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Editorial

Emerging Health Risks and Insurance 1
By Christophe Courbage

Health Apps—Hype or Opportunity in the Risk Management of Life and Health Insurance? 3
By Achim Regenauer

Social Epidemiology 6
By Séverine Rion Logean

A Matter of Style 12
By Florian Boecker

How Can Life and Health Insurers Help Clients Facing Environmental Risks? 17
By Steve Hales and Elisa Pestrin

Risk Management of Emerging Pandemics 20
By Gordon Woo

Underwriting: Enhanced Annuities 23
By Philip Wilson

Crowding Out of Long-Term Health Insurance by the Institutional Setting of the U.S. Health Insurance System 28
By Ines Läufer

12th Geneva Association Health and Ageing Conference on Insuring Health Care for the Elderly in Asia — Announcement 32

Call for Papers—Special Issue of *The Geneva Papers on Health* 32

Forthcoming Conferences of The Geneva Association 34

EDITORIAL

Emerging Health Risks and Insurance

By Christophe Courbage*

It is once again my pleasure to introduce to you this newsletter on health and ageing. As usual, this newsletter aims to present the various activities organised within the Health and Ageing research programme of The Geneva Association.

Most of this newsletter will be dedicated to the topic of emerging health risks and insurance, which was the theme of the last Health and Ageing conference that took place in Madrid on November 2014, hosted by MAPFRE Foundation. Allow me to briefly reflect on the issues at stake.

The changing global risk environment has led to the appearance of new risks in the context of health, including behavioural risk, big data, pandemics and environmental health risks. For all these risks, it is very likely that insurance will have an increasingly important role to play in helping society to adapt and become more resilient.

Starting with behavioural risks, the chief factors among them—smoking, heavy drinking, poor nutrition, lack of exercise—are known causes of cancer, diabetes, lung disease and cardiovascular diseases, which in turn drive health-care expenditures, disability and mortality. Insurers can develop various strategies to address these behavioural factors, ranging from risk-based pricing to using better analytics via new models and big data, which makes possible the development of continuous underwriting and predictive underwriting.

Insurers can also modify behavioural risk factors through wellness programmes that encourage healthy diets or increase physical activity. These programmes have been the fastest growing areas among employer benefits in the U.S. for several years, and health insurers in other countries are developing similar programmes. Wellness programmes offer exclusive rewards to motivate healthy engagements, such as free cinema tickets, cash back on holidays or rebates on spas. Engagements in wellness programmes have shown a decrease in claims for health insurance and life insurance, and

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a positive impact on sickness absence and employee performance and retention. The question is how such wellness programmes should be structured within an insurance contract to be efficient in the long term and to engage the higher risk population in healthier behaviours.

Big data, meanwhile, which contributes to medical innovation with the Internet by combining health apps, electronic medical records, genome data and public databases, can create many opportunities by providing information applicable to underwriting, claims management, product development, pricing and distribution. This also can lead to insurance policies that are more personalised and more specific to the individual risk profile and not governed by risk pooling. On the negative side, big data can create higher adverse selection, as consumers will know their health profile better, while insurers may not be able to use health data due to data protection legislation and anti-discrimination laws. With the proliferation of data, barriers to entry into insurance are changing, and the crucial question is who, of insurers, retailers, big pharma or social media companies, will offer the new business models.

A third emerging risk is pandemics, and the current Ebola crisis reminds us of the high vulnerability of societies and economies to pandemic risks. Pandemics are one of the most important tail risks for both life and non-life insurers with potential consequences for many insurance lines of business such as life and health, business interruption, liability and property loss. Impacts are also likely on capital markets and on the investments made by insurers. The insurance industry has an important role to play in managing this risk both through risk modelling and risk financing, as well as by helping to improve health system preparedness. In that way, the insurance industry can expand its social and economic role as a tool for individuals, institutions and governments to mitigate the impact of a major pandemic.

Finally, a fourth type of emerging health risk is environmental health risks, which broadly concern air quality, water quality, toxic substances and climate change. While these health risks have many consequences on claims for health and life insurers, they can also offer potential business opportunities in terms of products, underwriting and pricing. Illustrations of new products are specific coverage for asthma, term life insurance with specific riders linked to cancer, enhanced annuities for clients in heavily polluted cities, or group policies with pricing factors such as distance of the firm from public transportation, number of cars in the firm's fleet or whether there is internal quality monitoring. Other potential insurance products include an annuity payment to cover daily treatment expenses due to intoxication or microinsurance cover through payment of the daily salary in case the insured is not able to go to work due to water-related diseases (e.g. diarrhoea).

All these themes will be developed further in this newsletter with five contributions which had been presented at the 12th Health and Ageing conference in Madrid. Achim Regenauer addresses the implications of big data for life and health insurers. Séverine Rion Logean discusses how web-based data mining of chronic disease can open new opportunities for the insurance industry. Florian Boeker reviews lifestyle risk trends and their dynamic and varied impact on life and health re/insurance. Steve Hales and Elisa Pestrin describe the main environmental health risks and investigate their impact on the life and health insurance industry. Gordon Woo reflects on the risk management of pandemics and the contribution of insurance in that respect. Two other contributions complete the newsletter. One is from Philip Wilson on the market of enhanced annuities; the other is from Ines Läufer, who considers the institutional factors in the U.S. health insurance system which could make a long-term health insurance unattractive for many individuals.

Finally, I would like to inform you about two important future activities of the Health and Ageing research programme. The first one is the forthcoming Health and Ageing conference, hosted by the Singapore College of Insurance on 17–18 November 2015. The theme of the conference is 'Insuring health care for the elderly in Asia'. Further details regarding this conference are available on page 32 of this newsletter. The second important activity is the publication of an October 2016 special issue on health of *The Geneva Papers on Risk and Insurance—Issues and Practice*. I am very fortunate to co-edit this issue with John Nyman, Professor of Economics at the University of Minnesota. While the deadline is still far away, i.e. 9 December 2015, I encourage any parties interested to submit a paper for this special issue (see the call for papers on page 32).

I hope that this new issue of the Health and Ageing newsletter provides you with challenging thoughts and contribute to broadening the debate on finding solutions for the future financing of health and longevity risks and how insurance can help to be part of these solutions, one of the aims of the Health and Ageing research programme.

Health Apps—Hype or Opportunity in the Risk Management of Life and Health Insurance?

By Achim Regenauer⁺

"Is there a doctor on board?" the captain's voice inquires through the speakers. The Airbus took off from London half an hour ago and is on its way to Tokyo, when a passenger suddenly complains of acute chest pains. Fortunately, a doctor offers her help. The crew is relieved, at least for a moment. Because, instead of beginning with the treatment, the physician pulls out a smartphone. "You can't make a telephone call now!" one of the stewards blurts. But the doctor remains cool, places the smartphone on the patient's chest and analyses the ECG on its display using an app. She diagnoses a heart attack, and the captain turns the plane around immediately. When the plane lands, a rescue van is already waiting on the tarmac for the passenger, and it takes him to the nearest intensive care unit. Thanks to the rapid treatment, the passenger survives. Science fiction? No, this is already today's reality!

All kinds of information today can be collected, saved and transmitted by smartphone. That is one of the reasons why the volume of data available around the globe has increased so explosively in such a short time. Big data is what this is, and the next data explosion is already starting—triggered by digital networking in what is called the "Internet of Things" (IoT).

What are the implications of this for life and health insurance, that is, for an industry, the competence of which it is to estimate risks as accurately as possible, primarily on the basis of statistical data, and to adequately cover those risks? The following explanations endeavour to approach this highly topical question, by initially showing the extent of the rapidly accelerating data growth and then investigating the triggers and future drivers of this trend. Finally, we venture to describe a scenario for how things may develop in the future, while, of course, looking into possible risks and opportunities for life and health insurance.

Digitalisation and the disruptive power of the smartphone

The days in which data were only gathered and stored on paper are long gone. Large companies have been working with computers and storing information digitally ever since the 1970s. But although the amount of digital data being produced has continuously grown since then, 90 per cent of all the world's available digital data has been generated in just the last two years!

How can this enormous growth be explained? The fact that processors are getting ever cheaper and smaller plays a role, but also storage capacities are doubling every two years, and the higher transfer speeds are another aspect. Digital communication, information and exchange are being taken more and more for granted both in the private sphere and in business life. But the decisive surge presumably originated in the mobile availability of the Internet on smartphones. The explosive data growth is accompanied by the global spread of smartphones and the enhancement of their functionality with ever-new technology and apps. To illustrate: in 2011 there were no smartphones with digital payment function, mobile TV or health apps. Today, these are all standard equipment on new smartphones. Within the shortest period of time, the smartphone has developed into the mobile hub for the exchanging of numerous personal data. Every single piece of information can be stored electronically somewhere, and this includes large amounts of health data. The question remains as to whether and how this information can be usefully evaluated and used.

And it is a question that the health-care and insurance industries have been occupying themselves with since way before the advent of the smartphone, because the digitalisation of health has been striding forwards for decades now: in the U.S. today, around 70 per cent of all clinical data are available in electronic form. But most of this information is not used for any further purpose. And this despite the fact that better networking and the purposeful assessment of these health data would without doubt be beneficial, for example, to ensure medical assistance in rural areas despite a scarcity of medical practitioners, or to gain a better understanding of the risks arising from the

⁺ Chief Medical Director, Munich Re.

demographically-based increase of chronic ailments and to protect against them. In reality, this is hardly happening at all, because the data formats available and their IT systems are not suitable. The reason for this is the silo mentality in a heavily fragmented health-care system. Each clinic has its own data system, which means that the information is not comparable. For life and health insurers this means that around 90 per cent of all data are largely inaccessible to them. The EU Commission has recognised this and formulated the following demand in its eHealth Task Force Report 2012: "Governments should ensure that health data is ... gathered in a standard way, anonymised and then made freely available to anyone that can add value to it."¹

Up to now, this demand from 2012 has not been fulfilled either in the European or in any other health-care system, even though the dimension of the problem has further increased through the disruptive power of the smartphone. The American Medical Association, for instance, counted more than 97,000 health apps on the U.S. market in October 2014. They range from lifestyle apps for fitness, sports, wellness and nutrition, through to apps for medical monitoring by doctors, patients and consumers. For example, blood pressure, heart rate, body core temperature and blood sugar level can all be measured using a smartphone (often with the aid of additional hardware). Depending on the app, the owner of the smartphone can then transmit these data directly to the attending physician, who then has more information pertaining to the patient's blood pressure or blood sugar situation. Even skin cancer, as some apps promise, can be found without having to visit a doctor, simply by laying the smartphone on suspicious skin areas.

Lots of data, little significance?

Despite all the euphoria and the growing desire to measure one's own medical status, a good helping of scepticism is urgently advised here—both on the part of the user and in the health-care system itself, and even more so among life and health insurers. As the author sees it, four things have to be focused on particularly.

- (1) **Quality** of the health apps: Many of these apps are still too complicated to understand and use, generating e.g. unreliable alarms when exceeding certain threshold values. In addition, there is an almost complete lack of universal standards, although they would be urgently needed. The U.S. IMS Institute for Healthcare Informatics rated about 90 per cent of all health apps with 'poor performance' in its 2013 study.
- (2) **Compliance/engagement**: The fact that people like apps is made quite apparent by the enormous number of new ones being developed. According to one U.S. study, the usage duration of health apps is well above average, even when compared to non-health apps. Two-thirds of the users actively use their health app tool for more than a year, says the study. There are virtually no experience values on lasting changes of behaviour—for example, an adjustment of lifestyle. So the benefit of health apps for users would appear to remain unclear in this context. There are individual observations that evidence increased physical activity or more reliable tablet intake, but these findings are anything but proven.
- (3) **Fragmenting**: End consumers use health apps on a wide range of different devices, such as smartphones, tablets, smartwatches and special monitoring devices such as step counters, bicycle tachometers, etc. Every single device gathers data, but who can bring all those data from different platforms together to form meaningful health profiles?
- (4) **Evaluation** of the gathered data: how can valid lessons be learned from the biometric data collected? Do the apps perhaps even have an effect on the mortality and morbidity of the user group—two parameters that are essential for life and health insurers? This and many other questions, first and foremost the issue of data protection, remain unanswered to date.

Big data as the key to business-relevant answers

The challenges described above illustrate that: the knowledge gain does not increase proportionately to the quantity of the data. That is why it will be so important to make the data useful through comprehensive analysis.

Here, enormous overlaps result with big data, a buzzword that has been dominating the media since last year. In the first instance, the term only refers to a data volume that cannot be analysed with customary methods, because it is quite simply too large and complex and it changes too quickly. That is why big data technologies are needed, to

¹ European Union (2012) *Redesigning Health in Europe for 2020*, Luxembourg: Publications Office of the European Union, p. 10.

bring together, structure and evaluate unimaginable volumes of data from various sources almost in real time with the aid of intelligent algorithms. The first promising solutions are already here; the required IT is available and the software is now affordable as well. The goals of many big data projects are ambitious: using algorithms, they exploit the flood of data to identify correlations and patterns, and as the basis for decision-making in complex contexts. Even complex predictions no longer seem impossible—for instance, traffic-jam forecasts already function on this principle today.

