Swiss Re
Centre for Global Dialogue

The future of human longevity: cardiovascular health, longer lives

Conference report

In collaboration with

HARVARD
SCHOOL OF PUBLIC HEALTH

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Author: Julie Corliss

Photography: David Ausserhofer

global_dialogue@swissre.com

www.swissre.com/cgd

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Introduction

Our society is becoming older. Falls in birth and death rates, well established in developed economies, have spread through most of the world. This ageing of the population presents challenges and opportunities: the funding of more elderly living longer in their retirement; and meeting the increase in health costs associated with old age.

The re/insurance industry is a key player in this global debate. As a knowledge-based industry, the more information re/insurers have, the more accurately we can price existing risk pools and the better placed we are to offer new innovative products for our ageing communities. It was in this spirit that Swiss Re hosted 'The future of human longevity: cardiovascular health, longer lives' at the Swiss Re Centre for Global Dialogue on 10–12 November 2013.

The first day of the conference was dedicated to healthy ageing. Research has clearly demonstrated strong correlations between lifestyle, preventative measures and good health in old age. Healthy ageing not only prolongs life, it reduces health care costs and improves well-being. The re/insurance industry has great interest not only in the science of ageing, but the behavioural changes that may extend life.

The second day of the conference focused on health risk factors, with particular attention paid to cardiovascular disease in the emerging economies of India and China. This complemented research that had been presented in Boston in October 2013 on Brazil and Mexico as part of a joint collaboration between Swiss Re and the Harvard School of Public Health (HSPH) entitled SEARCH, the Systematic Explanatory Analyses of Risk Factors affecting Cardiovascular Health.

These rapidly emerging economies are shifting from a preponderance of communicable diseases to a greater incidence of chronic diseases such as diabetes and heart disease. Understanding the nature of this shift and particular national characteristics is of importance for both public health authorities and rapidly growing insurance markets.

The final day of the conference explored how the previous themes of the conference can enhance our understanding and predictions of future trends in mortality and longevity. Different models explored the impact of shock events such as infectious disease pandemics, the benefits of improvements in diagnosis and treatment, and the extent to which we are seeing divergence of health outcomes in our populations.

Living longer is a great human achievement. Societies are rapidly ageing around the world. Individuals are increasingly being expected to take responsibility for their future. This conference highlighted the value of insurance in uncertain times as we look forward to the dividends that should follow from widespread adoption of healthier behaviours.

Daniel Ryan
Head Life & Health Research & Development
Swiss Re

Preventive medicine: Balancing benefits and harms

Milo Puhan, Director, Institute of Social and Preventive Medicine, University of Zurich

Evidence underlying drug approval, clinical practice, and public health guidelines is often equivocal or often involves modest effects, said Milo Puhan. But sophisticated "evidence contextualisation" can help define when the benefits of these interventions will outweigh the risks. In particular, it can indicate whether a population strategy or a high-risk prevention strategy is more appropriate. Population strategies, such as limiting salt intake, have potentially massive positive impact but often come with a downside. A high-risk prevention strategy, such as primary prevention for cardiovascular disease, maximises benefits and limits harms to the individuals who might benefit.

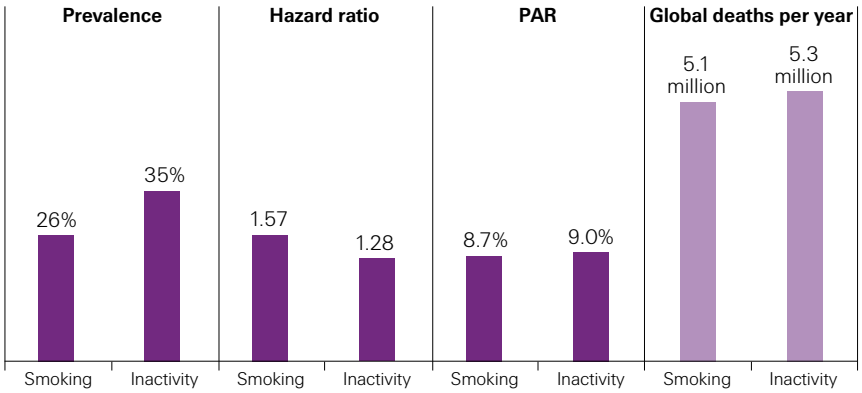


Figure 1:
Physical inactivity has enormous public health impact

Source: The Lancet 2012, volume 380, issue 9838, pages 192–193

Puhan used the example of low-dose aspirin for myocardial infarction (MI) prevention to illustrate the power of evidence contextualisation. The Gail Index method puts all outcome estimates on a single scale and expresses the result as a single number (positive = beneficial). Outcomes can be weighted and each modeled for different constellations of its risk factors. Modeling these clearly demonstrates how the treatment benefits (preventing heart attack or stroke) and harms (gastrointestinal bleeding) change for different populations. This provides "a more rational and transparent approach" than if a single risk estimate and preference for each outcome is assumed, said Puhan.

While a severe GI bleed may be much preferred by patients over the prospects of a severe stroke, the prognosis following is not that different. Bleeding risk is determined by age and NSAID usage. Modeling the Gail Index for uncertainties in prevention and risk estimates demonstrates that aspirin will benefit only a small percentage of those taking it. For all others, it will be harmful.

Instead of jumping directly from trials evidence and meta-analysis to public health recommendations, we need an additional step after evidence synthesis so as to come up with a risk-stratified analysis, Puhan asserted. "I think it is also very important to talk about preference-sensitive analysis because different people have different ideas whether it is worth it to them, in order to find whether we should come up with a population strategy or high-risk strategy," he said.

More accurate, rigorously tested, risk-prediction models are needed to allow public health to be truly evidence-based. Such models will allow better definition of the populations at risk that will benefit from interventions while minimising harms, including cost. For example, trial results of low dose CT screening suggested 12 000 lung cancer deaths per year in the United States could be prevented. While 14 lung cancer cases among 1 000 smokers were identified, 391 had screened positive, requiring potentially costly and harmful follow-up.

The failure of the Framingham Risk Score to correctly predict CVD incidence in different populations highlights the need for strengthening existing models. More detailed data on harms should replace assumptions, and additional data (such as biomarker information) should be incorporated, Puhan concluded.

Healthy life expectancy

Jean-Marie Robine, French National Institute of Health and Medical Research

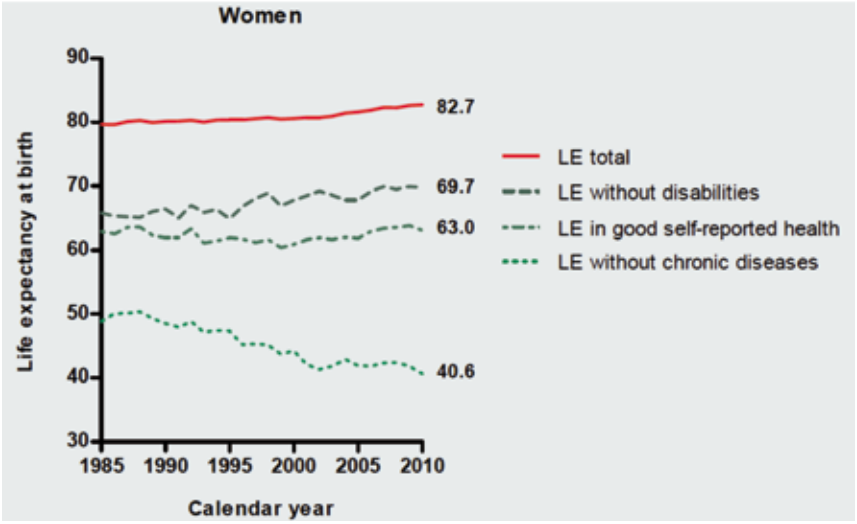
In the mid-1970s, life expectancy (LE) at age 65 in Western countries and Japan converged but then diverged in the individual countries during the ensuing 20 years, said Jean-Marie Robine. Since the mid-1990's, LE at 65 has risen in parallel in all these countries, conserving the differences that had developed. Currently, the international trend is an increase in LE at birth of 3 months per year, and LE at 65 of 2.5 months per year.

The numbers of "oldest old" have increased dramatically, creating a veritable "longevity revolution." Age-at-death distribution curves for French females highlight this trend. In mortality condition of 1907, less than 2% of French women reached age 90, while in 2007, almost 40% did, said Robine. In Europe and Japan respectively, every 10 years, the number of (overwhelmingly female) centenarians is doubling, and increasing 3 to 4 fold.

Consequently, LE is no longer enough to monitor the health status and longevity of our population, said Robine. "A better and more important question to ask is not how long are we living, but how long are we living in good health," he said.

To this end, measures to monitor the dynamic interplay between survival, morbidity and disability were developed. In its simplest form, LE comprises Healthy Life Years (HLY) and Unhealthy Life Years (ULY). Unhealthy years can be further subdivided to consider chronic morbidity and activity limitation. A 25-year series of an annual health survey in the Netherlands showed that self-reported good health persisted for decades in the presence of chronic morbidity (which, predictably, increased due to medical advances).

Figure 2:
Life expectancy at birth for women in the Netherlands, 1985–2010



Source: Engelaer et al, Robine et al, 2013

Since 2004, a mini-health survey of just 3 items (self-perceived health status, presence of chronic conditions, and extent of limitations due to health) has been included in the European Union Statistics on Income and Living Conditions. In particular, "LE without Activity Limitation" (popularly known as Healthy Life Years) was selected as one of the European Core Health Indicators, and as a structural indicator for the Lisbon Strategy (2000–2010) to assess at frequent intervals the European Union population quality of life and functional health status. A target of 2 more HLY by 2020 has been set.

A survey of more than 400 000 Europeans revealed a strict linear relationship between activity limitation and age. From 2005 to 2010, LE at 65 rose slightly and was 2.5 years higher for females. But "LE without Activity Limitation" was flat at about 8.5 years for both sexes. Thus the reported significant increases in perceived good health from both men and women were unexpected.

To enable direct comparison with the European data, Japan recently adopted Global Activity Limitation Indicators (GALI) and conducted a special survey. This showed that the remarkable Japanese longevity (almost matched by the French) includes significantly more disability-free years than are enjoyed by the French.

Workshop summaries

Muscle atrophy in the elderly: What are the mechanisms and are there ways to treat it?

