Better Life Insurance Risk Assessment by Leveraging Medical Innovations

To elevate insurance underwriting efficiency and accuracy, insurers must tap medical technology innovations such as wearable fitness devices, smart phone apps, gene tests and bio-monitor/risk-assessment techniques such as evidence-based underwriting.

Executive Summary

In today’s competitive environment, life insurers must win as many customers as possible, but at a price that is both profitable and equitable. This means their underwriting risk assessment techniques must be data driven and precise. Life insurers currently collect risk information through medical questionnaires on the underwriting proposal form, general practitioner (GP) or attending physician statements and medical tests. If the applicant is insurable, insurers assign the applicant to either preferred, standard or sub-standard classes using a preferred underwriting classification system. However, the approach is inherently subjective. Hence, applicants with no obvious risk parameters sometimes end up being rated differently by different insurers.

The number and variety of diseases has increased over the years. In the last quarter of the 20th century, at least 30 new diseases emerged, according to the World Health Organization. Thanks to globalization, people are now traveling the world, resulting in the rapid spread of communicable diseases. The Ebola virus disease epidemic is a case in point. Many lifestyle diseases are emerging in developing nations.

Given this backdrop, insurers are challenged to stay abreast of new diseases, diagnostics and treatments to make correct underwriting decisions.

Numerous medical innovations over the last decade offer a promising remedy. They include mapping of the human genome, cloning of human stem cells, targeted cancer therapies, combination drug therapy for HIV, minimally invasive or laparoscopic surgery, use of smart phone apps for medical imagery and remote treatment delivery, proliferation of bio-monitors, etc. In keeping with these innovations, underwriting risk assessment techniques have also evolved.

Emerging concepts in the medical risk assessment arena include evidence-based underwriting (EBU), use of wearable fitness devices in health insurance and the application of gene test results to the life and health underwriting process.

These innovations may lead to better understanding of particular risks and more granular risk classification. Use of EBU ensures that insurers use the latest medical breakthroughs to determine the risk of death or disability from a disease. Wearable fitness devices give health insurers
continuous access to the insured's precise health data. Gene test results not only help insurers to provide more accurate and transparent product pricing but also to explore the possibilities of innovative product and market development and customer engagement.

The regulations relating to the newer risk assessment techniques are, however, not crystal clear. Data privacy and security concerns need to be sorted out. But to reap early-mover advantages, insurers need to co-innovate with the medical industry sooner rather than later.

This white paper lays out ways insurers can improve underwriting efficiency and accuracy amid increasing lifestyle diseases and emerging epidemics by tapping medical technology innovation such as wearable fitness devices, smartphone apps, gene tests and bio-monitor and risk assessment techniques such as evidence-based underwriting.

Current Risk Assessment Challenges

During the last decade of the 20th century, most life insurers worldwide switched to a preferred underwriting classification from the historic age and sex (and later tobacco use) based underwriting. Preferred lives are those with lower mortality as a group than the remaining lives of the same age, known as residual lives. Under preferred underwriting, preferred and residual lives of the same age are grouped into two or more classes based on differing expected mortality. From there, separate premium rates are established. Among the criteria used for preferred underwriting classification are height and weight, blood pressure, total cholesterol, tobacco, drug and alcohol use, medical history, motor vehicle records, occupation, hazardous sports, bankruptcy, etc. Two basic approaches are used to apply these various criteria – the knockout approach and the system of debit and credits. In the knockout approach, the applicant must meet the cutoffs for the full criteria to qualify for a preferred class. On the other hand, a debit/credit approach is one where numerical points are assigned for good and bad levels for the criteria. At the end, the points are summed up and the point total determines the risk class into which the applicant is placed.

Though the above risk assessment methods appear to be useful, they often result in mortality overlaps among risk classes. In other words, the preferred class in most cases have higher mortality than ideal and the residual class have lower mortality than ideal. As different insurance companies use different criteria and cutoffs, as well as a different number of risk classes, the same applicant might receive a different rating by different insurers for similar products. In an open and competitive market, this can also result in product mispricing. The preferred criteria and the cutoffs should ideally be chosen scientifically and based on insurance data. This, however, can be challenging, as there might be complex interactions among different criteria – leaving the ultimate decision to the judgement of the actuaries and medical directors.

