

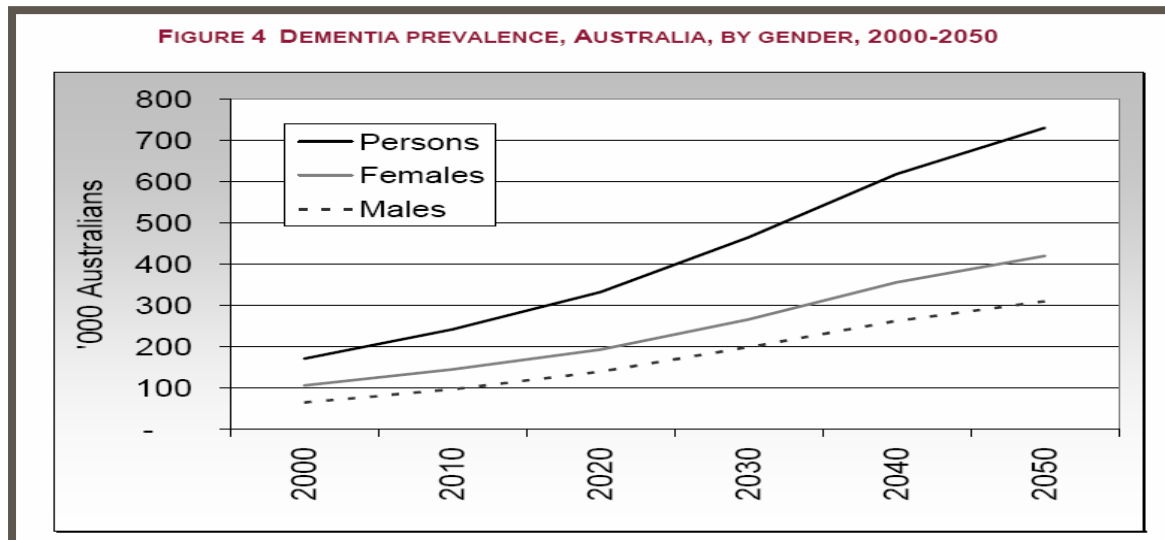


**Assistive technology for people living
with dementia**

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Dementia and the future

The latest report released by Alzheimer's Australia estimates that nearly 52,000 people will be newly diagnosed with dementia this year and that the total number of Australians with dementia will pass the 200,000 mark. By 2050 the total number of people with dementia will surpass 730,000 (Access Economics, 2005).



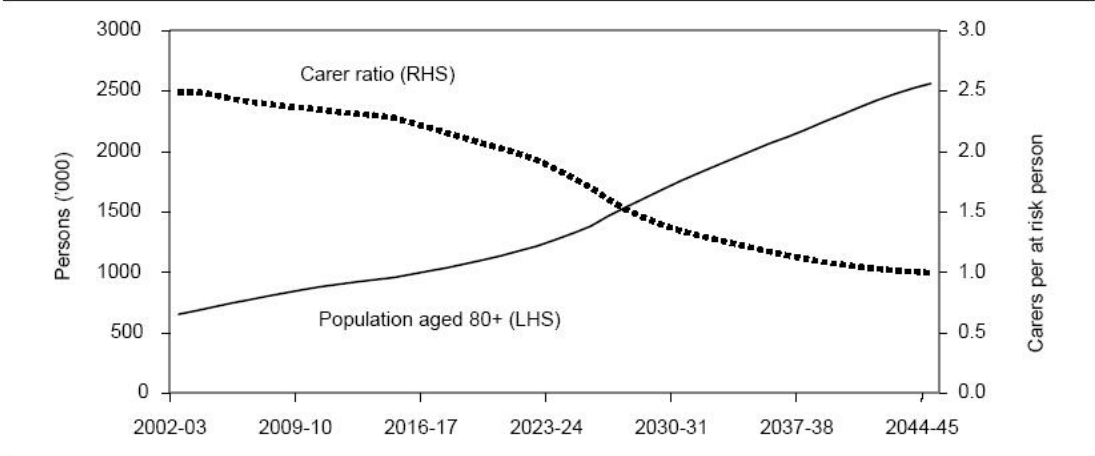
Recently the Treasurer Peter Costello was quoted in *The Age* newspaper (12/04/2005) as saying "We can't afford to have all older Australians in aged care homes, any more than we can afford to have them in hospitals." He continued by saying that the goal of social policy was to "...have them in their own homes, with support of carers, with the support of services coming into their homes so that as they live longer they can stay in their community rather than go for longer periods into institutional arrangements".

