Wearable Technology – How Can This Help Insurers?
by Ross Campbell, Gen Re, London

The demand for wearable health and wellness technology is expected to grow as new ideas and products emerge. Some devices are already important tools in clinical care while others are gizmos marketed as lifestyle accessories. A few insurers offer policies that reward policyholders who record their physical activity using wearable fitness devices. Whether or not insurers make such offers, the question is to what extent, if any, future pricing and product development will be shaped by policyholders’ use of discrete devices that automatically track their biometric information.

Coined in 1965, Moore’s Law states that computing power roughly doubles every 12 to 18 months.1 Four years later the Apollo Guidance Computer steered men to the moon and back with less processing power than a mobile phone.2 Gains in portable computing power have been enhanced by developments in Internet, wireless connectivity and micro-electromechanical systems. The Internet of Things (IoT) – when objects pass on data – is poised to deliver the space-age future we imagined while watching The Jetsons.3 This article looks at the development and application of smart technology in life and health insurance and specifically the role it may have in attracting better risks.

What is wearable?

Wearable systems are made when micro-sensors are embedded in textiles, applied to the skin or integrated into consumer electronics that can be worn, or carried, as an accessory. The IoT means virtually any object can be assigned a unique IP (Internet protocol) identifier so it can be communicated with over the Internet. A simple example of a unique identifier is the URL, or web address, that a browser uses to target and display a web page. Serious investment is pouring into the development of IoT devices that transfer data automatically across networks without human-to-computer interaction.

Many of the applications for this technology are in clinical domains such as health monitoring, mobile treatment and practical nursing.4 Sensors attached to the body or inside garments make it possible to track patients remotely and over extended...
Sensors sewn inside workout apparel can measure exercise duration and body position as well as collecting biometric data such as heart rate, exercise intensity, calories burned and recovery time. The results are calculated against predetermined user inputs of age, build and gender. An alternative use of wearable health-monitoring sensors is to protect athletes from injury during contact sports. One such device packs an electronic monitor and sensors inside a cap. The device can measure acceleration of the skull that occurs when the head is hit, snaps back or hits the ground after a fall. A microprocessor calculates the impact using an algorithm similar to the head injury criterion used to assess the intensity of impact in sports.

An earpiece can quantify personal energy levels using a combination of an infrared sensor, accelerometer, and algorithm. Heart rate earphones provide a soundtrack while measuring the impact of exercise using a sensor to track blood flow signals from the auricle – the external part of the ear – to capture heart rate and oxygen consumption. Other pocket-sized devices combine with online fitness programmes and promise to manage activity and nutrition, set goals and provide encouragement. Movement-based products package different functionalities including monitoring the quality of sleep.

Some of the devices spinning out of this development activity do appear, at least on first glimpse, to be solutions in search of a problem. Sony has filed a patent for a smart wig embedded with a variety of directional sensors and a communication interface. Microsoft has developed a prototype “smart bra” fitted with physiologic sensors – an electro-dermal activity sensor to track perspiration and an electrocardiograph – to monitor emotion and heart rate with the aim of preventing stress-related overeating, and defend it as an important step towards the application of affective computing sensitive to mood changes. The nature of the scientific innovation process is to create outliers that never receive mainstream following.

Periods of time – important for physical medicine and rehabilitation. Devices will soon allow continuous monitoring of physiological cues associated with such illnesses as epilepsy, Parkinson’s disease and heart failure. Ultra-thin, flexible polymer skin patches can monitor muscle movement and use stored data patterns to deliver controlled doses of medicine through the skin and track the therapeutic response. A body patch can control an ingestible sensor embedded inside medication to improve compliance with treatment. Smart contact lenses can measure glucose levels in diabetic tears or track ocular pressure in glaucoma. Smart eyewear that overlays the real world with digital information using augmented reality is already in use in telemedicine and tele-radiology. Further development will allow storage of treatment data for re-use on multiple patients, transfer to other doctors, and sharing between hospitals and specialist treatment centres in multiple countries.

