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LETTER FROM THE EDITOR

Dear readers:

Welcome back to *ReFlections*! This edition of *ReFlections* contains three articles that are pertinent both to the present and future of medical underwriting. The first article, on the topic of bariatric surgery, tackles the issues related to post-surgical mortality of the obese applicant. It describes the various types of surgery as well the benefits and risks of these procedures.

The next two articles are more attuned to the rapidly advancing future of underwriting. They can be considered as introductory articles that presage more in-depth discussions on the topics of Electronic Medical Records (EMR) and Predictive Modeling in subsequent articles. The author of the article on EMR is Sue Wehrman, who is a first-time

contributor to *ReFlections*. She, and other RGA associates, have devoted considerable time and energy to the study of this topic. Sue has recently been accepted for enrollment in a Master of Science accreditation program at St. Scholastica in Health Informatics and Information Management. We expect her to be a valuable source of knowledge for our industry. The second introductory article, on Predictive Modeling, was written by Dave Wheeler, RGA's Head of Global Mortality Markets for Underwriting. This very important topic will be covered in greater depth from an underwriting and actuarial perspective later this year.

At the end of these articles, please take note of the ongoing activities of the Longer Life Foundation as well as a description of RGA's On-Demand webcasts.

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BARIATRIC SURGERY

By J. Carl Holowaty M.D., D.B.I.M.

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Bariatrics is a branch of medicine that encompasses the causes, prevention and treatment of obesity. Treatments for obesity typically include dieting, exercise, behavioral therapy, pharmacotherapy and surgery. *Bariatric surgery* includes a variety of surgical procedures designed to reduce the caloric up-take of ingested foods.

The mortality implications of obesity have been fully delineated in previous articles in *ReFlections*.

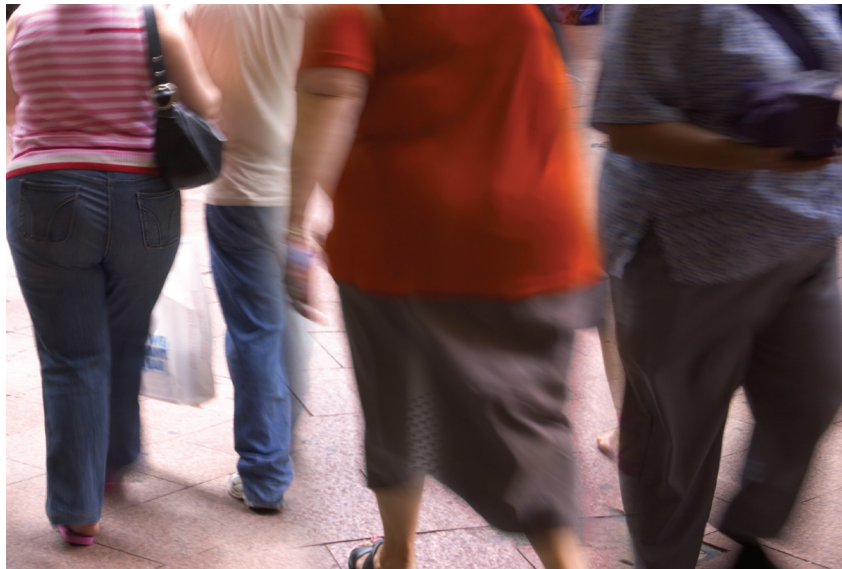
Unfortunately for many obese people, non-surgical efforts to significantly reduce BMI are not always sufficient or durable enough to materially reduce excess morbidity or mortality on a permanent basis. This article will outline various forms of bariatric surgery and evaluate the evidence that surgical treatments for obesity may offer hope of improvement in the long-term health of obese life insurance applicants.

Therapeutic Considerations

In general, bariatric surgery can be divided into three categories: procedures that restrict the passage of food, those that cause malabsorption of nutrients, and procedures that are combinations of these strategies. The most commonly utilized procedures will be described in more detail after a short explanation of the evolution of bariatric surgery.

