care Management and Practice showed a 200% increase in testing compliance and lowered HbA1c levels in children using the device. This was a pre-/post- test study design.

Relevance to health disparities

- This is a fun way to engage children in the management of childhood diabetes. However the cost could be inhibiting for low-income populations. This problem could be solved by devising a similar gaming system that stands alone, not requiring the purchase of an expensive gaming system that insurance companies are unlikely to fund.

Wii Gaming System

Seniors improve health with Wii: Lehigh Senior Center Players Use Game System to Get Exercise

Anamelechi, Anthony, June 21, 2008, The News-Press, accessed July 10, 2008 <http://www.news-press.com/apps/pbcs.dll/article?AID=/20080621/NEWS0103/806210372>

Wii Fit Helps Children's Hospital Patients

KETV 7 Omaha, July 7, 2008, accessed July 11, 2008

<http://www.ketv.com/health/16809604/detail.html?rss=oma&psp=news>

Comparison of Energy Expenditure in Adolescents When Playing New Generation and Sedentary Computer Games: Cross Sectional Study.

Graves L, Stratton G, Ridgers ND, Cable NT. BMJ. 2007 Dec 22;335(7633):1282-4.

The Wii offers an innovative video game system that changes traditional gaming behavior into an interactive experience. A more active lifestyle is being encouraged by, for example, requiring players to actually swing the controller in a tennis game. Most recently Wii has introduced Wii fit, a fun interactive way to consider health status and exercise. An article in The News-Press in Omaha reported that the system is being used in senior centers where 20-25 people gather to bowl on the Wii or use wii fit (<http://www.news-press.com/apps/pbcs.dll/article?AID=/20080621/NEWS0103/806210372>). The Wii has also been used in children's hospitals as a form of physical therapy. (<http://www.ketv.com/health/16809604/detail.html?rss=oma&psp=news>) Anecdotal evidence provided by physical therapists using the wii fit system as treatment for their patients indicate that the system helps improve balance and flexibility. They further reported that their patients are more engaged and excited about completing physical therapy sessions.

An article published by Graves et al. in December 2007 in the British Medical Journal compared energy expenditure in adolescents when playing wii vs. sedentary computer games. The study concluded that wii games such as boxing that engage active hip movement expend higher levels of energy than games such as bowling. Additionally, the study showed that if both upper limbs were engaged higher levels of energy were expended. The study ultimately concluded that adolescents using the Wii system expended more energy than those playing sedentary games. However, Graves also points out that the Wii sports game is not high enough intensity to meaningfully contribute to the daily recommended exercise for children.

Relevance to disparities

- There are obvious financial barriers to Wii use with low-income populations, however, it could be used in community centers in low-income populations promoting both a safe community activity and a way to be more active.

“Nutrition on the Go”

<http://www.diets.com/mobile/>, accessed February 2008

“Nutrition on the Go” was launched in February, 2008. It is a free service using cell phones, providing nutritional information on restaurant meals, including restaurants like McDonalds. The service is part of a larger online company called diets.com, which is a health and lifestyle website aimed at healthy eating and weight loss. The goal of the system is to provide free nutritional information to consumers so that they can make informed decisions about what they eat out as well as what they eat at home. “Nutrition

on the Go” provides nutritional information on specific menu items from 1700 restaurants, accessible for free through text messaging. Simply type in the name of the restaurant and the menu item and then text it to DIET1. The service will then immediately reply with a text message providing nutritional information on that specific meal.

Cell phone use is pervasive, even among low-income, minority populations, making them a good tool for health communications between doctors and patients as well as for reinforcing healthy behavior. The idea of using cell phones as a diet tool is not new. There are many online services that range from expensive nutritional counseling based on snap shots of meals that are sent to an online nutritional counselor to downloadable software to count calories. However, it is often difficult to weigh how good or bad a choice you are making before you order. “Nutrition on the Go” tries to address this issue.

Relevance to disparities

- Because it is often less expensive to eat at McDonalds than to buy healthy foods to cook at home, this kind of service could be an instrumental tool in nutrition education for low-income minority populations. Access to nutritional information at the touch of a button for free, could help reduce disparities in obesity in low-income minority populations, by providing the necessary information to make healthier choices when eating out.

A Randomized Trial Comparing Structured and Lifestyle Goals in an Internet-Mediated Walking Program for People with Type 2 Diabetes

Richardson CR, Mehari KS, McIntyre LG, Janney AW, Fortlage LA, Sen A, Strecher VJ, Piette JD. Int J Behav Nutr Phys Act. 2007 Nov 16;4:59.

A pilot randomized trial comparing goals targeting total daily accumulated step counts to goals targeting intensity of walking by counting the number of times walking lasted for 10 minutes or longer at a pace of at least 60 steps per minute was carried out with sedentary adults with type 2 diabetes. The objective of the study was to determine which strategy was more effective in increasing walking. Pedometers with USB ports were worn by participants. The data collected was uploaded to the Stepping Up to Health website. Participants immediately received step counts, calculated goals and motivational messages. The intervention lasted a total of 6 weeks. Both interventions impacted physical activity, but there was no difference between groups.

Relevance to disparities

- An intervention as simple as counting steps and intensity of walking linked to feedback and coaching can make a significant difference in physical activity essential to health especially among patients with chronic diseases such as type 2 diabetes. This intervention could be used with low-income populations effectively, however internet access could present a substantial obstacle.

Overview of Federal HIT & Biomonitoring Activity

July 2008

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Department of Health and Human Services

<http://www.hhs.gov/healthit/>

Assistant Secretary for Planning and Evaluation

http://aspe.hhs.gov/_/index.cfm

Health Information Activities: Caroline Taplin

http://aspe.hhs.gov/_/topic/topic.cfm?topic=Health%20Information%20Infrastructure

The office of the Assistant Secretary for Planning and Evaluation (ASPE) advises the Secretary of HHS on policy development including in the areas of health, disability, human services, data, and science. As part of this role, ASPE conducts research and evaluation studies, develops policy analyses, and estimates the cost and benefits of policy alternatives related to promoting the adoption and implementation of health IT.