In view of these opportunities, data are being referred to as the crude oil of the 21st century. But unlike black gold, the sources of digital gold are flowing ever more abundantly. Catchphrase: the Internet of Things: in January 2015, *Handelsblatt Online* cited the chief economist of the American Consumer Electronics Association (CEA) Shawn DuBravac as saying, "Two billion smartphones will become 50 billion networked devices". Then, he said, digitalisation will have reached the next level. Another example gives us a sense of what that means: the Google research lab is currently working on developing a contact lens for diabetics. It is said to have sensors that analyse the tear fluid to measure the blood sugar level. An integrated micro radio chip then sends the data in regular, short intervals straight to an app on the patient's smartphone. And in the future, it could fully automatically control an implanted insulin pump and theoretically, enable diabetics to lead a 'normal' life again.

The next disruptive leap—the iTunisation of personal health data?

This example shows that: the digital networking of biometric sensors (wearables) and various medical devices produces an enormous amount of health data that were never before available. Every single app gathers information and examines it separately in one way or another. A comprehensive health profile with meaningful data does not come about in this way. The Internet giants have also long since recognised this and acted. Owners of latest-generation smartphones already hold the first results of this in their hands: platform apps called Apple Health Kit, Google Fit or Samsung Health that automatically merge the data from all the installed health apps and compile a more comprehensive health profile. There now have been reports of considerable technical problems with the first versions of these apps, but fast digital progress will soon show these issues to be of a merely temporary nature, particularly in view of the fact that health data represent an asset of enormous value.

The role model is the iTunes principle for all kinds of music: The platform apps bundle all digital health data in one place, meet the user's demand for constant self-measurement and optimisation, give orientation or may help in the early recognition of medical problems. It is even conceivable that, in the future, they might serve as an electronic emergency pass and provide data that will open up entirely new business potential to commercial providers with the aid of big data technologies. It is to be assumed that a standardised IT platform will contribute significantly to the standardisation and quality improvement of health apps.

Opportunities and risks for the business model of life and health insurers

But wherever entirely new opportunities arise, risks also arise for established markets and business models. For example, it is entirely conceivable that medical problems might be recognised earlier in the future thanks to the digitalisation of health data. This could drive the costs of health insurers for preventative measures way up. On the other hand, the costs of diagnosis could possibly be reduced by medical self-monitoring. Right now, nobody can say what the actual effects on the cost structures of the insurance industry will be.

And there is another risk: an increasing disparity of information between the policyholder and the insurance company. If the consumer no longer goes to a doctor to diagnose a suspicion of, say, skin cancer, and instead only has to consult his smartphone, could the anti-selection risk for life and health insurers not also increase? The consumers are better informed about their health risks, and risk-relevant information might no longer find its way into official medical records.

The legal framework is also having great trouble trying to keep pace with the rapidly increasing range of health apps: What minimum medical standards and requirements apply? Who is liable for a diagnosis provided automatically? Who do the obtained data actually belong to? And what about data protection? These and many other questions still remain unanswered.

And yet, the insurance industry cannot and must not ignore the trend: in order to exploit the opportunities provided by the digitalisation of health data, life and health insurers have to occupy themselves with this new

technology and keep a close eye on possible consequences for their business model. Otherwise there is the danger that major Internet players from outside the insurance industry may move into the arising gaps and successively gain market shares. Since customers think less about tariffs when covering risks than about security for their problems, and seek orientation in an ever more complex (medical) world, health apps may be an option for improving the personal contact and lead to greater customer loyalty. For example, through the smart assessment of health data, life and health insurers, as the natural risk partners, could encourage their customers to lead more healthy lives. Applying behavioural economics insights, incentives could be offered here that might lead policyholders with a risky lifestyle to lastingly change their ways. In the best-case scenario, this might even change the image of the industry, away from that of a risk hedger that sanctions higher risk with higher premiums or exclusion clauses, towards that of a caretaker that proactively manages risk to minimise it.

Of course, this option is only one possible service or expansion of the business model that is made possible by the digitalisation of the insurance industry. It is without doubt recommendable to keep a close eye on these developments, which are not unimportant for life and health insurance companies.

Social Epidemiology

By Séverine Rion Logean⁺

Introduction

Web-based data mining of chronic or infectious disease provides real-time data on a global level, a fact that revolutionises health surveillance and opens new opportunities for the health and insurance industries, and for public health. Typically, online collected epidemiological data can fill gaps when company internal data is scarce, as for example when business is expanded to new markets or to complement available data sets from other sources.

If social media platforms provide a different picture of global health to that using traditional health surveys, we have identified invaluable data sources for a new generation of health surveillance systems.

Within Swiss Re we have developed a proprietary tool, the Chronic Disease Map (CDM) in order to observe regional real-time trends on different facets of chronic disease experience based on Twitter messages. As well as finding new data sources for smart analytics, Swiss Re has developed new in-house capabilities and expertise as we overcome challenges in producing the CDM Tool.

Background

In Life and Health reinsurance the availability of experience data, epidemiological data and mortality tables is crucial when it comes to product development or pricing. Working in Research and Development, we are often confronted with requests for health or disease data for regions where internal data is scarce or public data is not easily accessible. Epidemiological data may only be published several years after its collection, which limits its usefulness in judging recent trends. Data collection and processing by government agencies vary from country to country and may be difficult for external parties to judge, whereas the systematic collection of social media real-time data allows for new insights into global health and disease dynamics.

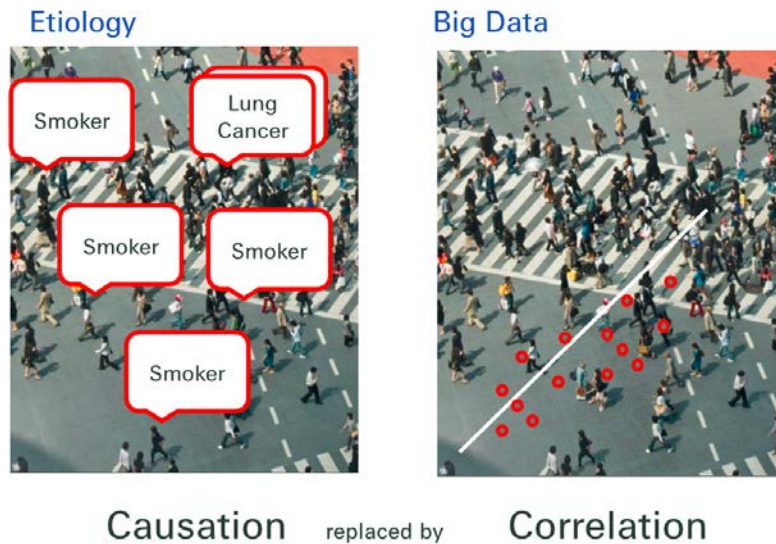
Digital epidemiology

Epidemiology is concerned with the dynamics of health and disease in humans. It takes into account risk factors and behaviours that influence the health outcomes, and aims to discover causal relationships between risk factors and disease. Traditionally, epidemiological data has been collected by public health agencies through hospitals, doctors or other healthcare institutions; a very time- and resource-consuming task. Thanks to digital communication technologies, data can nowadays be collected directly from individuals leaving online traces on public domains [1]. Data collection is thus much more efficient and covers many more data points. This offers new possibilities for data analysis: while traditional epidemiology seeks to reduce disease through reducing exposure to

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risk factors, big data analysis promotes correlation over causation. Correlation does not imply causation, but correlations in a large enough database can indicate a predictive relationship, which can be exploited in practice.

Picture 1: Big data analysis promotes correlation over causation [2].



The continuous revolution in the way people communicate and the increased use of electronic devices have increased dramatically the volumes of data being created and shared continuously. We are able to focus on different countries or regions and digital communication channels facilitate the accessibility, storage and analysis of the data [3]. Relevant information on disease epidemiology can be extracted from what we do and say on public platforms and analysed. Extracting meaningful information is challenging but provides huge opportunities [3].

Short history of the new data opportunity

Some of you will remember when Tim Berners-Lee, back in 1986, announced the arrival of the internet, the so-called Web 1.0. It was a revolutionary technology, allowing individual users to search and read information on the World Wide Web. Web 2.0 provides individuals with the opportunity to produce content and share that content through many channels. Examples are sharing text on blogs, videos on YouTube, or pictures on Instagram. Web 2.0 allows bidirectional communication, where every individual can communicate with many others. A collective intelligence is being created, allowing you to find the news and the news to find you (e.g. by following your favourite editors on Twitter).

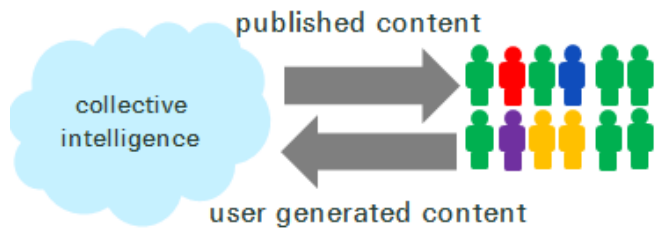
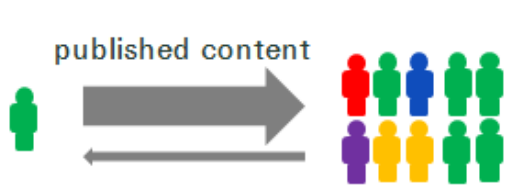
Picture 2: a) The Web 1.0 refers to the World Wide Web, an online unidirectional way of communication. b) The Web 2.0, allowing a bidirectional way of communication, building a cloud of collective intelligence.

a)

b)

Web 1.0

Web 2.0



Today we are at the brink of the next innovation, Web 3.0 or the internet of things. Not only individuals will be sharing content on the net, but sensors integrated in all kind of devices, houses, cars, etc., will be collecting data and share that data with other devices via the web. Fridges that keep themselves fully stocked without troubling you.

The amount of data that is being uploaded to the cloud is almost beyond comprehension and continuously growing. The numbers below shall give you an insight into how many messages or videos are shared on some of the most popular social media platforms.

Picture 3: Amount of data being shared on selected social media platforms: Twitter, YouTube and Facebook [4].

Twitter	5787 tweets are sent per second, 288 million monthly active users (2015)
YouTube	5 videos are uploaded to YouTube every second, > than 1 billion users (2015)
Facebook	55'000 pieces of content shared on Facebook every second (2013), over 1.39 billion monthly active users (2015)

Obviously not all these messages are related to chronic diseases. However, a PricewaterhouseCoopers study on social media and healthcare published in 2012 found that 15–30 per cent of consumers use social media to share health symptoms and comment on their own and others' experiences and behaviours [5]. Further 30–45 per cent of health decisions are affected by information from social media, such as coping with chronic conditions or pain, approach to diet, exercise, stress management, or taking medications [5]. As a recent controversial study from Facebook illustrated, social networks have the ability to influence emotions without direct interaction between people [6]. Further, 'social media medical doctors' that listen to your tweets and spot changes in your health might message you with recommendations, and may motivate some to share health data.

Chronic Disease Map Tool

The Chronic Disease Map Tool accumulates tweets over time, related to cancer, heart disease, diabetes and obesity on a geographical map. Specific search terms are chosen that are either descriptive of the condition, e.g. overweight for obesity or the treatments that might be used.

Picture 4: Chronic Disease Map Tool timeline representing time on the x-axis, and number of tweets for cardiovascular disease, cancer, diabetes and obesity, including all diseases, on the y-axis.



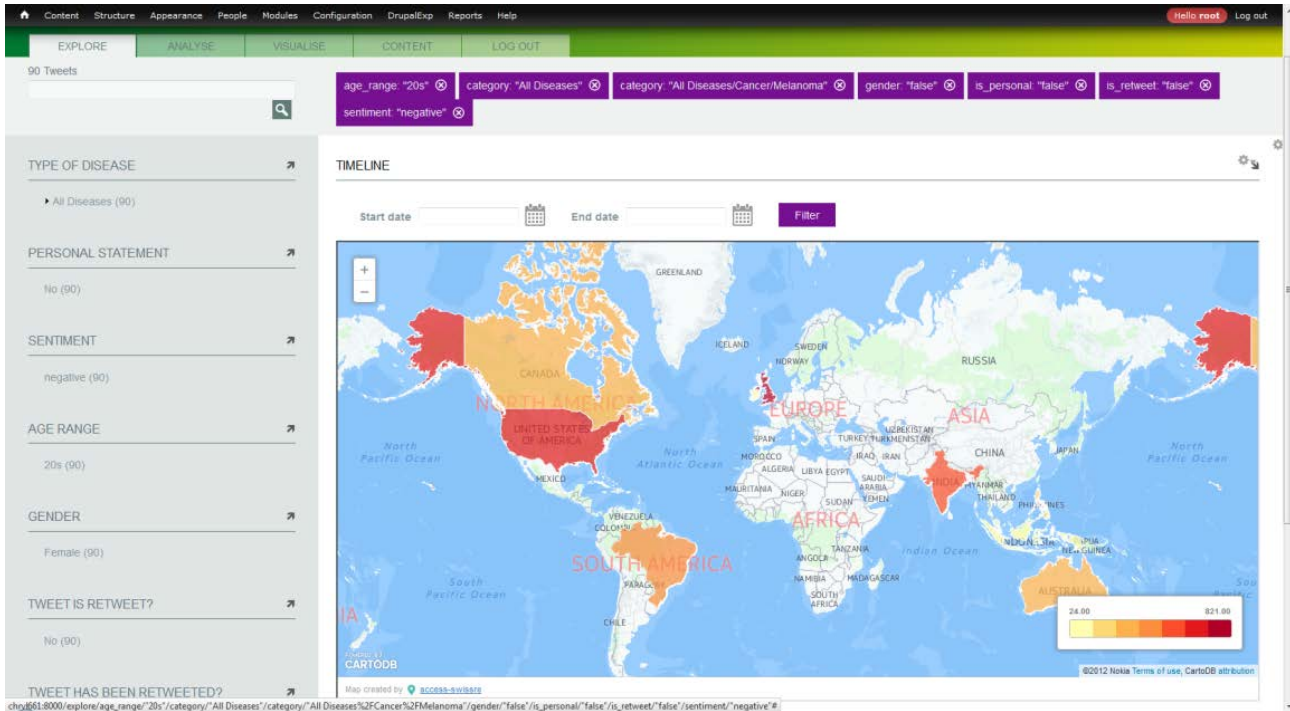
Source: Swiss Re

In order to relate the messages to personal disease, tweets are selected that include a personal attribute like “I have...” or “my”; World Wide Web links are not considered, as they are often related to publicity or news.

