HEALTHCARE MEETS TECHNOLOGY

THE IMPACT AND IMPLICATIONS OF MEDICAL INNOVATIONS

Authors:
Daniel Olsson
Kathy Lu
Elton Jaraicic
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TABLE OF CONTENTS</td>
<td>II</td>
</tr>
<tr>
<td>1 INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>1.1 THE HEALTHCARE INDUSTRY</td>
<td>1</td>
</tr>
<tr>
<td>1.1.1 Historical developments</td>
<td>1</td>
</tr>
<tr>
<td>1.1.2 Technological milestones</td>
<td>2</td>
</tr>
<tr>
<td>2 IMPACTED FIELDS OF HEALTHCARE</td>
<td>5</td>
</tr>
<tr>
<td>2.1 PHYSICALLY CHALLENGED</td>
<td>5</td>
</tr>
<tr>
<td>2.2 VISUALLY IMPAIRED</td>
<td>10</td>
</tr>
<tr>
<td>2.3 HEARING IMPAIRED</td>
<td>14</td>
</tr>
<tr>
<td>3 CONCLUSION</td>
<td>22</td>
</tr>
<tr>
<td>4 REFERENCES</td>
<td>24</td>
</tr>
</tbody>
</table>
1 INTRODUCTION

1.1 THE HEALTHCARE INDUSTRY

The Healthcare industry is offering new devices and treatments that enable people with disabilities to carry on activities once considered impossible. The innovation and research and development expenditures in this field are astronomical. Firms that are involved with healthcare pride themselves on innovation. Innovation is what has brought the significant changes forth that are later described in this research paper.

1.1.1 HISTORICAL DEVELOPEMENTS

Historically disabled individuals could most easily be grouped into three categories. Hearing impaired, visually challenged and physically disabled individuals comprised the bulk of people that could benefit greatly from innovative products and services. The oncoming information age has elevated the need for disabled individuals to depend on innovations to integrate them with new technology.
1.1.2 TECHNOLOGICAL MILESTONES

• 1900’S
  - FIRST ELECTROCARDIOGRAPH MACHINE

• 1920’S
  - FIRST MODERN RESPIRATOR

• 1930’S
  - ARTIFICIAL PACEMAKER INVENTED
  - KOUWENHOVEN CARDIOVASCULAR RESEARCH

• 1940’S
  - FIRST KIDNEY DIALYSIS MACHINE
  - PLASTIC CONTACT LENS CREATED

• 1950’S
  - FIRST ARTIFICIAL HIP REPLACEMENT
  - ARTIFICIAL HEART VALVE DEVELOPED
  - FIRST CARDIAC PACEMAKER
  - FIRST SUCCESSFUL OPEN-HEART BYPASS SURGERY
  - FIRST HUMAN KIDNEY TRANSPLANT

• 1960’S
  - FIRST TOTALLY INTERNAL PACEMAKER
LASER TREATMENTS MADE AVAILABLE FOR OPTIC PURPOSES

ICU WAS ADMINISTERED

NUCLEAR MACHINE

- 1970’S

  SOFT CONTACT LENS

  PHYSICAL THERAPY

  CT SCAN INTRODUCED

  FIRST COCHLEAR IMPLANT SURGERY

- 1980’S

  MRI SCANNERS

  FIRST PERMANENT ARTIFICIAL HEART IMPLANT

  DEEP-BRAIN ELECTRICAL STIMULATION SYSTEM

  FIRST LASER SURGERY ON HUMAN CORNEA

- 1990’S

  HUMAN GENOME PROJECT

  RADIOSURGERY CREATED

  BRACHYTHERAPY REMOTE AFTERLOADER USED TO DISSOLVE TUMORS INSIDE-OUT

  STEREOTACTIC NEEDLE BIOPSY SYSTEM TO DIAGNOSE BREAST CANCER

HTTP://WWW.GREATACHIEVEMENTS.ORG/?ID=3824
- Stem Cell Research - Discovering their purpose and using them for treatments
  Uses in Cloning
  Cure of diabetes and Parkinson's disease
  Cure of cancer