Markus A. Rüegg, Professor of Neurobiology, Biozentrum, University of Basel

Markus Rüegg discussed the ageing of the muscular system and strategies to prevent sarcopenia, the loss of muscle mass in older adults. Sarcopenia can be offset by exercise. Strength training promotes protein synthesis, causing hypertrophy of muscle, and endurance training increases blood flow and oxidative metabolism. Rüegg described several metabolic pathways in muscle cells that could potentially be altered by pharmacologic interventions, thereby slowing sarcopenia in older people.

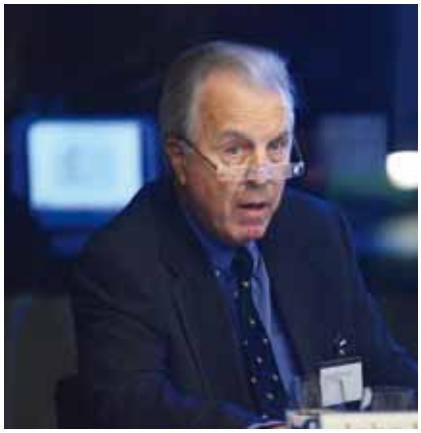
Endurance training triggers the expression of a transcription co-activator called PGC-1α, which acts on numerous cellular targets to improve oxidative capacity. In animal studies, enhanced expression of PGC-1α leads to increased numbers of mitochondria and blood vessels, longer life span, and less sarcopenia with age.

Rüegg also discussed the role of the mammalian target of rapamycin (mTOR) and its role in protein synthesis and muscle mass. mTOR regulates many aspects of cellular metabolism and is important during growth and development. However, its continued function in older animals is thought to contribute to the ageing process. Rapamycin, an inhibitor of mTOR, increases life span and slows the loss of locomotor function in many species.

Finally, Rüegg discussed activin receptor type-2B (ACTRIIB), another component of the muscle metabolic pathway. Antibodies that inhibit its function have been shown to reduce muscle wasting in patients with sporadic inclusion body myositis. These could potentially be exploited to prevent normal age-related sarcopenia.

In conclusion, Rüegg acknowledged the challenges involved in altering these pathways. Sarcopenia is a complex process and targeting any one pathway is not likely to completely halt its progression. Also, since these molecular pathways are involved in processes outside the muscular system, altering them might lead to unanticipated side effects. However, studying these mechanisms is useful for furthering our understanding of sarcopenia and of how exercise helps delay its progression.

Remote health status monitoring devices for clinical application



John Winistoerfer, Founder and CEO, Medical Network EMN AG

Quoting Dr. James Fries from a New England Journal of Medicine article published in 1980, John Winistoerfer said, "Chronic illness may presumably be postponed by changes in life style, and it has been shown that the physiological and psychologic markers of ageing may be modified. Thus, the average age at first infirmity can be raised, thereby making the morbidity curve more rectangular."

At that time, most demographers and heath policy experts felt that medical progress would increasingly prolong life but would result in extra years spent in poor health, leading to a pandemic of frail people, said Winistoerfer.

However, he noted that more than 75% of chronic diseases could be stabilised by behavior and lifestyle changes. He then described SENECA (for SENior Health ACAdemy), an online program to help people manage chronic risks, prevent or stabilise disease, and sustain their quality of life.

The program (currently in a beta version) focuses on five body systems: cardiovascular (hypertension, heart failure, and stroke), metabolic (diabetes), respiratory (sleep apnea and chronic obstructive pulmonary disease), skeletal (osteoporosis) and mental (stress and depression). Target groups include people at risk for these conditions, those who already have the conditions, and caregivers of people with the conditions.

Users can perform a free, anonymous online risk assessment that will indicate their possible risks. The initial user investment for the program is 650 euros, plus a monthly fee of 28 euros. This covers basic monitoring devices to record your weight, fat percentage, activity, blood pressure, blood sugar, oxygen saturation and lung function, all of which are configured to wirelessly transmit data to a computer to create your online health profile.

Users also receive tailored training modules about medication adherence, activity recommendations that feature strength, stretching, and circulation (aerobic) training, as well as recipes for 50 different meals designed to provide balanced nutrition to support chronic health conditions.

Insurance innovation to promote healthy ageing

Oliver Werneyer, Data & Distribution Leader, Swiss Re

This interactive workshop explored how innovations and trends will affect the insurance industry. The insurance industry desperately needs to catch up with other industries in terms of technology, communication, connections, data, and purpose, said Oliver Werneyer.

Insurance policies are still a perceived solution to a problem recognised in a particular moment, often in the past. Although many insurance policies are classified as "long term," all processes around it are not so. Developments and innovations can help the insurance industry foster a new and trusted relationship with policyholders. Sharing information is not about penalising people but about helping them to age better and to realise that a life insurance policy is essential, said Werneyer.

Promising approaches include: 1) underwriting in perpetuity, which means keeping engagement up and asking questions regularly rather than all upfront; 2) the integration of wearable devices into products and processes; 3) empowering the customer; and 4) insurance in social media, according to Werneyer.

Changes to the message are important because the customer base is changing. Healthy ageing strategies are always the best option, but insurance is still a good idea, even if you are healthy. Insurers and policyholders need to establish a reciprocal relationship, as this would lead to more engaged customers and offer something that healthy people can value.

Can behavioural economic informed interventions contribute to healthy ageing?

Alison McLean, Head of Behavioural Research, Swiss Re

Alison McLean began by reinforcing the message from the plenary sessions about the importance of identifying strategies to promote healthy ageing. She referred to research by the UK Pension Policy Institute, which indicated that up to 60% of people will need to work up to 11 years past state retirement age to have sufficient income to maintain their working age lifestyle in retirement. She posed the question: Will people be able to work in these older ages?

According to the Global Burden of Disease study 2010, many of the risk factors contributing to disability are lifestyle factors such as smoking and high blood pressure. McLean suggested that it will be important to identify effective interventions to address these lifestyle factors if we want to promote healthy ageing.

Traditionally, many lifestyle prevention policies have focused on providing people with information in an attempt to motivate them to change their behaviour. More recently, the effectiveness of these interventions has been questioned and behavioural economic informed interventions have been proposed an alternative or complementary approach. McLean stated that these interventions involve changing people's environment to make it easy for people to make healthy choices.

McLean described a study she is conducting to evaluate the effectiveness of these interventions at improving health-related behaviours. She highlighted the challenges of designing studies in this area. Audience members discussed this topic as well as potential negative consequences of using behavioural economic informed interventions, such as unintended consequences or the halo effect. The results of McLean's research will be available in late 2014.

Health risk factors

Life & health insurance innovation in high-growth economies

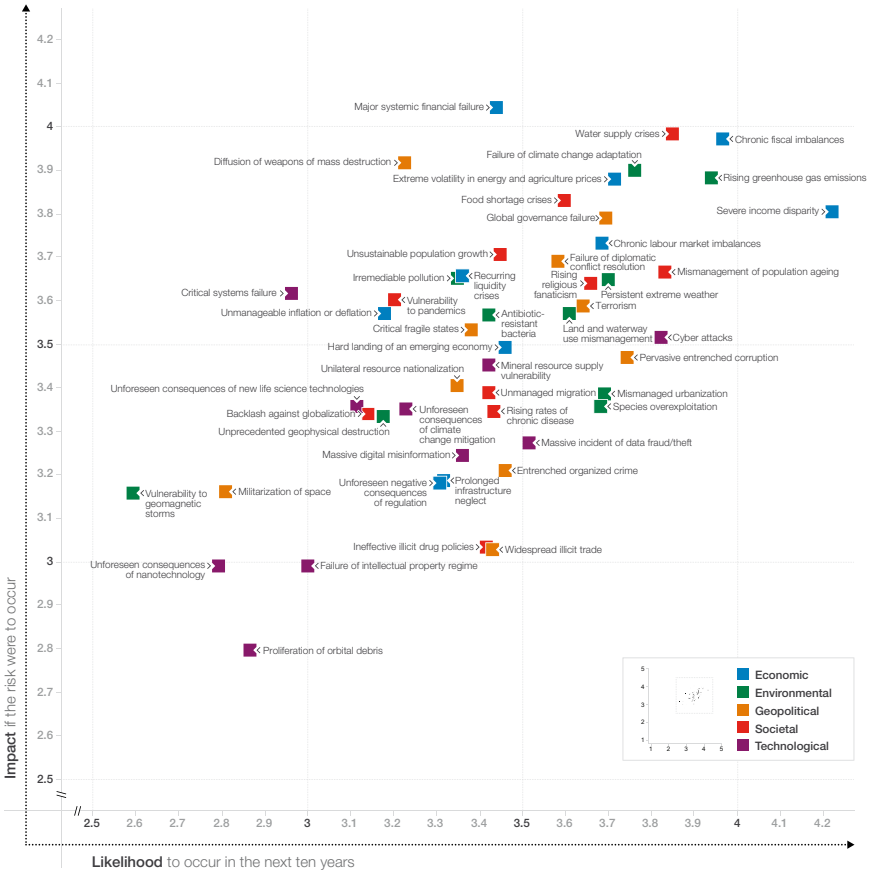
Christian Mumenthaler, CEO Reinsurance, Swiss Re

To explain Swiss Re's purpose and focus, Christian Mumenthaler began with a brief history. In 1861, the Swiss city of Glarus burned to the ground, causing damage totaling 10 million Swiss francs. But the local fire insurance company had reserves of only 500 000 Swiss francs.

The realisation that insurance cannot work for big catastrophes spurred the idea of insurance for insurers, said Mumenthaler. Under this new concept, called reinsurance, many insurance companies pay into a "super fund" that can pay out a large claim in the event of a catastrophe.

Founded in 1863, Swiss Re started small but soon grew into a global company to better diversify its risk. Today, the company has 60 offices in countries throughout the world, employs 10 000 people, and has $220 million in assets.

Figure 3:
Global Risks Landscape 2013 according to the World Economic Forum



Source: World Economic Forum, Global Risks Report 2013

As part of the World Economic Forum, Swiss Re works with academic and other institutions to map key risks in the world. The two major impacts are loss of life and loss of gross domestic product. People may take out policies worth up to $1 million, $10 million, or even $100 million. "We need to assess their risk and ask, 'What's the likelihood of that person dying?' to choose the right premium," said Mumenthaler. To that end, Swiss Re has created an online database known as the Life Guide that determines survival based on different health conditions.

Information in the Life Guide information must be evidence-based, as regulators wouldn't allow a company to charge a higher premium for someone with diabetes, for example, if there wasn't any proof that the condition led to a higher mortality rate. As of June 2013, the Life Guide had almost 10 000 users in 97 countries, is available in 10 languages, and includes more than 700 distinct medical conditions.