Applications for wearable technology extend to monitoring breathing, heart rate and sleep, tracking hydration levels and calorie intake, recording movement, controlling therapy and pain management, and programming exercise. Much product innovation has come from small start-up companies but major corporations have also spotted the market potential; for example, Samsung, Apple, Nike, Microsoft, Philips and Google are all active. Wireless connectivity and simple interfaces help make devices user-friendly.

**Beyond fitness applications**

Unlike the analogue processes they aim to replace, electronic fitness devices prompt users into activity while logging output data and physiological signs unobtrusively and with little or no personal input. Devices let users set goals and offer prizes when they achieve them. Devices automatically upload data to the Web where they may be analysed or shared on social media or manufacturer platforms. It is likely that single-purpose activity monitors will disappear in favour of integrated solutions or be replaced by smartphones linked to wearable accessories. The direction of travel in mobile phone functionality is towards health and fitness tracking. Some wearables manufacturers are leveraging the newest smartphone processors that were designed specifically to log movement and activity.
Investors and manufacturers believe in the future of wearable technology but consumer buy-in may be less than certain. Ownership of wearable fitness devices has tripled between 2012 and 2013 and demand is expected to continue to grow significantly during 2014. The market for fitness and activity-tracking devices is predicted to top $1 billion this year in the U.S. alone.\textsuperscript{27} But the market potential is not the whole story; it is about the data and what is done with it.

Towards digital health data

Technology already helps shape motor insurance premiums. Assisted-driving and automatic safety innovations in new vehicles help reduce the frequency and severity of accidents. In the future, self-driving cars may improve this further.\textsuperscript{29} Motor insurers use “black box” telematics technology to monitor driver behaviour and allow them to offer cover to young high-risk drivers. Motor manufacturers are making a big push for vehicle connectivity via the Internet and mobile phone networks.

Much has been written about big data in a life insurance context. Health metrics that are collated on a portfolio of lives would certainly qualify as such. Yet there is little clarity about how such data may be used effectively or how its accuracy may be validated. However, this may not be the point. Insurers may see simply attracting customers who are stimulated by the very idea of a fit-for-life health programme as a proxy for selecting virtually...
While predictive analytics remain some way in the future, the smartphone is likely to emerge as the hub where existing single-purpose devices are de-siloed and combined into a single health monitoring system. This development, combined with microfluidics, promises to put detailed digital health data in the hands of a much wider spectrum of people. It seems plausible that currently available wearable fitness-related gadgets appeal only to a subset of the insurable population. Tech-savvy early adopters are those most likely to invest the money and effort required to track and trace their lifestyles. As the same technology is incorporated within existing multiple-purpose devices, such as smartphone apps, then adoption by a wider population seems likely to increase.

Trials on patients with bipolar illness have successfully collected data on sleep, communication, mobility and vocal patterns via smartphone and analyzed them for changes representative of manic episodes. Giving doctors access to behavioral trends could, in future, help patients with mental health problems avoid hospitalisation and even suicide. Sensors can already pick up information on heart rate variability, breathing, oxygen saturation, pollen count and air quality. Processing these targeted outputs, and combining the results, could help doctors predict asthma attacks in their patients and intervene with treatment or advice.

Consumers may be prepared to provide an insurer with explicit permission to access their personal data if they find the rewards on offer suitably attractive. Whether policyholders will sustain regular physical exercise in return for a freeze, or small saving, on premiums is debatable but they may do it in return for more tangible leisure-related benefits.

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Endnotes

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Critical Illness – Fit for the Elderly?
by Tim Eppert, Gen Re, Cologne

In almost all important insurance markets, individual life expectancy has increased enormously during the past decades and is likely to increase further in the future – while birth rates fall in many countries. Although many societies are in the process of ageing, it is not yet possible to visualise the impact of this on Critical Illness (CI) insurance. One reason is the lack of penetration the product has into this market – a fact borne out by the findings of Gen Re’s most recent market survey. The proportion of in-force CI policies held by people over age 60 is still marginal (see Table 1). The data demonstrates that, up to now, younger consumers are seen as the main target group in many markets. It also serves to illustrate the rather limited experience that the industry has with this product in older ages.