Centers for Disease Control and Prevention

<http://www.cdc.gov/>

Public Health Information Network

Launched in 2002, the CDC's Public Health Information Network (PHIN) initiative is designed to improve the capacity of public health agencies to use and exchange information electronically. In pursuit of this goal, PHIN works to promote the use of standards and define technical requirements. These standards and technical requirements are determined by best practices related to efficient, effective, and interoperable public health information systems that support both routine public health activities and emergency preparedness and response.

Health Resources and Services Administration

Health Information Technology: Cheryl Austein-Casnoff

<http://www.hrsa.gov/healthit/>

The Health Information Technology office of HRSA has several grant programs supporting telehealth and EHR implementation by healthcare providers, including Health IT Electronic Health Record and Innovations Grants, the Rural Hospital Flexibility Grant Program – FLEX, and Telehealth Grants. In addition, HRSA's Health Information Technology office supports the following programs:

- **Health Center Controlled Networks: April 2007 Report**
 - <http://www.hrsa.gov/healthit/healthcenters.htm>

HRSA has implemented a grant program for networks of CHC's to achieve following purpose and mission:

Purpose: The Health Center Controlled Network (HCCN) Initiatives support the creation, development, and operation of networks of safety net providers to ensure access to health care for the medically underserved populations through the enhancement of health center operations.

Mission: contribute to increased access, greater coordination and continuity of care, improved quality, increased information analysis, enhanced medical decision-making, reduced costs, greater efficiency, enhanced recruitment of providers, and increased influence in the marketplace.

Activities: flexible, but so as to achieve goals of (i) increased access, (ii) enhanced efficiency, and/or (iii) higher level of performance and value. Network activities are focused around the core areas of administrative, clinical, managed care, financial, and information systems.

Examples of Grantee advances/uses of biomonitoring and EHR:

Boston Health Net, MA:

- Boston HealthNet has leveraged the work of its EHR by developing forms that help guide practitioners in collecting quality improvement measures.
- There is a committee in place that is standardizing form development so that in the future, collection of quality indicators can be streamlined and comparative across the network.

Pharmnet South, MS:

- Provides the capabilities to support near real-time patient information access when essential for clinical care and also supports ongoing monitoring of disease management progress and patient management quality improvement.

Greene County Health Care, INC., NC:

- Has a data warehouse that uses the Cognos report writer and is currently writing reports that track the draft AMACMS sets of clinical measures.
- Ability to flag sub-groups of patients i.e. a sub-set of diabetic patients (like a collaborative registry) and can then generate reports on either the total diabetic population of any member CHC or on the sub-group receiving more intensive care management.

The Neighborhood Healthcare Network, MN:

- Led a program that provided PDA's to clinicians containing care management information and community resources.
- Participates as a medical group in the Minnesota Community Measurement Report, the first report in the nation to measure the clinical quality of care at the clinic group level.

Community Health Systems of Louisiana, LA:

- CHLSA has equipped all network members with video conference technology which enables interconnectivity among network members, and allows patient education and other health related seminars from a centralized location.

Colorado Community Managed Care Network, CO:

- *Diabetes:* CCMCN coordinates a shared retinal camera to screen CHC diabetic patients for retinopathy and other eye conditions. Many CHC sites are in rural and frontier areas with no ophthalmologic services. On the other hand, some urban and suburban clinics cannot find specialists that will accept Medicaid or uninsured referrals. The camera is an expensive piece of equipment, but efficiencies are achieved by shuttling the camera to multiple sites.

Dakota Network of CHC's, SD:

- Diabetes Management "Grand Rounds" recently video cast to 24 CHC sites. Rural/Frontier Providers had the ability to participate and learn and not travel hundreds of miles to attend.

- Behavioral Health Consults: are being provided on at a number of sites via video conference.

Equipment is portable and easily moved to the exam room....patient has a fully interactive consult with a Mental Health Professional 100+ miles away.

- Bio-Metric Peripherals now available, coupled with the high-end software installed at each CHC Site, make Medical Specialty Referrals a reality. Referrals include: cardiology, pulmonology, radiology, dermatology, ENT, etc.

- ***EHR Guidelines for Health Centers: updated 2007***

- <http://www.hrsa.gov/healthit/ehrguidelines.htm>

HRSA has established and updated guidelines for health centers in choosing EHR systems including elements such as: general functions; demographics/care management; patient history; current health data, encounters, and health risk appraisal; progress notes; problem list; clinical practice guidelines; care plans; prevention; patient education; alerts/reminders; orders; results; medication and immunization management; confidentiality and security; clinical decision support; cost measuring/quality assurance; chronic disease management; consents, authorizations, and directives; technical underpinnings; clinical IT data dictionary; input mechanisms; ergonomic presentation; and billing.

Telehealth: Dena Puskin (also chair of Joint Working Group on Telehealth)

<http://www.hrsa.gov/telehealth/>

HRSA works to increase and improve the use of telehealth to meet the needs of underserved people, including those living in rural and remote areas, those who are low-income and uninsured or enrolled in Medicaid.

HRSA promotes the use of telehealth technologies by:

- Fostering partnerships within HRSA, and with other Federal agencies, states and private sector groups to create telehealth projects.
- Administering telehealth grant programs.
- Providing technical assistance.
- Evaluating the use of telehealth technologies and programs.
- Developing telehealth policy initiatives to improve access to quality health services.
- Promoting knowledge exchange about "best telehealth practices."