The treasurer's assertions were based on a recent Research report released by the Australian Government Productivity Commission titled *Economic Implications of an Ageing Australia* (2005). The report stated that there is uncertainty about how formal community care will develop because there are links between formal care in the community and informal care. The most alarming prediction was that there is likely to be a significant reduction in the proportion of potential informal carers over the longer term. The main reasons for this prediction was an increase in single person households, fewer children per family and greater workforce participation by women.

A main conclusion in the report was that expenditure on health services for older people might produce savings in aged care programs. The report provided the example that "a hip replacement may increase a person's mobility and prevent falls, thereby delaying the need for community or residential aged care". Assistive technology works in much

the same way. By assisting people at home with the activities of daily living and compensating for any deficits in function caused by dementia, people are able to stay at home longer and maintain higher levels of independence.

Figure 17 The number of carers will not match the growth in the aged



A matter of time

Futurologists base their careers (and reputations) on predicting the impact of change on the world we live in. One of the biggest drivers of change is technological innovation and one of the booming technologies of the 21st century is robotics. The United Nations Economic Commission for Europe reported that in 2003 there were approximately 50,000 in home service robots that perform simple tasks including vacuuming and lawn-mowing. It is predicted that by the end of 2006 there will be 500,000 robots in homes around the world. Futurologists and technophobes alike predict that by 2045 robots will be as much a part of our lives as toasters, kettles and televisions are today. Waiting 40 years for technologies to assist those currently living with dementia is not an option.

The future is now

GPS tracking

One of the primary symptoms of dementia is short term memory loss. This can often cause the person with dementia to become disoriented and confused as to their whereabouts. Both carers and the literature refer to this as a “behaviour of concern” called wandering. In essence though the real cause of the concern is not so much the “walking” or “wandering” as the inability of the carer or person with dementia to be “located”. Fortunately technology can offer a solution.



- **Locate a person to within a few metres:** GPS or Global Positioning Satellites enable this wristwatch sized device to pinpoint a persons location to within a radius of 3 metres any where in the world. This wristwatch is based on the same technology used by the US military’s multi-billion dollar GPS satellites in conjunction with the largest 100% digital wireless network in America.
- **Numeric Pager:** Using the internet and a secure password, send a message to the wristwatch to communicate with the wearer. This internet interface can also be used to locate the person if they become lost.
- **Remote Unlock:** A device that can locate the wearer anywhere in the world is only useful if the device is actually worn. This wristwatch features an electronic lock that is unlocked by sending an SMS or paging the device. This ensures that the wristwatch is not removed without confirmation that the wearer is safe.
- **Automatic Locates:** can be scheduled to see where your loved one is at a given time. Confirm that your loved one is safely at home while your still at the office!
- **"Breadcrumbing" Feature:** A series of "automatic locates" can be programmed to identify a trail of locations over a specific period of time. This feature is great for identifying favourite routes or series of destinations that the wearer may travel to.

- **"911" Call-For-Help Enable & Disable:** This North American product has the flexibility to automatically notify emergency services if activated. You can easily change the watch to enable or disable the "911" Call-For-Help feature depending upon the situation or level of awareness.

For approximately \$US 750 or around \$AU 1000 one of these wristwatches can be purchased with a monthly access service fee of around \$AU 40-50. Unfortunately this particular device is an out of production and out of stock. A new model is slated for 3rd quarter 2005.