Younger people are an obvious target group for benefits of CI protection, especially in the context of family protection and mortgage security. They are also simple to administer from an underwriting perspective as most are in good health, so agents may be less afraid of negative underwriting results, and premiums are low compared to higher ages.

In addition to political pressures, there is an economic incentive for insurers to address the demand for CI insurance from people aged 55 and over. While traditional target groups will shrink in coming years, the proportion of wealthy and healthy consumers close to retirement age is set to grow in many markets. Insurable interest continues even in retirement and not only if direct medical expenses need to be covered. The potential still exists to incur costs for short-term care following a medical event or when making housing adaptations to accommodate new disability, for example. Income Protection (IP) insurance has only a minor role, if any, to play for retired people, and their need to insure residual debts should also diminish. Hence, the insurable amount required by individuals should be smaller in high ages than in young ages for many markets.

In this scenario it becomes increasingly relevant that CI policies sold today work effectively in the future when a significant proportion of in-force policyholders have aged into their 70s and 80s. It is also appropriate to ask at this point how a CI product that is directly addressed to the older generation should look.

Shifts in claims and diseases
Cancer is currently responsible for almost 90% of all female CI claims in many markets. Even though the number of claimants aged 60 or more is limited, it is already possible to trace a marked increase in the proportion of cardiovascular disease claims compared to the age group 40-59 (see Figure 1). From population statistics it is possible to infer this effect will be even more pronounced for women in their 70s and 80s. It is arguable whether pure cancer cover, popular in several markets and offering a high level of protection for women in younger ages, remains appropriate for products that cover higher ages as well.

Table 1 – Distribution of in-force CI policies by age group

<table>
<thead>
<tr>
<th>Age</th>
<th>China</th>
<th>Hong Kong</th>
<th>Malaysia</th>
<th>Singapore</th>
<th>South Korea</th>
<th>Australia</th>
<th>UK</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-19</td>
<td>15%</td>
<td>5%</td>
<td>19%</td>
<td>16%</td>
<td>9%</td>
<td>2%</td>
<td>–</td>
</tr>
<tr>
<td>20-29</td>
<td>12%</td>
<td>17%</td>
<td>21%</td>
<td>16%</td>
<td>29%</td>
<td>7%</td>
<td>15%</td>
</tr>
<tr>
<td>30-39</td>
<td>28%</td>
<td>34%</td>
<td>30%</td>
<td>28%</td>
<td>30%</td>
<td>30%</td>
<td>43%</td>
</tr>
<tr>
<td>40-49</td>
<td>29%</td>
<td>30%</td>
<td>20%</td>
<td>25%</td>
<td>23%</td>
<td>40%</td>
<td>33%</td>
</tr>
<tr>
<td>50-59</td>
<td>15%</td>
<td>12%</td>
<td>9%</td>
<td>13%</td>
<td>7%</td>
<td>19%</td>
<td>9%</td>
</tr>
<tr>
<td>60+</td>
<td>2%</td>
<td>2%</td>
<td>1%</td>
<td>2%</td>
<td>–</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>Average</td>
<td>36%</td>
<td>37%</td>
<td>32%</td>
<td>35%</td>
<td>34%</td>
<td>42%</td>
<td>38%</td>
</tr>
</tbody>
</table>

Source: Gen Re Dread Disease Survey
Even within a disease significant change will evolve with increasing policyholder age. For example, the impact of prostate cancer on claims for all cancers is negligible in young men, but is globally the most frequent cancer for men aged 65 and over. Many prostate tumours found in older men are slow growing and, in many cases, will not be treated or pose any immediate health threat, but can easily be detected via screening.

A major issue in higher ages will be dementia. As dementia in young portfolios is almost non-existent, insurers risk not focusing enough on this disease and not deriving rates or definitions with sufficient care. A comparison of population rates for cancer and dementia reveals how strongly the weight of certain diseases on claims experience may change with increasing age (see Figure 2).