Mumenthaler then described two of Swiss Re's innovative projects in India and China. In 2008, the Indian government began a program to give hospital access to people with incomes below the poverty line. As a partner, Swiss Re is providing risk management and supporting clients with pricing and claims control. To date, almost 35 million families (about half of those who qualify) are covered and more than 11 000 hospitals are empanelled.

In China, many very expensive cancer therapies are not covered by insurance. Swiss Re partnered with Swiss drug maker Roche to enable coverage for the costly treatments through local companies in China, acting as their lead reinsurance partner.

In closing, Mumenthaler expressed his enthusiasm for the Swiss Re-HSPH partnership, noting that the two institutions' interests are "perfectly aligned." "Having more information about specific risks, particularly with regard to cardiovascular disease in these countries, is extremely important to us," he said.

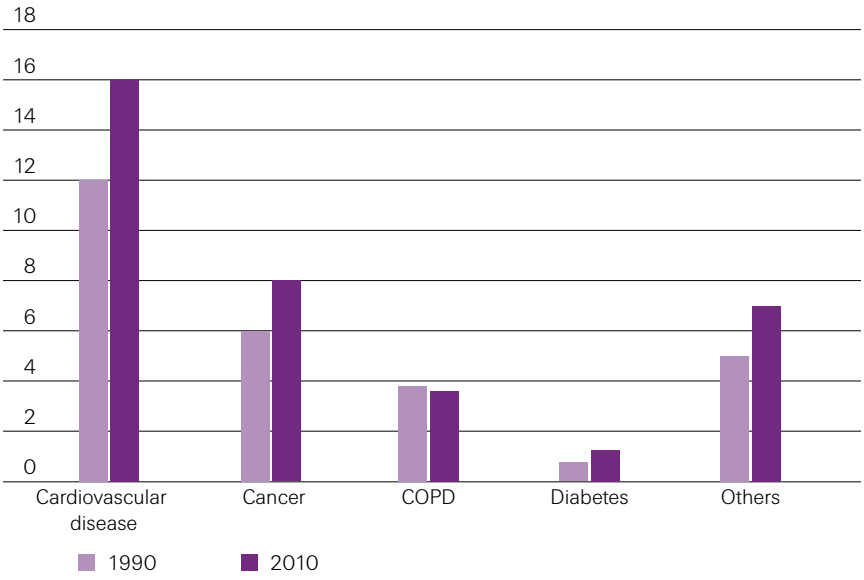
Our strategy: Focus on cardiovascular health in India and China

Joseph Brain, Cecil K. and Philip Drinker Professor of Environmental Physiology, Harvard School of Public Health

"Our planet is changing in profound ways. Infectious diseases are decreasing. Smallpox has been eradicated, and polio may be next," said Joe Brain. The impact of these changes is evident in the improved survival of newborns and children in almost all countries. The resulting effect on demographic profiles has, in turn, given rise to a new emphasis on ageing and longevity, he added.

As infectious disease rates have dropped, the importance of noncommunicable diseases (NCDs) – namely, heart disease, stroke, cancer, and diabetes – has risen. As the leading cause of death worldwide, heart disease is the initial focus of SEARCH, the Swiss Re-HSPH collaboration. The two countries we emphasise in this confe-rence, India and China, have rapidly developing economies and represent emerging markets for insurance products. Moreover, risk factors for morbidity and premature death in these countries are changing rapidly.

Figure 4:
Global deaths due to noncommunicable diseases in 1990 and 2010



Source: Hunter and Reddy 2013

What accounts for the dramatic increases in life expectancy over the past century? A primary driver is a decrease in infant morality, said Brain, noting the enormous discrepancies in infant mortality in time and space. China's rate of 12.1 per 1 000 live births is approximately double that of the United States, while the rate in India is still higher (43.9).

If we look at population profiles for China, India, and Switzerland, we project increases in the percentage of elderly people over the next decades. By dividing the estimated number of people between the ages of 20 and 65 (earners) by the number of people age 65 and older (retirees) for each country, we see large differences for 1990. For India, the ratio is 12.5, compared with 9.4 in China and 4.3 in Switzerland. But in 2050, the ratio of earners to retirees will drop in all three countries, and the estimated ratios in China (2.4) and Switzerland (2.3) will be similar, said Brain.

Why are we living longer? Environmental factors that affect healthy lifespan include tobacco use, unhealthy diet, physical inactivity, excessive use of alcohol, hypertension, indoor and outdoor air pollution, health systems, as well as poverty, stress, and prejudice concluded Brain. In brief, "Genetics cocks the gun, but environment pulls the trigger."

We need to expand health promotion on a population-wide basis – by encouraging people to use mass transit, to walk more, and to include healthy physical activity and diets in schools, said Brain. Such efforts are particularly important in India and China. If those countries focus instead on adopting expensive, even unnecessary, diagnosis and treatments for NCDs, that might frustrate efforts to offer basic health care for all the country's citizens, he emphasised.

Global burden of disease: From new estimates to better data

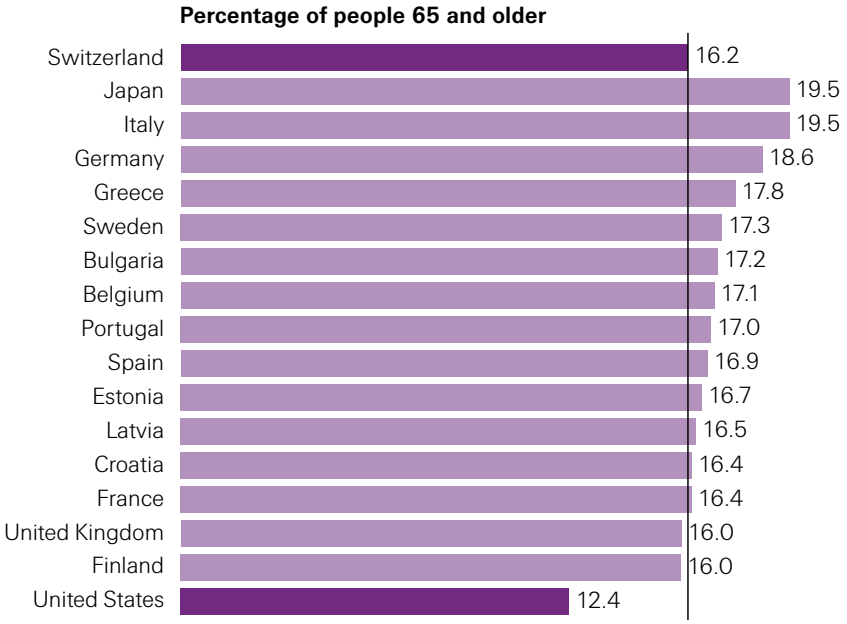
Thomas Zeltner, Special Envoy on Financing, World Health Organization

To better understand the global burden of disease in the future, we need to address three key challenges, said Thomas Zeltner. These challenges are grounded in the following assertions:

- What's measured, improves
- Healthy ageing starts at twenty
- All men are equal by nature and before the law

Life expectancy and the leading causes of death vary widely between different countries, Zeltner noted. In Switzerland, noncommunicable diseases (NCDs) account for 90% of all deaths, with cardiovascular disease accounting for most (38%), and cancer for 27%. The figures for China are strikingly similar. But in India, NCDs account for just over 53% of all deaths, and infectious diseases are still a major threat.

Figure 5:
The world's 15 "oldest" countries (2006)



Source: Carl Haub, 2006 World Population Data Sheet

Zeltner displayed the top five causes of global disability adjusted life years (DALYs) in 1990 and 2010, and asked the audience to predict the top five in 2030. Attendees predicted cancer, ischemic heart disease, mental health disorders, diabetes, and stroke.

He then asked the group to guess the top health risks in 2030; they predicted inactivity and high body mass index as the leading independent risk factors, following by high blood pressure. Smoking, alcohol, and high salt intake ranked far below.

In many countries, one-third or more of elderly people have four of more chronic illnesses, and many include a mental health condition. "We haven't figured out how to measure the multiplicity of diseases and the interconnectedness of these conditions," said Zeltner.

Over the past century, the typical life course of the average person has changed dramatically. Instead of spending the bulk of our lives working (preceded by a brief period of education and followed by a brief retirement), people may now spend longer periods of time learning, and their work lives (especially for women) may be interrupted by periods of caring for children or elderly relatives. Because we're living so much longer, the retirement period is far longer than in the past, Zeltner noted.

Because societies probably will not be able to use institutional care for the elderly, we need new models whereby families take more responsibility. Employers and companies need to adopt models that allow their employees both to keep learning and take time for caregiving, Zeltner stressed.

In discussing the topic of inequality in quality of life, Zeltner cited the WHO's constitution, which includes the phrase: "Unequal development in different countries in the promotion of health and control of disease, especially communicable disease, is a common danger." Failure to address this problem, he stressed, will lead to ever-higher numbers of young people in less developed countries emigrating to developed countries.

Metabolic syndrome and obesity epidemiology in the Chinese population

Frank Hu, Professor of Nutrition and Epidemiology, Harvard School of Public Health

Although China's history goes back some 5 000 years, the "new" China was founded just over 60 years ago in 1949. Within a decade, the economic and social campaign known as the Great Leap Forward led to a widespread famine from 1959 to 1961, which affected the health of future generations, said Frank Hu.

In utero exposure to famine increases the risk for metabolic diseases in adults, explained Hu. "People who are now in their 50s and 60s are very susceptible to diabetes and other metabolic diseases," he said.