Challenges were encountered in selecting tweeting populations that were representative of re-/insurance portfolios. Algorithms have been developed for Twitter population characterisation. Based on these, the Twitter population is

automatically classified according to age and gender. The geolocation of the tweets is provided by GNIP, one of the official Twitter data providers.

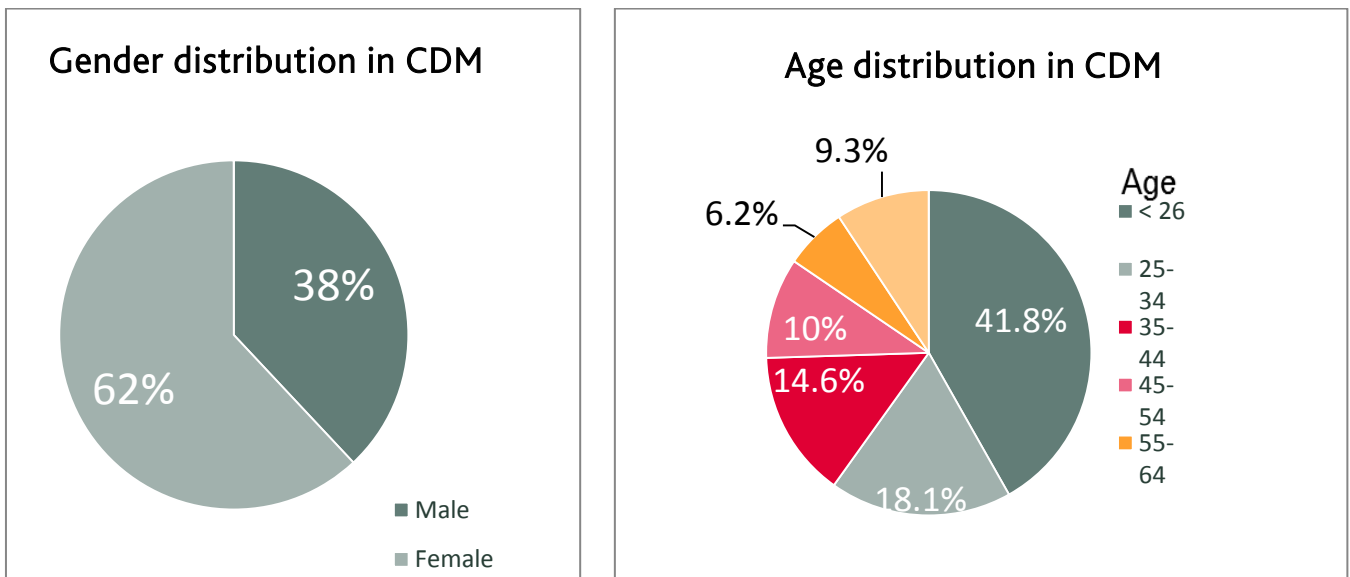
Picture 5: Chronic Disease Map Tool, overview.



Source: Swiss Re

So far, the CDM data shows a gender split of 62 per cent female (f) and 38 per cent male (m) tweeters. A publication by Beevolve from 2012 suggested a split of 53 per cent (f) versus 47 per cent (m) across Twitter. This is consistent with the expectation that more women are tweeting about their or their families' health. Gender classification of tweets is based on the content of the messages. Words or phrases related to emotional and social processes are mainly used by females (e.g. "excited", "love you", "best friend"), whereas males mention more swear words and object references, and fewer emoticons.

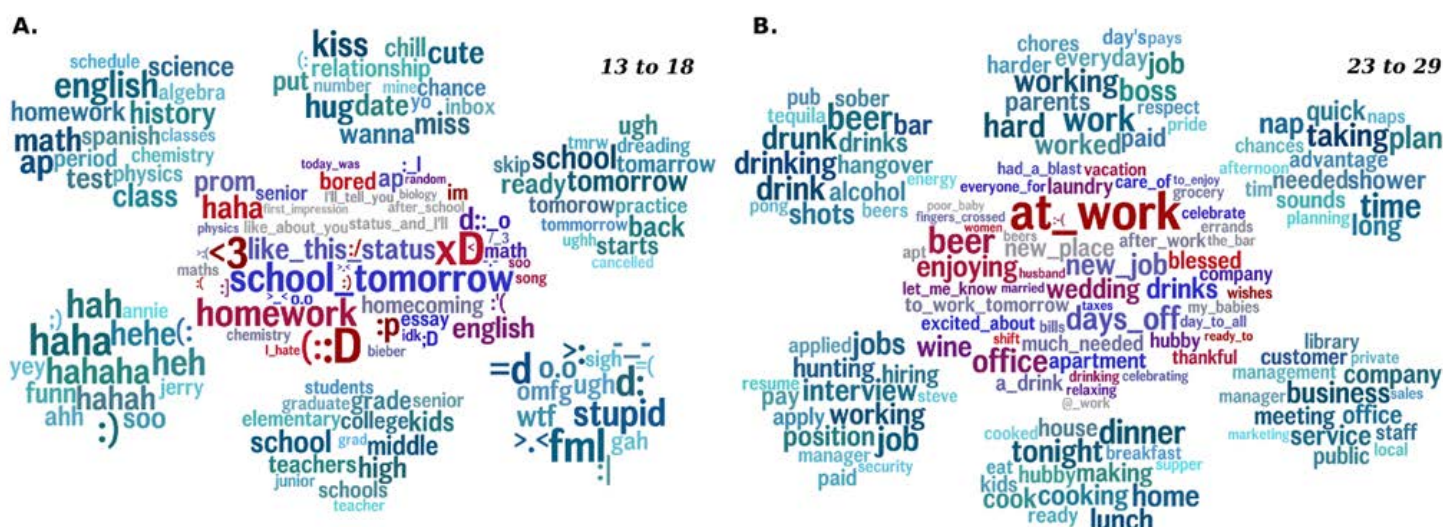
Picture 6: Chronic Disease Map Tool, gender and age distribution of Twitter messages.



Source: Swiss Re

With regard to the age of tweeters, the elderly are overly represented in the CDM Tool (see Picture 6), which is consistent with greater healthcare needs, but at the same time it is clear that Twitter spans the generations. Content of the messages can also be used to identify the age of tweeters. Whereas teenagers talk about education and school, those in their twenties focus on work, drinking, household chores, and time management.

Picture 7: Chronic Disease Map Tool, word clouds for teenagers A., and for those in their twenties B.



Source: Swiss Re

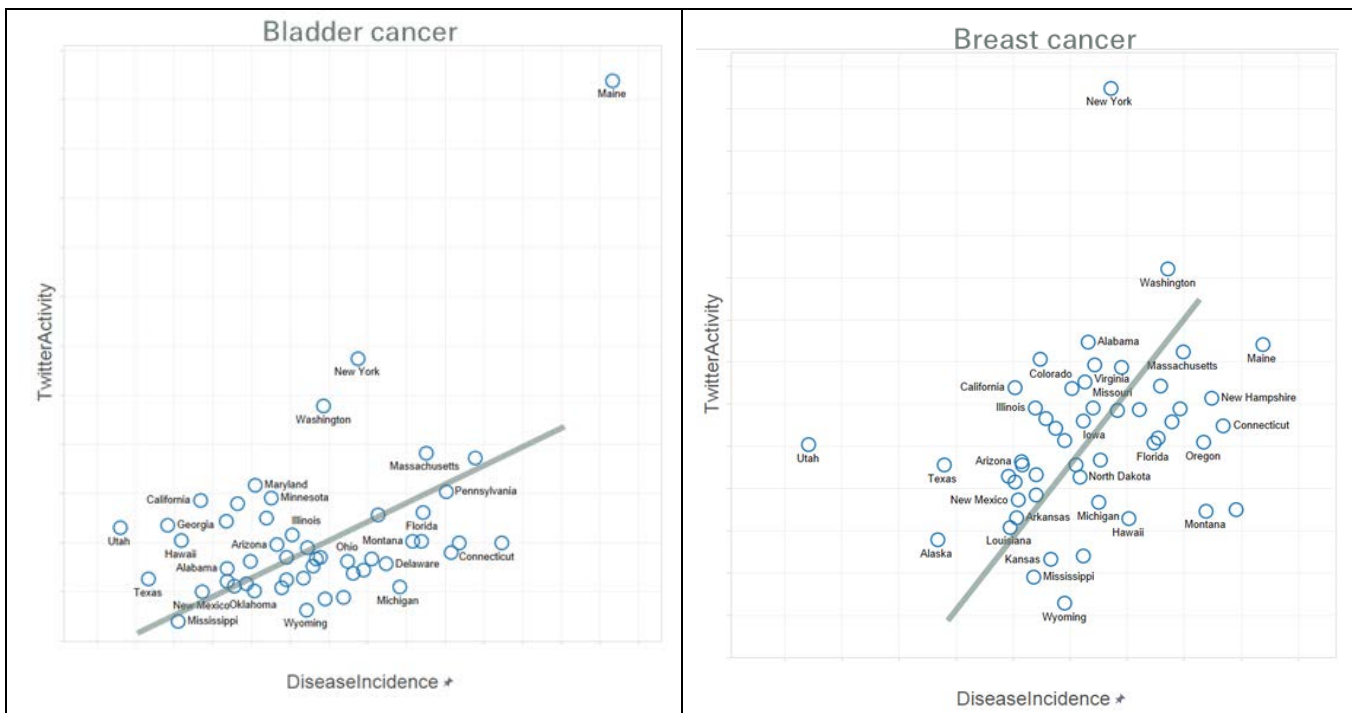
We found for both age and gender that in-house classification approaches worked better than commercial solutions. We are able to customise the classifiers to the domain of chronic disease, whereas the commercial approaches only offer domain independent classifiers (hence less specialised).

Application and relevance for the re/insurance industry

People's behaviour or concerns expressed online give indications on disease trends and encourage the insurance industry to develop new products, which meet new societal challenges. Marketing campaigns can be timely and focused on local topics of concern. Developing trends in claims can be identified and addressed. With regard to health behaviour, the uptake of new tobacco products at local and national level, for example, can be captured early and integrated into forward-looking scenario modelling. Furthermore, sentiment analysis on different treatments can identify individual concerns and likely drug adherence.

In one case study, we compared the Twitter activity on different cancers in several U.S. States with cancer diagnoses by the American Cancer Society (ACS). Comparisons can be made on the correlation between Twitter activity and cancer incidence, such as illustrated here for bladder cancer and breast cancer.

Picture 8: Twitter activity versus cancer incidence for bladder and breast cancer in different U.S. States.



Source: Swiss Re

In another, we looked at sentiment analysis on different classes of diabetic drugs to provide a picture on how individuals feel about their diabetes treatment. When looking for side effects, more complaints were linked to GPL (Glucagon-like peptide)-1- agonists than to insulins or thiazolidindiones. This is an interesting insight into diabetes management as it links to drug adherence which may limit secondary disease.

Conclusion and insights from the project

Social media is a valuable data source for Big Data and Smart Analytics applications for the re/insurance industry with potential predictive value. Respect of data privacy is and must be paramount, and data is strictly analysed on an aggregated basis. Distrust of social media analytics must be addressed by transparency over data sources and analytical techniques.

Potential use cases could include:

- defining targeted marketing campaigns that address local topics of concern
- supporting targeted product development through understanding consumer needs and behaviours
- supporting claims management and preparedness

Multidisciplinary groups of topic experts and data scientists must be involved to dig into the data and find genuine meaning. This is time-consuming work; the interpretation of Big Data comes not just by storing it. The same can be said in getting a system like the CDM running from scratch. Significant human effort was needed before the automated processing of data was possible. A clear challenge was determining the location of tweets, and classifying tweets according to age and gender.

The potential online sources of information are manifold. They include, but are not limited to, blogs, chat rooms, online news media, or other social networks like Facebook, YouTube, or web search records comparable to the Google Trends suite. The inclusion of different language searches and analytics broadens the access to regions where Twitter activity is not limited to the English language.