On CI claims some companies control the increasing impact of dementia, Parkinson’s disease and other age-specific conditions by limiting the age spectrum of coverage to a maximum age (e.g., 65) with all other diseases included in the scope of cover with no age limit. While this approach is an effective way to control premium increase in later years, it is not without risk. It could be seen as a form of age discrimination and may not be possible in countries where it is not permissible to restrict insurance cover by age. In this case it would be better to include cover for dementia and the rest for the complete policy term (and price for it explicitly) or not offer it at all as the additional protection in young ages is very small.

Consideration must be given to shifting medical guidelines if major organ transplantation or other surgical procedures are included in the scope of CI cover sold to older lives. Improvements in clinical practices, coupled with improved life expectancy, may increase the maximum age limits of people undergoing certain treatments and interventions, and this in turn could impact on future incidence rates in this area.

Medical events that are common in older age – fractures of the pelvis or femoral neck, for example – appear as an attractive addition to CI products aimed directly at this target group. In many markets hospital data provide robust information on their frequency. Depending on the total insured amount, a partial payment can be appropriate for such events. Assistance services could be added as well. To balance this, conditions predominantly seen as disorders of the young – polio, muscular dystrophy, encephalitis or meningitis, for example – could be removed from the cover.

Incurring claims from elderly lives implies that a high proportion of claimants will have multimorbidity. A study of 85-year-olds found that 68% had at least two chronic diseases. From a certain age onward, multi-morbidity is the norm, not the exception. This can complicate CI claims management as it will not always be clear what disease caused which physical limitation. A possible response is to price for a lump sum disability benefit or a long-term care cover based on an Activities of Daily Living (ADL) definition. When the combined consequences of the multiple diseases are severe...
enough to fail ADLs, a claim is payable whether or not it is possible to link the physical decline to a specific disease. For the specific diseases, however, it becomes more important to stress that the severity levels, which are part of the disease definition, must be caused by this specific disease.

Underwriting

For a young target group, the maximum end age will only have a small influence on underwriting requirements. However, if dementia is covered without an age limit, dementia-specific questions can improve the underwriting result.

But a standard underwriting approach is reaching its limits if such a product is to be systematically sold to the generation 55+. Classic risk factors, such as hypertension, are much more prevalent in higher ages than in younger ages (see Figure 3). This means they work less successfully as indicators of substandard risks in an underwriting context for elderly lives. Using these classic risk factors in the same way as for a 20-year-old would lead to unacceptably and unnecessarily high declinature rates. Compared to these risk factors, existing disease and treatment become more important to identify sub-standard risks.

The increase in existing disease and disease risk factors hinders the effectiveness of underwriting in the absence of intensive individual assessment, which in turn leads to an increased risk of asymmetric information and anti-selection. A limitation on the upper age limit for the entry age (e.g., age 70 or 75) is recommended, especially when an insurance company is just starting to sell to higher age groups and still needs to gather experience.

Product design

It is not only the shift in the claim causes, but also the strongly increasing frequency of claims that can be an issue in high ages (see Table 2). Data on population-based CI incidence rates for 36 diseases, including dementia, revealed that the CI incidence for women aged 85 is about 50 times as high as for women aged 25; for men the difference is even higher with a factor close to 100.4

<table>
<thead>
<tr>
<th>Age</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>45</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>65</td>
<td>20</td>
<td>13</td>
</tr>
<tr>
<td>85</td>
<td>99</td>
<td>53</td>
</tr>
</tbody>
</table>

Source: Author’s own calculations based on SIAS data

For the highest ages, claims will not only become more frequent, but it is harder to derive rates for these ages. Even in markets where CI is a commonly available product, insurers will rely on population data to some extent while there is only a small number of insured in the highest age category. Population statistics must be adjusted as the underlying definition is different and the selection effect for the insured portfolio needs to be calibrated. In addition, the very long durations between entry age and maximum covered age make it difficult to estimate how medical progress and changes to disease screening and social behaviours will impact the observed incidence rates over time. Taking this uncertainty into account will lead to a further increase in costs for old age CI.

