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Supplementary appendix

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APPENDIX

Report contributors

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A core group responsible for developing the conceptual framework and writing the report included Islene Araujo de Carvalho, John Beard, Somnath Chatterji, JoAnne Epping Jordan, Alison Harvey, Norah Keating, Aki Kuroda, Wahyu Retno Mahanani, Jean-Pierre Michel, Alana Officer, Anne Margriet Pot, Ritu Sadana, Jotheeswaran Amuthavalli Thiyagarajan and Lisa Warth. Chapter development was led by John Beard and Ritu Sadana (Chapter 1), John Beard and Jean-Pierre Michel (Chapter 2), John Beard and Somnath Chatterji (Chapter 3), Islene Araujo de Carvalho and JoAnne Epping Jordan (Chapter 4), Anne Margriet Pot and Peter Lloyd-Sherlock (Chapter 5) and Alana Officer and John Beard (Chapter 6).

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Additional contributors

Sharon Anderson, Yumiko Arai, Alanna Armitage, Marie-Charlotte Bouesseau, Francesco Branca, Mathias Braubach, David Burnes, Esteban Calvo, James Campbell, Matteo Cesari, Shelly Chadha, Hannie Comijs, Catherine d'Arcangues, Adrian Davis, Jens Deerberg, Joan Dzenowagis, Robert Enderbeek, Laura Ferguson, Ruth Finkelstein, Kelly Fitzgerald, Pascale Fritsch, Loic Garçon, Francisco Javier Gomez Batiste-Alentorn, Mike Hodin, Manfred Huber, Elif Islek, Josephine Jackisch, Matthew Jowett, Rania Kawar, Ed Kelley, Silvio Mariotti, Mike Martin, Hernan Montenegro, John Morris, Wendy Moyle, Karl Pillemer, Alex Ross, Martin Smalbrugge, Nuria Toro Polanco, Bill Reichman, Kelly Tremblay, Bruno Vellas, Armin Von Gunten, Robert Wallace, Huali Wang, Martin Webber.

Peer reviewers

Isabella Aboderin, Maysoon Al-Amoud, George Alleyne, Yumiko Arai, Alanna Armitage, Said Arnaout, Senarath Attanayake, Julie Byles, Matteo Cesari, Heung Cha, Shelly Chadha, Sung Choi, Alexandre Cote, June Crown, Joan Dzenowagis, Robert Eendebak, Ruth Finkelstein, Loic Garçon, Emmanuel Gonzalez-Bautista, Gustavo Gonzalez-Canali, Sally Greengross, Luis Miguel Gutierrez Robledo, Anna Howe, Manfred Huber, Alexandre Kalache, Rania Kawar, Rajat Khosla, Michael Kidd, Hyo Jeong Kim, Tom Kirkwood, Hans-Horst Konkolewsky, Nabil Kronfol, Ritchard Ledgerd, Bengt Lindstom, Stephen Lungaro-Mifsud, John McCallum, Roar Maagaard, Melissa Medich, Verena Menec, Juan Mezzich, Tim Muir, Leendert Nederveen, Triphonie Nkurunziza, S.Jay Olshansky, Desmond O'Neill, Paul Ong, Du Peng, Silvia Perel-Levin, Poul Erik Petersen, Toby Porter, Vinayak Mohan Prasad, Thomas Prohaska, Parminder Raina, Glenn Rees, William Reichman, Andreas Alois Reis, Nathalie Roebbel, Perminder Sachdev, Xenia Scheil-Adlung, Dorothea Schmidt, Shoji Shinkai, Alan Sinclair, Martin Smalbrugge, Mike Splaine, Victor Tabbush, Virpi Timonen, Andreas Ullrich, Enrique Vega, Adriana Velazquez Berumen, Armin von Gunten, Huali Wang, Ruth Warick, Jennifer Wenborn, Anthony Woolf, Tom Wright, Tuohong Zhang.

Box authors

John Beard and Laura Ferguson (1.1); Michael Marmot (1.2); Paul Nash (1.3); David Phillips (1.4); Ursula Staudinger (3.1); Tarun Dua and Shekhar Saxena (3.2, 3.3); Hiroshi Ogawa and Poul Erik Petersen (3.4); Ebtisam Alhuwaidi (4.1); Islene Araujo de Carvalho (4.2); Kiran Iyer, Nandita Kshetrimayum and Ganesh Shenoy Panchmal (4.3); Islene Araujo de Carvalho (4.4, 4.5); Silvia Costa,