- ***Joint Working Group on Telehealth***

- <http://www.hrsa.gov/telehealth/jwgt.htm>

HRSA has established a joint working group on telehealth, bringing together the Appalachian Regional Commission, the Department of Agriculture, the Department of Commerce, the Department of Defense, the Department of Education, the Federal Communications Commission, the Department of Health and Human Services, the Department of Justice, the Department of State, the National Aeronautics and Space Administration, and the Department of Veterans Affairs. The working group is a Federal interagency group that coordinates members' telehealth activities. Several member agencies provide telehealth grants and the JWGT ensures that there is no overlap in Federal funding. Members bring their unique telehealth expertise to the table, providing a forum to discuss and share information, to educate its members and to develop specific actions that reduce barriers to the effective use of telehealth technologies.

Health Disparities Collaboratives: Ahmed Calvo

<http://www.healthdisparities.net/hdc/html/home.aspx>

The HRSA Health Disparities Collaboratives (HDC) were developed to transform primary health care practices in order to improve the health care provided to everyone and to eliminate health disparities. In 1998, HRSA funded one Primary Care Association/Clinical Network team in each of five regional clusters, in addition to National Clinical Networks focused on oral health, migrant farm worker health care, and homeless health care to work together to develop the infrastructure support for the HDC. During the fall of 1998, HRSA selected eighty-eight health centers to participate in the HRSA Health Disparities Collaborative, which focused on diabetes. Since that time, other Collaborative areas of focus have included asthma, depression, cardiovascular disease, cancer screening/planned care, finance/redesign, prevention, diabetes prevention, perinatal/patient safety, and oral health. Approximately 800 health centers are participating in the HRSA Health Disparities Collaboratives as of September 2006. There is little mention of biomonitoring or telehealth on the Health Disparities Collaboratives website, but a 2006 HRSA report on HDCs does indicate the importance of EHRs and improved reporting to improving care.

Centers for Medicare and Medicaid Services

<http://www.cms.hhs.gov/>

- **Telemedicine**
 - <http://www.cms.hhs.gov/Telemedicine/>

Telemedicine is generally described as the use of communication equipment to link health care practitioners and patients in different locations. This technology is used by health care providers for many reasons, including increased cost efficiency, reduced transportation expenses, improved patient access to specialists and mental health providers, improved quality of care, and better communication among providers.

The Centers for Medicare & Medicaid Services (CMS) has not formally defined telemedicine for the Medicaid program, and Medicaid law does not recognize telemedicine as a distinct service. Nevertheless, Medicaid reimbursement for services furnished through telemedicine applications is

available, at the state's option, as a cost-effective alternative to the more traditional ways of providing medical care (e.g., face-to-face consultations or examinations). At least 18 states are allowing reimbursement for services provided via telemedicine for reasons that include improved access to specialists for rural communities and reduced transportation costs.

- **EHRs**

- http://www.cms.hhs.gov/DemoProjectsEvalRpts/downloads/2008_Electronic_Health_Records_Demonstration.pdf

In June, HHS officials selected twelve communities to take part in a five year Medicaid project to provide doctors with financial incentives to use electronic health records. The program is designed to test the effectiveness of incentives in increasing the use of EHRs in small- and medium-sized practices. Incentives will be distributed based on how well participating physicians meet benchmarks established by Centers for Medicare and Medicaid Services (CMS), starting with effective use of EHRs, then, in following years, moving on to national quality measures and the use of EHRs to improve care. Participating communities will recruit up to 200 physician practices, half of which will be offered incentives and the other half of which will serve as a control group. Participating practices are required to use EHR systems approved by the Certification Commission for Health IT to ensure that they meet interoperability and security standards. Although the program will cost \$150 million if the maximum amount in incentives is claimed, CMS expects the program to be budget-neutral, as the costs will be offset by savings achieved through EHR use.

Office of Minority Health

<http://www.omhrc.gov/>

National Health IT Collaborative for the Underserved: Garth Graham

<http://www.omhrc.gov/npa/templates/browse.aspx?lvl=2&lvlid=23>

The HHS Deputy Assistant Secretary for Minority Health is leading the new National Health IT Collaborative for the Underserved, a subset of the National Partnership for Action to End Health Disparities. The first meeting of the National Health IT Collaborative for the Underserved occurred on June 12, 2008. The organizations involved in the creation of the Collaborative are the HHS Office of Minority Health; the Health Information and Management Systems Society (HIMSS); the Summit Health Institute for Research and Education, Inc. (SHIRE), and Apptis, Inc., of Chantilly, VA. The Collaborative aims to reduce and ultimately eliminate health disparities experienced by medically underserved areas and populations through the use of advances in health IT. It will incorporate experience from both the public and private sectors to improve the health of communities and populations that have historically had the worst health outcomes and the least access to care. The Collaborative plans to develop models, strategies, recommendations, and model legislation for the expansion and use of health IT in underserved populations. The Collaborative will create workgroups on advocacy and policy, workforce training and development, and funding.

HHS Health IT and Underserved Populations Work Group: Co-chaired by Garth Graham and Cheryl Austein-Casnoff

The HHS Health IT and Underserved Populations work group is a collaboration within HHS, including the Office of Minority Health and AHRQ, established to examine the efforts of HHS activities around health IT and underserved populations and to monitor their impact. These efforts include assessments of ongoing activities, challenges and potential opportunities to further incorporate a focus on disparity populations into HHS activities in health IT.

Office of the National Coordinator: Robert M. Kolodner, MD

Deputy: Charles P. Friedman, PhD.

<http://www.hhs.gov/healthit/onc/mission/>

The Office of the National Coordinator for Health Information Technology (ONC) is designed to provide counsel to the Secretary of HHS and Departmental leadership for the development and nationwide implementation of an interoperable health information technology infrastructure. The office was created in 2004 by Executive Order and oversees four component offices: the Office of Health IT Adoption, the Office of Interoperability and Standards, the Office of Programs and Coordination, and the Office of Policy and Research. In addition, the ONC oversees the American Health Information Community.

