

Building smart houses

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An Englishman's home is his castle

An Englishman's home is his castle computer

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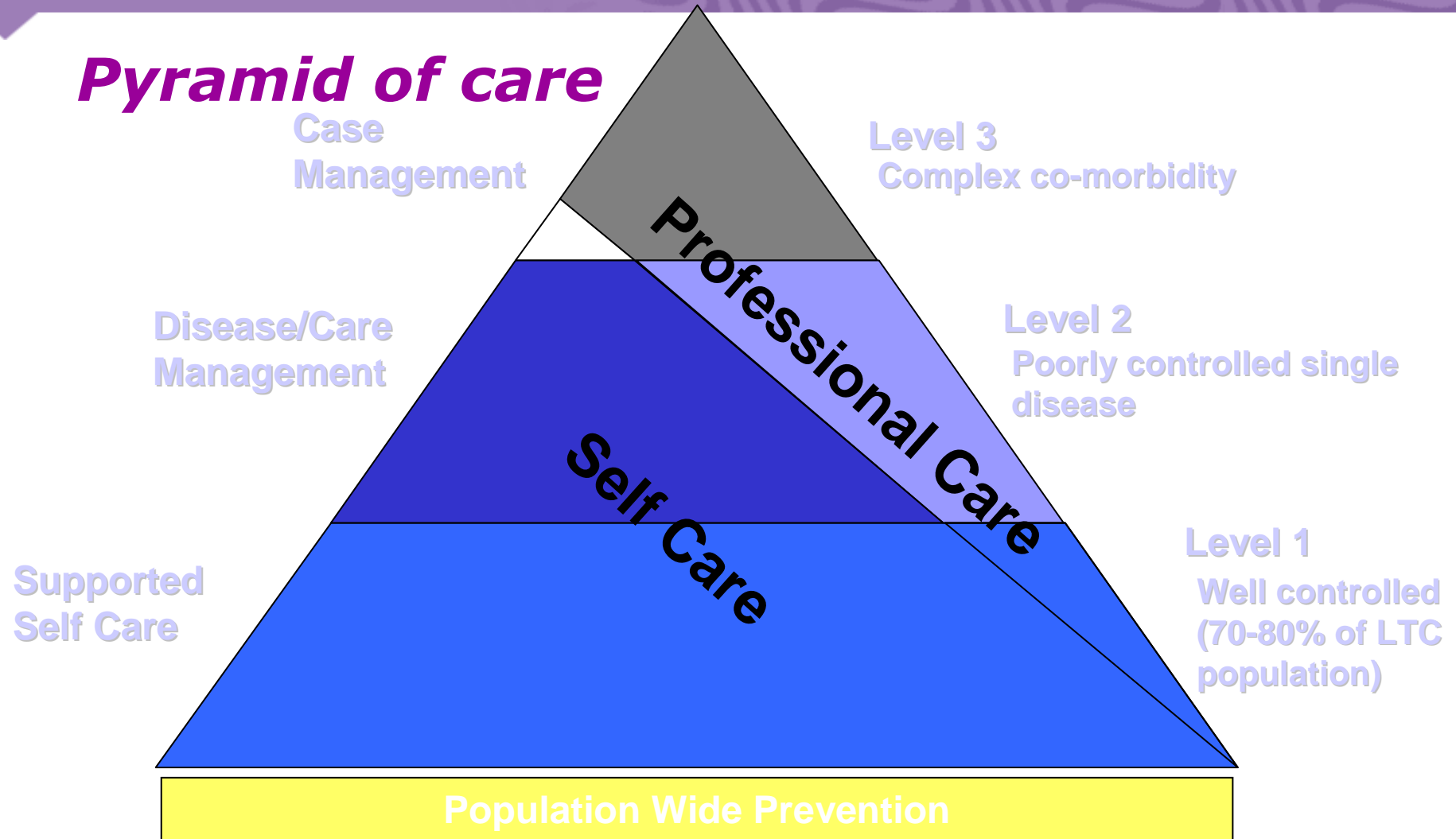
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- Home technology
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- What health/care problems can we help?
- Integration between home and other systems
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- Summary

Introduction

- **Why homes?**
 - No room at the inn
 - Demographic pressures placing demands on NHS and social care
 - Health budget cannot grow infinitely
 - People *need* to take more responsibility for their own (or the people they care for's) health and wellbeing
 - People *want* to live at home for longer
- **Why smart?**
 - Technology has many of the answers



Pyramid of care



Introduction

- Why University of Portsmouth?
 - Working in telemedicine/telecare/e-health since 1998
 - Early surveys
 - More recent evaluation work
 - More recent R&D projects
 - "Digital Wellbeing"
 - Living Lab: Monitoring people in their homes
 - An integrated service platform for the home
 - with PassivSystems Ltd (Newbury)



Homes already have a lot of tech



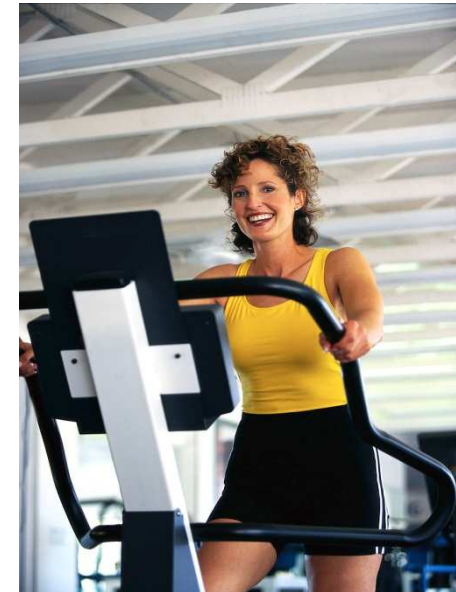
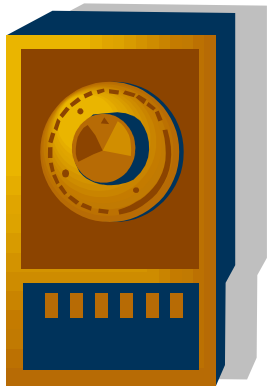
Homes already have a lot of tech