On the other hand, policyholders’ disposable income will typically not increase much after retirement and, in most cases, are likely to be significantly less than before. Unaffordable premiums in higher ages are unlikely to meet customers’ needs — and neither are they a suitable solution to reduce insurers’ exposure in higher ages as the likely lapses would be highly anti-selective.

Figure 3 – Proportion of population with hypertension (Germany)

Source: Neuheuser et al., Blood pressure in Germany 2008–2011. Results of the German Health Interview and Examination Survey for Adults (DEGS1)
There will still be insurers that do not want to offer cover beyond retirement. To cope with current and potential future anti-age discrimination laws, they may think about selling policies with a fixed duration instead of a fixed end-age.

Demographic transition offers chances, and insurers who directly address elderly consumers can gain new and wealthy target groups. They will, however, need to rethink their underwriting process and product design. Long-term care insurance already demonstrates that it is possible to accept a high proportion of older applicants. All insurers that offer cover up to high ages – whether they concentrate on current target groups or not – will be affected by ageing portfolios. Some effects, such as the uncertainty that comes along with long-term covers, may even have a harder hit on portfolios that sell to young entry ages. Robust definitions and limited sums at risk in high ages can help to manage the changing age structure. Insurers who adjust their products accordingly will be rewarded: due to increased awareness of the risks of critical illnesses in aging societies, excellent marketing perspectives exist.

Endnotes
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3 Multimorbidity patterns of and use of health services by Swedish 85-year-olds: an exploratory study, BMC Geriatrics 2013, 13:120.
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Air Pollution and Health

by Ian Cox, Gen Re, London

Poor air quality is typically linked to rapid economic expansion and industrialization. Man-made (anthropogenic) air pollution might therefore be assumed as only a modern phenomenon, yet people have endured poor air quality over many centuries. In fact, since wood and peat were first burned in enclosed living spaces for heating and cooking, the most polluted air was, and in many countries still is, found inside the home. The outdoor environment contributed naturally occurring air pollutants, such as volcanic dust, wind-blown sands or smoke from naturally occurring fires.

Once larger accumulations of people had settled together in towns and cities, widespread anthropogenic pollution of outdoor (ambient) air became a more acute health threat. Ambient air pollution is estimated by the World Health Organization (WHO) to have caused 3.7 million premature deaths in 2012 from cancer, cardiovascular and respiratory disease, the majority occurring in Western Pacific countries and Southeast Asia.

In the short term, air pollution can trigger asthma. Over longer periods it can provoke the development, or progression of, chronic obstructive pulmonary disease and emphysema. Exposure to concentrations of ambient particulate matter is an increased risk for cardiovascular events over both the short and medium terms. Outdoor air pollution is defined as carcinogenic to humans with increased risk of lung cancer.

The past

Accounts of the dirt and smell of urban pollution appear in ancient Egyptian and Roman texts. Early cities generated accumulations of discarded animal, human and food waste as well as concentrations of domestic smoke. The negative effects of the latter was recognised in China during the Tang dynasty and as urbanization progressed from 1000 A.D., increased numbers of Chinese lived in sooty, smoky surroundings that were understood to have a deleterious effect on their health and wellbeing.

Centuries later, London gained an unwelcome reputation as a city with high levels of pollution and smog. Notable events in the late 1800s and early 1900s are each associated with increased death rates. The first major European air pollution event of the modern era occurred in the Meuse valley of Belgium in 1930, the result of toxic smoke from a chemical factory being trapped at the valley floor by temperature inversion, where a layer of warm air acts as a lid trapping pollutants in the colder air below. Sixty deaths were reported but doctors and health officials were, at the time, perplexed as to their precise cause. A similar episode occurred in Pennsylvania during October 1948, when smog caused by the zinc and steel smelting killed 20 people and caused respiratory symptoms in thousands more.

Air quality in London could be so poor that attendants were required to walk in front of buses in broad daylight carrying lighted flares to show the drivers the direction of the road. People reported being unable to see a hand in front of their face, while livestock in the meat market was dying before slaughter. The 1952 London smog is linked with 4,000 deaths – although a recent review of the data concluded a figure closer to 12,000 – and all this during a time of high smoking prevalence with high rates of chronic obstructive pulmonary disease (COPD). Los Angeles gained a similar reputation in the early 1960s.