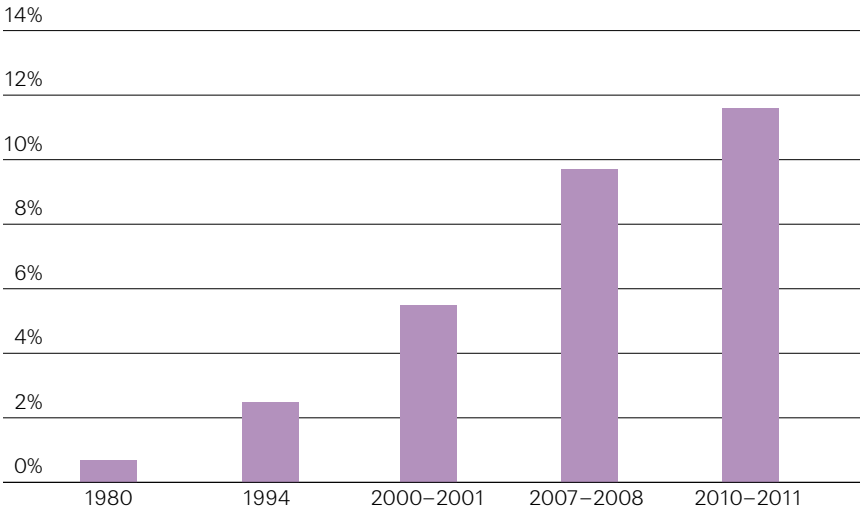


Figure 6:
Time trend of type 2 diabetes in China

Sources: Pan XR et al. Prevalence of diabetes and its risk factors in China, 1994. Diabetes Care 1997;20:1664-9.; Yang W et al. Prevalence of diabetes among men and women in China. N Engl J Med. 2010;362:1090–101; Xu Y et al. Prevalence and control of diabetes in Chinese adults. JAMA. 2013;310:948–59

As in countries throughout the world, infant mortality rates have fallen and life expectancy rates have risen in China. This dramatic shift in the population's structure has coincided with unprecedented economic growth. But even though China has the second largest economy in the world, per capita income remains low, said Hu.

While cardiovascular disease is the leading cause of death overall, ischemic heart disease is more common in urban areas while stroke is most common in rural areas. And with more than 100 million adults with diabetes, China is at the epicenter of the global diabetes epidemic, said Hu. But the disease manifests differently among Asians. Compared with other population groups, Asians tend to develop diabetes at a lower body-mass index (BMI) and at younger ages. They also have high rates of gestational diabetes.

Awareness of the disease, treatment, and adequate control are all very low in both rural and urban populations. The situation is similar for hypertension, but the rates are even higher, as more than 60% of Chinese people age 65 and older have hypertension.

However, only about one-quarter of Chinese are overweight or obese, which is much lower than in the United States. However, as of 2008, nearly half of all Chinese women had abdominal obesity and more than 25% of men did.

Dyslipidaemia is also quite prevalent, but even in major cities such as Beijing and Shanghai, only about one-third of adults get their blood lipids tested yearly. In rural areas, it's very rare to get a cholesterol test, Hu noted.

Estimates of metabolic syndrome depend on the criteria used to define the disorder. According to the US National Institutes of Health criteria (which include waist circumference), about 20% of Chinese adults have metabolic syndrome. But the figure is only about 10% if the Chinese Diabetes Society criteria (which include BMI) are used instead.

The risk factors responsible for China's health problems include a high prevalence of smoking; an explosion of fast-food restaurants; increased consumption of soft drinks; and a sharp decline in physical activity. This is because most people work in manufacturing rather than in agriculture, and they drive cars or motorcycles instead of riding bikes.

International variability in the CHD IMPACT model

Martin O'Flaherty, Senior Lecturer, Institute of Psychology, Health and Society, University of Liverpool

Starting in the 1960s, mortality rates from CHD declined dramatically in much of the western world, including the United States, the United Kingdom, and high-income Mediterranean countries. But in other countries around the world, the trends are very different, said Martin O'Flaherty.

His presentation explored these different trends, using results from the IMPACT model. This model aims to explain changes in CHD mortality rates in terms of the contribution of changes in risk factors and evidence-based treatments, Flaherty explained.

In 2000, more than 300 000 fewer people in the United States died from CHD than expected. How much was due to reductions in risk factors, and how much was due to treatments? O'Flaherty listed four possible causes and asked the audience to estimate how much the different factors contributed (audience votes in parentheses)

- Statins and treatments for high blood pressure (36%)
- Risk factor reductions (diet and lifestyle changes, including smoking cessation) (33%)
- Treatments for acute coronary syndrome (14%)
- Preventing death amongst those with CHD (secondary prevention and revascularization) (16%)

The IMPACT model shows a different picture, however. Two CHD risk factors – obesity and diabetes – increased by 7% and 10%, respectively. But other risk factors improved, including blood pressure, smoking, dietary cholesterol, and physical activity. Together these accounted for 61% of the lowered risk. Treatments (including those for acute myocardial infarction, secondary prevention, heart failure, angina, hypertension, and primary prevention with statins) accounted for 47% of the lowered risk. Nine percent was unexplained. Different researchers using the same data but different models came to similar conclusions, said O'Flaherty.

Mediterranean countries such as Spain had IMPACT results very similar to those in the US, O'Flaherty noted. In Nordic countries, the model showed that significant reductions in dietary cholesterol played a major role, especially in Sweden, where it accounted for 39% of the decreased CHD mortality risk. The same was true for central European countries such as Poland, which also showed a 39% reduction due to changes in dietary cholesterol. But in Poland and other post-Communist countries, such as Hungary and Romania, the decline in CHD mortality didn't occur until the late 1980s, following the profound socioeconomic changes after the collapse of the Soviet Unions, O'Flaherty explained.

What about CHD trends in countries with rising incidence, such as China, Syria, and Tunisia? According to the IMPACT model, cholesterol increases accounted for 77% of the rise in deaths from CHD in Beijing between 1984 and 1999. In both Syria and Tunisia, treatments are available but rarely used. Increases in blood pressure and cholesterol account for most of the increased risk.

"Population level changes in risk factors are powerful drivers of CHD mortality," said O'Flaherty, noting that risk factors can explain 60% to 70% of decreases and increases in CHD mortality trends.

Workshop summaries

Environmental and behavioural risk factors for cardiovascular disease in China

Doug Dockery, Professor of Environmental Epidemiology and Chair, Department of Environmental Health, Harvard School of Public Health

The rampant urbanisation that has occurred in China over the past 30 years has led to changes in both diet and physical activity, said Doug Dockery. Fast food companies such as Kentucky Fried Chicken and McDonald's are booming in Chinese cities, and severe traffic congestion makes bicycle riding (once popular in China) almost impossible, Dockery noted.

Increasing auto traffic also contributes to hazardous levels of smog in China's major cities. In rural areas in northern China, coal briquettes used for heating and cooking contribute to dangerous levels of indoor air pollution. As a result, life expectancies are 5.5 years lower in the north owing to an increased cardiorespiratory mortality.

Worldwide satellite data tracking shows extraordinarily high air pollution levels in China, particularly in the north. While levels in much of the United States range from 0 to 10 μg/m^3 of particulate matter, levels in northern China reach as high as 80 μg/m. While about 60% of Chinese males smoke, smoking is uncommon amongst Chinese women. Interestingly, China's overall smoking rate (28%) is similar to Switzerland, (27%), and the annual number of cigarettes smoked per capita is almost identical in the two countries.

In 2010, the top five reasons for years of lost life in China were stroke, ischemic heart disease, chronic obstructive pulmonary disease, and road injury, according to the Global Burden of Disease study. Behavioral risk factors contributing to those problems include diet, smoking, high body-mass index, and physical inactivity. But environmental factors such as ambient air pollution, indoor air pollution, occupational risks, and lead are also important contributors, noted Dockery.

"The concern is that when we look at these factors, which are all moving in the wrong direction, it portends a very bad future for China," said Dockery. "Is China going to repeat all the mistakes we made in the developed world, or do we see potential differences in the approach in China could take that might lead to a different outcome?" he asked.









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Time trend of risk factors for cardiovascular disease in China

Yanping Li, Swiss Re Fellow, Department of Nutrition, Harvard School of Public Health

Yanping Li reviewed and summarised the time trend of cardiovascular disease risk factors with findings from Chinese government reports, the China National Nutrition and Health Survey, and China nutrition and health cohorts.

She analysed food consumption, physical inactivity and low activity, smoking, alcohol, obesity, hypertension and diabetes. The main findings were as follows:

1) In recent decades, China has experienced a dramatic shift from a traditional dietary pattern to a Western dietary pattern.

2) In 2012, the prevalence of hypertension in China was 33.5%, which was comparable to the United States. However, the awareness and control rates are significantly less than in the U.S.

3) Despite tobacco control activities, the prevalence of smoking in China remains at a high level, and domestic production of cigarette keeps increasing.

4) Both diabetes and obesity rates have increased over time. In addition, diabetes in China occurs in people with a relatively low BMI.

5) The Chinese lifestyle is very sedentary, especially among young people.

Insurance product innovation around cardiovascular disease and diabetes

Himanshu Bhatia, Chief Medical Officer Asia, Swiss Re

Himanshu Bhatia started the session by showing a video from Professor Jeff DeGraff about innovation. DeGraff's four simple steps include:

1) Setting believable, high-quality targets

2) Using deep but diverse domain experts

3) Taking multiple shots at the goal

4) Learning from your experiences and making quick changes

Given that multiple countries in Asia were under consideration, Bhatia added a fifth step: Avoiding a one-size-fits-all approach.

He then described the complications of diabetes and explained the needs of people with diabetes, including products and programs around which insurance innovation can take place. Following this, Bhatia discussed innovations around insurance products for people with diabetes in the following countries:

1) Thailand. Products to cover people who face a high risk of diabetes and its complications are under development.

2) Hong Kong. Although many insurers currently decline coverage for people with diabetes, the market is considering accepting these people for medical reimbursement, using permanent exclusions.

3) India. Products to cover the common, critical complications of diabetes, in combination with wellness programs, are under development. These feature financial rewards for people who manage their disease effectively, and increased premiums for those who are unable to manage their diabetes.

4) Singapore. Pilot studies of holistic wellness programs tied with insurance benefits are underway.

Intense discussion ensued among the participants regarding risk management features from underwriting, actuarial pricing, and distribution viewpoints.

Ensuring appropriate care: A critical challenge in health systems worldwide

Vikas Saini, President, Lown Foundation

"Overuse of medical care is a pandemic," said Vikas Saini. Evidence for unnecessary health care in the United States is substantial. Each year, the harms of overly aggressive treatment are estimated to cause 30 000 deaths among Medicare recipients alone. In financial terms, unnecessary interventions are estimated to account for 10% to 30% of spending on healthcare in the United States, or $250bn–$800bn annually.

In the rest of the world, unwarranted variation in overtreatment, overmedication, and overdiagnosis is not the exception but the norm. A systematic review of medical practice variation in OECD countries revealed large differences across regions, hospitals, and physician practices for almost every condition and procedure studied. For example, the use of coronary angiography showed a 13-fold variation across 17 European countries.

Numerous, diverse reasons lead clinicians and hospitals to overtreat patients. They include: fear of malpractice lawsuits; supply-driven demand; knowledge gaps; biased research; profit seeking; patient demand; financial conflicts of guideline writers; a rapid uptake of unproven technology; and the failure to fully inform patients of the potential harms of elective treatments.