- **Entertainment**
 - Often centred around TV
 - satellite and cable are new routes into the home
 - the "remote control" as "simple" interaction device
 - Music anywhere
 - Games on various platforms
- **Communications**
 - Portable phones; mobile phones; smart phones
- **Computing**
 - Often integrating the above
 - Also big for education

Homes already have a lot of tech

- Alarm systems
 - First application of sensors
 - doors, PIRs, smoke detectors, etc.
 - Cameras
- Kitchen
 - Timers: oven, microwave
 - White goods slowly getting smarter

Homes are getting more tech



Homes are getting more tech

- Energy management
 - Heating: boiler, thermostat
 - Monitoring consumption of electricity, gas, water
 - Remote control of heating and lighting
- Health and fitness
 - Health monitoring: blood pressure, blood glucose, etc.
 - Fitness: exercise bikes
 - Most are self-prescribed

Existing tech getting joined up

- TV and Internet
 - sources of information
 - controlling set-top boxes remotely
- Communications
 - Accessing email/web/social media on both fixed and mobile devices

Technology advances: trends

- Everything:
 - is smaller
 - is faster
 - stores more data
 - is connected
 - is easier to use
 - is nicer to look at
 - is cheaper



Technology advances: applications

- Development and reduced cost of mobile devices
 - portability = convenience
- Wide availability and low cost of mobile networking
 - Bluetooth/ZigBee, Wi-Fi, 3G phone networks
- Ease of installing wireless devices in the home
 - no wires
- Ubiquity of web-based apps as a user interface
 - on computers and portable devices
- Richer information
 - multimedia: images used where once only had text
 - detail: complete record where once only had summaries
 - sharing: reduced cost of networking and data storage means more data can be shared in more places

Technology advances: applications

- **Sensors**
 - home devices
 - wearable devices
 - devices that measure things that previously couldn't be measured
 - devices that can measure more accurately, more frequently, more conveniently, at less cost
- **Miniaturisation**
 - data can be collected in new ways ...
 - ... and new places
 - less obvious / more comfort

Non-technology advances

- Design
 - Aesthetics of devices
- More marketing
 - Partly due to people's increasing {familiarity / ability / willingness} to use technology
 - Partly due to demands on providers to invest in technology
 - Partly due to globalisation of markets

Sensors

- Environmental sensors
 - temperature, humidity
- Emergency sensors
 - smoke, CO₂, flood
- Security sensors
 - door open, passive infra-red
- User-operated "sensors"
 - buttons on pendants, wristbands
- Energy sensors
 - mains, household circuits, specific devices

Sensors

- **Health sensors**
 - blood pressure, blood glucose, body temperature, lung capacity, ECG, pedometer
- **Care sensors**
 - pressure mats, bed mats, medicine dispenser
- **RFID**
 - to identify (and locate) everything
- **Information sources**
 - fridge, shopping list

Laerdal BedAlert



Electrical potential sensors (ECG)



University of Sussex

Future sensors



How can smart homes help people?

- Support
- Treatment
 - also management of chronic conditions
- Diagnosis
- Prevention

Who/what can we support?

- Specific conditions
 - Falls management
 - Mild dementia
 - Hospital discharge
 - Chronic condition
 - Stroke recovery
- Specific groups
 - Elderly
 - Mental health
 - Physical disability
 - Learning disability
 - Substance abusers
 - Socially isolated
 - Geographically isolated

What can smart homes add?

- Not much
 - just sense more things
 - integrate with other systems
 - make some things easier
- Ordinary, fit people
 - Wellbeing

Integrating home and other systems

- Access home systems remotely
 - alter central heating from the office/mobile
- Carer access to monitoring
 - website linked to home sensors

Pipe dreams?

- Remote doctor visits
 - save GP from travel; use local equipment
- Talking house
 - provides advice and support for daily activities
- Healthy house
 - monitors health, lifestyle and activities
- Home surgery
 - conduct simple medical procedures remotely

Issues 1

- **Integrating data**
 - common means of identifying people
 - provenance (quality) of data
 - accuracy
 - confidence levels
 - context
 - quantity of data is always going to be an issue
 - much data is redundant but you don't know which
 - timeliness (for diagnosis or prevention)
 - centralisation (logically yes, but often physically no)

Issues 2

- Confidentiality and privacy
 - spectre of Big Brother
- Convenience or expediency often trumps security
 - in which case, obtaining consent is meaningless
 - Tesco clubcard
- Many people assume that their healthcare records are already integrated

Challenge

Not about the technology

It's about engineering services
to ensure that the right (quality) information
is collected, gets to and is used in
the right place at the right time

Summary

- Technology making things smaller and cheaper
- Demographic and economic trends driving need for new solutions
- Increasing (user and practitioner) experience of home technology
- New applications continually being developed
- Integration and privacy are challenges

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