Alexandre Kalache, and Ina Voelcker (4.6); Islene Araujo de Carvalho (4.7); Islene Araujo de Carvalho, Luc Besançon and Alison Roberts (4.8); Eduardo Augusto Duque Bezerra (4.9); ; Loic Garçon (5.1); Amit Dias (5.2); Anne Margriet Pot (5.3); John Beard (5.4); Anne Margriet Pot (5.5); Dawn Brooker (5.6); Hussain Jafri and Theresa Lee (5.7); Marie-Charlotte Bouesseau, Xavier Gomez and Nuria Toro (5.8); Elif Islek (5.9); Fred Lafeber (5.10); Anne Margriet Pot (5.11); Jim Pearson (5.12); Lindsey Goldman and Lisa Warth (6.1); Laura Fergusen (6.2); HelpAge International (6.3); Lindy Clemson, Monica R Perracini, Vicky Scott, Catherine Sherrington, Anne Tiedemann and Sebastiana Zimba Kalula (6.4); Frances Heywood (6.5); Bobby Grewal (6.6); Jannis Pahler vor der Holte (6.7); David Hutton (6.8); Alana Officer (6.9); Thuy Bich Tran and Quyen Ngoc Tran (6.10); Adrian Bauman, David Buchner, Fiona Bull, Maria Fiatarone Singh, Alison Harvey and Dafna Merom (6.11); Jaclyn Kelly, Anne Berit Rafoss and Lisa Warth (6.12); Senarath Attanayake (6.13); Alana Officer and Lisa Warth (6.14); Lisa Warth (6.15); Jaclyn Kelly and Lisa Warth (6.16); Alana Officer and Lisa Warth (6.17); Stéphane Birchmeier (6.18); Islene Araujo de Carvalho and JoAnne Epping Jordan (7.1); Mitch Besser and Sarah Rohde (7.2); Jaclyn Kelly and Lisa Warth (7.3); Suzanne Garon (7.4); Tine Buffel (7.5).

Authors of background papers

- *Age-associated skin conditions and diseases*: *current perspectives and future options*. Ulrike Blume-Peytavi, Jan Kottner, Wolfram Sterry, Michael W Hodin, Tamara W Griffiths, Rachel EB Watson, Roderick J Hay, Christopher EM Griffiths.
- *Ageing and hearing health*. Adrian Davis, Catherine McMahon, Kathleen Pichora-Fuller, Shirley Russ, Frank Lin, Bolajoko Olusanya, Shelly Chadha, Kelly Tremblay.
- *Ageing, work, and health*. Ursula Staudinger, Ruth Finkelstein, Esteban Calvo, Kavita Sivaramakrishnan.
- *Developmental aspects of a life course approach to healthy ageing*. Mark Hanson, Cyrus Cooper, Avan Aihie-Sayer, John Beard.
- *Elder abuse*. Karl Pillemer, David Burnes, Catherine Riffin Mark S Lachs.
- *Ethics and older people*. Julian C Hughes.
- *Falls in older adults*: *current evidence gaps and priority challenges*. Monica Perracini, Lindy Clemson, Anne Tiedemann, Sebastiana Zimba Kalula, Vicky Scott, Catherine Sherrington.
- *Frailty: an emerging public health priority*. Matteo Cesari, Martin Prince, Roberto Bernabei, Piu Chan, Luis Miguel Gutierrez-Robledo, Jean-Pierre Michel, John E Morley, Paul Ong, Leocadio Rodriguez Manas, Alan Sinclair, Chang Won Won, Bruno Vellas.

- *Gender and ageing*. Julie Byles, Cate D'Este, Paul Kowal, Cassie Curryer, Louise Thomas, Adam Yates, Britta Baer, Anjana Bhushan, Joanna Vogel, Lilia Jara.
- *Genetic influences on functional capacities in ageing*. Andrea D Foebel, Nancy L Pedersen.
- *Healthy ageing: raising awareness of inequalities, determinants, and what could be done to improve health equity*. Ritu Sadana, Erik Blas, Suman Budhwani, Theadora Koller, Guillermo Paraje.
- *Investing in health to create a third demographic dividend*. Linda P Fried.
- *Medical and assistive health technologies*: *meeting the needs of ageing populations in low- and middle-income countrie*s. Chapal Khasnabis, Loic Garçon, Lloyd Walker, Yukiko Nakatani, Jostacio Lapitan, Alex Ross, Adriana Velazquez Berumen, Johan Borg.
- *Musculoskeletal (MSK) health and the impact of MSK disorders in the elderly*. Anthony Woolf, Lyn March, Alana Officer, Marita J Cross, Andrew M Briggs, Damian Hoy, Lidia Sanchez Riera, Fiona Blyth.
- *Older people as a resource for their own health*. Paul Ong.
- *Older people in humanitarian contexts: the impact of disaster on older people and the means of addressing their needs.* Hyo-Jeong Kim, Pascale Fritsch.
- *Physical activity in older adults*. Adrian Bauman, Maria Fiatarone Singh, David Buchner, Dafna Merom, Fiona Bull.
- *The right to health of older people.* Britta Baer, Anjana Bhushan, Hala Abou Taleb, Javier Vasquez, Rebekah Thomas.
- *What does rehabilitation offer to an ageing population?* Alarcos Cieza Moreno, Marta Imamura.

Conflicts of interest

None of the experts involved in the development of the report declared any conflicts of interest.

Statistical Annex

Figure 1. Death by age and region 2012

Data on mortality patterns across the life course are presented drawn from Global Health Estimates 2013: Deaths by Cause, Age, Sex and Regional Grouping, 2000-2012. Estimates shown are for 2012. The method and data sources for the estimation are described elsewhere (1).