History of Bariatric Surgery

Modern bariatric surgery had its beginnings in the 1950s with the intestinal bypass procedure which bypassed all but a very short length of the small bowel, but did not attempt to change the anatomy or function of the stomach. Understandably, this procedure led to serious nutritional problems, including liver failure, and was largely abandoned by the 1970s. Ultimately it was recommended that patients should have the procedure reversed, and other surgical options needed to be considered.



In the 1970s, the Vertical Banded Gastroplasty (VBG) was introduced. This procedure used a surgical stapler to significantly reduce the effective size of the stomach. In addition, a plastic band was wrapped around the stomach outlet to keep it from stretching. Unfortunately, many patients exhibited considerable vomiting and acid reflux. In addition, weight loss targets were often not achieved. Many patients eventually required revisions, conversion, or even reversals. The type of procedure is now uncommon in the U.S.

The Roux en Y Gastric Bypass (RNY) was frequently used for bariatric surgery beginning in the early 1980s. It combined the restriction of gastric volume with a limited degree of malabsorption of food in the small bowel. This procedure proved more efficacious than prior forms of surgery and also produced fewer side-effects; however, due to the failures of previous forms of bariatric surgery, this procedure did not initially become a popular method for treated obesity.

The reluctance to utilize bariatric surgery changed in 1992 when the National Institute of Health determined that both the VBG and RNY procedures had adequate safety and risk/benefit profiles in the treatment of morbid obesity. The standard needed to qualify for these procedures included either having a BMI of > 40 without health issues, or a BMI of 35 – 39 with obesity-related health issues.

In 1994, the first Laparoscopic Gastric Bypass was performed and soon adopted for use in VGB procedures. With the development of the Laparoscopic Adjustable Gastric Band in 1998, this less-invasive form of surgery quickly became popular.

The other form of bariatric surgery introduced in the 1990s was the Duodenal Switch procedure, which combined a Gastric Bypass procedure as well as a significant Intestinal-Bypass procedure. This procedure was not very popular, possibly owing to a frequent side effect of malabsorption and loose, watery stools. It was often reserved for patients with weights in excess of 600 pounds.

The procedure incorporated a 'Gastric Sleeve' as the first part of the two-stage procedure. Some patients did not proceed to the second stage of the Duodenal Switch and were left with the Gastric Sleeve in place. This procedure is now recognized as a stand-alone form of bariatric surgery.

Currently Used Forms of Bariatric Surgery

The Roux en Y (RNY or RUNY) procedure is a complex procedure that creates a very small upper stomach pouch that is completely separated from the rest of the stomach, which is left in situ, but completely uninvolved in the storage or passage of food. A 'Y'-shaped segment of the small bowel is attached to the small stomach pouch with a narrow opening that interferes with the normal mixing of food and gastric secretions with the subsequent reduction in normal absorption of nutrients in the small bowel. Due to the complexity of this procedure, there is a higher risk of complications, but also the likely benefit of greater weight loss.

- 2-day hospitalization
- return to full activity in 7-10 days
- 5-8% lifetime risk of major complication e.g., pulmonary emboli, bleeding, re-operation, infection, suture line leaks or perforations, bowel obstructions
- other considerations
Malnutrition, anemia, vitamin deficiency,

metabolic bone disease, stoma stenosis leading to vomiting, solid food intolerance, excessive weight loss, chronic diarrhea, hypoglycemia, 'dumping syndrome', inadequate weight loss, depression, various forms of addictive behavior.

Vertical Banded Gastroplasty (VBG and Laparoscopic VBG) procedures limit food intake by creating a small gastric pouch in the upper stomach with a very narrow outlet which is reinforced by a mesh band to prevent stretching. The passage of solid foods is restricted, but not that of high-calorie liquids. The presence of a small pouch with a restricted outlet leads to early satiety. This is a less complex procedure than the RNY, with generally lower rates of immediate post-operative complications. Unfortunately this procedure is also less-effective than the RNY, probably because it does not impede the passage or absorption of high-calorie liquids and the stomach pouch can stretch with over-eating.