Smart toilets

Not designed specifically for people with dementia, smart toilets have begun to evolve in Japan out of what has been dubbed the "toilet wars". Two of the combatants in this war are Matsushita (the parent company of Panasonic) and Inax (a lifestyle and technology based company). Between them they have added the following innovations to the humble toilet.



- **blood pressure:** inflatable cuff that measures blood pressure
- **body fat %** - a toilet seat equipped with electrodes that send a mild electric charge through the user's buttocks is able to measure the users body-fat ratio.
- **heart rate** – these same electrodes can also unobtrusively measure the users heart rate
- **urine sugar** – a small spoon held by a retractable, mechanical arm can be used to collect specimens of urine and measure the amount of sugar present. It is predicted that within 2 years smart toilets will also be able to measure albumin and blood in urine as well. Combining information about blood pressure, heart rate, body fat %, urine sugar levels, albumin and blood in urine allows for the unobtrusive charting of key health indicators.

- **Internet contact to GP for automated health monitoring** – this information can be collated and transmitted to the users GP for daily, weekly or monthly “check-ups” without needing to leave the home. Perhaps the greatest advantage of this system is the frequency at which this information is collected. Any significant change to these health indicators of either an acute or chronic nature would show up quickly, enabling early treatment and prevention. "You may think a toilet is just a toilet, but we would like to make a toilet a home health measuring center," Mr. Matsui, the Matsushita engineer. “With nursing homes largely full in Japan, the number of older people under home care is rising fast, jumping by nearly one quarter just last year”. Hironori Yamazaki, a developer of smart toilets commented that “In Japan, most people see the doctor after they become ill,... with an eye to our demographic change, we are setting out to make the toilet a space for the early discovery of disease.". The links between physical health and cognitive health range from subtle changes through to acute crises including pseudo-dementias caused by delirium. Confusion from dementia or delirium places an individual at further risk of dehydration, malnutrition, and poor medication compliance further compromising physical health and consequently cognitive health. Early detection and treatment of changes in physical health will act to stem this potential spiralling decline that often necessitates hospitalisation or placement in residential care.
- **voice prompts and speech recognition** – an optional feature is the inclusion of verbal prompts and speech recognition. Whether it be some gentle music to create a comfortable atmosphere, or the encouraging voice of a loved one to prompt the user through the various steps involved in using a toilet, smart toilets are designed to be tailored to individual needs.
- **The humble toilet is one of the last frontiers of technological development, but the inclusion of the microchip to this household fitting has the potential to relieve more than just our bladders. At a cost of \$3000-\$5000 it may be some time before this sees mainstream adoption, however that time may be sooner than expected. A new proverb for the 21st century may be a refinement of the old adage “an apple a day keeps the doctor away” to “a smart toilet today keeps the doctor away”**

Medication reminders

Patient Compliance – American statistics

Medication non-compliance (non-adherence), the failure to take drugs on time in the dosages prescribed, is as dangerous and costly as many illnesses.

125,000 deaths annually in the US are attributable to medication non-compliance. Meta-analysis has identified this as possibly the 6th leading cause of death in hospitalised patients in Australia (Pillans & Roberts, 1999). It is, in the words of The New York Times the world's "other drug problem".



Negative Economic Effects of Non-Compliance – an American perspective

- 23% of nursing home admissions are due to non-compliance with an associated cost of \$31.3 billion/year which equates to 380,000 patients.
- 10% of hospital admissions are due to non-compliance with a cost of \$15.2 billion/year from 3.5 million patients.

Prescriptions

- In America about 50% of the 2 billion prescriptions filled each year are not taken correctly.
- In Australia there are around 200 million prescriptions per year, with compliance rates of between 40-75% for the elderly population
- 1/3 of patients take all their medicine, 1/3 take some, 1/3 don't take any at all (prescription never filled).

Expecting someone who has a short term memory impairment to remember in the short term what day it is, what time of day it is, and whether they have taken their medications is slightly more successful than pouring all their medications into a bowl and instructing them to have a handful with breakfast. Pillboxes and Webster packs have

alleviated some of the problems associated with compliance, however they still rely on the consumer to remember what day and time it is. The MD2 is a product developed in America to address the problem of medication non-compliance.