- Digital X-Rays - Eliminates the wait for x-rays to produce an image
  Allows radiologist to look at image and make diagnosis on the spot

- Genetic Engineering - Altering human genes to prevent diseases and increase life span
  Discovery came from Human Genome Project
  Very controversial because it deals with altering one's mortality and creating the "perfect human race"
  http://www.exampleessays.com/viewpaper/87421.html
2 IMPACTED FIELDS OF HEALTHCARE

2.1 PHYSICALLY CHALLENGED

Physical disabilities exist in all age’s stages of life. From young to old all generations are faced with debilitating accidents and natural imperfections. Developments and innovations during the recent decade have made significant impact on improving the quality of life for affected individuals. Several companies have focused special business divisions for the sole purpose of innovating in this discipline. Technology leaders like IBM, Siemens, Apple, and Nokia are introducing new products and services on a regular basis.

Past

<table>
<thead>
<tr>
<th>disability</th>
<th>ability</th>
</tr>
</thead>
</table>

 Figure 1. From IBM

Society has traditionally been mostly concerned with the ability of a human being and their participation has been attributed mostly to what has been understood about their disabilities. People with severe disabilities were often hidden from society and even their own family members. Progressively however, a disability was regarded less as something to be shunned and more as something to be pitied and possibly treated. The new acceptance of disabilities has lead to a “medical model” of disability and is advancing with scientific research directed towards improving quality of life.

This discussion of “quality of life” that continues to plague modern understanding of disability is somewhat skewed. It is centered on physical sensory disabilities and has sub categories like: severely disabled, somewhat disabled, slightly disabled and non-disabled. Some people believe that this
model has additional twists and turns and allocates resources and attention to rehabilitation and treatments than eliminating social barriers and compatibility for the disabled (IBM, 2007). In simplified terms there is a lot of potential progress to be made by innovations to the individual as well as the surroundings.

Present

disability  ability

personal

inaccessible  accessible

societal

Figure 2. From IBM

A disabled person is subject to environments and barriers that limit the possibilities of participating in certain activities. In many cases industrial designers try to create facilities and experiences that are enjoyable by most people and hope that the severely disabled could adapt them to that environment or experience. This was thought to be the most efficient solution, but in reality severe complications always result.
In the future it is essential to consider jobs, products and services from a variety of angles. Technology and advanced modeling is a tremendous help where scenarios analysis is of greater and greater value. The ideal situation considers an infinite number of abilities, skills, and potentials and designs the experience, product or service to accommodate as many variations as possible. There is no one idealized state so modeling quickly becoming one of the most useful tools in the development process. Interestingly enough recent studies have showed that more than half of the accommodations needed by employees and job applicants with disabilities cost absolutely nothing to implement (IBM, 2007). Dedication and imagination are the two biggest barriers in our rapidly evolving society.

People with mobility disabilities have physical impairments that substantially limit movement and fine motor controls, such as lifting, walking, and typing. Mobility impaired individuals
experience difficulties in using the computer's input devices and in handling storage media. Solutions for persons with mobility disabilities include switches, latches, and controls that are easy to manipulate, and diskettes and media that are easy to insert and remove.

Additional solutions include alternate input capabilities, such as voice input or the ability to enter information at the user’s own pace. For example, sequences of keystrokes can be typed, one at a time, rather than simultaneously as in Ctrl+Alt+Del. Many of these needs are supported by assistive technology, operating systems, and hardware platforms. Furthermore, making the Web site accessible will make it more compatible with voice input and control technologies. http://www-03.ibm.com/able/access_ibm/disability.html

The Wheelchair has a longer history than most people think. It dates back to the fifth century in China in its common form. Other “furniture on wheels” can be traced back 1000 years earlier to the Greeks. The modern wheelchair began to take shape in the late 19th century, with the creation of “push” wheels. Motorized wheelchairs where introduced in 1918 and even folding portable models where available by 1933. Many of these innovative creations came from individuals who were themselves disabled. Herbert Everest (paralyzed in a mining accident) joined forces with a mechanical engineering buddy and contributed much to its development. In Europe, a lightweight frame and ultra mobile units where first developed by Rainer Kuschall. (Wikipedia, 2007)

Several enhancements to the wheelchair market have made mobility a possibility for millions of disabled people. Mobility scooters like the one pictured below are available for incredibly competitive pricing. Insurance companies have policies that will cover these costs in many cases (some are as cheap as 500$).