- 20% of patients do not lose weight
- only half of the patients lose as much as 50% of desired weight loss
- hospital stays are often 1 day
- return to regular activities in 7-10 days

Laparoscopic Adjustable Gastric Bands, which are a variant of the AGB procedure, are designed to restrict the consumption of food, since the reduction in stomach volume results in early satiety. Attempts to overeat usually result in regurgitation of food. In order to place these bands, several small incisions are made in the abdomen to allow access to the stomach and the esophagus. A variety of different bands are available to the surgeon, who will select the specific band length and width depending on the anatomy of the patient. The bands are placed around the upper stomach and esophagus to create a constrictive band that results in a very small stomach pouch with a narrowed outlet. The pouch is only about 20 – 30 cc (~1 oz.) in volume. Once the correct pouch size has been formed, the band is usually fastened to the wall of the stomach in order to prevent slippage. The inner layer of the band is an inflatable balloon that can be inflated to tighten the outlet of the newly formed small stomach. This band is filled with saline and the volume and pressure of the saline-filled balloon is controlled through a small reservoir (port) that is placed under the skin on the abdominal wall and is connected to the band by IV tubing. This part of the procedure is normally done after there has been recovery from the first part of the procedure.

This filling of the band is usually repeated periodically to encourage the formation of scar tissue at the outlet of the stomach.

Some of significant complications of this procedure are due to either slippage of the band (from under-inflation or inadequate fixation of the device) or over-inflation, which can lead to tissue necrosis, bleeding, or infection. The presence of a saline port allows for periodic adjustment of the belt if either of these situations is suspected. Removal of the band is always an option.

- this procedure can be done either on an in-patient or, in select cases, out-patient basis
- usually no overnight hospital stay is required
- return to regular activities usually less than 7 days
- approximately 25% of patients have their bands removed for a variety of reasons
- these bands are not permanent, and may ultimately need to be replaced if desired
- no stapling or incision of the stomach is required

Biliopancreatic Diversion (BPD) bypasses a long segment of the small intestine and typically includes removal of a portion of the stomach. In order to avoid gastric 'dumping syndrome', some doctors will preserve the pylorus of the stomach. In addition, weight loss can be enhanced by resecting the greater curvature of the stomach (gastric sleeve).

Gastric 'dumping syndrome', a relatively common complication of gastric surgery, occurs when foods leave the stomach earlier than they should, resulting in a distension of the duodenum from the presence of excessive hyperosmolar food from the stomach. This causes secondary entry of water into the intestinal lumen, with resultant osmotic diarrhea related symptoms. This syndrome can be subdivided into early and/or late dumping. Early dumping begins with or immediately after the ingestion of a meal

Symptoms include nausea, vomiting, bloating, cramping, diarrhea, dizziness and fatigue. Late dumping occurs 1–3 hours after eating. Symptoms include weakness, sweating and dizziness. These two types of dumping can co-exist. It is speculated that early dumping is related to inadequate digestion of fats, and late dumping is related to carbohydrates. The dumping of carbohydrates into the gut triggers the pancreas to release large amounts of insulin into the blood, which then leads to hypoglycemia-related symptoms.

Statistics

Approximately one-third of the U.S. population is obese. Many overweight and/or obese individuals struggle to reduce their weight in the effort to improve their health and sense of wellness. Dietary and exercise management is often not either adequate or durable. While bariatric surgery is an effective means of reducing both weight and some of the risk factors associated with obesity, it is certainly not a panacea for the average obese individual. During the previous decade, the annual number of bariatric surgery procedures performed annually was in the range of 100,000 – 200,000. Approximately 80% of these procedures were performed on females.

In general, people lose approximately one-half of their excess body weight in the first year after bariatric surgery. According to the Cleveland Clinic Health Education Center, bariatric surgery patients lose about two-thirds of their excess weight within two years.