- **Stores up to 60 days worth of medication** – MD2 contains 60 medication cups that can be dispensed between 1 –6 times per day. Each cup can contain up to 50 aspirin sized pills. Most users will find that they only need to fill this machine once every 3 – 4 weeks,
- **verbal prompts to remind user to take medications** – the built in calendar clock will trigger an alarm when it is time for the person to take their medications. The MD2 will verbally remind the user to take their medications and will only release the medication cup if the dispense button is pressed when the alarm is sounding.
- **Internet connection to inform caregiver when medications are missed** – If the user forgets or otherwise fails to take their medication at any time, the MD2 will repeat the verbal reminder. If after several minutes the dispense button has still not been pressed, then the MD2 will contact the caregiver to inform them of the missed medication. Similarly if the MD2 is running low on pills it will alert the caregiver so that it can be refilled.
- **secure storage of medications (tamper-proof)** – Medications are stored in the MD2's lockable compartment to ensure that only those with a key can access the 60 medication cups
- **battery backup system** – mains power and a battery backup system to ensure that even in the event of a power failure, medications can still be dispensed.

The MD2 is available for purchase for around \$1000AUD. It is currently the most sophisticated medication reminder on the market and has been used successfully with people with dementia. As one buyer stated "***My mother has Alzheimer's and would constantly forget to take her medications. Now, she never forgets and even calls MD-2 'her little buddy.'***"

Economies of Scale

For the economy as a whole, there is a presumption that the real costs of production will tend to decline over time due to productivity improvements. But these gains may not apply — or may apply to a lesser extent — to long-term aged care services where the scope for such improvements appears limited. Long-term aged care services are also generally highly labour intensive. And, while the impact of technological change on input demand is difficult to foresee, there appears to be relatively little scope for capital substitution or other means of improving labour productivity in the foreseeable future. Moreover, demographic projections imply that demand for nursing staff, and other long-term aged care labour, will generally be increasing, at a time when the population base for the labour force is falling. This is likely to put upward pressure on wage rates.

	<i>Low Care</i>	<i>High Care</i>
<i>Residential</i>	\$ 20,000	\$ 40,000
TOTAL	\$ 20,000	\$ 40,000
<i>Community (CACP / EACH)</i>	\$ 10,000	\$ 20,000
<i>Smart toilet</i>	\$ 3,000	\$ 3,000
<i>MD.2 Personal Medication System</i>	\$ 1,000	\$ 1,000
<i>GPS tracking</i>	\$ 1,500	\$ 1,500
TOTAL	\$ 15,500	\$ 25,500

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<i>GPS tracking</i>	\$ 1,500	\$ 1,500
TOTAL	\$ 5,500	\$ 5,500

All of these factors imply that, for a constant quantity and quality of long-term aged care services, total costs are likely to increase rather than decrease in the years ahead.

1996-97 estimates of the average cost for residential care in Australia placed the figure at \$40,000/year per person for high-level nursing home care, and \$20,000/year per person for low-level hostel care. With little scope to reduce costs within long-term care settings, the alternative is community care. Community Aged Care Packages and Extended Aged Care at home have been estimated to cost \$10,000 and \$20,000 respectively. These programs provide on average between 10 – 17 hours of support per week. When considering that 9+ hours of this per

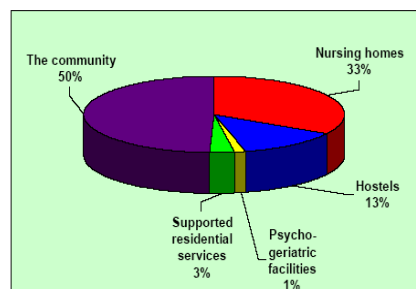
week constitutes personal care, that leaves minimal time to assist on a daily basis with medications and meals. There is even less scope for support for those who may wander at night. For comparison purposes, the estimated costs of a selection of assistive technologies both with and without CACP and EACH packages are shown.