"Levels of overtreatment in healthcare in emerging markets like India and China are difficult to assess because solid data is missing," Saini said. However, anecdotal information suggests there is also considerable overuse in these lower-middle-income countries, especially among those in the growing middle class, who are willing to pay more for medical care. This consumer-orientated segment takes their cue from developed countries. They see new technology and innovation as inherently good and are likely to adopt the western "more is better" medical culture.

Shared decision-making between physicians and patients, better clinical guidelines, evidence-based medicine, appropriate use criteria and "choosing wisely" will be crucial to reduce unnecessary treatments and testing and to improve health care quality overall. To preempt treatment excesses and optimise resource utilisation, reduction of excess hospital capacity and payment reforms to cut financial incentives for individuals or institutions delivering healthcare are needed.

Finally, insurance companies can play an important role for innovations in health care delivery and payment models. Enhancing mutual trust and transparency as well as data-sharing between clinicians, patients, and payers is critical. Partnering with hospitals for bundled payments for elective procedures, and consulting with beneficiaries about risks of unnecessary treatment are needed to ensure sustainable health care systems.

Health and cardiovascular disease in Asia

K. Srinath Reddy, President, Public Health Foundation of India; President, World Heart Federation

Srinath Reddy's presentation focused on cardiovascular disease trends in Asia, which as a whole accounts for 56% of the global population. Worldwide, high blood pressure is the leading risk factor for cardiovascular disease. When other risk factors such as dyslipidaemia, smoking, and diabetes are present, this creates conditions that favor blood clotting, leading to a greater incidence of ischemic stroke and heart attack as opposed to hemorrhagic stroke, said Reddy.

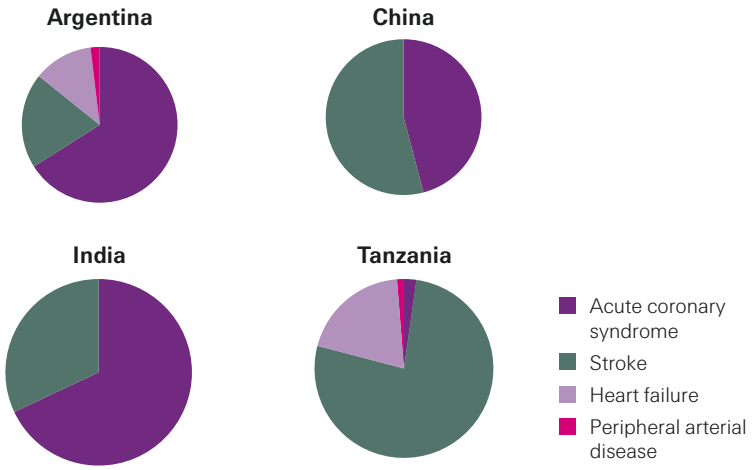


Figure 7:
Cardiovascular disease: Reasons for hospitalisation

Source: Huffman M. et al (2011), PLoS One

One major risk factor in China is elevated plasma cholesterol, which rose from an average of 150 mg/dl in 1958 to 220 mg/dl in 2003. Another is smoking, said Reddy, noting that China consumes one-third of the world's cigarettes.

Elsewhere in Asia, cardiovascular disease accounts for 30% of all deaths in Indonesia and 27% in Thailand. In both countries, tobacco use is far more common in men than in women. Rates for other risk factors, such as inactivity, high blood pressure and high cholesterol, are similar in both men and women, but women are more likely to be overweight or obese than men in both countries.

In India, 29% of deaths were attributed to cardiovascular disease in 2005, but that figure is projected to rise to about 36% by 2030, according to the World Health Organization. Findings from the 2007 INTERHEART study revealed that in India, the median age for a first heart attack is 52 years – a full decade earlier than in Western and Central European countries and China. That translates to many more years of lost life due to cardiovascular disease.

"No country that aims to position itself as an economic partner in the 21st century can afford such a hemorrhaging of human resources in the productive prime of midlife," said Reddy.

Indians may face a high risk of diabetes and cardiovascular disease because they tend to have a higher percentage of body fat, especially in the upper body. Also, their typical lipid profiles are more likely to lead to atherosclerosis. In addition, nearly 48% of men and 20% of women use tobacco in some form, including cigarettes, bidi (unprocessed tobacco rolled in tobacco leaves), and smokeless tobacco.

In terms of interventions, an industrial workplace study by Reddy and colleagues that focused on lowering tobacco and salt use, and increasing fruit consumption and physical activity, showed promising results. Blood pressure and cholesterol levels improved markedly, and the cost was just $7 USD. In 2010, India piloted the National Program for Prevention and Control of Diabetes, CVD, and Stroke, which began a national scale-up in 2012. The goal is to create simple solutions for across-the-board interventions that can stem the tide of cardiovascular disease in India and elsewhere in Asia, said Reddy.

Ageing Asia's health & care (insurance) challenge

David Muiry, Head of Global Health, Swiss Re

The social and economic issues facing Asia today include demographic, resource, and insurance challenges, said David Muiry. "But the flip side of challenge is opportunity, and we certainly see a lot of opportunity," he said.

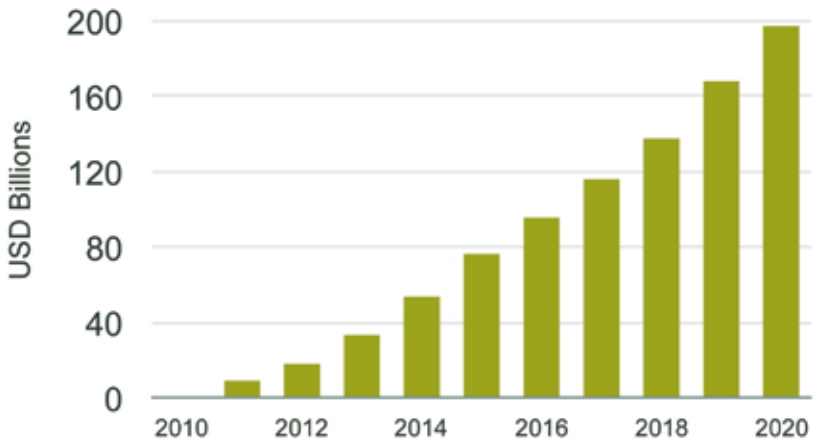
The increase in the population of ageing people is a global issue, but Asia is experiencing this faster than anywhere else. The growth in the elderly population over the next three to four decades will be staggering, with an estimated quarter billion people ages 60 and older in both China and India, said Muiry.

This change, driven by increases in life expectancy, will become a profound challenge because of the dramatic decline in fertility rates happening at the same time. The old-age dependency ratio is the ratio of dependents (people ages 65 and over) to working-age people (those ages 15 to 64). Today, the ratio in Asia is 10% (that is, there is 1 person age 65 and older for every 10 people between the ages of 15 and 64). But the ratio will rise to an estimated 27% in 2050. With regard to the resource challenge, the costs of health care are increasing inexorably throughout the Asian region. It is highest in Japan, currently about $3 000 to $5 000 USD per capita, which is similar to expenditures in Western Europe. Costs are far lower in other Asian markets, however.

In terms of financing, "Nowhere in Asia do we see insurance contributing more than 10% of the total health care expenditures," said Muiry." In many countries, out-of-pocket costs make up a significant proportion of the expenditures. A major medical event can deplete a family's savings and can put them into poverty, he added.

In the future, the protection gap in Asia is projected to widen substantially and is forecast to reach $197 billion USD by 2020, based on population and economic growth and medical inflation.

Figure 8:
The health protection gap in Asia



Source: Asia health protection gap study, Swiss Re (2012)

The expectation for family support to meet medical expenses, especially among retirees, is much higher in Asia than in Europe. However, several factors – including rising expectations of health and care needs in retirement, dissatisfaction with government-financed care, and the expansion of the health and social care delivery infrastructure – means private insurance has the potential to play a bigger role in health and care financing, said Muiry. In addition, a shifting focus toward protection-based insurance in Asia bodes well for more public-private partnerships for financing and managing health and care benefits.

In conclusion, health care needs and costs are increasing dramatically, and the scale of the anticipated health protection gap is such that governments will be unable or unwilling to absorb the additional financial burden. As such, there is a great opportunity for private insurance to provide access to appropriate healthcare while protecting an individual's savings and wealth from catastrophic depletion.

A life course approach to ageing

Paul Ong, Health Policy and Programme Adviser, HelpAge International

What does "reaping the longevity dividend" that human and economic development has delivered mean for countries at the bottom? asked Paul Ong. In many of them, the prospect of retirement is a luxury option most people have not even heard of.

HelpAge International (HAI) works extensively with countries in the bottom third of the Human Development Index (HDI) on ageing issues. HAI has programs in many areas such as social protection, health, and livelihoods, and confronts issues of social and economic justice. HAI is committed to the UN Convention on human rights of older people.

National increases in per capita income strongly correlate with longer Life Expectancy (LE), up to a point. "But it only goes so far towards improving quality of life (QOL), which dominates how we look at health and ageing," said Ong. In developed countries, a more predictable progression in terms of the life course and health prospects allows insurance instrument calculations. Although this is a simplification, in the main, it starts with a young, healthy person, who then acquires morbidities that require care in older age, before finally becoming an ill and frail older person that finally dies. By contrast, in low HDI countries, death more often comes suddenly by violence or through undiagnosed or unmanaged illnesses.

Physical health declines with age globally. In the UK, surveys show that mental health status can be maintained into old age in the face of physical decline because QOL is maintained, thanks to a strong welfare safety net. In contrast, in countries like Kyrgyzstan, where health care and social protections are less well developed, mental health status falls in parallel with physical function. The consequences of physical impairment in low HDI countries are stark. "In Mozambique, Kyrgyzstan, Tanzania, and even Peru and India, villagers say, 'I don't care about my hypertension, it's my arthritis, my back pain that's most important.' The reason is simple: If you can't bend, you can't work or plant your fields, you can't eat. It is a death sentence," reported Ong.

Developmental intervention is needed in countries such as Bangladesh, which has a LE at birth of 70 and a Healthy Life Expectancy (HLE) of 54 and Mozambique, which has a LE at birth of 53 and HLE of 37. The disparities in these LEs compared with developed countries, such as Japan, (where the LE at birth is 83 and HLE is 73) raise questions about whether there is healthy life equity that all deserve. Premature ageing in poor countries challenges the definition of "old." Causes include the ravages of illness, wars, and having households with skipped generations, where the working adults are absent due to death by AIDS or emigration for work.