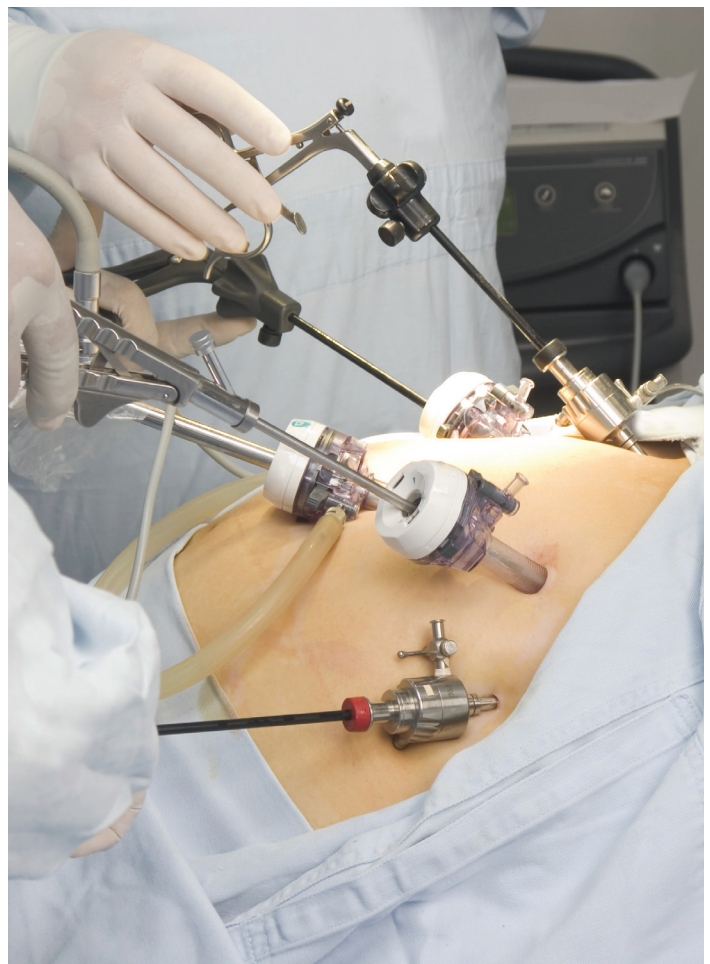
The amount of weight loss following bariatric surgery is quite variable, and will depend on the type of procedure performed as well as the individual. While weight loss is often both significant and durable, it is not unusual for the weight loss to be either insufficient or conversely excessive. In the case of VBG procedures, this can be very dependent on the placement of the band.

Bariatric surgery is not inexpensive, which, combined with surgical mortality and morbidity concerns, may partially explain the limitation in its usage.

Bariatric Surgery	Average Cost	Price Range
Gastric Bypass	\$25,000	\$18,000-\$35,000
LAP-BAND	\$18,000	\$12,000-\$25,000
Gastric Sleeve	\$15,000	\$10,000-\$25,000
Roux-en-Y gastric bypass	\$25,000	\$20,000-\$35,000
Biliopancreatic diversion bypass	\$23,000	\$20,000-\$25,000
Duodenal switch	\$20,000	\$18,000-\$30,000

Complications of Bariatric Surgery

As with any surgical procedure, complication rates will vary by the specific procedure, the experience of the surgeon and pre-operative risk factors present. The typical complications of the basic types of bariatric surgery are listed in the table above: (see ACP table in Volume 1 ENDO X Obesity – 13). The most common operative related complications, which occur in up to 30% of patients, are bleeding, wound infections, atelectasis, pneumonia and hernia. Other serious, but rarer, complications are anastomotic stenosis or leakage, thromboembolism and bowel obstruction. The overall death rate associated with bariatric surgery has been improving since 2002. Mortality rates now range within 0.1% -0.7%, depending on factors such as the pre-operative health status of the patient, the specific procedure performed, and the experience of the surgical team/health facility (*Surgical Obesity Related Discussion, 2011 Dec 22*). In general, laparoscopic techniques result in less-serious complications, but in the long run may involve more problems with device slippage, erosion of the stomach and the need for re-operation.



