Cities, environmental stressors, ageing and chronic disease
OVERVIEW

› Why do environmental stressors impact more on the ageing?

› Is it more of a problem in cities?

› Extreme heat and aged care facilities

› Activities - How can practitioners respond to these two major issues facing developed countries?
“Ageing is usually defined as the progressive loses of biological function accompanied by decreasing fertility and increasing mortality with advancing age. This process usually occurs after sexual maturation and continues up to the time of maximum longevity (life span) for members of a species. Death is the final event. Roughly speaking life span of an organism is proportional to its size -- bacteria may only live for a few hours, an insect a few days, and an elephant for years” (accessed 23 September, 2013 http://universe-review.ca/R10-27-ageing.htm)
Life Span

http://universe-review.ca/R10-27-ageing.htm

Environmental stressors
Exposure to Environmental stressors

› Exposure is contact between the environmental agent and an individual

› Exposure is measured as the product of concentration to environmental stressors e.g. noise, air pollution (DOSE) and the length of time the individual has been exposed (TIME)
**Table 1. Pharmacokinetic changes that may contribute to increased susceptibility in older persons.**

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<th>Process</th>
<th>Pharmacokinetic changes in aging adults</th>
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<tr>
<td><strong>Absorption</strong></td>
<td>No significant changes in gastric absorption; decline in gastric acid production&lt;br&gt;Changes in dermal absorption, barrier function&lt;br&gt;Changes in lung volume, elasticity, ventilation rate</td>
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<td><strong>Distribution</strong></td>
<td>Change in body composition&lt;br&gt;Decreased total body water in older adults results in decreased volume of distribution/higher serum levels for polar compounds&lt;br&gt;Decreased muscle mass and increased relative adipose levels result in higher accumulation of lipophilic compounds and slower clearance&lt;br&gt;Plasma protein binding—decrease in plasma albumin (which bind acidic compounds), increase in $\alpha_1$-glycoprotein (bind basic compounds)&lt;br&gt;Potential for increased permeability of blood—brain barrier with concurrent disease (diabetes, hypertension, cerebrovascular ischemia)</td>
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<td><strong>Metabolism</strong></td>
<td>Reduced liver volume and liver blood flow&lt;br&gt;Minor effects on phase I and II metabolism in healthy aging&lt;br&gt;Significant metabolic effects in conjunction with frailty/age-associated disease&lt;br&gt;Decline in specific cytochrome P450 content&lt;br&gt;Polyphtarmacy—interactions of environmental toxicants with therapeutic compounds, herbal supplements, and diet due to shared metabolic pathways, and/or induction or inhibition of metabolic enzymes and/or transporters</td>
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<td><strong>Excretion</strong></td>
<td>Reduced renal function&lt;br&gt;Reduced blood flow&lt;br&gt;Reduced glomerular filtration&lt;br&gt;Reduced renal mono-oxygenase (MFO) activity, inducibility&lt;br&gt;Reduced biliary excretion&lt;br&gt;Reduced pulmonary excretion</td>
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MFO, mixed-function oxidase.
The Intergovernmental Panel on Climate Change (IPCC, 2007) concluded:

Human beings are exposed to climate change through changing weather patterns (for example, more intense and frequent extreme events) and indirectly through changes in water, air, food quality and quantity, ecosystems, agriculture, and economy. At this early stage the effects are small but are projected to progressively increase in all countries and regions.

Ageing Population
- diminished thermoregulation
- Diminished physiologic heat-adaption
- Live alone
- Reduced social contact
- Chronic health issues

Australian Health System in 20 years
The ageing of Australia's population, already evident in the current age structure, is expected to continue. This is the result of sustained low levels of fertility combined with increasing life expectancy at birth. The median age of Australia's population (36.8 years at 30 June 2007) is projected to increase to between 38.7 years and 40.7 years in 2026 (Series A and C respectively) and to between 41.9 years and 45.2 years in 2056 (Series A and C).

The age composition of Australia's population is projected to change considerably as a result of population ageing. By 2056 there will be a greater proportion of people aged 65 years and over than at 30 June 2007, and a lower proportion of people aged under 15 years. In 2007 people aged 65 years and over made up 13% of Australia's population. This proportion is projected to increase to between 23% and 25% in 2056 (Series B and C respectively) and to between 25% and 28% in 2101 (Series B and C). The proportion of people aged under 15 years is projected to decrease from 19% in 2007 to between 15% and 18% in 2056 (Series C and A respectively) and to between 14% and 17% in 2101 (Series C and A).