Mortality rates in 5-year age intervals up to 85+ were extracted. The total number of deaths in each 5-year age category was calculated for countries classified by the World Bank analytical income classification of economies which was based on the 2012 Atlas gross national income per capita estimates. Countries in the high income grouping were further categorised by OECD membership or non membership, as the epidemiology in each of these settings is quite distinct.

We grouped deaths into the following eight broad cause categories: injuries, cardiovascular diseases, chronic respiratory diseases, cancers, diabetes mellitus, other noncommunicable diseases, maternal causes and communicable diseases,.

Figure 2. Years of Life Lost per 100,000 population. Top 10 causes in people aged 60 years or older.

Years of life lost (YLL) is a measure of premature mortality that takes into account both the frequency of deaths and the age at which it occurs. YLL are calculated from the number of deaths at each age multiplied by a global standard life expectancy for the age at which death occurs. Estimates are presented for 2012. . Underlying causes of death were classified using the ICD-10 International Classification of Diseases; there were 114 single causes that were used to analyse leading causes of death.. The method and data sources for the estimation are described elsewhere (2).

Figure 3. Range and mean intrinsic capacity of men and women in countries in the Study on global AGEing and adult health (SAGE) 2007–2010 (wave 1).

Analysis considered participants in wave one of the six country Study on global AGEing and adult health.[3] The summary score of the state of each individual's health was based on 16 self-reported questions assessing the individual's impairments in bodily and mental functions, that were grouped into eight health domains, namely, vision, mobility, self-care, cognition, interpersonal activities, pain and discomfort, sleep and energy, and affect[4]. For each question, the responses were recorded on a 5-point scale ranging from no difficulty to extreme difficulty. Additionally, physical measures including grip strength, gait speed, and cognitive function (verbal fluency, immediate and delayed

recall) were used. A global score in health from these health-related measures was obtained using a factor analysis approach[5]. The score was converted to a 0 to 100 health score, where 0 represents the worst health and 100 represents the best health. Analysis was carried out using STATA 13.

Figure 4. Physical capacity across the life course, stratified by ability to manage on current income
Data were from the Australian Longitudinal Study on Women's Health, a large population-based study of factors affecting the health and well-being in three generations of women. The sample was largely representative of the wider Australian female population in these age groups and used data from the young (born in 1973-78), mid-age (1946-51), and older (1921-26) cohorts.[6] The first survey in 1996 included 14,247, 13,715, and 12,432 women, respectively. Between 1996 and 2012, five follow-up surveys have been completed at approximate 3 year intervals on a rolling basis. The analyses used data from all participants who provided any data at any time point.

Outcome - Physical functioning. Physical functioning was measured with the Medical Outcomes Survey 36-item Short-Form health survey (SF-36). The score ranges from 0 to 100 with higher scores indicating better physical functioning.

Independent variable - managing on income. Managing on income was assessed by asking: "How do you manage on the income you have available?" Response options were collapsed into 'impossible to manage', 'always difficult', 'sometimes difficult', 'not too bad' and 'easy'.

Statistical analysis
Characteristics were summarized for the three cohorts separately. To depict the associations of baseline managing on income with the temporal course of physical function, spline regression was used assuming linear associations between knots. The same knots were used based on a structured selection procedure whereby knots were placed at 3-year intervals and systematically removed if no statistically significant difference in slope was found before and after the knot. Separate lines were fitted for each level of managing on income.

References

1. WHO methods and data sources for country-level causes of death 2000-2012. Department of Health Statistics and Information Systems WHO, Geneva. 2014. Global Health Estimates Technical Paper WHO/HIS/HSI/GHE/2014.7. http://www.who.int/healthinfo/global_burden_disease/GlobalCOD_method_2000_2012.pdf?ua=1

2. WHO methods and data sources for global burden of disease estimates 2000-2011. Department of Health Statistics and Information Systems WHO, Geneva. 2013. Global Health Estimates Technical Paper WHO/HIS/HSI/GHE/2013.4. http://www.who.int/healthinfo/statistics/GlobalDALYmethods_2000_2011.pdf?ua=1
3. Kowal P, Chatterji S, Naidoo N, et al. Data resource profile: the World Health Organization Study on global AGEing and adult health (SAGE). *IntJEpidemiol* 2012; **41**(6): 1639-49.
4. Salomon JA, Mathers CD, Chatterji S, Sadana R, Üstün TB, Murray CJL. Quantifying individual levels of health: definitions, concepts, and measurement levels. In: Murray CJL, Evans DB, eds. Health systems performance assessment: Debates, methods, empiricism. Geneva: World Health Organization; 2003:301-18.
5. Bartholomew D, Knott M and Moustaki I. Latent Variable Models and Factor Analysis: A Unified Approach, Third Edition. John Wiley and Sons. 2011
6. Lee C, Dobson AJ, Brown WJ, et al. Cohort Profile: the Australian Longitudinal Study on Women's Health. *International Journal of Epidemiology* 2005; **34**(5): 987-91.