Examples from HAI operations suggest that sometimes, the more effective route to improved LEs and better health, would be through encouraging structural development, such as ensuring better food security or an improved water supply, rather than well-intentioned but very siloed health programs.

Ong said, "We need to define the world we want when we are old," given the challenges of preserving QOL and dignity.

Workshop summaries

Heart attack, cancer and stroke: Real people's fears versus the hard reality of life

Marianne Gilchrist, Regional Director, Health Solutions, Swiss Re

Life expectancy (LE) varies widely in Asia, said Marianne Gilchrist. The current life expectancy (LE) at birth in Japan is 82.7 years and is expected to rise to 87.4 in 2050. Hong Kong's current LE at birth is 82.4 and is expected to rise to 89 in 2050. The current LE is India is just 64.9, and in China, it is 74.4. In 2012, only one country (Japan) had more than 30% of its population over age 60. By 2050, more than 64 countries are expected to have more than 30% of their inhabitants older than 60.

In Asia, pre-retirees report that they started retirement planning around age 40, plan to retire in their early 60s, and plan to live into their early 80s. Retirees reported similar numbers, except that they started retirement planning in their mid-50s. However, Chinese respondents have unrealistic expectations regarding their longevity: Pre-retirees believe they will live to age 89, and retirees expect to live to age 94.

About half of the Chinese people surveyed were also quite optimistic about having a better quality of life after retiring, in contrast with people in Korea and Japan, where 62% of pre-retirees expect to have worse quality of life.

Gilchrist showed data about health expectations during retirement, perceptions of incidence, treatment costs, and insurance coverage for heart disease, stroke and cancer, and shared the following projections:

- Cardiovascular disease death rates are projected to surge in China by up to 73% by 2030.
- If current stroke trends continue, 12 million people will die of stroke by 2030.
- New cancer cases are projected to rise to 17 million, by 2020, with almost of half of these new cases in Asia.

Throughout Asia, more than 60% of retirees see health insurance as essential to their own protection, but relatively few plan to buy health insurance, said Gilchrist. Barriers include already being insured by a government plan, premiums that are too expensive (particularly as a person gets older), and a perceived lack of need.

China's elderly dilemma: Health and financing

David Lu, Senior Medical Officer, Swiss Re

The peak of China's "ageing tsunami" will arrive in about 2020. Around 250 million people will enter their 60s within the next 10 years. This generation enjoyed better education after China opened her door to the world in 1978, and this difference should be taken into account when planning for their needs, which are based on survey results from the current elderly.

Under China's new healthcare reform, almost 95% of the elderly are already covered under three national basic medical insurance schemes. However, the gap between health protection and the real medical expenditures is still huge. Out-of-pocket payments for hospitalisation range from 30% to 70%. In 2011, 27% of patients were discharged from the hospital due to financial difficulty, and 11% of families experienced catastrophic health expenditures. The percentage of "empty nest" elderly is over 50%. Nearly half worry about poor health, 46% expect to provide home medical services, and 21% of them are willing to pay. Neither public nor private long-term care financing systems have been established.

Three pillars support the newly released national eldercare strategy: home care, community care, and institutional care. The government encourages commercial insurance to provide medical insurance in addition to the national basic health insurance, critical illness insurance, long-term care insurance, as well as providing insurance links to health management, eldercare services, and medical liability insurance products.

Early life influences on noncommunicable diseases

Michelle Williams, Stephen B. Kay Family Professor of Public Health and Chair, Department of Epidemiology, Harvard School of Public Health

Michelle Williams discussed the current understanding of how in utero conditions help determine the risk of obesity, diabetes, and heart disease. She began by introducing the Barker hypothesis, which was derived from the observation that low birth weight (LBW) babies are more likely to develop heart disease as adults. Cardiovascular risk factors, including insulin resistance, type 2 diabetes, and metabolic syndrome, are also associated with LBW.

Barker proposed that malnourishment during pregnancy alters the expression of genes associated with nutrient metabolism in the fetus, maximising efficient calorie use throughout life, thus creating a "thrifty phenotype." The mismatch of a nutritionally deprived intrauterine environment with a calorie-dense diet and Western lifestyle sets the stage for cardiovascular risk.

More recent studies have told a more complex story, as high birth weight (macrosomic) babies are also prone to obesity as adults, creating a J-shaped curve, where both low and high birth weight increase the risk of the same maladaptive outcome. Women with diabetes commonly give birth to macrosomic babies.

Williams considered how these phenomena may be playing out in China and India, two countries with recent histories of malnutrition coupled with a rapid nutritional and epidemiological transition that foster increased weight gain in adulthood. China reflects our newer understanding of the combined effect of restricted intrauterine growth coupled with adiposity rebound (or excessive weight gain) in childhood and adulthood. Among older people, those with LBW who were born during the time of severe caloric restriction had elevated risks of cardiometabolic disorders such as insulin resistance, type 2 diabetes, and hypertension. This epidemiological pattern was largely consistent with the Barker hypothesis. However, studies of children born in the last decade suggest that relationship between birth weight and cardiometabolic disease risk factors is more complex.

Williams then discussed the "thin-fat" phenotype seen in India, where one-third of the babies are LBW and diabetes rates have reached epidemic proportions. Many poor, rural Indians are born small. However, as this population adopts a more sedentary lifestyle and diets high in calorie-dense foods, the risk of cardiometabolic disorders (particularly type 2 diabetes) increases, even at what would be considered a normal body weight in western populations.

The role of behavioural and environmental factors in cardiovascular disease in India

Daniel Corsi, Swiss Re Fellow, Harvard Center for Population & Development Studies, Harvard School of Public Health
Brian Ivanovic, Manager & Senior Researcher Applied R&D, Life & Health, Swiss Re

Socioeconomic factors such as income and education modify the distribution of risk factors for cardiovascular disease. However, the effect of socioeconomic status (SES) on cardiovascular risk differs between Western and developing countries. This finding has implications for properly identifying at-risk populations for health interventions in developing countries.

Brian Ivanovic began by reviewing the typical distribution of cardiovascular risk factors and disease by SES in Western countries, using time series data from the US Behavioral Risk Factor Surveillance System and US National Health Interview Survey. For measures of both income and education, groups with the highest SES levels tend to have the lowest levels of cardiovascular risk factors and reduced prevalence of future cardiovascular disease.

Daniel Corsi then reviewed his research on the patterns of cardiovascular risk in India, using time series data from the Global Burden of Disease study. Over the past decade, there have been significant declines in morbidity from infectious disease in tandem with a 66% increase in ischemic heart disease mortality and morbidity. Do these summary measures of health in India apply uniformly across the Indian population, or are they are concentrated within certain groups? asked Corsi.

He used a variety socioeconomic status measures including caste, household wealth, education levels, and household living standard to study of morbidity and mortality distribution. All-cause mortality was highest in the groups with the lowest household wealth. But while overall mortality was lowest in the higher SES groups, those with higher levels of education tended to have a higher proportion of cardiovascular deaths.

Preliminary data from the Longitudinal Ageing Study in India demonstrated a positive association between education and wealth and the burden of cardiovascular risks and disease. In contrast to Western countries, rates of coronary heart disease, elevated lipids, diabetes, and hypertension were highest in Indians who had the most wealth and education. Wealth was also inversely associated with physical activity levels.

Certain risk factors lacked consistent positive or negative patterning. For example, higher levels of education were associated with lower levels of smoking, but those with the highest level of wealth did not have the lowest smoking prevalence.

Corsi noted that targeting interventions to lower SES groups, as is commonly done in the West, does not necessarily identify the populations at greatest risk of cardiovascular disease in India. Policies that are aimed at reducing cardiovascular disease need to consider the distribution of cardiovascular risk factors and disease in India to maximise the future benefits of population health interventions.

Panel discussion on health risk factors in Asia

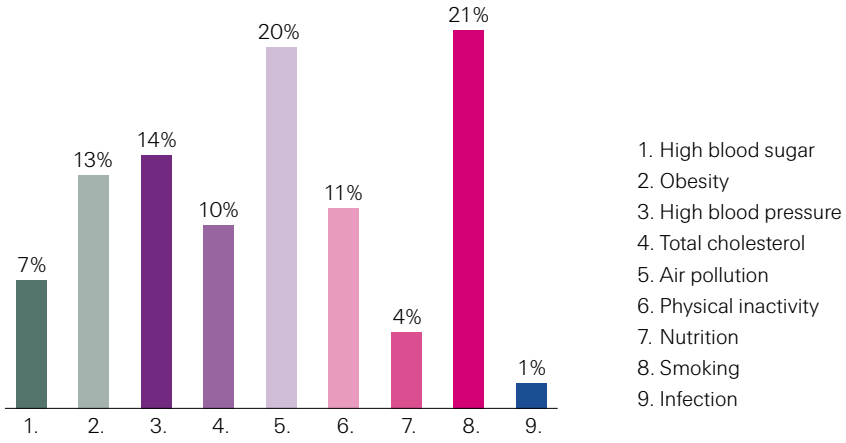
Moderator: Christoph Nabholz, Head Business Development, Swiss Re Centre for Global Dialogue
Panelists: Thomas Zeltner, Doug Dockery, Frank Hu, Srinath Ready

In China, noncommunicable diseases (NCDs) have been the main drivers of mortality. But in India, we see a completely different picture, where communicable diseases, maternal and neonatal morbidity, and nutrition are still important causes of death, said Christoph Nabholz.

Among people in the insurance-relevant age intervals, cancer and cardiovascular disease are the leading causes of death in China. In India, the top two causes are cardiovascular disease and communicable diseases.

Nabholz asked the audience to rank the top four health risks in China from the following nine factors: high blood sugar, obesity, high blood pressure, high cholesterol, air pollution, physical inactivity, nutrition, smoking, and infection.

Figure 9:
Audience poll on biggest health risk factors in China today



Source: Swiss Re

They ranked smoking as number one, followed by air pollution. That makes sense, given China's high smoking rate and its strong contribution in both heart disease and cancer, said Frank Hu. Social pressure to smoke in China remains strong, especially in groups of male business colleagues, he added.

China has three main sources of air pollution: 1) domestic coal burning for cooking and heating, 2) coal burning for power generation and industrial development, and 3) car exhausts from heavy traffic, said Doug Dockery.

Reducing pollution from cooking, and increasing smoking prevention efforts, make the most sense to target, said Thomas Zeltner. Targeting traffic and industry are more complicated because of China's strong push for economic development. Dockery noted that removing sulfur from gas, diesel, and coal could address pollution from industry and traffic, but there are major infrastructure issues to address.