Most-Commonly Used Bariatric Procedures

Type of Surgery	Procedure	Average Weight Loss	Medical Complications	Management
Restrictive	Vertical banded gastroplasty	≈ 17% (5 yr)	Nausea, vomiting, gastric distention	Reversal of procedure if complications unacceptable
	Laparoscopic adjustable gastric banding	17-21% (5-10 yr)	Nausea, vomiting, slippage, erosion, and leakage	Adjustment of band to minimize nausea; revision, reversal, or conversion of procedure if necessary
Malabsorptive	Biliopancreatic diversion	≈ 27% (5-10 yr)	Diarrhea, fatty stools, protein-calorie malnutrition, anemia (low iron), deficiency of vitamin D (and other fat-soluble vitamins), hypocalcemia, hyperparathyroidism, metabolic bone disease, vitamin B12 deficiency, Wernicke encephalopathy (rare)	Monitoring of levels and replacement of nutritional deficiencies; patients often require high oral or parenteral doses
Combination	Gastric bypass	≈ 27% (5-10 yr)	Reductions in levels of iron, calcium, vitamin D, Vitamin B12, folate, dumping syndrome; hyperinsulinemic hypoglycemia (rare)	Monitoring of nutrient levels and oral supplementation with iron tablets (325 mg), vitamin B12 (500-1,000 mg), folate (1 mg), calcium 500-1,000 mg, and vitamin D (400-1,200 IU). Small, frequent, high-fiber, and low-fat meals. Acarbose, calcium channel blockers, diazoxide, somatostatin

Bariatric surgeries such as biliopancreatic diversion have a high incidence of malabsorption that will require attention to supplementation with nutrients such as iron and vitamins. On occasion, malabsorption can be severe enough to necessitate reversal of the procedure.

While weight loss following bariatric surgery is clearly the desired outcome, on occasion, weight loss is either too precipitous, or may be more gradual but eventually excessive. Careful follow-up by nutritionists and physicians is required to ensure that lean body mass targets are not exceeded.

Effect of Weight Reduction on Mortality

Mortality increases with increasing levels of obesity. Its impact is greater in younger populations and also in less-fit populations. Most of the excess mortality is related to co-morbid conditions such as coronary artery disease, diabetes and cancer. It appears however that even a relatively modest decrease in obesity can result in mortality improvements, regardless of the methods of reduction in obesity.

In the case of bariatric surgery, weight loss can be substantial and often more durable than through dietary changes or the use of pharmaceutical agents. The Roux-en-Y procedure, for example, results in an average weight loss of 50% of excess body weight, as well remission of diabetes mellitus in approximately 80% of patients. (*American Family Physician*, 2011 Oct 1;84(7):805-14).

Bariatric surgery has been associated with a reduction in cardiovascular events and deaths. (*JAMA* 2012;307(1)). All-cause mortality improvements have been estimated at between 23%-40%. (*NEJM* 2009; 361 (5): 520-1).

It is possible however that the mortality benefits of bariatric surgery may not be universal. For example,

while short-term studies of predominantly young low-risk females have shown mortality benefit, a study of older high risk male patients did not demonstrate significant improvements in mortality (*JAMA* 2011;305(23):2419-2426).

Bariatric surgery can have some positive implications for morbidity as well as mortality. As an example, improvements can be demonstrated in gait parameters, walking speed, quality of life and of perceived functional limitations (*Surgical Obesity Related Discussions*, 2012 Jan 16).

Conclusions

Bariatric surgery can result in durable reductions in both mortality and morbidity in well-selected obese individuals. From an underwriting perspective, applicants can be considered for life insurance purposes following a relatively brief post-surgical period to ensure that there are no serious post-operative complications. While it is not uncommon to regain at least some of the initial lost weight, even a small degree of durable weight loss will produce mortality and morbidity benefits. Risk selection for bariatric surgery applicants should include a consideration of any possible side-effects of the procedure that might lead to consideration for reversal of the procedure. ■

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Dr. J. Carl Holowaty is Senior Vice President and Chief Medical Director of RGA Reinsurance Company. He is responsible for the management of the medical department; research, development and maintenance of RGA's underwriting manual; and editing RGA's medical newsletter, ReFlections. In addition to his responsibilities at RGA, Dr. Holowaty serves as the Deputy Medical Director of the Longer Life Foundation. Dr. Holowaty earned his medical degree and a BSc in biochemistry from the University of British Columbia. He is a member of business and insurance industry organizations AAIM, CLIMOA and MMDA.