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A Matter of Style

By Florian Boecker⁺

Lifestyle risks are now the overall dominant factor that determines the likelihood of a long and healthy life. Florian Boecker, Head of Life Solutions at PartnerRe, reviews lifestyle risk trends and their dynamic and varied impact on life and health re/insurance.

We all hope (and in many cases, expect) to live a long, healthy life. Over the last century, disease and accident prevention measures and medical progress have massively improved our chances of doing just that. Indeed, the world average life expectancy at birth more than doubled over this period, increasing from 31 years at the beginning of the 20th century to 68 years in 2013² (although there is still a large contrast between developed countries, where a newborn can expect to live well beyond its 80th birthday, and the poorest countries where it will struggle to reach its 50th). Most of this progress in life expectancy is due to the successful fight against infectious diseases, better treatment of cardiovascular disease and a reduction in accidents and injuries.

However, we are not doing as well as we could do in minimising our risk of disease and injury when the contributory cause relates to the way in which we (in the main, choose to) live our lives. Known to re/insurers as 'lifestyle risk factors'—smoking, drinking, drugs, poor dietary habits and lack of physical exercise, for example—have a significant negative influence on our health.

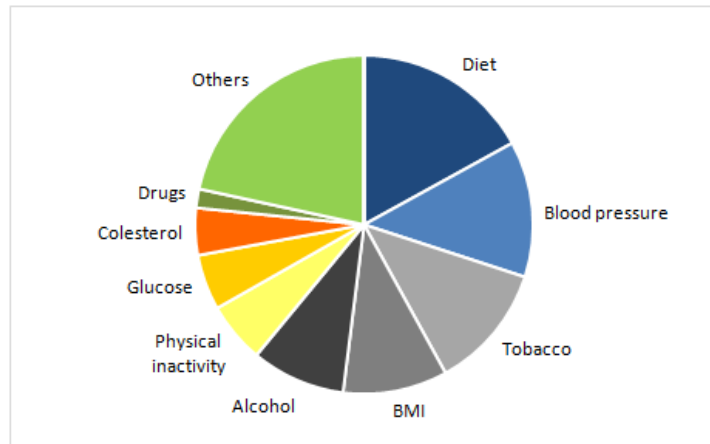
To better understand the impact of lifestyle risk factors, we can look at the disability-adjusted life years (DALYs) concept, a measure of the 'burden of disease'. This measure is defined as the number of healthy years lost due to both sickness and premature mortality, compared to an ideal situation where everyone in the population lives healthily to an advanced age.³ Splitting DALYs by cause indicates where the major health issues lie in a population. As Figure 1 shows, DALYs directly linked to lifestyle risk factors account for more than 75 per cent of total DALYs in developed countries. This demonstrates just how important it is to monitor and understand the various lifestyle-related risk factors and their respective evolution.

⁺ Head of Life Solutions, PartnerRe. To find out more about PartnerRe's Life risk solutions and for more research articles on life and health insurance: <http://www.partnerre.com/risk-solutions/life>.

² *CIA World Factbook*.

³ http://www.who.int/healthinfo/global_burden_disease/metrics_daly/en/.

Figure 1: DALYs in developed countries in 2010 by cause.



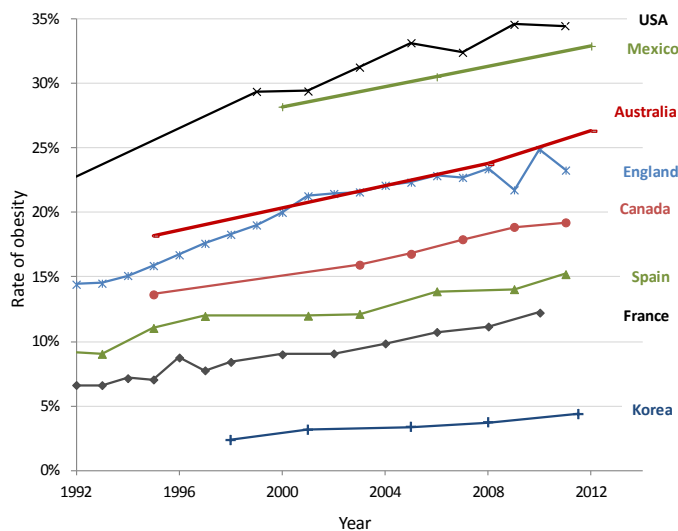
Source: Institute for Health Metrics and Evaluation (www.healthdata.org).

Over-sized vs under-sized

Weight-related issues are the biggest contributor to DALYs in developed countries (Figure 1), with problems at both ends of the weight spectrum.

At one end of the scale, a rapidly increasing number of people, especially in developed countries, now qualify as obese, i.e. have a body mass index (BMI⁴) of 30 or higher (Figure 2). Of particular concern is the fact that the highly obese subpopulation (persons with a BMI of 35 or higher) is growing even more rapidly than the 'normally obese' group.

Figure 2: Development of obesity rates by country.



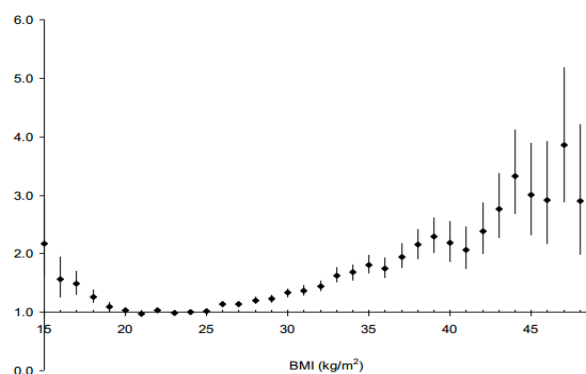
Source: OECD.

Obesity is linked to higher mortality incidences (Figure 3), mainly from cardiovascular diseases, type 2 diabetes and cancers. Although recent studies indicate that moderate overweight can actually reduce mortality in certain age groups, the severe negative impact of obesity on morbidity is unambiguous.⁵

⁴ BMI is of course a very imperfect measure for the adequacy of a person's weight; however, it is still widely used and is considered sufficient in the context of this article.

⁵ Source: Gutterman, S. (2014) 'Obesity and Mortality', *Proceedings, 30th International Congress of Actuaries*, 30 March–4 April 2014, Washington, DC.

Figure 3: Mortality hazard ratios (with 95% confidence interval) by body mass index (BMI) for healthy never-smokers.



Source: Berrington de Gonzalez *et al.* (2010) *New England Journal of Medicine* 363:2211–2219.

Increasing obesity rates are considered to be the result of the appeal and convenience of low-cost, often unhealthy food, combined with low levels of physical activity and the general acceptance of a certain level of overweight as a developing norm in some societies.

While we will have to live with the consequences of increasing obesity, including the financial strain on health systems, there is at the same time some positive news. The recent, and hopefully sustainable, trend towards personal fitness and health programmes could lead to a partial reversal of the obesity trend, although the effect may be selective within certain subgroups. Technology, primarily in the form of wearable fitness trackers and health apps, has the potential to play a crucial role in this development by encouraging users to enhance their activity and fitness levels.

While obesity remains an immense societal problem, being underweight is also a major health concern. As Figure 3 shows, the mortality hazard ratio for a BMI of 15 is above 2 (which means that a person with a BMI of 15 has more than double the mortality of a person of the same age with an 'ideal' BMI in the low 20s), which is similar to that for a BMI of 40.

Contributing to these figures, severe eating disorders such as anorexia nervosa and bulimia nervosa have the highest mortality rates of all major mental illnesses.⁶ Although it is surprisingly difficult to find credible data for the prevalence of eating disorders in the general population, these conditions are substantially more present amongst younger women and seem to be increasing in this subgroup. While the underlying factors are complex, peer pressure fostered by social networks, fashion trends and movements that promote extreme thinness as an ideal body form,⁷ seem to play a progressively more important role. This is certainly something to monitor carefully.

Still cool to smoke?

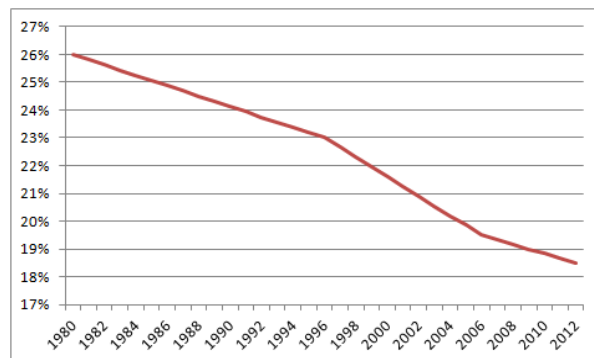
The use of tobacco increased continuously throughout the first three quarters of the last century; it proliferated during the major wars of this period, supported by aggressive marketing and PR campaigns by the tobacco industry. Since the causal link between smoking and certain types of cancers has been established, the attitude of society towards tobacco consumption has changed, leading to the introduction of a broad variety of measures to discourage smoking.⁸ As a result, the prevalence of smoking around the world has significantly decreased (see Figure 4).

⁶ See for example <http://www.anad.org/get-information/about-eating-disorders/eating-disorders-statistics/> or R. Lozano *et al.* (2012) *The Lancet* 380(9859): 2197–2223.

⁷ e.g. Pro Ana (pro-anorexia) and Pro Mia (pro-bulimia).

⁸ *The Emperor of All Maladies* by Siddhartha Mukherjee (2010) [New York: Scribner] is an excellent reference for this topic.

Figure 4: Prevalence of global smoking over the last three decades.



Source: Institute for Health Metrics and Evaluation (IHME).

Relatively recently, a new trend has emerged: e-cigarettes became very popular within just a few years of their introduction (see Figure 5 and King *et al.*¹⁰). In terms of health risk, the jury is still very much out on the associated long-term health effects of e-cigarettes and many are concerned by their potential to attract non-smokers. There is also anecdotal evidence that e-cigarettes are being used to consume illicit substances such as hashish oil. They are, however, overall considered by many researchers to be the 'healthier choice' because they lack most of the toxic ingredients that are present in tobacco, delivering mainly just nicotine (plus propylene glycol/glycerine) in vapour form. As Figure 5 shows, the interest around e-cigarettes may already have peaked, supported by a corresponding fall in reported sales¹¹ in some markets.

Figure 5: Trending of the search term 'E-Cigs'



Source: Google trends.

A tiple too many

Alcohol has a multi-faceted, predominantly negative, impact on health. Excessive 'binge' drinking and chronic alcohol consumption have slightly different effects, respectively linked to injuries and poisoning vs severe diseases including liver cirrhosis and cancers.

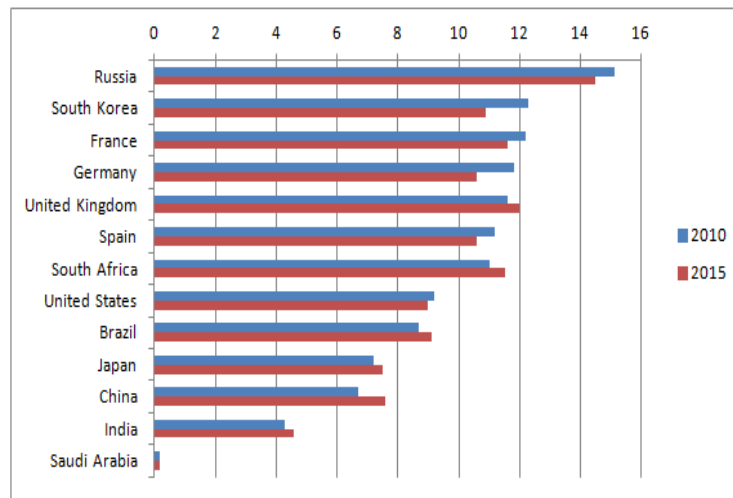
The trends in alcohol consumption vary significantly by country (see Figure 6).

⁹ www.healthdata.org.

¹⁰ King, B.A., Patel, R., Nguyen, K. and Dube, S.R. (2014) 'Trends in awareness and use of electronic cigarettes among U.S. adults, 2010–2013', *Nicotine & Tobacco Research* 17(2): 219–227.

¹¹ <http://www.bloomberg.com/news/articles/2014-07-16/e-cig-sales-slide-as-regular-smokers-return-to-real-thing>

Figure 6: Litres of pure alcohol consumed per person (aged 15 years and older) in 2010 and 2015 (estimated), by country.



Source: WHO [Global Status Report on Alcohol and Health 2014](#).

In developed countries with an established 'drinking culture', a person aged 15 years and over consumes on average 11–12 litres of pure alcohol per year. This equates to approximately three small (0.2 litre) beers per person per day—every person, every day! Although this number is alarming, the good news is that consumption is generally decreasing in most of those countries. Recent statistics from the U.K., for example, indicate that binge drinking levels are falling. However, some subpopulations, such as older men, are drinking more.¹²

Developing countries, for example China, India and Brazil, are experiencing an increase in alcohol consumption, but from a lower level compared to developed countries. This trend is mainly driven by a westernisation of lifestyle in combination with the increased affordability and availability of alcoholic beverages.

These two country groups are framed on the one side by Eastern European countries, which in general display very high alcohol consumption, and on the other by Islamic countries with negligible drinking levels. Both extremes indicate the importance of social acceptance of alcohol consumption as a determinant of its prevalence—an effect that we see to varying extents for all major lifestyle risk factors.