American Health Information Community: Secretary Michael O. Leavitt, Chair

<http://www.hhs.gov/healthit/community/background/>

The American Health Information Community (AHIC) is a federal advisory body, chartered in 2005 to make recommendations to the Secretary of the U.S. Department of Health and Human Services on how to accelerate the development and adoption of health information technology. AHIC was formed by the Secretary to help advance efforts to achieve President Bush's goal for most Americans to have access to secure electronic health records by 2014. AHIC is currently in the process of forming and transferring responsibilities to a public-private successor body led by LMI and Brookings. AHIC has formed seven workgroups: chronic care, confidentiality, privacy & security, consumer empowerment, electronic health records, personalized healthcare, population health, and quality. Although final recommendations from the work groups have not been posted, draft recommendations can be found for some under the archives section for each workgroup.

Health Information Technology Standards Panel (HITSP)

<http://www.hhs.gov/healthit/standards/activities/>

The Health Information Technology Standards Panel (HITSP) was established by the Office of the National Coordinator to identify and harmonize data and technical standards for healthcare. HITSP is a public-private partnership with participation from more than 300 health-related organizations. Their work has been directed at harmonizing standards to use for priorities advanced by AHIC, working with standard development organizations (SDOs) to ensure that standards exist to meet health needs, ensuring specific guidance exists to implement harmonized standards, and fostering the availability and

use of health information technology standards nationally. Working toward these goals, HITSP has three sets of interoperability standards along with implementation guidance.

Health IT Certification/ Certification Commission for Healthcare Information Technology:

Mark Leavitt, MD, PhD

<http://www.cchit.org/>

The Certification Commission for Healthcare Information Technology is a voluntary, private-sector organization to certify health IT products, formed in 2004 by the American Health Information Management Association, the Healthcare Information and Management Systems Society, and The National Alliance for Health Information Technology. In September 2005, HHS awarded the Certification Commission for Healthcare Information Technology a three-year contract to develop and evaluate certification criteria and create an inspection process for health IT. HHS has asked CCHIT to advance certification for Ambulatory Electronic Health Records (EHRs), Inpatient EHRs, Health networks, Components of developing Personal Health Records (PHRs), and EHRs for specialty practices and special care settings. CCHIT had approved certification criteria for Ambulatory and Inpatient EHR and has created a PHR task force. A list of CCHIT certified EHRs is available on their website (<http://www.cchit.org/choose/index.asp>).

Federal Health Architecture (FHA)

<http://www.hhs.gov/fedhealtharch/index.html>

The Federal Health Architecture (FHA) was established as an eGov Line of Business in response to The President's Management Agenda calling for increased efficiency and effectiveness in government operations. The FHA is responsible for: leveraging federal expertise in creating a federal framework that would be derived from a national health IT infrastructure; supporting federal activities in the development and adoption of health IT standards; and, ensuring that federal agencies can seamlessly exchange health data between and among themselves, with state, local and tribal governments, and with private sector healthcare organizations. The FHA website has not been updated since 2006.

Agency for Healthcare Research and Quality: Carolyn M. Clancy, M.D.

<http://healthit.ahrq.gov/portal/server.pt?open=512&objID=650&PageID=0&parentname=ObjMgr&parentid=106&mode=2&dummy=t>

AHRQ Health IT Portfolio

AHRQ is the nation's lead research agency on health care quality, safety, efficiency, and effectiveness and plays a critical role in the drive to adopt health IT. The AHRQ health IT initiative includes contracts with Six States that are building out our existing health IT networks and grants to more than 100 communities, hospitals, providers and health care systems. AHRQ's goals in this initiative are to: help clinicians develop higher-quality, safer health care; put the patient more squarely at the center of health care; stimulate planning and implementation of health IT, especially in rural and underserved areas; identify the most successful approaches, as well as barriers, to implementation; and, make the business case for health IT by evaluating costs and benefits. AHRQ has awarded grants to more than 100 communities, hospitals, providers and health care systems, particularly in rural and small communities,

and has awarded contracts to Six States - Colorado, Delaware, Indiana, Rhode Island, Tennessee, and Utah - totaling \$34.70 million to help them lead the way in regional health information exchange and collaboration.

National Resource Center for Health Information Technology

http://healthit.ahrq.gov/portal/server.pt?open=512&objID=562&&PageID=5531&mode=2&in_hi_userid=3882&cached=true

National Resource Center: National Opinion Research Center: Dan Gaylin

<http://www.norc.org/projects/ahrq+national+resource+center+for+health+information+technology.htm>

In 2004, AHRQ established the National Resource Center for Health Information Technology to advance the goals of the Department of Health and Human Services' Secretary Mike O. Levitt for modernizing health care through the best and most effective use of IT. Led by the National Opinion Research Center (NORC) at the University of Chicago the National Resource Center provides direct technical assistance and consulting services to AHRQ projects involved in developing, testing, and using health IT applications, with a particular focus on addressing challenges to health IT implementation in rural and small community settings. In doing so, the National Resource Center is helping to build the Nation's capacity across health care settings-large and small, urban and frontier-for the effective use of health IT.

In addition, the National Resource Center serves as the link between the health care community at large and the researchers and experts who are on the front lines of health IT. As the central repository for lessons learned from AHRQ's health IT initiative, the National Resource Center will encourage adoption of health IT by disseminating the latest tools, best practices, and research results from this unique real-world laboratory. This knowledge library of new health IT findings and research will grow over time, serving as the hub for dissemination and translation of results from AHRQ-funded projects to the broader health care, public health, and health IT communities, and to the public at large.