As for the leading health risk factors in India, the audience chose obesity as number one, followed by high blood sugar and high blood pressure. Problematic dietary factors in India include the use of hydrogenated vegetable oil and a low intake of fruits and vegetables, said Srinath Reddy. For reducing obesity, increasing physical activity may be more realistic than decreasing calorie intake, said Zeltner.

To that end, better urban planning could create more "activity-friendly" cities that have spaces where it is easy to walk, cycle, and do group exercise, said Reddy. As Hu noted, all the risk factors are interrelated. "We really need a multifactorial approach to deal with them at the same time," he said.

Longevity modelling

Global trends and projections for causes of death: Implications for longevity

Colin Mathers, Coordinator, Mortality and Burden of Disease, World Health Organization

Pooling data from those countries where the highest life expectancy (LE) at birth was observed during a particular historical period (e.g. data from England circa 1800, now from Japan) shows a constant increase of 2.5 years per decade, or 6 hours per day, since 1800. This astonishing rate is "as important as economic growth in improving well-being in humans," said Colin Mathers. Since 1990, global LE at birth has increased 3 years per decade.

Life expectancy at older ages for both sexes has also increased, particularly since 1970 – a trend most clearly reflected in WHO data from Australia. Decreases in smoking-related cardiovascular disease (CVD) and lung cancer due to reduced smoking, and also improved risk factor control (especially blood pressure surveillance), account for most of the rise in LE at 65. The WHO mortality database of death registrations shows similar trends elsewhere. But in the Russian Federation, the disintegration of the Soviet Union resulted in unexpectedly dramatic and rapid increases in alcohol-related and CVD deaths at younger ages, and fluctuations in LE at 65.

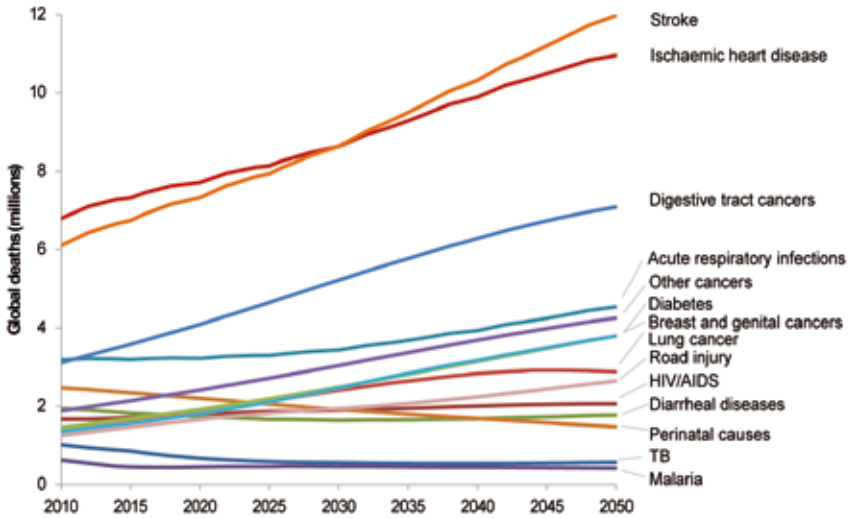
WHO life tables from 1990 to 2011 for member states reveal significant regional and income group differences in average gains in LE at 60. At the extremes are gains for men in high income, and Eastern European countries, of 1.63 and 0.22 years per decade, respectively.

Various metrics devised to demonstrate mortality compression show no evidence for compression. "We seem to be quite a long way from the biological limit to life at the population level," said Mathers. Consequently, global increases in LE are likely to continue.

Analysis of gains in LE at older ages has revealed the enormous contributions of improvements in CVD and diabetes interventions in both men and women, and of smoking cessation in men. The female smoking epidemic lagged behind men, and effects on LE of smoking reduction in women are not yet apparent.

WHO projections through 2050 of mortality trends is based on regression modeling using 50 years' worth of death registration data. Modelling considered age, sex, cause of death, as well as income, education, smoking intensity, BMI trends, and time (as a proxy for technological progress). Caveats for the long projections include impacts of game-changing research breakthroughs, new or resurgent infectious disease, and global instabilities like climate and conflict. Projections predict large growths in annual noncommunicable disease (NCD) and CVD deaths in all income regions, as population ageing outweighs lower cause-specific death rates.

Figure 10:
Global projections for selected causes of death



Source: Mathers and Loncar, PLoS Medicine, 2006

Consequently, at UN General Assembly urging, since 2011 WHO has led a global monitoring initiative that aims to reduce the chronic disease burden. Some indicators with targets have been agreed (reduced tobacco use, hypertension, and salt intake, and trans fat elimination). These aim to reduce premature (younger than age 70) NCD mortality by 25% within the next 20 years. Such targets could improve the health of all, but it remains to be seen whether member countries will implement the program.

Futures of healthcare: Evidence, prediction, longevity

John Wilden, CEO, Global Health Futures

Global Health Futures' purpose is to develop 21st century healthcare strategies principally for the eight main healthcare stakeholders. Its first aim is to enumerate cure. A critical question about longevity, he said, is whether curing disease will increase longevity, and if so, by how much?

The Foundation for World Health aims to educate the public and other agencies about "curative healthcare" and their roles in this new aspiration, said John Wilden. The increase in longevity that accelerated in the 20th century is partly attributable to post-industrialisation improved living standards and public health measures. Reductions in smoking prevalence, infectious disease and hypertension also played important roles. However, an impact on cancer mortality remains elusive.

If deaths from cardiovascular disease and cancer were eradicated, so far estimates suggest life expectancy might increase by 2 to 8 years. Also, "Healthcare as practiced already accepts ageing as a disease," said Wilden, adding that is now acceptable for doctors to list ageing as the cause of death on the death certificate.

Curative healthcare is a progression from mankind's millennia-long tradition of remedial healthcare (defined as treatment after someone seeks care for symptoms) to the more recent practice of preventive healthcare (for example, vaccination, or interventions at a pre-symptomatic state). Remedial healthcare has a limited effect on disease and comes at an enormous economic cost. Preventive healthcare can maintain a less compromised status.

Curative healthcare is a new field, "where the potential for disease is detected and treated without impairing biological or physiological function" to maintain a guaranteed, sustainable pre-disease status. It aims to monitor cellular networks and intervene to influence targets in the nucleus, cytoplasm and organelles within the cell and matrices between cells.

In December 2012, the editors of the New England]ournal of Medicine described their vision of what medicine might bring in the next 100 years. Their depiction provided a good description of the framework envisaged for curative healthcare, namely, the definition of individuals at the molecular and genomic levels; the consequent re-categorisation of disease; and the subsequent analyses of interactions with drugs, nutrients, microbiomes, and therapeutic devices. Their vision is predicated on the ability of "big data" to handle individual patient databases and interlink them with international databases to implement a more curative approach. More transparent, sound, and equitable healthcare worldwide could result.

The biological foundation for cures requires a multidisciplinary approach to molecular and cellular technologies. These approaches range from laboratory studies to create implantable new organs and within existing ones, to clinical trials for monogenic gene disorders as a prelude to tackle more complicated diseases.

The majority of the human genome regulate about 20% of the human genome responsible for creating proteins which provide the building blocks for cellular function. Chemical changes to the four nucleic acids comprising DNA, a phenomenon known as epigenetics, starts in embryo and may lead to gene mutations resulting in disease. "Nuclear reprogramming" offers an opportunity to target both regulatory and epigenetic factors.

The identification of disease-preventing genes in "super-centurions" offers another approach to reprogramming cells to more sustainable health, thereby beginning to fulfil the criteria for "curative healthcare".

Funding longer lives

Matthias Weber, Group Chief Underwriting Officer, Swiss Re

When Swiss Re surveyed more than 22 000 people in 19 different markets and asked, "What do you think are the two most important risks facing your country at the moment?" the results varied widely, said Matthias Weber.

People in France, the United States, and Germany all cited economic risk, whereas citizens of South Africa, Mexico, and Brazil were most concerned about crime, terrorism, and civil unrest. Hong Kong residents cited pandemic and disease outbreaks, likely because of the H1N1 and SARS outbreaks in nearby China at the time of the survey.

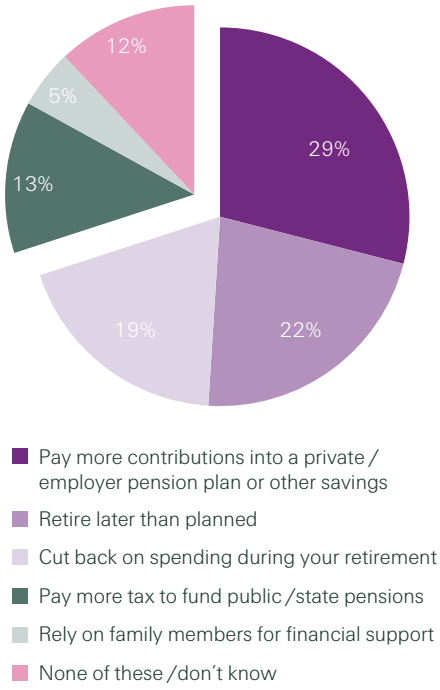
China and Switzerland were most concerned about climate change, pollution, and species loss. Germany, Singapore, and Japan – all of which have populations that are already old or are rapidly ageing – cited the costs of ageing societies as their greatest concern.

When asked to predict their concerns 20 years in the future, Chinese respondents said that the proportion of people aged 65 and older will be a major financial concern for society. In India, projected food shortages topped the list of concerns. Both answers reflect demographic realities in each country, explained Weber. China's one-child policy has limited the number of working-age people able to support retired people, while India's continued population growth will strain their food supply.

When asked how to best fund their own futures, 70% of participants chose individual responsibility through higher contributions into pension plans or other savings, deferred retirement, or cut backs in on spending during retirement.

Which of the following actions are you MOST willing to take to ensure a financially secure retirement?

Figure 11:
Responsibility for retirement costs



Source: Swiss Re Risk Perception Survey

Insurance companies have developed various strategies to meet the challenge of funding increased longevity, which since the 1990s has exceeded all projections. Defined benefit pension schemes pose the biggest problem, but an approach like direct hedging can help meet future liabilities. Here, all the liability is ultimately passed on to an insurance or reinsurance company such as Swiss Re. Cash flows between the pension plan and the reinsurers for the differences between what the pension plan expected to pay out and actually paid out, dependent on the insured individual's retirement span.