The Phantom from Drive Medical is a good travel scooter that features a 15-mile battery range per charge. It comes with an upgraded contoured, padded seat with adjustable, flip-up armrests. The seat also swivels, and is height-adjustable. The standard price includes a front basket, adjustable tiller, and rear anti-tips. Another great feature of the Phantom is its standard safety headlight. One advantage of the Phantom is its small size. It is one of the narrowest mobility scooters available, so it’s perfect
for navigating tight spaces such as between cars in a parking lot, or in narrow grocery aisles. It also has a tight turning radius to help negotiate turns in areas with limited space. And when you’re ready to transport, the Phantom disassembles easily into lightweight pieces that are easy to manage.

http://www.scooter.com/Drive-Medical/Phantom-3-Wheel-3-Wheel-Travel-Scooter/mobility-product/46

Hotels like the Manchester Grand Hyatt in San Diego have done extensive improvements to cater to individuals with mobility impairments. The staff is extensively trained to provide assistance to these people and pledges that all activities should be available to all guests. Some of the special features at this hotel include:

- Audio/visual smoke detectors
- Connecting rooms available
- Braille symbols in elevators
- Restaurant/room service menus in Braille
Bathtub benches and grab rails

Roll-in showers (upon request)

Wheelchair accessible: doors, sink/vanity and towel racks, climate controls, peepholes, closet poles, and health club

2.2 VISUALLY IMPAIRED

Speech application give input to or control an application, or text-to-speech to hear output is becoming mainstream in the U.S. and other areas of the world. Speech technologies are spreading through almost every vertical market “to increase, maintain, or improve the functional capabilities of persons with disabilities.” (www.voicesignal.com). Technologies are integrated into a diverse market of applications to be assistive and adaptive to impair including:

- Phone – command and control of phone features, voice-activated dialing, personal name dialing, information portals, speech-enabled interactive voice response, auto-attendants
- Computers - command and control of computer functions: Internet access, screen reading, email, business and personal productivity software
- Dictation – document creation and editing, form filling, and email Note takers
- Automated Living- command and control of environment controls and applications.

Speech technology products are automatically accessible because speech is a good form of input and output for many different users with disabilities. Interactive voice response products have enabled mobility and sight impaired people to access applications without the need for a computer, such as accessing financial data from their bank, or getting a quick stock quote or sports score. Systems with speech and touchtone allow users to choose, such that those that can’t speak can use touchtone, and those that find touchtone difficult can use speech. By adding speech as an alternative, we drive the acceptance of speech and improve accessibility.

For people with partial vision loss, using screen features of telephones can be difficult. Viewing screens, looking up phone numbers or contact information, knowing who is calling or whether hitting redial on the phone is problematic. While talking on the phone does not require the use of hands or eyes, navigating the telephone, dialing or taking advantage of advanced phone features is difficult. With the mobile user in mind, voice-activated dialing was developed and is an available feature in
cellular phone. Automatic speech recognition is being used to help navigate advanced features on both cellular and landline phones. For example, numerous models of Samsung, Nokia and Motorola phones use Voice Signal. Automatic speech recognition and text to speech features can be found in the navigation GPS to provide and information to the visually impaired. Nokia Phones & Price need to be added. Expanding feature functionality on existing products; phones, PDAs, tools for the market are incorporating more accessibility features that can be used by everyone. In addition, many of the industries that incorporate speech into their products, such as voice and call processing, are looking at standardizing functionality to make it more accessible. Soon we may find standards for slow down and replay of prompts.