It has always taken time for the awareness of the causes and health effects to trigger legislation to limit the pollution – with varying impact. Environmental legislation is nothing new; in response to the choking city air the Roman Senate introduced a law over 2,000 years ago – aerem corrumpere non licit (“polluting the air is not allowed”). In 1306 the English king Edward I attempted to ban the burning of coal in London. Yet the past remains very much the present for the estimated 3 billion people worldwide who cook and heat their homes with biomass fuels and coal and are thus exposed to the serious health risks of indoor smoke. The same applies to those who live in the firing line of outdoor smoke produced by...
Particulate matter (PM) has become the focus of air quality monitoring. The size of PM in the air is important as smaller particles are more likely to be inhaled deep into the lungs and affect the body. Larger particles are more likely to be filtered in the nasal passages and the larger airways. Initially, PM with a median diameter of 10 microns (μm) was monitored (PM$_{10}$). Now most countries also monitor particles of a median diameter of 2.5μm (PM$_{2.5}$) as standard. A human hair has a diameter of approximately 50μm. Some countries persist in using old and less precise PM measures – Total Respired Particles (TRP) or Total Suspended Particles (TSP).

PM monitoring is undertaken at static measuring stations close to roads, schools and centres of population. Handheld machines are now available, while satellite monitoring allows for remote measurement. The spread of information on the Internet makes real-time air pollution levels instantly available. Many articles and reports imply, incorrectly, that PM is a distinct entity when in fact it has varying constituents depending on the location. PM may be very different in one country when compared to another, or even vary between cities or areas in the same country.

The Environmental Protection Agency (EPA) was set up in the U.S. in 1970 as a direct response to concern over environmental pollution at a national level. The EPA identified key pollutants to measure, record and report publicly (see Table 1).

<table>
<thead>
<tr>
<th>Source</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen Oxides</td>
<td>Impaired lung function, inflammatory response in blood vessels</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>Impaired lung function, inflammatory response in blood vessels</td>
</tr>
<tr>
<td>Ozone</td>
<td>Lung irritation and congestion, coughing and breathlessness; worsens existing bronchitis, emphysema and asthma</td>
</tr>
<tr>
<td>Sulphur Dioxide</td>
<td>Asthma and COPD exacerbations</td>
</tr>
<tr>
<td>Lead</td>
<td>Nervous system, kidney function, immune system; neurological effects in children, cardiovascular effects in adults</td>
</tr>
<tr>
<td>Particulate Matter</td>
<td>Respiratory diseases, heart attack, hypertension and cancer</td>
</tr>
</tbody>
</table>
The WHO first published air quality guidelines, including safe thresholds for particulate matter, ozone, nitrogen dioxide and sulphur dioxide levels, in 1987. Updated in 2005 the guidelines are open to interpretation and implementation by national risk management and environment policies. While most countries have set levels to attain that will reduce harm, levels vary internationally. Variance may depend on the technology available to measure the pollutants but also on what is attainable through controls in the short term. Targets that are hopelessly optimistic are seldom useful; it is better to have something to aim for that can be achieved and then review these targets at a subsequent time.

In many countries, monitoring goes hand in hand with restrictions on emissions and the burning of certain fuels. The reduction in the use of sulphur containing coals has meant that sulphur dioxide levels have fallen in many countries in the west. Lead has been removed from vehicle fuel in most countries with a rapid consequential fall in atmospheric lead levels.

Air pollution and health

The impact on health has only relatively recently been the subject of scientific study. Early efforts reported the effects on lung function by chemicals carried within polluted air. Asthmatics were, unsurprisingly, particularly sensitive to air pollution with reduced lung function, increased school absence and hospital admissions.5

The main focus of research has centred on the health effects of anthropogenic pollution that arises from industrial processes and vehicle emissions. In a study of six cities, Dollery and Pope (1993) demonstrated that mortality was significantly higher in the most polluted compared to the least polluted, and that this difference persisted when corrected for smoking, age, gender, body mass index (BMI) and occupational exposure.