Credibility of the rating depends on the source of data. Nonmedical details are generally sourced from a filled-in application form. Insurers sometimes cross-check the information (e.g., with motor vehicle records or a credit bureau). Paramedical and medical tests are sometimes requested to obtain information such as height, weight, blood pressure, heart condition, blood cholesterol and sugar levels, etc. Attending physician statements may be consulted about the applicant's medical history. However, if the sum assured is not significant, insurers generally waive some tests and checks, and underwrite the risk solely based on the application form. Performing tests and seeking reports is costly and time-consuming. This also creates inconveniences for the applicant. Any error in the underwriting rating may result in non-taken policies.

New diseases are regularly being identified. Due to the increasing movement of people across geographies, communicable diseases are spreading worldwide. For example, in September 2012

Figure 1

Super preferred Preferred Standard Declined

NUMBER OF INDIVIDUALS

EXPECTED MORTALITY

Preferred Underwriting

Figure 1
an Egyptian doctor in Saudi Arabia isolated a new human virus, which came to be known as Middle East respiratory system coronavirus (MERS-CoV). By early 2014, the virus had spread to Malaysia, Philippines, France, Germany, Italy, UK, Tunisia and Greece, killing approximately 100 people. In developing countries lifestyle diseases are arising due to changed eating habits, sleep patterns and increased stress levels. In keeping with the increase in the number and variety of diseases, new diagnostic techniques and drugs have emerged. For example, better medicines and therapies are available to treat cancer or HIV/AIDS. These developments mean insurers must update their underwriting manuals on a regular basis.

Innovations in Medical Underwriting
Innovations across medical fields are creating new avenues for life and health insurance risk assessments. In this section, we discuss three such innovations that impact life and health insurance underwriting – evidence-based underwriting (EBU), use of data spawned by wearable fitness devices and the use of gene testing results.

Evidence-Based Underwriting
Evidence-based underwriting is an offshoot of evidence-based medicine (EBM). EBM is the process of systematically reviewing, appraising and using clinical research findings to aid the delivery of optimum clinical care to patients. The practice of EBM requires the integration of individual clinical expertise with the best available external clinical evidence to deliver a cost-justified standard of care. Evidence-based underwriting (EBU) or evidence-based risk assessment (EBRA) similarly is the practice of making precise insurance decisions through the identification, evaluation and application of relevant, statistically valid and actuarially sound clinical data. In a word, these methods require the use of objective data to support decisions on mortality or morbidity risk.

EBU is a five-step process, as depicted in Figure 2. It starts with framing the question/s around answers sought. Then EBU proceeds toward collecting evidence from multiple internal and external sources and appraising the evidence on its appropriateness to the current case. Finally, the evidence is analyzed and interpreted to produce EBU guidelines.

EBU is not a new concept. In recent times, however, searching medical databases on a global scale and regular assessment of external data sources are more feasible due to the Internet. Current best evidence is also becoming easier to obtain than ever with access to electronic medical data from multiple third-party providers.

Capitalizing on this, a few large reinsurers have developed automated systems for evidence collection and analysis.

The EBU Process

![Figure 2](image-url)

Define the Questions
For example, if an applicant has diabetes mellitus impairment, the question can be asked as: Does the applicant have an absolute mortality risk consistent with the standard risk pool? If not, what is the magnitude of the extra risk?

Find the Evidence
Perform systematic review of medical journals, insurance publications, biomedical databases (e.g., EMBASE), etc. and gather data.

Critically Appraise the Evidence
Assess the data for validity, impact and applicability.

Analyze and Interpret the Results
Use common statistical measures (e.g., frequency distribution, significance, etc.) to arrive at the best estimate of the risk.

Produce Evidence-Based Underwriting Guidelines
Produce/recalibrate guidelines for accuracy and reliability. Produce a background paper that can be used by others.
Niche technology companies have emerged. One such company is BioSignia, which provides cloud-hosted EBU platforms such as its mortality assessment technology (MAT), which provides a statistical tool that uses a mathematical algorithm to access disparate studies in the medical literature and calculate the relative impact of multiple variables. It then applies the resulting knowledge to individuals on a case-by-case basis.