Insurance in a world of fast-changing lifestyles

In a world which has overcome many of the 'big killers' of the past, lifestyle choices have now become the dominant factor that determines the likelihood of a long and healthy life. They are therefore of great importance not just to the individual and to society in general, but also to life and health re/insurers.

The good news is that substantial progress is being made; smoking and alcohol consumption are on the decline in many countries and personal fitness is increasing in popularity, all of which will have a positive impact on health and mortality. However, there are worrying, negative developments in some areas, such as obesity, and lifestyle risk is clearly a dynamic area with subgroups that are at substantially higher risk irrespective of positive overall trends.

Looking into the future, technology, especially better data analytics, is set to lead to new life and health insurance products that are both very attractive for the policyholders, while at the same time protecting the re/insurers against anti-selection. Predictive underwriting will make insurance purchases more convenient for the policyholder. Wearables offer the opportunity to monitor and positively influence the behaviour of individuals and could be used to provide flexible, highly customised insurance protection at a comparably low price. These devices may actually become the life and health equivalent to telematics. In addition, previously uninsurable subpopulations, such as

¹² See 'Sex, Drugs and Rock 'n' Roll: Impact of Lifestyle Choices in the Over 50s', PartnerRe, 2013.

HIV-positive individuals, are now already able to access affordable life insurance cover¹³ due to advances in the treatment of this infection and a greatly enhanced comprehension of the risks associated with it.

An area where improvement is needed relates to the speed at which the re/insurance industry responds to changing trends, a good example being e-cigarettes, which may have gone through most of their 'popularity cycle' before the industry fully incorporated this phenomenon into underwriting.

As an industry, we need to better understand lifestyle risks and their impact on our customers. For better or worse, they are the key group of risk factors in life and health re/insurance, they are dynamic and they can be influenced.

How Can Life and Health Insurers Help Clients Facing Environmental Risks?

Steve Hales⁺ and Elisa Pestrin⁺⁺

Introduction

Over the next 30 years most of the world's population growth will occur in urban areas of developing countries—precisely where the health impacts on human beings of environmental risks can be expected to be the most significant. Insurers who want to grow their business in terms of numbers of lives insured will need to understand these risks, as they cannot assume that the risk factors affecting mature market populations can be merely extrapolated.

But also in mature markets, environmental risks offer opportunities. Volatile weather patterns produce significant property damage every year: is there potential for life and health insurers to take a more active role?

In this article, we describe the main types of environmental risk, and discuss the potential impact on insurers in terms of:

- underwriting
- product design
- corporate social responsibility
- infrastructure investments that can be linked to mitigating environmental risks.

What is an environmental risk?

An environmental risk can be defined as a factor outside the body that can affect a person's well-being and influence their behaviour. It can be created by man through the introduction of a new technology, a product, or a chemical, or it can result from natural processes which happen to interact with human activities.

They can be distinguished between risks reasonably well anticipated (such as flooding in a valley or pollution from an industrial smelter) and wholly unsuspected effects at the time the technology or activity was developed (such as possible effects on the earth's ozone layer of fluorocarbon sprays).

The second type is a challenge for insurers in terms of underwriting and product design: the lag time between the risk exposures and the resulting risk effects or disease diagnosis can be many years (e.g. mesothelioma might only occur 30 years after exposure to asbestos). What about future trends? Is it possible that materials that are regarded as safe at the moment may produce adverse health impacts 20–30 years into the future? When an insurer analyses and underwrites risks, he should try to make allowance for emerging risk factors on human beings in the future. Looking at the past may provide some clues, as can sensitivity testing and scenario planning, but in the end, it is a risk that by definition cannot be quantified.

¹³ See 'The changing profile of HIV', *PartnerReviews*, December 2012.

⁺ Head of Global Life, Generali.

⁺⁺ Senior Life Reinsurance Analyst, Generali.

In this article, we discuss the four main types of environmental risk:

- air pollution
- poor water quality
- climate change
- toxic substances.

The WHO estimated that 8.5 per cent of total world deaths are attributable to the first three categories, with impacts heavily skewed towards lower income regions: 9.3 per cent in low- and middle-income regions and 2.6 per cent in high-income regions:

Percentage of deaths			
Risk	World	Low and middle income	High income
Indoor smoke from solid fuels	3.3	3.9	0.0
Urban outdoor air pollution	2.0	1.9	2.5
Unsafe water, sanitation, hygiene	3.2	3.8	0.1
Global climate change	0.2	0.3	0.0
Total	8.5	9.3	2.6

Source: World Health Organization: *Global Health Risks Report 2004*.

As shown in the table above, we distinguish between two different kinds of air pollution: indoor air pollution, mainly generated by inefficient ventilated stoves burning biomass fuels such as coal, crop waste and dung, or wood, generally used among the world's poorest population for their eating and cooking needs; and outdoor air pollution, mainly generated by industries and energy production, by road traffic and as a consequence of the inefficient combustion of fuels for transport.

Both household (indoor) and ambient (outdoor) air pollution cause respiratory diseases such as asthma in the short term and, over the long period, many other diseases that can be fatal such as stroke, heart disease and, in particular, lung cancer. Some studies suggest that poor air quality may take as long as 15 years to reach peak impact on people's health and so the relative impact may increase with industrialisation. Given the rapid growth of large cities around the world, this is an aspect of underwriting that needs to be under constant study.

Air quality is kept under control by monitoring the particulate matter (PM) level through measuring stations close to roads, schools and center of population. The PM is a microscopic solid or liquid matter suspended in the earth's atmosphere and depending on its size in the air, can be inhaled deep into the lungs (smaller particles) or be filtered in the nasal passages and the larger airways (larger particles).

In practice, it is difficult to establish a 'common' scale of the most polluted cities in the world for several reasons:

- (1) the measure may vary depending on the technology available to do it;
- (2) the real time spread of information on the internet may give different results over time;
- (3) the level of air quality has become a political issue and is therefore open to interpretation.

Consistent and reliable data surveys are then a key challenge. What is not in doubt is that decreasing air pollution is an important step in creating a healthy environment.

We can be affected by pollution not only through the air we breathe, but also through the water we drink or we use for bathing.

If we think that most of the earth's surface is covered by water and that most of the human body is composed of water, we can easily realise that there is a crucial linkage between water, health and ecosystems.

Poor access to safe and clean water can be a key factor in water-related vectors illness, such as diarrhoea or diseases such as malaria. Regions most affected by malaria are rural areas of developing countries, in particular, African regions where poorly designed irrigation and water systems are unfortunately too common.

The third of the environmental risks we want to analyse is linked to climate changes. Certain human activities have also been identified as significant causes of recent climate change, often referred to as “global warming”. The principal reason for the global increase in temperature is industrialisation, with the burning of more and more quantities of oil, gasoline and coal, the cutting down of forests, and the use of certain farming methods. Warming has been linked to an increment in the spreading of diseases, and extreme weather events create conditions for fostering disease outbreaks.

Last of the environmental risks is linked to toxic substances. The term ‘agrochemicals’ refers to the broad range of chemical products used in agriculture, including not only pesticides (insecticides, herbicides, and fungicides), but also some synthetic fertilisers (hormones and other chemical growth agents).

Unfortunately, many of these agrochemicals are toxic to humans and are not always judiciously utilised, in particular in developing countries where economies may be heavily reliant on agriculture. Additionally, the inappropriate use of toxic chemicals may be emitted directly into air and water.

What should insurers be thinking about?

Basic biometric and lifestyle risks continue to be the main factors affecting mortality and morbidity, but from this brief description of the different kinds of environmental risks, we can see that they represent risks that are potentially significant in certain geographies, and may be expected to develop over time.

Therefore they need to be analysed by insurers in order to develop relevant and robust products with specific terms and conditions, based on an appropriate pricing. So, what should insurers be thinking about?

If we focus on air pollution, one of the worst consequences can be lung cancer, even if the lag time between the exposure to pollution and the disease’s incidence can be many years. In order to help individuals face this risk, insurers can develop and market products covering defined diseases linked to high pollution levels during the long term, such as lung cancer, or products that cover more short-term needs, such as asthma.

In this case, the claims ratio may vary considerably depending on the pollution level and therefore, the insurer can start thinking of pricing and underwriting depending on this level. One option can be to define various geographical areas according to their pollution level and then to offer a discounted or a loaded premium accordingly.

Where the impacts are expected to be long term and difficult to measure, i.e., difficult to encapsulate in specific insurance offers, there is also potential for insurers to direct their Corporate Social Responsibility and investment focus to this area of constantly increasing public awareness:

- (1) Some safety measures have to be implemented on a country level. People need to be aware of the consequences their behaviour can have on the environment. This logic could provide the basis for a focused corporate social responsibility programme, linked to investments: public awareness of the impact of private transportation linked to investment in public transportation systems is an example of where insurers could take a position in an area which will affect their business in the long term.
- (2) Products can be developed by insurers according to these needs. For example, in the employee benefit business field, insurers can develop group policies including pricing factors such as distance of the company from public transportation or the number of cars in the company’s fleet, or internal air quality monitoring.

Insurers can offer some services such as providing proper masks when the level of air pollution reaches some trigger points or water filter equipment for families living in areas with limited access to safe water. There can be many problems arising from poor water sanitation systems, not as risky as lung cancer but critical enough to affect people’s health where access to medical facilities is limited and working conditions are fragile. For Europeans, diarrhoea is nothing but an (embarrassing) inconvenience, but for wage earners in rural areas of developing countries, it can be much more dangerous, both for health and income. This problem is mainly linked to poor water sources available. A partnership with technical and skilled companies in order to develop and build up new infrastructures with the aim of improving water quality, sanitation and to increase the access to adequate and safe water can make a huge difference. In terms of insurance products we can imagine some micro-coverages such as the payment of a daily salary in case the insured is not able to go to work. In this way, the insured can have the chance to recover, thus limiting the spread of other water-related vector illnesses such as malaria.

Related to environmental risk management is the spread of disease. The recent Ebola outbreak demonstrated how quickly infectious diseases can spread, particularly when the problem crosses national borders. By reacting more quickly, as well as focusing on the causal factors for the spreading, lives could have been saved at a much reduced financial cost. Is there a role to play for insurers in providing coverages to governments to help them combat pandemics?

In a natural catastrophe, the relevant loss and its cost is spread among many parties: national and local governments, insurers and reinsurers, non-governmental organisations, individuals and companies. However, even if the insurer is only one of the entities suffering a catastrophic loss, the insurance industry can play an active and important role in studying, preventing and foreseeing climate changes—currently, most catastrophe models are based on past experience, but they should be developed in order to take into consideration future projections.

In addition to contributing to the prevention and forecasting of catastrophic events arising from climate changes, insurers can offer products covering post catastrophe health support including rehabilitation programs, potentially to individuals, companies and governments.

Conclusions

Insurance is still one of the main tools for spreading risks across time and over large geographical areas, and we believe that environmental risks fall within an insurers' business scope. Like any risk, they represent downside potential if not understood correctly, and business potential if fully leveraged.

We believe that environmental risk understanding and management is key for insurers wishing to expand in less mature markets, and represent potential for socially responsible products and services in mature markets (witness the floods and big freezes experienced in European countries and the U.S. recently: should we just think in terms of property damage?).

Environmental risks are a fact of life and, as such, we need to incorporate them in our way of doing business.

Risk Management of Emerging Pandemics

By Gordon Woo⁺

The fire in a peat bog

The London office of RMS is in Monument Street. The name refers to the monument to the Great Fire of London in 1666, which started close by and burned down most of the city of London. At that time, there was no professional fire service to control the conflagration and extinguish the flames. The monument also commemorates the introduction of fire insurance, which arose a year later from the ashes of London. It was clearly in the interests of fire insurers to have an active response to any threat of fire to an insured property, and private fire-fighting teams were sent out to mitigate this risk. This is far from being an optimal solution. If a fire broke out close to an insured property, the fire there should be put out, rather than being allowed to spread to the insured property. Fire insurers have a commercial interest in communal fire safety that extends well beyond their own insured properties, to include sources of conflagration that might be many kilometres away. Wildfire is a good example of a peril that, if not brought under control by a forest fire service, could engulf a neighbouring town.

The World Health Organization (WHO) has likened the Ebola crisis of 2014 to a fire in a peat bog 'that flares up on the surface and is stamped out, but continues to smoulder underground, flaring up in the same place or somewhere else.'¹⁴ This graphic fire metaphor is instructive also in communicating the need for urgent emergency preparedness and response for dealing with emerging pandemics.

A pandemic is a deadly infectious disease which spreads globally via the international travel of infected persons. Especially if infected passengers show little or no signs of illness, closing borders has very limited impact other than to retard by a few weeks the spread of a pandemic. The origins of a pandemic lie in the genetic mixing of animal

⁺ Catastrophist, Risk Management Solutions (RMS), London, U.K.