United States Health Information Knowledgebase

<http://dcg.dnsalias.net/registry/x/>

The United States Health Information Knowledgebase (USHIK) provides and maintains a metadata registry of health information data element definitions, values and information models. This allows for comparison, browsing and synchronization of data in a uniform interface, which helps to ensure the data quality of shared information and to support interoperability. The USHIK provides a repository for facts about characteristics of data that are necessary to clearly describe, inventory, analyze and classify data, easing sharing and interoperability.

National Institutes of Health

<http://www.nih.gov/>

National Center on Minority Health and Health Disparities (NCMHD): Dr. John Ruffin

http://www.ncmhd.nih.gov/about_ncmhd/mission.asp

Office of Innovation and Program Coordination: Dr. Kyu Rhee

The National Center on Minority Health and Health Disparities (NCMHD) works to promote minority health and to lead, coordinate, support, and assess the NIH effort to reduce and ultimately eliminate health disparities. In this capacity, NCMHD conducts and supports basic, clinical, social, and behavioral research, promotes research infrastructure and training, fosters emerging programs, disseminates information, and reaches out to minority and other health disparity communities. The NCMHD serves as the focal point for coordinating and focusing the minority health disparities research and other health disparities research programs at the NIH into a national health research agenda.

Small Business Innovation Research/Small Business Technology Transfer Program

SBIR/SBTR makes grants to small businesses and to partnerships between small businesses and nonprofit research institutions to bring innovative technologies to market designed to empower health disparity communities to achieve health equity through health education and disease prevention. High priority is given to research activities designed to empower health disparity communities to achieve health equity through health education, disease prevention, and partnering in community based, problem driven research.

National Institute of Biomedical Imaging and Bioengineering: Telehealth Program Area: Grace C.Y. Peng, PhD.

<http://www.nibib.nih.gov/Research/ProgramAreas/Telehealth>

NIBIB's Telehealth Program Area supports technology development that incorporates telemetry and remote access in the acquisition, analysis and monitoring of biomedical data. NIBIB supports the development of software and hardware for telehealth studies that have broad applications as well as early stage development of telehealth technologies that may have specific focus areas.

Department of Defense

Telemedicine and Advanced Technology Research Center: Karl E. Friedl, USA

<http://www.tatrc.org/index.html>

The Telemedicine and Advanced Technology Research Center (TATRC) has been exploring and implementing telemedicine and other advanced medical technology solutions for over 15 years. By exploring new developments, TATRC strives to improve health care for the US Armed Forces, their families and the public sector. Since its inception, TATRC has played a prominent role in developing advanced technologies in areas such as: health informatics; medical imaging; mobile computing and remote monitoring; and simulation and training. TATRC also played an important role in championing organizations such as The American Telemedicine Association (ATA) during its early years, and has continued to be an important thought leader in areas such as the use of virtual reality tools, biomaterials and hospital-of-the-future concepts. TATRC's vision encompasses the creation of opportunities for technology transfer to the public sector as well as the battlefield. Additionally, TATRC has partnered with numerous universities, commercial enterprises, and other federal agencies,

supporting approximately 500 ongoing research projects. TATRC currently has projects in EHRs, robotics, prosthetics, disease biomarkers, and many other areas.

Department of Veterans Affairs

Office of Care Coordination Services: Adam Darkins, MD, MPH, FRCS

<http://www.va.gov/occ/>

VA's Office of Care Coordination Services (CCS) was established in July 2003 to act as the national program office to support VA's national implementation of care coordination, coordinate clinical input into VA's patient-held record -My HealtheVet, and coordinate clinical input into e-health information to veteran patients. Part of the Office of Patient Care Services, CCS works to improve access to care and health of veterans using health informatics, disease management and telehealth technologies to target care and case management. CCS oversees efforts in Care Coordination Home Telehealth (CCHT), Care Coordination General Telehealth (CCGT), and Care Coordination involving Store-and-Forward Telehealth (CCSF), as well as the My HealtheVet program.

Care Coordination Home Telehealth (CCHT): Ellen Edmonson/Patricia Ryan

<http://www.va.gov/occ/telehealth/ccht/index.asp>

The VA has established care coordination programs in all 21 Veterans Integrated Service Networks across the country, focusing on veterans with diabetes, chronic heart failure, chronic obstructive pulmonary disease (COPD), depression or post-traumatic stress disorder. The specific support structure for CCHT varies among VISNs, but generally care coordinators evaluate patients through a phone interview and, based on condition and willingness and ability to participate, create a care plan based on the use of phone, computer, video phone, cameras, or monitoring devices. CCHT has also established interoperability standards and national contracts with home health vendors in order to make moving or traveling easy for CCHT patients.

Care Coordination General Telehealth (CCGT): John Peters

<http://www.va.gov/occ/telehealth/ccgt/index.asp>

The VA has also implemented General Telehealth programs (CCGT) using real-time videoconferencing technologies that allow veterans to communicate with health providers and specialists from great distances away. CCGT uses these telehealth technologies to make diagnoses, manage care, perform check-ups, and, in the case of Telemental Health, actually provide care. CCGT is offered in the areas of polytrauma rehabilitation, telemental health, telerehabilitation, and telesurgery. This program makes these services more accessible to veterans living in remote areas, areas with severe weather, or even areas with bad traffic.

Store-and-Forward Telehealth (CCSF): John Peters

<http://www.va.gov/occ/telehealth/ccsf/index.asp>

Additionally, the VA is using imaging and communication technologies to allow for remote consultation with specialists. Focusing on the areas of teledermatology, teleretinal imaging, and teleradiology, the program allows images to be taken and stored and then forwarded to specialists elsewhere. In the case of teledermatology, this can allow for treatment recommendations to be sent to a patient's primary care physician or for a referral to a dermatologist. For teleretinal imaging, preliminary screening for diabetes-related eye complications can be completed remotely, and for teleradiology, expert opinions and x-ray reports can be obtained remotely. These store-and-forward techniques can save many clinic visits.