A typical longevity trade by public and corporate pension schemes involves up to a few billion USD. Reinsurers end up with these risks because they can exploit the anti-correlation between mortality liability (i.e. life insurance) with longevity risks, thus requiring less capital to support both risks. Swiss Re's exposure to mortality and longevity liabilities differs geographically. To hedge against the risk of different rates of change in mortality between these countries and in different age cohorts, insurers have structured longevity bonds based on indices of such mortality changes. Investors buy the bonds but forfeit their money if the indices diverge by a set amount.

"Increases in longevity are great for the people involved but pose a challenge for society. We believe insurance can address these challenges through innovation and collaboration," concluded Weber.

Workshop summaries

Disease-based models of longevity

Séverine Rion, Head of Life & Health R&D Europe, Swiss Re
Daniel Ryan, Head of Life & Health R&D, Swiss Re
Florian Rechfeld, Medical Biochemist, Swiss Re

We have seen unprecedented increases in old age life expectancy in recent decades around the world. The question is whether such increases can continue. It is customary to think in terms of all-cause mortality, and to assume that better understanding of past trends will provide the clearest insights into the future. Nevertheless, expert opinion in gerontology and demography is increasingly divided, with uncertainty as the future resolution of conflicting drivers from medical advances, healthcare funding and individual attitudes.

Swiss Re Life & Health R&D has promoted a deeper understanding of the drivers of future life expectancy through access to patient medical data and seeking out expert opinions on future diagnosis and survival for key diseases. Databases such as the Clinical Practice Research Datalink, CPRD, in the UK provide individual patient histories of symptoms, laboratory tests, diagnosed diseases and prescribed treatments

We can use such databases and forward-looking scenarios to predict the progression of disease in individuals, the development of co-morbidities and the effectiveness of treatments. As an example, if such data had been available in 1987 when the first statin was launched, we would have known the population affected by hyperlipaemia and would have been able to estimate from clinical trials how many fatal myocardial infarctions could be avoided through treatment with statins.

Current and future developments must both be captured in any meaningful scenario. Possible developments might include any of the following categories:

- Promotion and adoption of healthy lifestyle choices
- Advances in screening and diagnostic technology
- Wider use and better compliance with existing treatments
- Pharmaceutical pipeline and ongoing discoveries in human genetics

We have gathered evidence in support of potential scenarios through search of scientific literature, pharmaceutical databases, government publications, and research collaborations and discussions with leading experts.

Our presentation highlighted the extent of the necessary investment to achieve such understanding with particular focus on advances in cancer genetics and the development of novel forms of treatment for cancer. Breakthroughs in human genetics have provided dramatic insights into the underlying genetic alterations of cancer initiation, progression and survival. The identification of cancer associated genetic biomarkers is the key step in the development of personalised medicine and targeted therapies. We therefore need to understand the pipeline of potential treatments as well as the likely evolution of clinical trials in response to concerns from regulators, the pharmaceutical industry and the public at large.

The alternative approach to predicting future life expectancy that we presented provides valuable insights into how future mortality improvements could be achieved and hence a common currency for considering projections produced by more established actuarial techniques. In addition, by considering underlying health and illness, further insights on disease and survival trends may be of value to other insurance products such as critical illness or impaired annuities.

Influenza, heart disease, and vaccine strategies

Stephen Kramer, Head of Epidemiological Research, Swiss Re

Influenza is a major cause of illness and death throughout the world, resulting in an estimated 250 000 to 500 000 deaths annually. The WHO recommends vaccinations for the young, elderly and those persons with high-risk conditions. Not surprisingly, the definition of high-risk conditions has gained attention in the medical and scientific communities, said Stephen Kramer, who highlighted the current available data on influenza, heart disease, and vaccinations.

Recent work has established an association between cardiovascular disease (CVD) and an increased risk of pneumonia, hospital admission, the need for ventilator support, and death, in people with either seasonal or pandemic influenza. In addition, for patients with CVD, the 2009 pH1N1 case showed an attributable increase in admissions to hospitals and intensive care units. Hypertension is associated with a higher risk of death with pandemic influenza (odds ratio 1.49). The link between flu vaccination for the CVD population, and a reduced risk of hospitalisation and further cardiac complications, is less established. Some studies show a reduced risk of death among those who were vaccinated (hazard ratio of 0.54), while others show no difference in mortality between vaccinated and un-vaccinated populations.

Swiss Re has modelled the spread of pandemic influenza in order to understand the potential range of mortality outcomes. The model – which accounts for factors such as behaviour, antibiotics, antivirals, and vaccines – provides insights to age-mixing or contact between different age groups. Children shed viruses longer than adults, so they are important in determining community outbreak initiation and spread. The outcome of Swiss Re's modelling conforms to the public belief that the elderly population is at a higher risk for mortality than the non-elderly population.

By the GRADE approach to health recommendations, overall the evidence for a direct causal relationship between CVD and adverse influenza outcomes is low, though a strong association is evident. But a number of questions remain. First, is there enough evidence to warrant a vaccination recommendation to those with CVD? Currently, public health officials suggest vaccinating the young would better protect the elderly. Second, is it right to vaccinate one group to protect another, given that the young may not benefit much themselves? Finally, are there alternative approaches that may be more useful and more ethical?

Explaining socioeconomic trends in coronary heart disease mortality in England, 2000–2007: The IMPACTsec model

Madhavi Bajekal, Senior Research Fellow, University College London

Madhavi Bajekal described why socioeconomic inequalities in coronary heart disease (CHD) mortality have persisted despite the rapid fall in mortality since the 1980s. She presented results from the IMPACTsec model for England.

Since the 1980s, socioeconomic inequalities have had a significant effect on life expectancy, lifespan variability, morbidity, and disability in both males and females. People in disadvantaged circumstances live shorter lives, develop diseases earlier, and spend more years in disability. Poor and rich people die from the same causes but at different rates. There is an inverse social gradient in health: Each higher social grade has lower rates of ill-health and death.

A fall in CHD mortality has led to rapid improvements in life expectancy over the last 25 years. But CHD remains a leading cause of death and a source of persistent inequalities. The IMPACT model can quantify the contribution of risk factor improvements and case-fatality rates to the fall in CHD mortality. A previous IMPACT study for England and Wales covering the period from 1981 to 2000 showed that 50% to 75% of CHD reduction was due to net risk factor reduction, with falling smoking rates having the biggest impact. Between 25% and 50% of the reduction was attributed to evidence-based therapies.

The new IMPACTsec model extends the previous model by adding a socioeconomic dimension and updates it to cover the period 2000–2007. Results from the IMPACTsec model showed that in England, CHD mortality fell by 36% in just 7 years, which is faster than in previous decades. The annual pace of decline was fastest for the most affluent, and slowest for the most deprived population quintiles. For England as a whole, treatments explained about 52% of this reduction and risk factors explained about 34%, with falling systolic blood pressure levels having the largest impact.

More lives were saved in deprived than affluent areas, due to bigger reductions in risk factors. But these gains were partly offset by faster increases in diabetes and body-mass index in deprived areas. On the other hand, treatments contributed uniformly to about half the lives saved across all deprivation quintiles.

In general, the relative importance of smoking as a driving force for the CHD mortality reductions has diminished over the latter part of the 20th century. Better medical management of patients has been, and will continue to be, a significant factor for gains in life expectancy in the early 21st century.

Cause-of-death mortality: Impact of cause-elimination and links between the causes

Séverine Arnold (-Gaille), Assistant Professor in Actuarial Science, University of Lausanne

To better forecast future mortality, it is important to understand current mortality curves by causes of death. However, such analysis is often not done due to various challenges such as differences in training, coding, and interpretation of rules between physicians, which could lead to inconsistent classification of causes of death, said Séverine Arnold. In addition, causes of death are less reliable at older ages, when there could be multiple competing risks.

Past studies have usually assumed independence between the causes of death. Using multinomial logit models, one can incorporate the dependency of causes of death in mortality forecasts. The results presented assume that if one cause is eliminated, its probability is assigned proportionally to the remaining causes of death. The model could be used to forecast future mortality trends, assuming reduction or elimination of certain causes of death. It is useful in understanding the relationship between targeting causes of death and age-specific mortality.

When forecasting future mortality, the model assumes past trends would continue, unless specifically modified. The forecast results are still yet to be compared with actual data. One suggestion from the audience was to put lung cancer data into the model and compare the forecast versus actual mortality trend.

Panel discussion on the future estimation of longevity

Moderator: Daniel Ryan, Head Life & Health R&D, Swiss Re
Panelists: Steven Baxter, Tim Crayford, Madhavi Bajekal, Stephen Kramer, Matthew Edwards

Daniel Ryan began the discussion by showing regional differences in the pace of life expectancy at birth in 1970 compared with 2010, taken from the Global Burden of Disease study. He then showed comparisons of male and female life expectancy from age 60 in developing countries (Brazil, China, India, and Mexico) and developed countries (Japan, Switzerland, the United Kingdom and the United States).

For all the countries, the annual change per capita in life expectancy from the 1970s to 2010–2015 was about 0.1, or about one year per decade, similar to the projected annual change over next 40 years, according to the United Nations (UN) Populations Prospects, version 2012.

Ryan then asked the audience if they agreed with the UN projections, or if they thought life expectancy will increase more slowly or more quickly. Other possible choices included more convergence or divergence between different countries; a worsening of LE; or "don't know." Most people predicted convergence for both men and women.

Given that we have an inherent distrust of projections, what might we do? asked Ryan.

Steven Kramer pointed out the need to know whether the projections included economic scenarios, demographics, risk factors, and policies. Madhavi Bajekal added that probably most of the change in the future might come from curative medicine and novel technologies – the so-called "black swans" in the room.

"We need to contextualize the projections, whether we're talking about them on a global, national, regional, or socioeconomic level," said Steven Baxter. Some things we have a degree of certainty about, such as how smoking policies might affect lung cancer rates. But we don't know about the black swans, which we cannot contextualize because we're anchored to our existing understanding, he added.

Joe Brain suggested that new technologies and artificial devices might affect the length of productive life to a greater degree than stem cells or other medical therapies. "But we haven't talked about the big black swans for the next century. What if nuclear war breaks out between Iran and Israel? What if bird flu becomes easily transmissible with a high case fatality rate?"

Swiss Re Centre for Global Dialogue
Gheistrasse 37
8803 Rüschlikon
Switzerland

Telephone +41 43 285 8100
Fax +41 43 282 8101
global_dialogue@swissre.com
www.swissre.com/cgd