Speech is also being used in conjunction with phone and contact applications that tie the computer and phone together. Using SVOX multilingual Mobile Accessibility enables users to send, receive and read short message service and multimedia messages, update and access contacts, hear call log and return calls, get audio caller ID, operate alarms, and set personal ring tones for individual callers. (www.SVOX.com). Vodafone offers a service that allows users to access dial tone and manipulate phone and contact functions using speech on their Owasy 22C GSM/GPRS phones, and ALVA’s Mobile Phone Organizer provides a PDA and telephone specifically designed for people with visual impairments, that can output Braille or speech.

The gap between telephone and computer are the note taker products such as PDAs incorporating Braille. These products provide the same functionality as their non-Braille with the ability to convert from Braille to standard text and back. Prices are around $5,000. Brands on the market include; the Braille Note PK from Pulse Data (www.pulsedata.com), PAC Mate from Freedom Scientific, Braille Hansone. Some of these also incorporate Bluetooth or WiFi technology allowing it easier to download to other devices without cables.

Visual impairments can input using a keyboard through a screen reader uses text to speech to speak everything on the screen to the user; from plain text to control buttons and menu items. For example, Dolphin Computer Access (www.dolphinusa.com) creates software products that allow visually impaired people to use information technology in its original form. The screen reader talks as the user types, either word by word, character, or entire documents. It allows the user to navigate through menus, file systems or Windows controls, read Web pages, icons, Internet graphic labels, or emails. A popular screen reader program, JAWS (Job Access with Speech) from Freedom Scientific (www.freedomscientific.com) uses text to speech to read what is on the computer, or
output to Braille displays to allowing the user to interact with popular email programs, word processors, Internet browsers, contact management software, spreadsheets, presentation packages, software tools and database management software. JAWS provide customized command structures for specific applications. People with visual disabilities are individuals who are blind, have low vision, or have color blindness. People who are blind need text equivalents for the images used on the Web page, because they and their assistive screen reader technology cannot obtain the information from the image. A person who has a visual disability will not find the mouse useful because it requires hand and eye coordination. Instead, this person must navigate the Web page using only the keyboard. For example, the Tab key is used to move the focus to the item that needs to be selected. A screen reader then announces the item so the user knows where the focus is on the page. The user then presses the Enter key instead of "clicking" the mouse button. Those who have low vision need the assistance of a hardware or software magnifier to enlarge the text beyond simple font enlargement. People who are color blind or who have low vision benefit from good contrasting colors. When information is presented by color alone, a person who is color blind misses that information. Similarly, if information is presented using any attribute by itself (for example, contrast, depth, size, location, or font), a user who has low vision might not detect the difference. Magnification might reformat the location, change the contrast, or distort the size and fonts of the text and objects on the Web page. It is best to use multiple attributes. For example, if both color and a fill pattern are used on different bars on a graph, they can be viewed in either color or black and white. Instead of using size attributes on the font element to denote a heading, the heading element should be used to correctly mark up a heading so that assistive technology can identify headings.

http://www-03.ibm.com/able/access_ibm/disability.html

In addition to dictation and navigation products, other companies, such as Premier Assistive Technology (www.premier-programming.com) market products that enable users to accomplish more complex tasks, such as mail merge, spreadsheet calculations, or accounting. They have developed a multitude of e-text readers, scan and read programs and point solutions like the Ultimate Talking Dictionary, Talking Calculator, Talking Checkbook, and Talking Word Processor.