My HealtheVet

<http://www.myhealth.va.gov/>

The VA also has an internet-based Personal Health Record service available to veterans, called My HealtheVet. This service includes a personal health journal, with personal information, health insurance information, military health history, medications, allergies, immunizations, tests, medical log, and other tools. It also provides a system to log and track data on cholesterol, blood sugar, blood pressure, weight, pain, or other health aspects. There is also an option for formatting and printing wallet cards with important health information. The service offers online prescription refills and information on health and Veterans Health Administration services.

VA/DoD Health IT Sharing (HITS) Program Office: Craig Luigart, VHA Office of Information

<http://www1.va.gov/vadodhealthitsharing/>

The VA/DoD Health IT program, under the VHA Office of Information, serves as an umbrella organization responsible for the oversight and coordination of VA/DoD health IT projects and programs within VA. This responsibility includes identifying opportunities for VA/DoD collaboration and cooperation, supporting the seamless transition of veterans from military service through the provision of high-quality health information technology solutions, and facilitating and supporting the development of mutually beneficial health information technology sharing agreements between VHA and the Military Health System (MHS). In order to pursue these goals, the VA/DoD Health IT program has three parts: Federal Health Information Exchange (FHIE), which provides a one-way transfer of information from DoD to the VA; Bidirectional Health Information Exchange (BHIE), sharing information between DoD and the VA for shared patients; and Clinical Data Repository/Health Data Repository (CDHR), supporting technical interoperability between DoD's Clinical Data Repository (CDR) and the VA's Health Data Repository (HDR). The program is also working toward interoperability in laboratory data sharing.

VA Office of Research & Development: Joel Kupersmith, MD

<http://www.research.va.gov/default.cfm>

Research on Health Disparities and Minority Health

<http://www.research.va.gov/about/research-health-disparities.cfm>

The VA Health Services R&D Service (HSR&D) supports research on health disparities in many ways. There are many studies completed and underway on health disparities in the Veterans Health Administration and comparing health disparities within and outside of the Veterans Administration. Acknowledging that studies have shown the existence of health disparities in the United States, there is some particular interest in why these disparities persist in the VA system, where financial barriers to care are minimized.

- **Understanding Racial and Ethnic Variations in Health Outcomes for Chronic Diseases, Charleston, SC: Leonard Egede, MD, MS**
 - <http://www.hsrd.research.va.gov/about/centers/trep.cfm#charleston>

In addition to the general research on health disparities supported by the VA, they also support a Targeted Research Enhancement Program in Charleston, SC focused on health disparities. This program is concentrated on advancing knowledge on racial and ethnic variations in care by focusing on two patient level factors - patient trust and patient preferences for care and on evaluating the incremental effect of these patient level factors on racial and ethnic disparities in health outcomes for chronic medical conditions such as diabetes, hypertension, and osteoarthritis of the knee that are highly prevalent in the veteran population.

- **Center for Health Equity Research and Promotion, Pittsburgh/Philadelphia, PA: Michael J. Fine MD, MSc/David J. Asch MD, MBA**
 - http://www.hsrd.research.va.gov/about/centers/centers_of_excellence.cfm#pittsburgh

Along with the Targeted Research Enhancement Program, the VA also supports a Center of Excellence located in Pittsburgh and Philadelphia and directed at researching and promoting health equity. The Center develops and supports research, education, policy making, and dissemination that focuses on: disparities related to race/ethnicity; socioeconomic status; and comorbid illness in patients with conditions prevalent in the veteran population, such as cardiovascular disease, HIV, and alcohol and substance abuse.

VA Technology Transfer Program: Amy Centanni http://www.research.va.gov/programs/tech_transfer/default.cfm

The VA has developed a Technology Transfer Program (TTP) in order to translate the results of discoveries made by VA employees into practice. This tries to ensure the development, patenting, and commercialization of all worthy discoveries made by VA employees. To this end, the TTP focuses on educating inventors concerning their rights and obligations, evaluating all inventions, obtaining patents and assisting in commercialization of products. TTP works to aggressively disseminate educational information and to get products to the market. They also determine when it is necessary and appropriate for the VA to assert an ownership interest in a new technology to ensure availability to veterans. Relevant technologies cover a wide range of uses, from cancer or diabetes care to diagnostic procedures and many other categories of health technology.

Indian Health Service

<http://www.ihs.gov/index.asp>

Telehealth: Mark Thomas

<http://www.ihs.gov/NonMedicalPrograms/DFEE/telemed/default.cfm?content=coverpage.html>

The IHS telehealth program, along with actually implementing telehealth technology to reduce geographic barriers to care, also supports telehealth efforts in innovation, resource/infrastructure development, business modeling, and collaboration. In partnership with IHS Areas and individual IHS/tribal facilities, the telehealth program works to: support the initiatives and priorities of IHS; identify and disseminate information on emerging telehealth applications and experience; provide consultation and support to IHS facilities and programs; propose/implement new models of service delivery based on telehealth; develop business modeling specific to telehealth sustainability; and enhance distance education via emerging tele-education tools.