¹⁴ WHO (2015) 'Factors that contributed to undetected spread of the Ebola virus and impeded rapid containment'.

and human viruses, arising from the juxtaposition of animal and human populations in live animal markets, the encroachment of people deeper into wilderness territory and the consumption of bush meat. Most likely therefore, pandemics will emerge from developing countries. Expanding populations heighten the risk. The index case of the 2014 Ebola crisis was a small boy in a remote area of Guinea who played in a hollow tree infested by diseased bats. Guinea, like its afflicted neighbours Sierra Leone and Liberia, is amongst the poorest nations of the world and the most deprived in terms of social health infrastructure. These poor countries lacked the medical and financial resources to control the spread of Ebola, but how then could Ebola be controlled and eradicated from West Africa?

Unlike malaria and cholera, which were initially thought to be the most probable causes of illness in Guinea, an infectious disease like Ebola can spread internationally and put all populations at risk. But with so many stakeholders across the globe having national interests in the control of infectious disease, the willingness of the more generous and concerned donors to support the control effort has been tempered by their frustration at the apathy of other apparently free-riding stakeholders. The classic economic paradigm of the 'tragedy of the commons' explains the apparent lack of urgency of some self-interested stakeholders to commit resources to help deal with the collective international problem.¹⁵

When a fire is raging, those who have contributed most to financing the fire service cannot afford to wait for free-riders to make their due contribution as the hat is passed around. The longer the delay, the more fire loss there will be. Like fire, a pandemic can also spread at an exponential rate. In April 2014, WHO estimated a modest cost of USD 4.8 million to control the Ebola outbreak. By the end of July, this had risen to USD 100 million; a month later this was almost half a billion, and by the end of September the cost had ballooned to USD 1 billion. As of 15 October 2014, only USD 257 million had been received, with another USD 162 million pledged.

One of the greatest challenges of the Ebola crisis has been to get treatment centres fully operational and bring in more health workers. A considerable amount of money was needed to pay not just health workers, but also cleaners, funeral staff and the people assigned to trace contacts. The original outbreak in the forest region of Guinea might have been contained early, but for unseemly and counter-productive haggling over who should pay for tracing contacts, Ebola then was allowed to spread to different parts of Guinea and into Sierra Leone. WHO worked closely with governments and partners at the highest level to recruit teams and deploy resources and equipment. But, in a desperate race against time to limit the spread of the epidemic, the overall international response was far too lethargic.

Insurance solutions

Infectious disease pandemics are rare multi-decadal occurrences and thus are amenable to insurance solutions. Other than a world war, the disaster scenario of millions of excess deaths worldwide is associated by life insurers with a major influenza pandemic, such as the one that struck in 1918. Life insurers, therefore, are amongst the leading stakeholders in pandemic risk mitigation. As with fire insurers, they have a vested interest in active response measures taken early to control and suppress a societal insured peril. Pandemic viruses, like that of 1918, which struck down those in the prime of life, are of particular importance.

Another major global stakeholder in the early control of emerging pandemics is the World Bank. The economic impact of a pandemic is severe on all countries, but especially on poorer nations with extremely fragile health-care systems. It is in such countries that a new pandemic virus is most likely to take hold, because they lack the medical infrastructure capacity for disease surveillance, diagnosis and treatment. The ability of these poor nations to repay World Bank loans would be severely compromised, and indeed, their indebtedness would be increased yet further with the burden of extra loans to assist in the pandemic recovery process. According to the World Bank, the Ebola crisis has cost the three most impacted countries USD 1.6 billion in economic growth. It is fitting and timely therefore that the President of the World Bank, Jim Yong Kim, who is himself a physician rather than an economist, should openly advocate and welcome the involvement of the insurance industry in finding innovative financial solutions to the challenge of funding early action to control an emerging pandemic.

President Kim has urged increased collaboration between countries, multi-lateral institutions, corporations and donors to work together to develop a Pandemic Emergency Facility, with capital coming from the International Bank for Reconstruction and Development (IBRD) and capital markets. To help overcome traditional backsliding in

¹⁵ See Hardin, G. (1968) 'The tragedy of the commons', *Science* 162(3859): 1243–1248.

cooperative initiatives, he has suggested that commercial market mechanisms be used to drive forward improvements in preparedness. Thus insurance premiums for dealing with an emerging pandemic would be reduced through the strengthening of health-care systems, improved surveillance and crisis readiness of medical response teams.

Various insurance and bond financial solutions will be needed. One initiative being explored by the African Risk Capacity (ARC), an African catastrophe insurance pool, is the provision of insurance cover for a pandemic to enable affected African countries to respond promptly to initial cases, and to mitigate the effects of a spreading pandemic. The incentive of lower premiums, if adequate actions are taken to lower pandemic risk, should improve resilience and benefit the health-care systems in African countries ridden with endemic corruption and poor governance.

Pricing of pandemic insurance

The pricing of insurance, bonds or other financial instruments for funding rapid response to emerging pandemics requires epidemiological risk analysis. This type of risk analysis has been routinely used by RMS to price excess mortality catastrophe bonds since the most recent influenza pandemic in 2009. At the core of this epidemiological risk analysis is the modelling of the spread of an epidemic through a population, and the toll of the seriously ill and dead. The two key model parameters are the measures R_0 (basic reproductive ratio) of the transmissibility of the pandemic virus from one host to another, and the death rate per case of the pandemic virus.

The ratio R_0 characterises the spread of a pandemic. This is the average number of others infected by a virus carrier. A value above unity is sufficient for the virus to continue spreading, as in a chain reaction. From the onset of the Ebola pandemic until October 2014, this was around 2, and explains the alarming growth of infections over a period of about six months. The virology of Ebola fortunately limited the reproductive ratio. Ebola is not transmitted by those infected but not symptomatic, and also the incubation period is quite long, allowing days to track contacts of virus carriers, provided resources are available for this task. These resources were notably lacking as the Ebola crisis deepened.

But R_0 depends not just on virology but also on sociology. This latter factor for West Africa tended to increase R_0 . Traditional funeral customs exacerbated the risk of contagion amongst family and friends of the deceased: 60 per cent of Ebola cases in Guinea, and 80 per cent of Ebola cases in Sierra Leone were linked with touching and washing the dead. Yet, with international assistance, a reduction in R_0 was eventually achieved through a remarkable transformation in public response to the Ebola crisis. Social customs changed dramatically, partly through legally enforced cremation of the dead, and partly through non-shaking of hands and other general public hygiene improvements.

Key to the pricing of insurance for mitigating the spread of a future pandemic will be modelling in a stepwise time-dependent manner the social transformation of R_0 , as population behaviour adapts to the menace of a lethal virus. Another dynamic change to be captured in the epidemiological risk modelling is the prospect of a progressive reduction in the case lethality rate, with the improved clinical care which is possible with increased international funding. This is an important factor in gaining control of an emerging pandemic. If death rates are very high, then families sceptical of the value of health care become reluctant to give up infected relatives for fear of never seeing them again. This in turn increases R_0 , since family members and close friends become more likely to become infected. However, if substantial funding can be made available early to provide effective care for the sick, then the prospects for recovery in health-care centres improve, and there will be enhanced societal compliance with directives to report all cases of severe illness.

Insurance risk management

With the passing of the 2014 Ebola crisis, every living person in the world has dodged a bullet—nobody on any continent was secure from becoming a victim. The legacy of this crisis must be that the world will never again be so poorly prepared financially for controlling the spread of an epidemic. As President Kim of the World Bank has emphasised, passing around the hat for contributions whilst an epidemic is spreading is not a viable option. The insurance industry will be expected to rise to the challenge of a significant role in ensuring greater preparedness for a future pandemic. For this assignment, pandemic risk modelling will be a key part of risk management.

Underwriting: Enhanced Annuities

By Philip Wilson*

Introduction

Life insurance companies must meet the needs of an ageing population, and lifetime annuities are one of the key products to meet this need. As underwriters we will be asked for opinions in respect to both group pricing (so-called 'bulk annuity deals') and at times, individuals who are seeking an enhanced annuity because they are sub-standard risks. Impaired annuity products are very popular in the U.K. because of the tax treatment of all annuities. To a lesser extent they are also popular in the U.S., and will become even more in vogue as governments recognise the need for retirees to fund their own retirement. An individual who has a medical impairment, logically, has a reduced life expectancy and therefore an increased annuity payment.

It follows that not all medical conditions will give rise to entitlement to an advanced annuity. However, whenever the prognosis for a condition is poor, e.g. with certain types of cancer (of the oesophagus or pancreas for instance, and the treating oncologist estimates limited life expectancy), or there are severe sequelae causing inability to perform two or more of the activities of daily living, e.g. following stroke, cardiac event, severe airways disease or liver ascites and cirrhosis, it is likely that consideration would be given to an enhanced annuity.

This paper attempts to provide some guidance on how to assess the longevity of high-age impaired lives.

Pricing

It is important for the underwriter to understand the mortality assumptions contained in our life insurance products and even more important in the assessment of longevity products. The general population may be the basis of pricing some annuities, but annuitants tend to be from upper socio-economic classes and not the general population. There may be some experience from bulk annuity deals or better still, an in-force block of annuity policies, but regardless, a degree of conservatism, in respect of interest assumptions and mortality, is ideal.

Predicting death is different than predicting longevity

Underwriters are adept at assessing mortality and have at their disposal sophisticated guidelines both from reinsurance manuals and various statistical data on the Internet. Ninety percent of sub-standard cases are moderately sub-standard and can be assessed relatively easily. Highly sub-standard cases can be declined, while for enhanced annuities, the opposite applies. That is, the more significant the impairment, the larger the annuity so we will be confronted by much larger numbers of highly sub-standard individuals that we have never assessed—because we have declined these risks. Lastly, the sub-standard annuitant has a completely different attitude than the life insurance applicant—he or she wants to convince the underwriter that they are very, very unwell. Non-disclosure is not seen in this cohort, but over-disclosure may be. However, there may be anti-selection, as once the individual has convinced the underwriter to allow a larger annuity payment, it is then in the interests of the insured to receive payments for as long as possible. The standard life underwriting approach of adjusting for extra mortality by simply increasing the risk premium by a factor such as +100 per cent is simply not applicable, so we must develop different methods for assessing how long we think the individual will live.

Understanding longevity

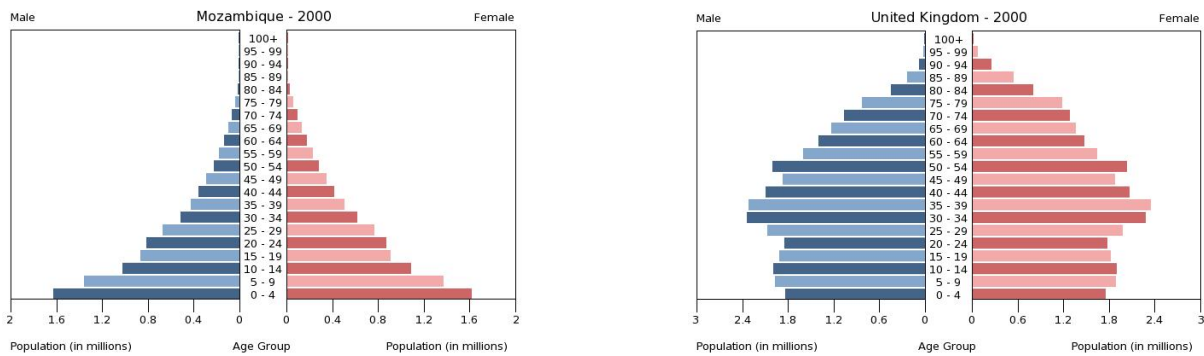
It is important to understand the general topic of longevity in order to apply certain principals to the assessment of individuals seeking enhanced annuity payments.

Firstly, mortality has been improving rapidly over the last few decades, and almost all predictions of the future rate of improvement have been incorrect. There is considerable debate as to the rate of improvement, and of course, large discrepancies in this rate geographically as illustrated by the two population pyramids Figure 1.

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Figure 1: Longevity in an emerging nation vs a developed nation

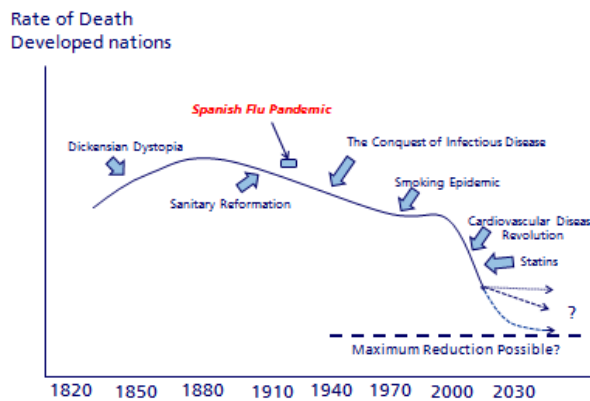


The shape of the illustration on the left (Mozambique) is typical for emerging nations, while the right illustration (U.K.) is typical of developed nations¹⁶.

Within populations there are certain cohorts that live longer (or have shorter lifespans), with the most obvious being the working population versus the unemployed. It is much more difficult to explain why in the U.K., generations born on either side of the pre-World War II period (1925–1945), exhibit more rapid improvement in longevity as compared to the generations born on either side of that generation. In the long-term, the rate of death in populations has increased or reduced as shown in Figure 2.

Figure 2: Mortality trends in the U.K.