Data from Wearable Fitness Devices Used in Health Insurance

An explosion of wearable fitness devices over the last couple of years has interesting implications for health and life insurers. These devices, which can be worn as bracelets, clipped on a waistband or in some cases implanted in the body, collect various health data, such as the number of calories expended, number of steps walked, quality of sleep, nutrients consumed, heart rate, etc. In most cases, the device wirelessly transmits the data to the wearer’s smart phone where the data is processed and various statistics are displayed. The information is often stored on the cloud for later retrieval through other devices. Among the products in this category are Fitbit’s Flex, Misfit’s Shine, Nike’s Fuelband, Jawbone’s UP24, etc. Wearable fitness and activity tracking devices are predicted to top $1 billion in sales in 2014.7

The “quantifiable self” movement, which aims to measure all aspects of people’s daily lives through wearable devices, has resulted in a large body of behavioral data. This conveys an initial understanding of how the behavioral pattern affects life expectancy and quality of life. Harnessing this data, insurers can determine an applicant’s medical or physical-fitness age, which is more meaningful for risk assessment than chronological age.

Gene Test Results for Life and Health Insurance Underwriting

Over the last decade, the cost of human genome sequencing has reduced a million times – from $2.7 billion in 2003 for the first human genome sequencing to as low as $1,000 now.8 In addition, the accuracy of genome sequencing has improved dramatically (see Figure 3). As a result, a plethora of companies around the world – Illumina (U.S.), 23andme (U.S.), GenePlanet (UK and continental Europe), deCode Genetics (Iceland) and Strand Life Sciences (India), to name a few – have brought gene testing direct to the consumer. The main goal of genetic testing is to discover a genetic predisposition for certain diseases in order to detect them early through screening and timely treatment.

Gene testing also reveals information enabling appropriate action and lifestyle changes to
reduce the risk or to prevent the development of certain diseases. Hence, it could be argued that even an otherwise healthy person should get his or her genes tested. However, there are contrary viewpoints as well, such as that gene tests could result in overdiagnosis, induce anxiety that one would suffer from a disease which may not actually happen, privacy concerns and high cost. Nevertheless, humankind’s irresistible curiosity to know what their genes have in store for them could lead more and more people throughout the world to have their whole genome sequenced in the next few years.

From an underwriting perspective, the insured’s genetic information is critically important to life and health insurers. In their effort to appropriately categorize the risk that the insured poses to the company and to reduce adverse selection, underwriters gather the insured’s age, health, lifestyle and other information that has a bearing on mortality and morbidity. Evidently, genetic information, which reveals an insured’s likelihood to suffer a critical disease, is a crucial piece of information for a more granular risk classification.

**Underwriting Innovations to Solve Insurers’ Challenges**

**EBU for Precise and Systematic Underwriting**

An EBU framework similar to the one depicted in Figure 4 could help insurers collect information about applicants as well as the latest medical R&D data from multiple sources in real time in order to make underwriting decisions.

Apart from helping insurers maximize sales and maintain profitability, EBU also results in fairness to the consumer. Insurers are under constant regulatory pressure to explain the basis of any differentiation in insurance underwriting and to ensure there is no unfair discrimination. EBU helps insurers defend their risk rating. EBU considers the advances in medical sciences as much as possible and evaluates the risk in an objective manner. EBU, in some cases, can make the medical tests redundant, which could save money for insurers and reduce hassles for applicants.

EBU helps health insurers examine how the health condition of the insured could change over time (and hence, how claim costs could vary in the future). Most projections are based on past costs and current medical condition. However, conditions differ greatly in their longevity and cost pattern. For example, an acute slipped disk can be expensive to treat at the time of diagnosis, but lingering health effects are few and, therefore, costs tend to normalize over time. On the other hand, a chronic condition such as diabetes mellitus usually stays and gradually becomes severe and causes other health issues. As a result, expected claim costs tend to stabilize at a relatively higher level compared with a nondiabetic person of the same age and gender. EBU guidelines, which rely on claims data and clinical expertise, can reveal and justify a time-sensitive rating structure for various conditions.