Office of Information Technology: Theresa Cullen

http://www.ihs.gov/CIO/InfoTech_index.asp

Resource and Patient Management System: George Huggins

<http://www.ihs.gov/Cio/RPMS/index.cfm?module=home&option=index>

The Resource and Patient Management System (RPMS) is an electronic health care information system that provides Practice Management functions for IHS-direct, tribal and urban Indian health care delivery facilities throughout the United States. RPMS provides clinical and administrative information to local health care providers and program managers and provides administrative information at the regional and national levels. RPMS is meant to improve the availability of medical information on American Indian and Alaska Native patients, thereby improving the diagnoses, decision making, and health care recommendations of IHS physicians and other IHS health care providers. As part of RPMS, the Clinical Reporting System is a software application designed to facilitate national reporting and local and area monitoring of health data and clinical performance measures. From local database information, CRS can produce reports for any or all of over 300+ clinical performance measures, representing 55 clinical topics. The iCare component of RPMS is designed to be a user-friendly population health care management tool.

Federal Communications Commission

<http://www.fcc.gov/>

Rural Health Care Pilot Program

<http://www.fcc.gov/cgb/rural/rhcp.html#faqs>

In September 2006, the FCC established the Rural Health Care Pilot Program, which provides funding to support up to 85 percent of the costs associated with the construction of a state or regional broadband networks and the advanced telecommunications and information services provided over that network,

connection to Internet2¹ or National LambdaRail and connection to the public Internet. The purpose of this funding is to bring the benefits of telehealth and telemedicine services to areas of the country with the most acute need for those benefits. As feasible, participants are required to implement health IT standards identified by HHS. The health care facilities participating in RHCPP include hospitals, clinics, universities and research centers, behavioral health sites, correctional facility clinics, and community health centers.

Related, Non-Federal Biomonitoring & HIT Activities

Continua Alliance

Continua Alliance is working to establish a system of interoperable personal telehealth solutions that fosters independence and empowers people and organizations to better manage health and wellness. They are working toward this goal through the development of interoperability guidelines, establishment of a product certification program, and collaboration with government and health care industry leaders. In April, Continua Alliance hosted a Plugfest, giving ten companies the opportunity to test the interoperability of biomonitoring devices such as cardio monitors, medication monitors, blood pressure, glucose and weight monitors, thermometers and pulse oximeters, as well as “manager” devices. The test went well and Continua plans to hold another one in July. An April report in Europe Healthcare IT News (<http://healthcareitnews.eu/content/view/970/44/>) indicates that Continua plans to release draft standards and specifications by Fall 2008 and eHealthEurope notes that the first interoperable products will be available by the end of the year (<http://ehealthurope.net/news/3748/>).

Relating interoperability to disparities reduction, Continua notes that, among other proven connectivity standards, they will be considering Bluetooth[®], USB, Wi-Fi[™], Z-Wave[™] and ZigBee[™]. The recent Federal Health IT Strategic Plan asserts that interoperability standards will create opportunities for more health information service providers, ultimately reducing costs to the consumer. However the exact connectivity standard is important. A recent American College of Physicians report does note that, while home internet access is increasing across the United States, a health care delivery system that leverages computer access and internet connectivity could leave people out. While more specific information is difficult to find, it would follow that systems using technology that is already widely accessed would leave fewest people out and have the quickest diffusion time; this may mean that USB, Wi-Fi[™], or Bluetooth[®], as they are already widely utilized technologies, may be more accessible than Z-Wave[™] and ZigBee[™]. And it is unclear how WiMax will affect and link these more local or physical connections to the internet grid. As noted in the DRA report on the possible use of cell phones in reducing disparities, cell phone technology has shown a relatively equitable diffusion, and use of cell phones is very high, including among African American and Hispanic populations. Technologies that could interface with such already-available technologies (use of a cell phone as a “manager” device, rather than purchase of a separate device) could reduce costs to consumers by reducing the number of devices consumers are required to purchase. And the shortcomings of cell phones for many individuals as tools for health monitoring and health management/behavior change (e.g. small screen, small keys, difficult to operate,

poor quality voice input, expensive internet connections) are evolving. For example the functionalities of the iPhone will continue to evolve and prices will drop.

Center for Future Health: Cecelia Horowitz

<http://www.futurehealth.rochester.edu/>

The Center for Future Health is working toward a Proactive Health System designed for early detection, personal care, and caregiver support rather than crisis management, a system that summarizes personal health information for individuals and caregivers to promote better health decisions. The Center for Future Health believes that putting health care technologies into everyday lives is integral to achieving this goal, and they are committed to the development and implementation of technologies for self, home, and mobile care, as well as integrating health technology efforts, creating specialists in integrative health technology, and establishing a community model for proactive health. The Center for Future Health recently received a grant from the Robert Wood Johnson Foundation to lead a project on proactive self-care technology. The Robert Wood Johnson Foundation funded the exploratory phase of the project and the new grant will support the engineering of a system for cardiac monitoring. The system is focused on supporting proactive self care to reduce the need for acute care.

Medical Automation Research Center: Robin Felder

<http://marc.med.virginia.edu/index.php>

The Medical Automation Research Center (MARC) was established in 1985 to improve the efficiency of clinical laboratory services, performing basic biomedical and engineering research, clinical investigations and trials, demonstration and education projects related to medical efficiency and safety, and business development. The MARC provides leadership for increasing international awareness of the place of technology in improving the efficiency of medical care and in reducing errors. The MARC has established activity centers in molecular automation, technologies to promote dignified ageing, medical efficiency technologies, simulation/animation, and educational programs. The MARC envisions the use of technology, automation, and robotic systems reducing health care costs while increasing the quality of healthcare.