Long Term Mortality Trends



INTERNAL USE ONLY

Some of the factors that will influence the mortality rate in a given cohort:

Lifestyle changes—globally the rate of tobacco use is reducing, while in modern Western-type communities, the rate of obesity is increasing. This begs the question, “Is sugar the new tobacco?” Increased awareness of the benefits of a healthy lifestyle seems to be one of the factors in recent increased longevity in many countries but the western diets adopted by some Asian communities may slow longevity improvement.

Pandemic or other catastrophe—the 1918 Spanish flu killed an estimated 30–50 million people¹⁸. Since then our ability to contain viral events has greatly improved, but another highly contagious and lethal virus could have a major impact on the global mortality rate.

¹⁶ For worldwide data see www.census.gov/population/international

¹⁷ See www.gapminder.org/world

¹⁸ See www.flu.gov/pandemic/history/1918/

Medical breakthroughs—the “cure for cancer” may be the next major medical breakthrough, but we are already seeing major improvements in circulatory disease mortality from statins and aspirin use. Surgical procedures (such as stent insertion) are providing not only a better lifestyle, but also improved longevity.

Increased wealth—as wealth increases so does the access to medical care. In the most basic example, certain populations gain better understanding of cleanliness and, as a result, improved sanitation systems and longevity follows.

Increased lifespan versus improving longevity

The population pyramids illustrate that there are very few people living beyond the age of 100, but there is considerable debate as to whether humans will show an increased lifespan—so that we will start seeing larger numbers of people living beyond the age of 110 or 120. James Vaupel is a leading advocate for the plasticity of longevity, and believes that the ceiling of life expectancy will continue to rise as it has linearly for hundreds of years¹⁹. The counter argument, presented by S. Jay Olshansky, argues that the gains in recent decades from improved public health care have done as much as they can, and any further increases in lifespan must come from the prevention of diseases that come with ageing²⁰. An increased lifespan has major implications for our industry and especially for annuity products. Whether you favour Vaupel’s or Olshansky’s argument, the chances that the human lifespan will increase seem rather good.

Information on changes in population mortality and improving longevity can be readily obtained on the Internet and from various publications. Suffice to say, changes in future longevity for various populations are difficult to predict. Predicting longevity in a particular annuitant may be somewhat less difficult as we will be presented with a great deal of medical information that should allow at least a well-informed decision.

High Age, Individual Risks

Most applicants for enhanced lifetime annuities will probably be over age 70, and the assessment of extra mortality for these applicants can be difficult. Almost all life insurance applicants will have some degree of impairment, but does that make an individual “sub-standard” or less likely to live to the age predicted within the pricing? Most life insurers have restricted the entry for life insurance to age 65 or 70, so as underwriters we see very few cases and we do not have well-developed guidelines. Underwriting manuals are written to account for the bulk of applicants – approximately between the ages of 40 to 60, so the reinsurance manuals don’t provide much assistance. Dr. Brackenridge’s book, *Medical Selection of Risks*, has over 1000 pages of fantastic information on virtually all medical underwriting, but contains only 15 pages dedicated to “Older Age Underwriting.”²¹ According to Brackenridge, “...the underlying expected death rate of an older population already accounts for much of the high incidence of death...” and... “Traditional underwriting practices, however, do not generally take this into account...” (p.116). Potential customers over age 70 are more than likely to have significant coronary artery disease, impaired renal function and reduced lung function, and much of the “extra mortality” may already be built into the “Standard Rate.”

It is also worth noting that population-based rates will differ from insured population versus annuity death rates. Annuitants should be comparatively wealthy individuals and therefore exhibit greater longevity as compared to the other two categories.

So how should underwriters select those that are at extra risk?

Based on U.S. experience, there are at least two significant conditions, currently not assessed in most countries, that play a major part in the prediction of longevity at high ages:

- (1) Cognitive Impairment—difficult to assess accurately, but many tools are available and fully explained in Brackenridge (the clock-drawing test, Mini-Cog test, etc.)

¹⁹ See Vaupel, ‘Demographic analysis of aging and longevity’, *The American Economic Review* May 1988

²⁰ See Olshansky, S.J., Carnes, B.A. and Cassel, C. (1990) ‘In search of Methuselah, estimating the upper limits to human Longevity’, *Science* 250(4981): 634-640.

²¹ Brackenridge, R.D.C., Croxson, R.S. and Mackenzie, B.R. (eds) (2006) *Brackenridge’s Medical Selection of Risks*, 5th edn, Basingstoke. U.K.: Palgrave Macmillan.



(2) Frailty—higher levels of physical activity seem to indicate increased longevity

Depressive illness is a very strong predictor of higher mortality in high-age groups.²² Oftentimes, the only evidence of a significant depression is determined by the number and dosage of various medications.

Comorbidity plays an important role in survival rates of the elderly. The cause of death may be cancer or myocardial infarction (MI), but diabetes and chronic obstructive airway disease (COPD) are often found to be co-morbid conditions. We should be wary of the elderly taking a cocktail of six or seven different medications, even if some appear to be rather innocuous (such as sleeping pills).

In addition to our normal underwriting approach for younger lives, we should also consider obtaining information in respect to exercise, activity, travel and even hobbies. In one study,²³ the speed of gait (walking) was found to be a key longevity indicator, while in another, elderly people who had influenza vaccinations were found to have increased longevity. Gait speed may be an indicator of lower limb power (i.e. not fragile), and having had a flu vaccination may indicate advanced thinking (the ability to consider whether to have the vaccination seems to be important).

Additionally, the typical blood panel obtained for younger applicants may not be all that useful for older applicants, as all will have some degree of organ dysfunction such as renal and liver impairment. In the elderly, haemoglobin levels outside the normal range may be an indicator of nutritional deficiency and chronic disease.

It is commonly known that women live longer than men; at high ages this is particularly relevant, as a 2–3 year difference in average age at death may represent a 15 per cent increase in life expectancy for older aged women.

What is the standard mortality at higher ages and how does extra mortality effect life expectancy? The following table (courtesy of Swiss Re²⁴) is extracted from [VBT 2008 U.S. mortality tables](#).

Table 1: Life expectancy—female non-smokers

Life Expectancy		Reduction in Life Expectancy by Extra Mortality		
Age	Std Rates	+100%	+200%	+300%
65	24	4	7	8
70	20	4	6	8
75	17	4	6	7
80	13	3	5	6
85	9	2	4	4

Brackenridge provides a short sample of male data (p. 85) below. Note the marked difference from 2008 female select (non-smoker) to 1992 male ultimate, illustrating the need to understand the underlying rate basis before assessing sub-standardness, especially in high-age individuals.

Table 2: Life expectancy—male non-smokers

Life Expectancy		Reduction in Life Expectancy by Extra Mortality		
Age	Std Rates	+100%	+200%	+300%
70	14	5	7	8
80	8	3	5	5

²² See www.webmd.com/depression/guide/depression-elderly

²³ Harmon, K. (2011) 'Walking speed predicts life expectancy of older adults', *Scientific American*, January.

²⁴ See Somerville, K and Marks, J., 'Actuarial underpinning of older age mortality', slide 10, presentation at the AAIM 121st Annual Meeting, 13–18 October 2012, San Diego, CA, Academy of Insurance Medicine.

Underwriting at higher ages by necessity should use the concept of reduced life expectancy rather than the usual sub-standard methodology. An example is the use of flat extra premiums as a USD 10 per mille load on an 80-year-old may be financially the same as a 50 per cent load.

This concept of reduced life expectancy can be translated into the assessment of enhanced annuity business.

Underwriting of sub-standard annuities

Portfolio anti-selection can be caused by poor product design or underwriting error, or by individuals who have better information as compared to our technical experts. As previously mentioned, enhanced annuities provide great opportunity for the latter, so our design, pricing and underwriting must be sound and somewhat conservatively based. In pricing, conservatism could mean taking both increased life span and improved longevity into account.

However, in our underwriting, there is difficulty in converting extra mortality or reduced life expectancy into an increased annuity payment. By estimating extra mortality and translating this to reduced life expectancy, we can provide an approximate 'age of annuity calculation.'

In order to determine the appropriate methodology for calculating the annuity, we use the following concepts based on Brackenridge's tables (Table 5.6 is found on p. 85; Table 5.8 is found on p. 88/90):

A = Sub-standard life expectancy

B = Equivalent age, using additional years to age

C = Anticipated life expectancy for standard lives.

The best way to illustrate the methodology is to use the following examples:

Applicant A is a male aged 70 and has USD 100,000 to invest in a lifetime annuity. He has moderate cardiovascular disease and type 2 diabetes; we deem these conditions to be included in the standard annuity rate (USD 639 per month from an online calculator). This individual has slow gait, and there is other evidence of frailty from past medical records. We therefore assess him as having an extra mortality of +200 per cent—a sub-standard life expectancy of seven years (A), so an equivalent age (B) of 80, the anticipated life expectancy for standard male lives (C). The monthly annuity payment then becomes USD 917.

Applicant B is a female aged 66 and is investing the same amount of money. She has rheumatoid arthritis causing significant immobility and takes medication for hypertension and raised lipids. The immobility represents significant extra mortality at +150 per cent or a reduced life expectancy of some 11 years (age 79), so the annuity increases from the standard of USD 535 to USD 819 per month.

Applicant C is a male aged 73 and also has USD 100,000 to invest. He has cardiovascular disease, COPD and mild renal impairment considered acceptable within the standard annuity rate. He also has osteoarthritis with severe mobility limitation and significant cognitive impairment based on external testing. In this case the extra mortality is deemed to be +500 per cent, so the life expectancy is estimated as three to five years. The standard monthly annuity is USD 707, but we could offer an age equivalent of around 90—resulting in an annuity of USD 1477 per month.

Summary

The concept of longevity and recent improvements, together with the likelihood of an increased human lifespan, makes enhanced annuity pricing difficult. Therefore, pricing must be inherently conservatively based. Standard annuity prices have cardiovascular disease, cancer and many other ageing impairments already built into the annuity rate, so we must introduce cognitive impairment and frailty into the assessment.

Underwriting of enhanced annuities requires a different approach. This type of underwriting needs to focus on the period of reduced life expectancy and consequently, the additional years—that must be added to the actual age.

Crowding Out of Long-Term Health Insurance by the Institutional Setting of the U.S. Health Insurance System*

By Ines Läufer⁺

Introduction

In the U.S., prior to the introduction of the 'Affordable Care Act' by President Obama, 50 million people under the age of 65 were neither covered by private health insurance nor by the social health care system 'Medicaid'. The key focus of President Obama's reform is the reduction of the number of uninsured people. The main elements of the reform are a health insurance mandate and the strict regulation of private insurance premiums. Right from the beginning, this initiative was accompanied by strong protests and led to controversial discussions in the public and political arenas. The debate about the reform seems to shift the attention away from the fundamental question regarding the reasons that have led to the current level of uninsured people.

Two observations are striking: first, not all of today's uninsured persons have been without health insurance all the time. Many of them have had health insurance at some point in life through the group insurance of their employer, which they lost either as a result of a job change or a job loss. The '[Commonwealth Fund Health Insurance Tracking Survey of U.S. Adults, 2011](#)' concluded that 'losing or changing jobs was the primary reason people experienced a gap' (Collins *et al.* 2012). Second, the income level of many of those uninsured people is well above the poverty threshold of the U.S. Even in households with incomes above 300 percent of the poverty line, 11.6 million people have been uninsured, corresponding to 26 percent of the total uninsured (Pauly, 2010, p. 11). Therefore, it is obviously not just the poor or people with a minor income who have no health-care coverage (Kunreuther *et al.* 2013, pp. 246–250). It is worth noting however, that health insurance premiums can be unaffordable even for people with a higher income in case of pre-existing conditions. If individual health insurance premiums are risk-dependent, those pre-existing conditions go along with high premiums. But in this case, there remains the question why this premium risk has not been covered by a health insurance contract earlier in life. Of course, foregoing long-term health insurance could just be classified as reckless or irrational and driven by the underestimation of potential risks (Kunreuther *et al.* 2013, p. 246 f.). But this short article focuses on another explanation: It considers the institutional factors in the U.S. health insurance system which could make a long-term health insurance unattractive for many individuals.

Options for health insurance in the U.S.

When seeking insurance of the health cost risk under the age of 65, American residents have two options: Employer-sponsored health insurance and/or individual long-term health insurance. These alternatives differ in terms of insurance of the premium risk or the 'reclassification' risk: an illness can induce a long-term condition such as cancer or heart disease, which leads to an increase in current and future health costs. If health insurance was short term and a person wanted to acquire a new insurance contract after the former insurance contract expires, one would have to accept a permanently higher insurance premium to insure the same health benefit catalogue.

As employer-sponsored insurance is job-dependent, and job loss goes along with losing health insurance.²⁵ Having lost group health insurance and falling back on the individual insurance market, those pre-existing conditions imply

* An elaborate analysis of this only briefly examined issue will be published this year in the journal: *Sozialer Fortschritt/German Review of Social Policy*.

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²⁵ The 1985 enacted COBRA (Consolidated Omnibus Budget Reconciliation Act) allows employees having lost employer insurance to keep their insurance policy for up to 18 months, paying 102 percent of the employer's premium. Therefore no individual risk equivalent premiums may be required during this period (Madrian, 1994, p. 29).

a (prohibitively) high individual insurance premium. Therefore, employer-group insurance can only provide an incomplete protection, as the premium risk is not completely insured and depends on the risk of losing the job.