AllWrite from Sensory (www.sensorysoftware.com) is a talking word processor that provides complete speech support and large print editing for the visually impaired, but can also help people with reading or learning disabilities as well, due to the level of speech feedback it provides. AllWrite
Colligo’s Scan N Talk allows any book to be read by the user by placing the book face down on the screen and pushing a button. For the visually impaired, losing your sight and not being able to pick out matching clothes, make change for a $20 bill become a task that prohibits you from living independently. Simple tasks we take for granted now become difficult. Text to speech is now used in many assistive devices including currency readers and bar code readers, color and light detectors, and talking compasses. The i.d. mate II from Sendero uses text to speech to read bar code information on packages, prescriptions, CDs, or any item that is not readily identifiable and has a bar code. These tools can be lifesavers. Text to speech is being used in simple devices, such as thermometers to read out temperature, and prescription pill bottles. When you can’t see the pill bottle for instructions or to make sure of dosage or the right pill, it can be deadly. Companies have started to create useful products to help. For example, Wizard Software’s MedivoxRx division markets “Rex,” a disposable, talking pill bottle that provides verbal access to medication information for people unable to read printed labels. En-Vision America’s Scrip Talk system reads a downloadable label attached to a prescription bottle.

Ralph the Automated Home Assistant (Corpier Consulting Services) is also a product that uses ASR, TTS and artificial intelligence to provide assistance in the form of a “virtual companion and servant. (www.rxtalks.com). Ralph uses adaptable speech recognition, improving recognition over time. Ralph can turn on and off devices; dim or brighten lighting; open and close drapes or blinds; open or close sliding or hinged doors; lock and unlock doors; control TV, stereo, and VCR; manage temperature controls; monitor motion and movement in and outside the house; answer the phone, take messages, and call out based on 128 different alert conditions to different contacts; act as an alarm clock and reminder service and take confirmations of reminders; add items to shopping lists; retrieve weather and news headlines and read them; search for up-to-date channel listings and summaries on command; alert users as to upcoming shows and record requests; act as home security system; and take dictation and read emails.
2.3 HEARING IMPAIRED

Hearing loss is more prevalent than diabetes, all pediatric cancers, and numerous other medical conditions. However, medical professionals learn little about hearing impairment, about how to advise parents of children who are deaf or hard of hearing, or about the special considerations needed in the care of children with hearing loss.

Recent recommendations for universal hearing screening have resulted in numerous articles regarding the tests, the utility of testing, the role of the audiologist in amplification, and the importance of early intervention programs. The importance of the treating the patient along with the primary care physician cannot be overemphasized. In many instances, the ear doctor develops a long-term relationship with patients and their families, caring for the patients through their spectrum of development.

Pediatricians play a crucial role in providing referrals to audiologists, otolaryngologists, and special programs. To do so, they must understand the nature of hearing loss and the equipment that can improve auditory reception, the linguistic and social development of children who have hearing impairment, and the educational and linguistic options available to children who are deaf or hard of hearing.

The goals must always be to integrate the child into the family and into society and to enable the growth and development of a healthy, confident child who is deaf or hard of hearing. To meet these goals, clinicians should use any communication strategy and equipment that is best suited for the individual child and his or her family.

New technology and better treatment has improved the lives of hearing impaired. However, the cost associated to receiving these benefits may be to high for the average person. A further breakdown of technology, treatment, and costs by company name is made below: http://www.emedicine.com/ped/topic931.htm
Treatment for CHL

Conductive hearing loss (CHL) results from anything that prevents the transmission of sound from the outside world to the cochlea. Causes range from impaction of cerumen to middle-ear effusions or dysfunction or fixation of the ossicular chain.

Manage CHL due to otitis media or its sequelae with a course of appropriate antibiotics. A patient with a serous otitis media for longer than 3 months benefit from myringotomy and removal of the fluid in the middle ear. Ventilation tubes may ultimately be necessary. If the hearing loss continues, amplification with a hearing aid may be needed. Speech therapy is rarely necessary unless the loss is prolonged and cannot be corrected with amplification.