American Telemedicine Association: Elizabeth A. Krupinski, PhD, University of Arizona

The American Telemedicine Association was established in 1993 with the goal of overcoming barriers to the advancement of telemedicine through the professional, ethical and equitable improvement in health care delivery. The American Telemedicine Association works as a resource and advocate promoting access to medical care for consumers and health professionals via telecommunications technology. To do this, ATA brings together diverse groups from traditional medicine, academic medical centers, technology and telecommunications companies, e-health, medical societies, government and others. As part of its work, ATA is committed to: educating government about telemedicine as an essential component in the delivery of modern medical care; serving as a clearinghouse for telemedical information and services; fostering networking and collaboration among interests in medicine and technology; promoting research and education including the sponsorship of scientific educational

meetings and the *Telemedicine and e-Health Journal*; and spearheading the development of appropriate clinical and industry policies and standards. President Elect is Karen S. Rheuban, MD, University of Virginia. <http://www.americantelemed.org/>

**Center for Aging Services Technologies (CAST): Majd Alwan, Ph.D.
Director**

<http://www.agingtech.org/index.aspx>

The goal of the Center for Aging Services Technologies is to expedite the development, evaluation and adoption of emerging technologies that will transform the aging experience. CAST works to guide a global vision of how technologies can improve the quality of life for seniors while also reducing health care costs, sponsoring pilot evaluations with seniors to accelerate technology research and development, advocating the removal of barriers to the commercialization of proven solutions, and promoting dialogue on interoperability and access. CAST has brought together more than 400 technology companies, aging-services organizations, businesses, research universities and government representatives working on policy, pilot programs, standards, communications, and education.

Summit Health Institute for Research and Education, Inc.: Ruth Perot

<http://www.shireinc.org/>

Summit Health Institute for Research and Education (SHIRE) is a nonprofit organization that works to eliminate health disparities and to support vulnerable populations in attaining optimal health. SHIRE strives to identify inequities, propose solutions, and mobilize grassroots groups to address issues of access to and quality of healthcare for underserved populations. SHIRE also advocates for universal healthcare. In pursuing these goals, SHIRE focuses on education, research and advocacy.

DRA Project – Cell Phone & Wireless Communication Update Memo July 2008

From: Meghan McConaughey, IAF Intern, Georgetown University

At the April 2006 DRA Project Partners meeting, cell phones, including the related equipment, services, and infrastructure, were chosen as an important area for potential disparity reducing advances and a [DRA Project report on cell phones and disparities](#) was prepared and released in September of that year. It accompanied the [reports on the larger biomonitoring field](#) and the disparity reducing opportunities there.

Cell phones and wireless technologies could be used to support continuous passive biomonitoring, provide warning of disease, and reinforce healthier behavior in culturally appropriate ways. There are many opportunities for using cell phones to improve health outcomes and reduce disparities, and several cell phone-based systems are already available for reinforcing nutrition and managing diabetes.

Since 2006 cell phone technology has continued to advance. Both cellular phone and internet penetration rates have continued to climb in the U.S., making cell phones and internet-based systems increasingly appropriate for disparities-reducing biomonitoring platforms. The forecast that telephone use would further merge with internet use has been borne out. Leading edge technologies such as the iPhone will be followed by lower cost, but still multifunction devices, that merge phone, text mail, and web browsing. Using cell phones to link glucose monitoring and other other biomonitoring equipment to the patient's medical records and their health care provider has grown.

A major question raised in 2006 dealt with the infrastructure – particularly where the spectrum allocation activities of the FCC would lead to free or altered internet access in ways that might lead to reduced health disparities. The FCC has been attempting to influence wireless accessibility as it auctions off portions of the wireless spectrum by putting stipulations on how successful bidders can use their spectrum allocation. In March 2008, as part of a larger auction of the 700MHz spectrum, the FCC offered the D Block portion of that spectrum as a public-private partnership, such that the commercial developer of the broadband network for that spectrum would have access to the portion of the spectrum allocated to public-safety users, though in the case of an emergency that use could be preempted. However, no company bid more than the reservation price for the D Block of the 700MHz spectrum, causing the FCC to reevaluate its stipulations. In the meantime, free wireless access has been a cause for discussion in FCC spectrum allocations as well. M2Z Networks Inc., with support from a range of political figures, pressed the FCC to allocate part of the broadcast spectrum to their company,



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with the plan of offering free broadband internet access to customers willing to subscribe to its advertising-based internet service. The FCC declined. The FCC is, however, offering for auction spectrum in the 2155MHz-2180MHz band with the stipulation that any successful applicant dedicate 25% of its network capacity to providing a free broadband service, install a network-based internet filtering system to block pornography and allow open access to third-party devices and applications. This auction is scheduled for the fall, but T-Mobile, which owns the adjacent spectrum, is concerned about possible interference and the FCC has agreed to extend the deadline for comments on the planned auction. Thus, the FCC is exerting some influence in how the allocated spectrum is used, both to improve access to free broadband internet and to improve public wireless infrastructure, but the results are still unclear.

The 2006 report identified the emergence of WiMax as a competitor to WiFi – with broader power and range than WiFi; possibly bringing broader access to phone and internet communications. WiMax does offer more flexible on-the-go broadband access than Wi-Fi, currently the most common wireless internet technology. The WiMax Forum has recently announced the first batch of WiMax Forum Certified products, currently limited to just subscriber and base stations.¹ However, WiMax serves an essentially different purpose from Wi-Fi and an Intel-Motorola report, along with the Intel website, argue that the two technologies are complementary rather than rivals.² Unlike Wi-Fi, rather than allowing for privately managed local networks, WiMax provides “last mile” internet access for wireless access over a large area or in areas where wired broadband is unfeasible or not available. In fact, Intel has created a dual WiMax/Wi-Fi chip for computers. WiMax may replace Wi-Fi for some applications, particularly city-wide networks and truly mobile internet access, but Wi-Fi will still be a relevant technology for local home and business networks and WiMax is unlikely to make Wi-Fi obsolete in the near future. WiMax-based cell phones, however, are now beginning to be ready for market and may one day be the standard for on-the-go internet access, affecting the use of cell phone internet access and BlackBerry technologies.

¹ <http://www.wimaxforum.org/home/>

² http://download.intel.com/pressroom/kits/mobileworld/wimax_and_wifi_together.pdf