Despite numerous benefits, there are certain challenges associated with EBU. For one, there

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Evidence-Based Underwriting Framework

![Evidence-Based Underwriting Framework](image)

**Figure 4**

**Evidence Analyzer**

- **Rules Engine**
- **Internal Data**

**Evidence Based Underwriting**

- **Lab Data** (e.g., ExamOne)
- **Medical Journals** (e.g., PubMed/BMJ)
- **Information Exchange** (e.g., MIB)
- **Prescription Data** (e.g., Ingenix/Milliman)
- **Biomedical Databases** (MEDLINE/EMBASE)
- **Govt. Agencies** (e.g., NIH)
- **Other Internet Web Sites**

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is a lack of sizeable volumes of meaningful, rule-based, generalizable evidence data across all geographies. Due to various and incompatible formats of the external data, it is difficult to automatically read, interpret and compare them. Moreover, there are people and system costs associated with EBU. To effectively use EBU, underwriters need to be trained in biostatistics.

However, systematic collection of medical and customer data by various players, along with continuous improvement in big data technologies and predictive analytics, will help evidence-based risk assessments to gain ground. Currently, most direct insurers turn to their reinsurance partners for help with supportive evidence data. In the near future, evidence-based risk assessment could become commonplace and direct writers would be a significant user of this approach.

Wearable Fitness Device Data for Health Monitoring

Insurers can access an applicant’s or insured’s health and fitness data generated by wearable devices in two ways: During new business underwriting, they can ask applicants to provide daily activity reports (e.g. Fitbit activity reports) in the event they are already using wearable fitness devices. Secondly, insurers can provide wearable devices to the insured at a subsidized rate – or for free – to directly monitor their health and activity on an ongoing basis, as depicted in Figure 5.

As an incentive, insurers can make appropriate premium adjustments if the insured lives a healthy life. This will be a win-win situation for both the insured and the insurer. Some insurers have already started to use this approach on an experimental basis. In the UK, for example, PruHealth offers its customers a wearable fitness device from Fitbug at a reduced price. The device tracks the number of steps the customer takes each day and awards “vitality” points that can be redeemed for cinema tickets or gym memberships, among other options. In India, Apollo Munich Health Insurance Company is integrating wearable fitness gadgets from GetActive, a local high-technology start-up, in its product offerings. Many companies that sell wearable devices have now started maintaining data repositories of their customers. Insurers can liaise with them for seamless real-time access to the data.

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Concerns that typically arise when it comes to leveraging data generated from wearable devices include privacy, security and standardization. In the U.S., the Food and Drug Administration (FDA) issued its final guidelines last year on medical devices and mobile apps. However, most observers contend that the regulations are not clear on what is and what is not covered. Moreover, there are no widely accepted technology standards for wearable devices yet. Hacking the data or the actual device itself is also a concern. However, as the aforementioned challenges are sorted out over time, insurers will need to prepare themselves to capitalize on the wearables movement.

**Genetic Data to Boost Premium Setting, New Product Development**

Insurers can use the applicant's genetic info for more precise disease and death risk identification and charge a premium appropriate to the risk (see Figure 6). But, in addition, insurers can leverage genetic information to devise innovative products. For example, riders or bolt-on policies can be designed to cover a specific disease. Insurers can push these policies if the insured's genetic information shows susceptibility to a particular disorder. It makes sense for the insured as well to add such a rider to his main policy if his predictive genetic test reveals a chance of a “polygenic” disease (e.g., diabetes, hypertension, etc.).

Insurers can also customize products for individual applicants. For example, if an insured is susceptible only to a few diseases he/she does not need coverage for all ailments that a typical critical illness (CI) product offers. The insurer may customize the cover accordingly and, hence, a premium increase could be avoided.

Once insurers know the genetic make-up of their customers, they can engage with them in novel ways. For example, if the insurer knows that the insured is susceptible to some preventable diseases, it can play the role of a counsellor and help the insured make necessary lifestyle and behavior changes. The insured, her physician and the insurer can engage collaboratively. This will be a win-win situation for both customers and insurers. Given the explosion of social media and mobility, it is not at all difficult for insurers to engage with those insured in this way. This could be accomplished in parallel with how P&C insurers track (and positively influence) customers’ driving behaviors through telematics.

Genetic profiling may give rise to a life and health insurance market similar to the excess and surplus (E&S) line in P&C. These products could serve people highly predisposed to a genetic disorder (e.g., “monogenic” diseases such as Huntington’s) who fail to get desired coverage from main street life insurers. Like E&S, this can be a profitable business for insurers. It would also ensure that people with complex risk characteristics, as revealed by their gene sequences, do not go without coverage.