ELECTRONIC MEDICAL RECORDS – DREAM VS. REALITY

By Susan L. Wehrman FLMI, ACS

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When most of us contemplate how life insurance might work once the world has adopted electronic health records, our imagination conjures up a rosy vision where every applicant's medical information will flow automatically on demand and be presented seamlessly to an underwriter who can simply point and click on every medical detail recorded throughout an individual's lifetime and deliver underwriting decisions in the blink of an eye. The information will be complete, accurate, legible and searchable. Agents will be thrilled, as policies may ultimately be provided on demand; actuaries will delight in the limitless opportunities for data mining, research and product development. Everyone will have all the data they will ever need, and what a wonderful world it will be.

This is the dream, but what is the reality?

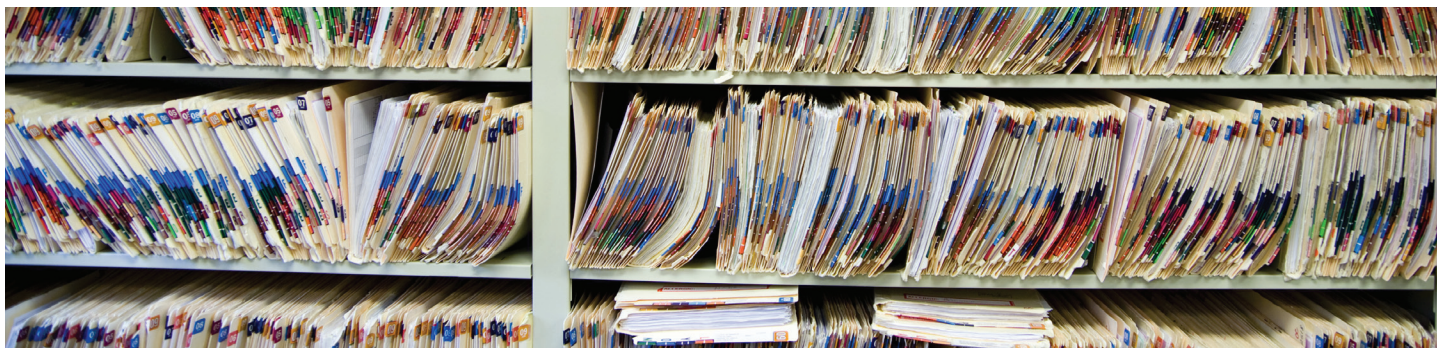
We are on a very long road to realizing the dream – where the journey will be as significant as reaching the destination. A global survey of RGA's offices shows that underwriters are already seeing hard-copy printouts of EMRs in many of our insurance markets; however, this reality means our case files are becoming larger (1800+ pages in some instances!). These electronic medical records are usually from one doctor or from one medical practice or hospital. We have not yet seen a universal Electronic Health Record (EHR) that contains every doctor visit across a country including all allied health, laboratory and pharmacy information in a single record – but nearly every developed nation has an electronic record initiative.

United States

In 2004, President George W. Bush laid out a 10-year EHR adoption plan, which included creating the Office of the National Coordinator (ONC) for Health Information Technology. This office oversees development of policies and standards related to health information technology, and is responsible for the development and adoption of a national health IT infrastructure that permits electronic exchange and use of health information, and certification of standards and technology required for exchange of health information. Bush's goal was for all Americans to have Electronic Health Records (EHRs) by 2014.