Based on the Medical Discounts Company and its website: http://www.medicaldiscounts.com/ent.htm, the cost of a discounted myringotomy is $480. Note, the cost is usually higher but is quite often covered by insurance. The treatment is a surgical approach, which involve cutting a slit in the ear drum. If hearing loss continues speech therapy will be necessary. A technological approach to speech therapy is computer assisted therapy. One company that provides such a service is Bugalow Software. There package costs 1295.00 and allows the user to learn on his own and when he wants too. A more traditional approach to speech therapy can be found in government programs, private practice, and schools like Georgia State University. This school provides a 2 semester program for speech therapy. A link to the schools website can be found here: http://education.gsu.edu/epse/1791.html. Also, below is the cost table associated to Georgia State University speech therapy:
<table>
<thead>
<tr>
<th>Clinic Service</th>
<th>Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Therapy Registration Fee for Fall and Spring Semester</td>
<td>$225.00</td>
</tr>
<tr>
<td>Therapy Registration Fee for Summer Semester</td>
<td>$150.00</td>
</tr>
<tr>
<td>Speech-Language Evaluation</td>
<td>$100.00</td>
</tr>
<tr>
<td>Hearing Evaluation</td>
<td>$50.00</td>
</tr>
<tr>
<td>Hearing Screening (on-campus)</td>
<td>$10.00</td>
</tr>
<tr>
<td>Speech-Language Screening (on-campus)</td>
<td>$10.00</td>
</tr>
<tr>
<td>Speech-Language-Hearing Screening (off-campus)</td>
<td>$15.00</td>
</tr>
</tbody>
</table>

Note: Rarely does CHL require a myringotomy or speech therapy. Both should only be used when antibiotics and hearing implication (hearing implication is discussed later) fail over a prolonged period. Therefore, the cost for CHL patients on average must less than what is stated above.

Treatment for SNHL

Sensorineural hearing loss (SNHL) may result from disruptions in transmission after the cochlea. These disruptions may be a result of hair cell destruction in the cochlea or damage to the eighth cranial nerve. Sounds perceived by the brain are both diminished and distorted. The degree of distortion is independent of the degree of hearing loss (e.g., mild hearing loss but very poor speech discrimination is possible.

SNHL cannot be treated medically. Amplification with hearing aids is used to give the child as much auditory input as possible. Speech therapy may be beneficial. If the child requires special schooling, the program determines how much speech training is routinely part of the school day. Preferential seating and use of FM systems should be discussed with the patient's family and teachers.

In older children and in adults, goals for amplification may be as much as 40-60 dB or whatever achieves a nominal hearing level. The limiting factor is the physical sound pressure exerted on the tympanic membrane, which becomes painful after a certain threshold. Young children with
small ear canals perceive pain at amplification volumes as low as 10-15 dB. Modern hearing aids can selectively amplify a specified range of frequencies more than others rather than all frequencies equally.

After the hearing aid is fitted by using proper molds, the hearing aid is tested to see how well it matches the goals for loudness at various frequencies. With an older child, speech recognition can be part of this testing. For a young child, the most important goal is to optimize auditory input without causing pain, which can cause the child to avoid using the hearing aid.

Young children should use their hearing aids because the stimulus helps to connect them to their environment and because it maximizes auditory language development. Older children may choose not to use their hearing aids. Parents should be reasonable. For example, if their child is succeeding in school, the hearing aids may not offer a substantial language benefit. If the child prefers not to wear the hearing aids after school, parents should respect this decision.

No medical disadvantage occurs if children choose to not use hearing aids. In fact, many deaf adults use their hearing aids selectively or not at all because they find that the extraneous noises and distortions they hear are more bothersome than helpful. They may use their hearing aids only when they anticipate a particular benefit.

For all SNHL and CHL patients, hearing aids have been used in the past, and are presently expanding benefits to the hearing impaired as technology improves. A hearing aid is an electroacoustic body-worn apparatus which typically fits in or behind the wearer’s ear, and is designed to amplify and modulate sounds for the wearer. Earlier devices, known as an ear trumpet or ear horn, were passive funnel-like amplification cones designed to gather sound energy and direct it into the ear canal. Here is a cost analysis sheet created by wikipedia.org and can be found at [http://en.wikipedia.org/wiki/Hearing_aid#Purchase_costs](http://en.wikipedia.org/wiki/Hearing_aid#Purchase_costs).
Purchase costs

Several industrialized countries supply free or heavily-discounted hearing aids through their publicly funded health care system.