Though insurers need an insured’s genetic information for risk assessment, insurance regulations in various countries do not fully allow its use at present. In the U.S., the Genetic Information Nondiscrimination Act (GINA) prevents health insurers from discriminating on the basis of genetic information to make eligibility, coverage, underwriting or premium-setting decisions.

**What Insurers Can Do with Genetic Information**

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<thead>
<tr>
<th>Action</th>
<th>Description</th>
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<tbody>
<tr>
<td>Charge premium relevant for insured’s death or disease risk.</td>
<td>Develop new market for unusual/complex risks as revealed by genetic tests (similar to excess and surplus line).</td>
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<tr>
<td>Customize product (e.g., CI policy covering only diseases insured is genetically susceptible to).</td>
<td>Engage with customer and GP to improve lifestyle and monitor health for preventable genetic diseases.</td>
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<tr>
<td>Develop new product (e.g. riders covering hereditary disease).</td>
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*Figure 6*
Several European countries have prohibited or introduced moratoria on the use of genetic information by insurance companies. In the UK, the Association of British Insurers (ABI) and the federal government have agreed on a voluntary moratorium covering the use of predictive genetic test results for life insurance policies under £500,000, or critical illness policies under £300,000. Similarly, in Germany, insurers may request genetic tests only for life insurance policies paying more than €300,000 or disability policies paying more than €30,000 annually.

In Canada, however, the position of the Canadian Life and Health Insurance Association (CLHIA) on the issue of insurers’ using genetic testing is as follows: Insurers would not require an applicant to undergo genetic testing; however, if genetic testing is done and the information is available to the applicant and/or applicant’s physician, the insurer would request access to that information just as it would for other aspects of the applicant’s health history.

Some studies suggest that a ban on the use of genetic information would not significantly impact the efficient economic operation of insurance markets. From a social welfare perspective, the studies conclude that even if a ban results in lower-risk individuals paying higher prices and vice versa, it would improve the equitable distribution of well-being overall. These studies, however, agree that the situation might change in the future.

If predictive genetic tests are allowed to determine the risk rating, they will effectively increase the cost of insurance for those with defective genes. But innovative means, as suggested above, can help contain the cost escalation. The premium would be less for customers with healthy genes. Insurers such as L&G and Zurich in the UK consider negative genetic test results voluntarily shared by the applicant to offset any adverse decisions due to family history. Once customers are confident that insurers would not turn them down or charge exorbitant premiums if they disclose their gene test results, more people will turn to gene sequencing. These could lead to early detection and, potentially, prevention of fatal diseases. Ongoing enhancements in gene therapy could, eventually, cure diseases such as cancer or Down syndrome in the near future. Risk of death from genetic and hereditary diseases could be reduced, which would make the population healthier.

Regulations that now prohibit the use of genetic information by the insurers would eventually be relaxed. But insurers also need to do their part to ensure they are able to take advantage of these developments. Unfortunately, many insurers lack proper actuarial or statistical data upon which to base their underwriting decisions on genetic information, according to a case study that recently appeared in the Medical Journal of Australia. Having a qualified team of geneticists at their disposal is highly recommended for life and health insurers. They should pay close attention to actuarially relevant genetic information and include it in the actuarial model.

The national trade associations representing life insurance companies (e.g., the Association of British Insurers in the UK or the American Council of Life Insurers (ACLI) in the U.S.) should liaise with researchers and academia to establish a statistical correlation between genetic predisposition and the actual incidence of a disease. This would give a scientific basis for using genetic information in the underwriting process.

Looking Ahead

While EBU and data from wearable bio-monitors could help advance risk assessment, genetic data also can help propel innovative product and market developments. Both are more objective and transparent ways to assess risk. If the above techniques are executed judiciously, they will help insurers and consumers: Insurers will be able to accept risk at appropriate price points resulting in more sales and profit; consumers will pay a fair price for their individual risk.

As regulations and insurance industry practices evolve, insurers who proactively incorporate medical innovators into their operating models will be better positioned to prosper in the years ahead.
Glossary

- **Polygenic disease**: results from mutations of multiple genes and often associated with environmental causes. Examples: cancer, diabetes, epilepsy, heart disease, etc.

- **Monogenic disease**: results from small modifications in a single gene. Examples: cystic fibrosis, sickle-cell anemia, Huntington's disease.

Footnotes


11. Many “lucky” (low risk) people would subsidize a few “unlucky” (higher risk) people.


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