The bright Future of Diagnostic Imaging

Paul Smit
Senior Vice President Medical Systems
Overview

- The role of Imaging in healthcare
- State of the art
- Philips’ position
- New developments
Role of imaging in healthcare

- Treatment (Imaging)
- Follow up (Imaging)
- Diagnostic Imaging
- Tests
- Acute Care System
- Symptoms
- Cured or chronic
Role of Diagnostic Imaging in Healthcare

- Determine nature, location and size of disease in patients with symptoms
- Guide interventions
- Monitor the progress of treatment
Market for Imaging has shown consistent growth

Growth is driven by new applications, increasing accuracy and increasing speed

>1 Billion Imaging Procedures/Year worldwide (source: Medtech Insight)

On average, 2 out of every 5 Patient Visits involve an imaging procedure in USA (source: SG-2)
Medical Technology creates proven benefits

• “New technologies often bring health improvements and productivity benefits.”

• “Around 70% of the survival improvement in heart attack mortality is a result of changes in technology.”

Source: Technology Benefits based on Study by Cutler and McClellan
....which translates into a healthier population

Source: NCHS
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CardioVascular X-Ray

**Average price: € 1 mln**

- Diagnosis of bloodvessels
  - Heart
  - Brain
  - Body
- Guides treatments of the cardiovascular system
  - Clot removal, e.g. dottering
  - Stent placement
  - Aneurysms repair
  - Arythmia repair
Philips’ continuous improvements in Cardiovascular X-Ray

250x finer details

<table>
<thead>
<tr>
<th></th>
<th>1999</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detail visible</td>
<td>0.001 mm³</td>
<td>0.000,004 mm³</td>
</tr>
<tr>
<td>Measurement time</td>
<td>35 s</td>
<td>5 s</td>
</tr>
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</table>
Repairing arteries in the brain

Zooming allows the cardiologist to enlarge the microscopic images to the desired size
Philips’ continuous improvements in Computed Tomography, CT

Average price € 0.4 – 1 mln

- Diagnosis of anatomy, all body parts
- Workhorse of Radiology
- Continuously faster and more accurate
Diagnosing lung cancer

• Courtesy of Wiemker et al. Medica Mundi 2003

35x faster in 5 years
Philips’ continuous improvements in MRI
Average price: € 0.6 - 3 mln

- Diagnosis of anatomy, most body parts
- Unique in imaging soft tissue, such as the brain and nervous system
- Continuously faster and more accurate

12 seconds
Analyzing the brain

<table>
<thead>
<tr>
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<th>1998</th>
<th>2003</th>
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<tbody>
<tr>
<td>Detail visible</td>
<td>1 mm²</td>
<td>0.06 mm²</td>
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<tr>
<td>Scanning time</td>
<td>90 s</td>
<td>8 s</td>
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15x faster
Philips’ continuous improvements in Ultrasound

Average price: € 50 – 300 k

- Most cost-efficient imaging technology
- Wide array of applications, incl. cardiovascular
- Anatomy of many parts of the body
- Obstetrics/Gynecology
Live 3-Dimensional Ultrasound

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<th>1998</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal / noise</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>Procedure time</td>
<td>20 min.</td>
<td>5 min.</td>
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</table>
Nuclear Medicine

Average price: € 0.4 - 2 mln

- Most sensitive technology
- Gold standard to assess heart infarction
- Gold standard to detect primary cancer and metastases
- Increasingly used for brain (infarction)
Philips’ trackrecord of continuous improvements in Nuclear Medicine

- GEMINI: world’s first and only “open” Positron Emission Tomography (PET) – CT
- 3D registration of PET and CT data
- Two scans for the price of one
- Much better localization and identification of disease
- Improved Radiation treatments
And reduced the cost per patient

- Greater than 50% reduction in scanning time
  - 60 minute scans reduced to less than 30 minutes
  - Enhanced image quality
  - True clinical flexibility
…Continuous improvement in Performance, drives usage and creates new procedures

- X-Ray: repair of brain vessels
- CT: screening for lung cancer, cardiac CT, virtual colonoscopy
- MR: whole body cardiovascular scans, cardiac MR, orthopedics
- US: Biopsy guidance, mammography
- CT-PET: cancer localization and staging, monitoring of cancer treatment
... No wonder Imaging Systems are widely recognized for their impact

- MR and CT are considered the most important innovations in healthcare of the last 20 years

*Fuchs & Sox Health Affairs 2001*
....Which drive continuous growth in Imaging

Threefold increase in this decade:
- Aging population
- New cancer, Cardio Vascular and Neuro applications
- Growth of Image guided interventions
- Molecular Imaging

Source: SG-2, Philips
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Philips is leading in many imaging areas:

- # 1 in Cardiovascular X-Ray
- # 1 in digital X-Ray and digital Ultrasound in Cardiovascular Ultrasound
- # 1 in Nuclear Medicine
- # 1 to market with 16 slice CT
- # 1 in high-field MR
- # 1 in oncology simulation and planning
Technology leadership:
*Re-use of Unique technology from Philips Research*

**Xres™**
*extreme resolution*

From MRI → To Ultrasound → To X-Ray
Clinical Leadership through collaborative research: Virtual Colonoscopy with CT
Clinical Leadership through collaborative research: Virtual Colonoscopy with CT
Clinical Leadership through collaborative Research: Stunning details with MR

- Fast and very sharp images

High Resolution: 0.04 mm³
Clinical Leadership through collaborative research: Ultrasound

<table>
<thead>
<tr>
<th>Feature</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>Improved tissue differentiation</td>
<td>96.6%</td>
</tr>
<tr>
<td>Reduced image artifacts</td>
<td>93.2%</td>
</tr>
<tr>
<td>Better delineation of borders/margins</td>
<td>95.9%</td>
</tr>
<tr>
<td>Better overall image quality</td>
<td>96.2%</td>
</tr>
<tr>
<td>Changed patient management</td>
<td>17.6%</td>
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More accurate US images can change the way patients are treated
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Fusing MRI and X-Ray for targeted drug delivery
XMR-guided targeted drug delivery
(FeRx in HCC)

Courtesy: UCSF
Molecular Imaging

- Images the cells at work inside the living body
- Allows earlier detection and characterization of disease
- Early assessment of treatment
Molecular Imaging: the key ingredients

Imaging Modalities

Targeted Contrast Agents

Targeting Bio-molecule

Contrast Element, e.g. Gd
Speeding up time-to-market of new imaging procedures
Clinical areas

- Oncology
- Cardiology
- Neurodegenerative diseases of the brain

Courtesy: S. Wickline et al. Washington University, St Louis, USA
MR: Seeing the tumor grow

- As new micro arteries are developing....
Summarizing

- Imaging has made a big impact on healthcare over the last decades
- Continuous Technology development for better and faster diagnosis while lowering costs
- Future is bright as true Molecular Imaging is coming in sight