The sample of technologies presented today is by no means exhaustive, and will not be suitable for all people with dementia. They do however illustrate the potential cost savings. Mass production, the principle of supply & demand, and competition will lower the costs of these and other assistive technologies making them even more affordable. It is foreseeable that with planning and clever implementation it will be possible in some instances to rely solely on assistive technology to maintain a person living with dementia's independence in the community.

Economies of scale



- ⌘ 66,000 people with dementia living in Nursing homes
- ⌘ 26,000 people with dementia living in Hostels
- ⌘ 100,000 people with dementia living in the community



Source: Access Economics based on 1996 data from Gibson et al (1999).

Australia currently spends about \$6 billion on aged care services, which accounts for more than 1 per cent of the GDP. The prospective ageing of the population raises issues of how much this may increase in the future, and of our capacity as a nation to finance such increases. When looking at the population of people living with dementia in Australia in both residential and community care, one can begin to imagine the magnitude of the potential savings from the use of assistive technologies.

Where to from here

As stated previously, the three assistive technologies presented today are just a sample of the broad range of innovations possible. In order to expand the range of options for consumers there needs to be more work done in:

- **Consumer needs** – identifying specifically tasks and areas that people living with dementia need assistance with is the first step.
- **Product development** – the manufacturing industry needs to sense and respond to this consumer need by developing and refining assistive technology products.
- **Ethical challenges** – the rest of us must tackle the ethical challenges that will arise out of development of these new technologies. Issues of consent, confidentiality, and dignity will need to be explored with any new technologies that are developed.



Life Enhancing Technology group

- **The concept:** - Alzheimer's Australia South Australia has formed the Life Enhancing Technology group to investigate and promote the development of assistive technologies for people living with dementia. Our mission is to enhance the quality of life of people living with memory loss or related disorders through the use of assistive technologies and environmental design.
- **The group** – We have an interest in creating working partnerships with consumers, academics, and manufacturers. It is our intention to have representation of these groups with the Life Enhancing Technology group.
- **The goals**
 1. *Assistive technology for people living with memory loss or related disorders being available in an equitable and accessible manner*
 2. *To improve community understanding of assistive technology and its application in enhancing the functioning of people living with memory loss or related disorders*
 3. *Promoting the development of new technology and exploring new applications for existing technology*
 4. *Develop and practice standards in the ethical use of assistive technology with a person centred focus*
 5. *Develop standards in the quality of assistive technology products*



I would like to extend my thanks to you all for taking the time to listen to this presentation on assistive technology. If you would like to know more or have information to share I can be contacted as per my details. Thank you.

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References

Access Economics (2005). *Dementia estimates and projections: Australian states and territories*, Canberra

Access Economics (2003). *The Dementia Epidemic: Economic Impact and Positive Solutions for Australia*, Canberra

Asimo video footage courtesy of TokyoDV (2003)

Australian Government Productivity Commission (2005), *Economic Implications of an Ageing Australia*

Brooke, J. (October 8, 2002) The New York Times, Japanese Masters Get Closer to the Toilet Nirvana

Johnston P, (2003) *World Robotics Statistics Market Analysis Forecasts Case Studies and Profitability of Robot Investment*, United Nations Publications

Madge, A, (2000), *Long-Term Aged Care: Expenditure Trends and Projections*, Productivity Commission Staff Research Paper, Canberra, October.

N. Roy, G. Baltus, D. Fox, F. Gemperle, J. Goetz, T. Hirsch, D. Margaritis, M. Montemerlo, J. Pineau, J. Schulte, and S. Thrun, (2000) "Towards Personal Service Robots for the Elderly," *Workshop on Interactive Robots and Entertainment (WIRE 2000)*,.

The Jetsons video footage courtesy of Warners Bros (2004)

Peter Costello quote as appears in 'The Age' 12/04/2005

GPS Locater Watch For Alzheimer's Patients – <http://www.emergencymedicalsystems.com>

MD2 medication dispenser – <http://www.epill.com>

Smart toilets - <http://www.globalaging.org/health/world/toilet.htm>