It is now recognised that air pollution can increase the risk of heart attack, hypertension and possibly stroke. The inhalation of the chemicals deep into the lungs allows absorption of these chemicals into the bloodstream, setting off an inflammatory process that not only affects the lungs but also has an effect on the cardiovascular system, including the coronary arteries.

Studies relate the increased risk of disease to differences in PM levels. A recent publication analysed 11 European cohorts with 100,000 adults as a meta-analysis. It reported that increasing air pollution increases the risk of heart attack.6 For each 5µg/m³ increase in PM$_{2.5}$ the risk of heart attack increases by 13% and 12% with each 10µg/m³ of PM$_{10}$.

The European Study of Cohorts for Air Pollution Effects (ESCAPE) demonstrated an increased risk of lung cancer with a hazard ratio of 1.22 for each 10µg/m³ increase of PM$_{10}$ and 1.18 per 5 µg/m³ of PM$_{2.5}$.7 Increasing awareness of the impact of air pollution on lung cancer prompted the International Agency on Research on Cancer (IARC) to recognise it as a carcinogen in October 2013.8

In lung cancer, there is a lag time of 15-20 years after tobacco smoking and disease incidence. Mesothelioma occurs 30 years after exposure to asbestos. The lag time between exposure and disease diagnosis, or death, may be equally long with air pollution and studies have not been followed up for a similar period. Countries where levels of air pollution are currently high may not experience the peak of the effects until many more years have passed. It has been shown that air pollution increases mortality over periods up to 15 years.

There is increasing concern that heavy metals associated with serious health effects, such as cadmium, lead and mercury, are being inhaled as PM. Ambient pollution consists of small particles and gaseous compounds that drift slowly to land, accelerated by rain, where they cause secondary pollution of soil and ground water. Estimates put the amount of land in China that is polluted with heavy metals at 20%. This secondary pollution, now the subject of independent study, is thought likely to impact health in a different manner to air pollution, affecting the gastrointestinal tract, the liver or urinary system.

The future

Governments must balance the severity of air pollution with the economic consequences of legislation taken to combat it. Increasing publicity and the widespread availability of real-time monitoring of pollution levels has brought added pressure to act. At a recent seminar in China, the
author noted many delegates monitoring local outdoor air quality using smartphones. The availability of this information is difficult to ignore and social pressure has begun to grab attention although this may currently be more apparent in China than in India.

Solar and wind power development has increased rapidly especially in China. However, it is estimated that levels of pollution will be difficult to even start reducing by 2030. Recent announcements from the Chinese government that 6 million old cars that do not meet emission standards will be taken off the road to help reduce pollution are a welcome development. Drones are now reported as being used to make sure that power-generating plants are adhering to more strict laws on emissions.

Future research may look at even smaller PM size as technology allows, with ultrafine particles likely to be even more important than those currently measured. However, the focus on PM size is a blunt tool that fails to differentiate the precise chemicals it contains. The composition of PM varies from region to region, so measurement of its size alone may not strictly be comparable. The PM from coal burning and industrial process in China may not have similar constituents as the PM breathed in Singapore or in Malaysia, where it comes predominantly from forest-burning in neighbouring Indonesia. The substantive measurement is the same but the components may not be equivalent in their health effects.

Air pollution increases mortality and the incidence of critical conditions in both the short and long terms. It increases the number of consultations and hospital admissions and increases the sickness rate leading to work absence. The impact is felt in life and disability claims. Pricing actuaries must take a view on how much the levels of pollution will affect future claims. If pollution has been present in one country for a long time, the effect may be already in felt in claims experience. However, if pollution is increasing, or the medical conditions covered by policies have a long lag-time, it is likely that the effects will also increase and this may have to be reflected in the pricing for future problems.
> Risk Matters – Ebola Is Not Swine Flu

Ross Campbell discusses the current deadly outbreak of Ebola virus disease (EVD). Although a reminder of the potential for a virus to spread rapidly, the mechanics of EVD suggests it is unlikely to reach epidemic proportions.