There were 344,100 people aged 85 years and over in Australia at 30 June 2007, making up 1.6% of the population. This group is projected to grow rapidly throughout the projection period, to between 4.9% and 7.3% by 2056 (Series B and A respectively), and to between 5.8% and 9.3% by 2101 (Series B and A).
In 2009, around 15% of the population in Australia was aged 65+ years.

In 2026, this will rise to around 22%.
"If we reach a figure of carbon dioxide concentrations in the atmosphere of 440 parts per million (ppm), we reach what's called "the tipping point".

After that we're into totally unknown territory. There is a step-change in the way climate change will work... now at the moment we're up to 382 ppm pushing on 383. The concentration is increasing by about 2 to 3 ppm a year, so we're going to get to that 440 relatively soon. We've got perhaps 20 years before we really do start to face potentially catastrophic consequences.

'Prof. Peter F. Smith on renewables and climate change (1 Sept, 2006)
Climate change and health

Climate Change and Health (McMichael et al 2008)

- Human actions are changing many of the world’s natural environmental systems, including the climate system. These systems are intrinsic to life processes and fundamental to human health, and their disruption and depletion make it more difficult to tackle health inequalities. Indeed, we will not achieve the UN millennium development health goals if environmental destruction continues.¹ Health professionals have a vital contributory role in preventing and reducing the health effects of global environmental change.
A complete understanding of this dimension of human health requires knowledge about the effects of global economic and climate change on: ecosystem sustainability and on human health; on the effects of pollutants within human communities; on the interaction between environment, development, and human health; and on the management of solutions to these challenges across local, regional, and global scales.
Does living in cities long term expose the ageing to increased prevalence of chronic disease?

Locality based analysis
Study overview

› WHY did we do the study?
› WHO were selected?
› HOW did we undertake study?
› WHAT did we find?
› So WHAT?
› WHERE to next?
The aim was to examine the relationship between long-term exposure to environmental stressors of ageing, urban-based Australians and incidence of non-infectious chronic diseases.
Why?

› The population of Australia is ageing
› The ageing population is more likely to live in cities
› The burden of chronic disease is increasing as the population ages
› Urban exposure to noise, air pollution and pesticides is known to increase the likelihood of specific chronic diseases
› Forms part of a sub-study of ABBA ARC Linkage grant
While Australia is double the size of Europe, three-quarters of the country is sparsely populated countryside or harsh outback, leaving the bulk of the population to inhabit a thin strip down the southeast coast. In fact, around 50 percent of the population live in the three largest cities -- Sydney, Melbourne and Brisbane -- on a combined land area that is about the size of Brunei or Trinidad & Tobago.

*Michael Perry, Reuters March 15, 2010*
Population Density in Australia, 2012
Who?

› A cohort of 1312 participants from the Household Income and Labour Dynamics in Australia (HILDA) Survey

› All were aged over 45 years and interviewed at baseline (Wave1 2001)

› Lived in the same location for at least 20 years
How?

- Arthritis
- Asthma
- Any type of cancer
- Chronic bronchitis or emphysema
- Type 2 diabetes (adult onset)

- Depression/anxiety
- Heart/coronary disease
- High blood pressure/hypertension
- Other circulatory conditions
Logistic regression was undertaken with the presence of at least one long-term health condition as the outcome variable.

Covariates were age, gender, geographic area and socio-economic status (SEIFA).
What?

- increasing age
- being male
- living in a major city or inner urban area, and
- living in an area with a lower socio-economic status
Findings from our research

› Our study of ageing Australians reinforces the association between long-term exposure to environmental stressors such as air pollution and noise in large cities and developing long-term health conditions.

› The analysis at baseline demonstrated that older urban and city dwellers were more likely to have one or more long-term health conditions.
The paucity of literature into the effects of environmental exposure on the life-course of an individual highlights the difficulties associated with the conduct of this type of research. As an urban dwelling population ages and environmental exposures increase there is the likelihood that the burden of disease will increase as a result of the combination of these factors.
Findings from our research (ABBA ARC Linkage Grant)

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