Australia

The Australian Department of Health and Ageing provides eligible Australian citizens and residents with a basic hearing aid free-of-charge, though recipients can pay a "top up" charge if they wish to upgrade to a hearing aid with more or better features. Maintenance of these hearing aids and a regular supply of batteries is also provided, on payment of a small annual maintenance fee.

Canada

In Canada, health care is a responsibility of the provinces. In the province of Ontario, the price of hearing aids is partially reimbursed through the Assistive Devices Program of the Ministry of Health and Long-Term Care, up to $500 for each hearing aid, every three years. Audiological appointments are covered through the provincial public health plan, provided they are conducted under the supervision of ear, nose and throat doctors, usually in hospital settings. Private sector hearing aid clinics also exist and the hearing aids are covered to the same extent as with the non-profit and hospital providers. A popular choice for buying hearing aids in Ontario is the Canadian Hearing Society, a non-profit organization located in cities and towns across the province.

Iceland

Social Insurance pays a onetime fee of ISK 30,000 for any kind of hearing aid, however the rules are complicated and requires that both ears have a significant hearing loss in order to qualify for reimbursement. BTE hearing aids range from ISK 60,000 ISK to 300,000 ISK.

UK

Within the UK, the NHS provides BTE hearing aids to NHS patients, on long-term loan, free of charge. Though BTEs are often the only style available, and private purchases are usually necessary if a recipient desires a different style. Private purchases can cost between £600 to £3,500.
Most private US health care providers do not provide coverage for hearing aids, so all costs are usually borne by the recipient. Such costs can vary between $500 to $5,000. Though if an adult has a hearing loss which substantially limits major life activities, some state-run vocational programs can provide upwards of full financial assistance. Severe and profound hearing loss often falls within the "substantially limiting" category. The cost of hearing aids is a tax deductible medical expense.

Here are the major players in the hearing aids industry.

Note: As mentioned, earlier the benefit of wearing a hearing aid is usually more at earlier speech and communication stages. Therefore, after a hearing impaired person gets used to communication in their daily activities, wearing a hearing aid can be sometimes less beneficial and more painful. Also, the cost associated to speech therapy, and CHL patients (other than surgery, myringotomy) apply to SNHL people.

It seems the future of hearing aids may be in cochlear implants. Cochlear implants are implantable devices inserted through the skull and into the cochlea by using a drill. The device is connected, with a wire, to a subcutaneous magnet left behind the ear. The patient wears an exterior magnet connected by wire to a computer processor. Cochlear implants are not invisible. The processor alone is at least the size of a cigarette box or deck of cards, and it is worn on a large harness. However, new technologies are reducing the size of the devices.

Cochlear implants create sound in the brain by directly stimulating the auditory nerve. The processor divides sound in the hearing frequencies into 22 channels (current technology). Sound received by the processor in a given frequency is converted into an electronic impulse across the
magnets to the CI itself, which then stimulates the nerve at 22 corresponding locations along the cochlea. CIs may be considered for implantation in children with profound hearing loss.

The training required for use is substantial and very important. Unless the child and parents participate in the training, much of the potential benefit of the cochlear implant is lost.

Cochlear implants are frequently mischaracterized as a cure for deafness. Many people believe that they may have potential adverse health effects, in addition to the risks of surgery and infection. Conversely, as the technology of the cochlear implant improves, it could potentially signal the demise of the Deaf community. A cure for blindness or spinal cord injury would not destroy the communities of individuals with those disabilities in a similar fashion. Cochlear implants do provide many children with substantial hearing and auditory language benefit. However, no way exists to predict who will do well or how well they will do. Therefore, balanced and realistic counseling is important.

http://www.emedicine.com/ped/topic931.htm#Cochlearimplants

Also here is a diagram provided by http://en.wikipedia.org/wiki/Cochlear_implant which displays the implant.