> Claims Focus 2014, No. 1

Dr. John Delfosse discusses how a person’s fitness to drive is defined and how illness can affect this freedom and the ability to work. This edition also includes details on how illness such as epilepsy and diabetes can affect driver fitness.

> Underwriting Focus 2014, No. 1

Lynn Baillie looks at the impact of increased diagnoses of autism and attention deficit hyperactivity disorder. Dr. Ian Cox describes the potential for overdiagnosis to create medical labels for people or to trigger treatments that are not beneficial. This issue includes a discussion on whether a new definition is needed for cancer.

> Risk Matters Oceania – Direct-to-Consumer Gene Testing in an Australian Context

Dr. John Cummins reviews the developments in genomic medicine and the potential impact on the life insurance industry’s right to underwrite

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Mark Your Calendar

Gen Re offices around the world will run the following events:

> **Gen Re, Mexico:**
  Life/Health Seminar – 14 to 19 September 2014

> **Gen Re, Sydney:**
  Annual Risk Seminar, Sydney – 18 September 2014
  Annual Risk Seminar, Auckland – 24 September 2014

> **Gen Re, London:**
  Risk Matters Symposium – 18 September 2014

> **Gen Re, Cologne:**
  International Seminar on Risk Management – 22 and 23 September 2014
  Seminar of International Product Trends – 25 and 26 September 2014

> **Gen Re, Milan** ran an underwriting seminar on 11 June 2014. Dr. Anna Tanzini, Specialist in Forensic Medicine and Insurance”, presented “The Anatomy, Physiology and Pathology of Common Heart Diseases”, and Stelio Rossi, Senior Underwriter, Gen Re, Milan, presented “Evaluation of Applicants with Heart Disease”.

> **Gen Re, London** hosted “ReGenerate” on 16 and 17 June 2014. The event was attended by 41 clients from 25 companies. Peter Temple, Regional Director, UK, Ireland and South Africa, presented “How Obama Won With Big Data”, Steve Mannik, President, Gen Re, U.S, presented “Challenges in the U.S. Market”, Adele Groyer, Actuary, Gen Re UK, presented “Understanding the Customer”, Claire Henshall, Claims Manager, Gen Re UK, presented “Attitudes to rehabilitation: results of a survey of UK and international claims managers”, Dr. Chris Ball, Consultant Medical Officer, Gen Re UK, presented “The Medicalising of Everyday Life”, Damian Killen, Managing Director, Thrive Consulting, presented “How We Like to Persuade and be Persuaded” and Ross Tucker, Sports Scientist, presented “Bending the Arc of Performance”.

> **Gen Re China** hosted insurance medicine seminars in Shanghai and Beijing on 16 and 17 June 2014 that were attended by over 160 delegates. Dr. Ian Cox, Consultant Medical Officer, Gen Re Life/Health, presented “Air Pollution and Health” and “Cardiomyopathies”.

> **Gen Re, Sydney** ran a claims and underwriting workshop for New Zealand clients on 19 and 20 June 2014. Under the theme “Negotiating and Influencing”, Viviane Murphy, Senior Account Manager, Gen Re, Sydney presented “The Negotiation Model” and “Selling your Decision” to 45 delegates.


> **Gen Re, Cologne** held a seminar for Disability Insurers on 30 June 2014 attended by underwriters, actuaries, claims and product managers from 38 German companies. Ulrich Pasdika, Unit Manager Life/ Health Germany and Research & Development, Gen Re, Cologne, provided a review of market developments. Thomas Gehling, Senior Product Underwriter, Annika Tiedemann, Head of Underwriting Research and Björn Borchmann, Head of Claims Management and Claims Visiting Service, all Gen Re, Cologne, co-presented “Driving Factors on Disability Claims”. Björn Borchmann and Holger Schmarowski, Head of Underwriting International, Gen Re, Cologne, co-presented “New Approaches for Underwriting and Claims Management”. Dr. Angelika Nebe (Deutsche Rentenversicherung) presented “Mental Illness and State Pensions”. Michael Franke (Executive Director, Franke und Bornberg) presented “Consumer Need for Disability Insurance”.