In contrast to that, long-term protection which includes premium risk insurance can allow for a risk-independent premium over time (Pauly *et al.* 1995; Cochrane 1995). In this case, health conditions developed in the course of life do not go along with rising premiums. The individual premium can either be independent of changes of individual health risks which occur after the insurance contract has been signed (Pauly *et al.*, 1995; Cochrane 1995), but increase with age, or it could be independent of risk factors and age if ageing provisions are included (Arentz *et al.* 2012).

Crowding out of individual long-term contracts by employer-provided insurance

In a competitive labour market, one expects employers to adapt wage-fringe benefits packages to workers' preferences. An employee could consider health insurance options during the job search and purposely seek an employer offering health insurance, preferring him over other employers without health insurance. Under this assumption, seeking insurance via employers could be modelled as an individual decision to be insured via the employer instead of purchasing individual insurance. Monheit and Vistnes (1999) conclude in their empirical analysis of workers' job choice that the sorting of workers to different employers, offering or non-offering health insurance reflects their preferences for health insurance. If employers offer health insurance to attract workers, the costs of health insurance reduce the potential of wages in cash. In consequence, explaining foregoing long-term protection requires analysing the potential advantages of group insurance for employees over the alternative of higher cash wages in combination with the closure of a long-term individual health insurance contract.

Premiums of employer group insurance are community rated. Employers are not allowed to consider an employee's risk factors (including age), neither in the premium setting nor in wage setting.²⁶ This setting seems at first glance unattractive to low-risk persons since the resulting average premium is too high compared to their expected health costs. However, several factors can create a large price gap between individual and group insurance even for persons with low risks. First, a large employer may benefit from the linkage of employment and insurance group as the insurance pool can be large enough to reduce risk variation. Therefore, the insurer's risk of deviation of expenditures from the expected value of expenditures for this group is reduced (Zweifel and Eisen 2003, p. 240 ff.) and therefore, less risk management in terms of building financial reserves and risk pooling is needed than in case of insuring a small group or an individual (Blumberg and Nichols, 2004, p. 47). Furthermore, insuring groups instead of individuals can allow foregoing individual risk assessment. In case of (a large) group insurance, the marginal effect of an individual employee's risk is low. Therefore, it can be sufficient for a private insurer to consider general group characteristics (such as industry) to calculate the expected costs of the group. In consequence, especially large firms can benefit from saving the costs of individual risk underwriting.

Second, group insurance via the employer saves the transaction costs resulting from searching for and contracting with an insurer: Only one person, namely the employer, acts on behalf of his employees and spends time for searching and contracting with the insurer (Blumberg and Nichols, 2004, p. 47). Administration costs can be 25–30 percent lower than for an individual insurance contract (Blumberg and Nichols 2004, p. 47). Due to those economies of group insurance, premiums can be lower than individual insurance premiums, even for lower-than-average risks.

Beside the cost advantages of employer-sponsored group insurance due to the combination of workplace and insurance, a price advantage of employer health insurance is created by the exclusive tax advantage for employer-

²⁶ The empirical question, if and to what extent wages are age dependent to compensate for age dependent health care costs remains unclear (Bundorf *et al.* 2010, footnote 7). Empirical studies of Sheiner (1999) and Pauly and Herring (1999) conclude that health insurance wage deductions vary with age. But even if this result was representative and reflecting different health costs risks, a further premium differentiation would contravene with the 'Americans with Disabilities Act' (1990) and the Federal 'Health Insurance Portability and Accountability Act' (HIPAA) introduced in 1996. Therefore, the assumption of group, average health insurance premiums is consistent (Bundorf *et al.*, 2010, footnote 7; Cochrane, 1995, p. 458).

group insurance. Premiums paid by an employer for his employees are exempted from all employees' taxes, federal and state income tax and social security contributions (Monahan and Schwarcz, 2010, pp. 14–15). Additionally, the employer can save social security contributions. Under the assumption that employers pass employment-related taxes and contributions on to their employees, it is the employee who benefits from this tax deduction (Finkelstein, 2002). Additionally, if employees have to pay a separate premium for group insurance, these can be exempted from taxes as well (Monahan and Schwarcz, 2010, pp. 14–15). As this tax advantage only applies to employer group insurance, individual health insurance contracts are getting comparatively more expensive.²⁷ The average tax rate can amount to 34 percent; therefore, tax sponsoring of health insurance alone can already reduce the price of group insurance by 34 percent compared to an individual insurance (Gruber, 2011, p. 516).²⁸

In the light of these cost advantages of employer health insurance, employer group insurance could be considered as a preferable alternative over a full individual health insurance.

Cost factors of insurance the remaining health-cost risk

Considering the predominant employer-based system, the remaining health cost risk can be defined by two components: The risk of losing the employer-sponsored insurance and the risk of having developed pre-existing conditions in the meantime. A risk-averse person could therefore be willing to additionally insure the remaining premium risk of employer group insurance on an individual basis. Explaining an insurance gap as the result of foregoing individual protection in a predominantly employer-sponsored health insurance system requires not only analysing the advantage of group insurance over a full individual long-term protection, but also considering obviously existing impediments to insuring only the remaining premium risk.

The dominance of the employer-sponsored insurance system can reduce the benefits of a long-term individual insurance contract, as there is an uncertain planning horizon during the time period under the age of 65. In fact, the individual health insurance market is characterised by a frequent enter and exit at various periods (Brown and Connelly, 2005, p. 28). This can reduce the benefits of a long-term insurance contract (Pauly *et al.*, 1995, p. 150). If the individual insurance should only function as a subordinate, the willingness-to-pay for individual insurance could depend not only on a persons' individual health risk, but also on the individual expected probability of losing (respectively not getting) a job with group insurance. If the individually expected insurance track is not adequately reflected in lower premiums of the individual insurance (because the health care would partially be delivered by the employer), the price of a complementary insurance would be systematically too high.

Additional costs of an insurance contract arise on the side of the insurant; he/she has to consider the remaining risk of health costs, invest time and effort to care and search for such insurance, communicate with the insurer and take a decision. In effect, psychological findings indicate that choice overload may constitute an important barrier to take any action and decision. It could depress insurance take-up (Baicker *et al.*, 2012, p. 115). The problem of choosing and taking the decision to insure a certain risk could be higher for smaller risks if the range of smaller risks is broader, which could make the selection of the health risk less obvious. In this case, the reduction of individual health costs risks via the dominant employer-sponsored system and the institution Medicare could have an effect on insurance take-up, as it might not be worth it to deal with such a comparatively small risks.

To sum up, the institutional setting of the U.S. health insurance system before the implementation of the Affordable Care Act can crowd out the incentive of individual protection against long-term health risk: it reduces the individual health-cost risk, but not proportionally the costs of insuring this risk, therefore raising the relative

²⁷ Self-employed persons can benefit from limited tax deductions (Monahan and Schwarcz, 2010, pp. 14–15).

²⁸ This advantage can be regarded as the state's reaction to employers' increasing payment of fringe benefits: During World War II, wages were fixed to prevent the inflationary dynamics of an increasing demand for labour. To compensate for inadequate wage incentives, employers used the alternative of fringe benefits (Thomasson, 2003). Second, sponsoring employer health benefits was considered as the second-best substitute for a lacking comprehensive social health insurance system (Hacker, 2002). Already at the beginning of the 20th century, implementation of a social health insurance was intended but failed due to the politically fragmented system (Hacker, 2002, p. 194).

costs of premium risk insurance. The cost advantage of employer insurance not only results from the linkage of employment and insurance—rather, it is also state-induced, due to the exclusive tax-sponsoring of employer group insurance which creates a large price gap between the two insurance options. Additionally, Medicare insurance after the age of 65 considerably reduces health-cost risks, making it less attractive to complement employer insurance with premium risk insurance; given the fixed costs of considering, searching and purchasing an individual health insurance, the remaining health-cost risk can be too low to be insured separately. As a result, foregoing long-term insurance in favour of employer-insurance can induce non-insurance later on due to a job loss and pre-existing conditions developed in the meantime (Cochrane, 2014, p. 22).

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ANNOUNCEMENT

12th Geneva Association Health and Ageing Conference Insurance Health Care for the Elderly in Asia

16–17 November 2015, Singapore

Co-organised with the Singapore College of Insurance and supported by Asia Capital Re

The Geneva Association has the pleasure to inform you that the 12th Health and Ageing Conference, generously hosted by Singapore College of Insurance, will take place in Singapore on 16–17 November 2015. The conference will focus on the medical aspects of ageing in Asia, the challenges of financing the health of an ageing population and the role insurance can play in Asia.

Topics will include:

- The nature and determinants of health care for the elderly in Asia
- Sustainability of health-care financing for the elderly in Asia
- Health-care providers and new health technology
- Insurance solutions to cover the health of an ageing population in Asia
- Other sources of financing the health of an ageing population
- Challenges for insurers in covering health risks for an ageing population.

We encourage you to submit contributions related to the topics of the conference. Suggestions for other topics will be considered.

Should you be interested in contributing to this conference, please contact christophe_courbage@genevaassociation.org

Participants will come from insurance and reinsurance companies, universities and related institutions. There is no conference fee. The conference will have a limited number of participants to guarantee an active exchange of opinions and animated discussions.

For further information, please contact our Conference Coordinator, Ms Barbara Botterill at barbara_botterill@genevaassociation.org

CALL FOR PAPERS

Special Issue October 2016 on Health

The Geneva Papers on Risk and Insurance—Issues and Practice

We encourage you to submit contributions related to the following areas, but are not necessarily limited to:

- The impact of integrating an ageing population in health insurance systems
- New health technology and insurance
- Development of health-care systems and the capitalisation debate
- The interaction of public and private systems in health-care provision
- Insuring and managing long-term care risks
- Health issues for an ageing population in the workplace
- Risk classification in health insurance
- Climate risks and its impact on health and insurance.

All contributions will go through a refereeing process. The editors for this special issue are Christophe Courbage and John Nyman. Papers should be submitted electronically via the website of *The Geneva Papers* (<http://gpp.msubmit.net/cgi-bin/main.plex>) by **9 December 2015** at the latest.

THE RESEARCH PROGRAMME ON HEALTH AND AGEING

The Health and Ageing Research programme of The Geneva Association seeks to bring together analyses, studies, facts and figures linked to issues in health provision and the role of insurance, with an emphasis on the changing demographic structure whereby the population over 60 years old largely exceeds that of other groups. The key is to test new and promising ideas, linking them to related works and initiatives in the health sector and to try to find solutions for the future financing of health care.

We are particularly interested in the impact of an ageing population in health insurance systems; the development of insurance for long-term care risk; the effect of technology on health insurance; development of health-care systems and the capitalisation issue; the interaction of public and private systems in health provision; performance of health systems; health issues for an ageing population in the workplace.

The Geneva Association

The Geneva Association is the leading international insurance think tank for strategically important insurance and risk management issues.

The Geneva Association identifies fundamental trends and strategic issues where insurance plays a substantial role or which influence the insurance sector. Through the development of research programmes, regular publications and the organisation of international meetings, The Geneva Association serves as a catalyst for progress in the understanding of risk and insurance matters and acts as an information creator and disseminator. It is the leading voice of the largest insurance groups worldwide in the dialogue with international institutions. In parallel, it advances—in economic and cultural terms—the development and application of risk management and the understanding of uncertainty in the modern economy.

The Geneva Association membership comprises a statutory maximum of 90 chief executive officers (CEOs) from the world's top insurance and reinsurance companies. It organises international expert networks and manages discussion platforms for senior insurance executives and specialists as well as policymakers, regulators and multilateral organisations. The Geneva Association's annual General Assembly is the most prestigious gathering of leading insurance CEOs worldwide.

Established in 1973, The Geneva Association, officially the "International Association for the Study of Insurance Economics", has offices in Geneva and Basel, Switzerland and is a non-profit organisation funded by its Members.

The Geneva Association Health and Ageing Newsletter, N° 32, April 2015

This newsletter for Health and Ageing is linked to the research programme on Health and Ageing and is published biannually in April and October. For information and suggestions, please write to the Editor at the Geneva office. To subscribe to the e-Newsletter, please go to: <https://www.genevaassociation.org/subscriptions>.

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FORTHCOMING CONFERENCES OF THE GENEVA ASSOCIATION**2015****May**

13-16 **Singapore** **42nd General Assembly of The Geneva Association**, hosted by the Monetary Authority of Singapore (Members only)

28-29 **Berlin** **16th Joint Seminar of the European Association of Law and Economics (EALE) and The Geneva Association**

August

2-6 **Munich** **3rd World Risk and Insurance Economics Congress (WRIEC)**, organised by EGRIE in cooperation with APRIA, ARIA and The Geneva Association

October

20 **Munich** **9th Geneva Association Meeting of Chief Investment Officers**, hosted by Allianz Investment Management (CIO members only)

November

16-17 **Singapore** **12th Health and Ageing Conference on "Insuring health-care for the elderly in Asia"**, co-organised with the Singapore College of Insurance

2016**June**

8-11 **Rome** **43rd General Assembly of The Geneva Association**, hosted by the Italian Members (Members only)