Illustration of the internal parts of a cochlear implant.

This seems to be the future for the deaf community. Or better yet a future of a non-existent deaf community. Many hearing aid companies mentioned above are jumping on board this new technology. The cost of the surgery, device, hospitalization and everything else incurred as a result of the cochlear implant are far greater than that of the traditional hearing aids. Therefore, this technology is still not widely accessible to
the general public. According to the website, http://en.wikipedia.org/wiki/Cochlear_implant#Cost, “In the United States, medical costs run from USD$45,000 to $105,000: this includes evaluation, the surgery itself, hardware (device), hospitalization and rehabilitation. Some or all of this may be covered by health insurance. In the United Kingdom, the NHS covers cochlear implants in full, as does Medicare in Australia.”

Clearly, new technologies, surgical procedures, and therapy can help a person with hearing loss. As technology gets cheaper, the world should see much fewer deaf people with even greater communication/socials skills.

People who are deaf or hard of hearing require visual representations of auditory information that the Web site provides. Solutions for these disabilities include closed captioning, blinking error messages, and transcripts of the spoken audio. The primary concern is to ensure that audio output information is provided in a redundant equivalent visual form.

http://www-03.ibm.com/able/access_ibm/disability.html
3 CONCLUSION

The needs of individuals vary by type of impairment. For example, a person who has loss of movement has difficulty with keyboards, buttons, and controls, but can get visual feedback from phones, the computer screen and small appliances. Conversely, sight-impaired individuals have the reverse, although finding the right button to press has its difficulties too. Speech technologies are great for command and control for the first group, and information conveyance to the latter. Consequently, while one type of assistive technology might greatly help one group, it might hinder another. For example, speech recognition for voice dialing benefits the sight-impaired, but is difficult or impossible for those who are speech-impaired. Some products are obvious, or take no more training for a person with disabilities than one without. For example, a sight-impaired individual has the same learning curve on using voice-activated dialing to get to a voice portal that can give them stock quotes and sports scores, as a sighted individual has. Other things are not so simple. Another device is the PC usage is built around navigating using a GUI, Navigation programs such as JAWS use to guide the user and help them navigate. Without the graphical input it takes weeks in a training program to become proficient at using JAWS or any other program that acts as a navigational aid.

Change in making products become more accessible cannot just happen in training centers, but will have to come from companies creating products demand market. For example, by adding speech, we have helped some individuals, while creating new difficulties for others. The speech-driven interactive voice response products are difficult to use for speech and hearing-impaired individuals, so the voice processing industry is looking at modifications for the use of speech technologies to make systems more user-friendly. For example, theses industry is creating standards for speech commands so that users can slow down prompts. This allows users with speech difficulties adequate
time to give input and commands or to slow down or replay prompts and text to speech output, so that persons with auditory or cognitive impairments can utilize voice systems more effectively. The VoiceXL (www.voicexl.com) from Interactive Digital provides a solution for interactive voice response vendors delivering VoiceXML applications, such as Avaya and Plum Voice Portals that do just that. VoiceXL works with VoiceXML applications to match the pace and cadence of the caller, adjusting itself to the exhibited capabilities of each caller, so that the application speeds up for expert users, and slows down for novices or those having difficulties with the application.
4 REFERENCES

EPICS: Engineering Projects in Community Service  Published in the *International Journal of Engineering Education*, Volume 21 number 1, February 2005, pp. 139-150.

HTTP://WWW.GREATACHIEVEMENTS.ORG/?ID=3824


http://www.exampleessays.com/viewpaper/87421.html

www.ibm.com

www.scooter.com

www.census.gov

www.nokia.com

www.samsung.com

www.voicesignal.com

www.SVOX.com

www.pulsedata.com

www.dolphinusa.com

www.freedomscientific.com

www.premier-programming.com
www.sensorysoftware.com

www.voicexl.com

www.rxtalks.com

www.envisionamerica.com