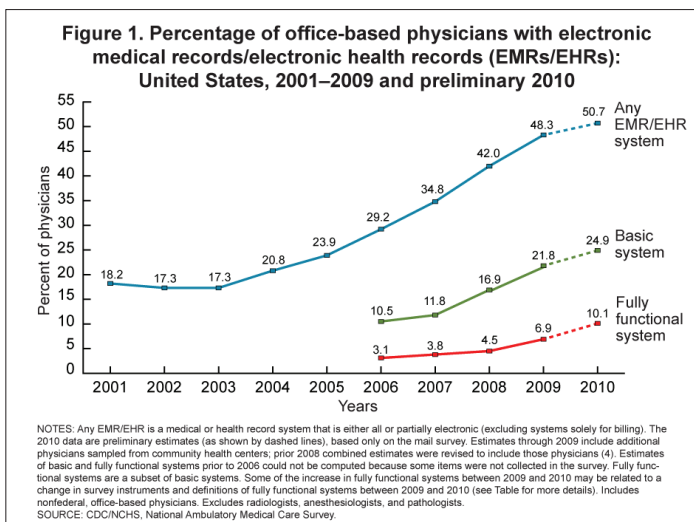


In 2009, President Obama passed the American Recovery and Reinvestment Act of 2009 (ARRA) – also known as the “Stimulus Law” – which was enacted to promote the “Meaningful Use” of Electronic Health Records (EHRs) and related technologies. This Act included a subsection that provides funding to promote adoption of Health Information Technology (HIT), called the Health Information Technology for Economic and Clinical Health Act (HITECH). HITECH seeks not merely EHR adoption, but the meaningful use of the EHR to improve quality, safety and efficiency. Therefore, simply transferring information from paper to digital form is NOT enough. Providers must show they are using EHRs in ways that can be measured in both quality and quantity. Collectively, these Acts provide \$19.2 billion in HIT spending.



Of course, this is not just free money. There are incentives – accompanied by penalties. Under HITECH, federal incentive payments are available to doctors and hospitals when they adopt EHRs and demonstrate use in ways that can improve quality, safety and effectiveness of care. Eligible¹ professionals can receive as much as \$44,000 over a five-year period through Medicare or up to \$63,750 over six years through Medicaid. Eligible hospitals can qualify under both programs and potentially receive in excess of \$2 million. These incentives will be distributed until 2014. For 2015 and later, providers who do not successfully demonstrate Meaningful Use will be penalized in the form of reduced reimbursement from Medicare and Medicaid.

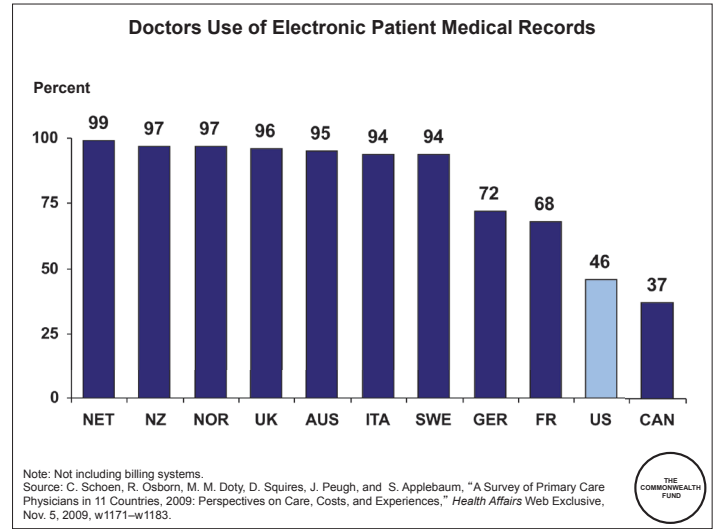
Another key element of the government's Health Information Technology (HIT) strategy is the development of the Nationwide Health Information Network (NHIN), which will provide the foundation for an interoperable, standards-based network for the secure exchange of healthcare information. It represents the HIT superhighway – a 'network of networks' built from state and regional Health Information Exchanges (HIEs). It is intended to function much like the Internet – data will reside at the point of care, and special protocols and authorizations will be required to access it.



Source: Center for Disease Control

Outside the U.S.

As in the U.S., Health Information Technology (HIT) is being implemented across the globe to improve the quality of patient care and reduce healthcare costs.



Source: The Commonwealth Fund

Again, as in the U.S., the drivers for adoption of Electronic Health Records (EHRs) in most countries come from government incentive programs providing funding to providers to adopt and use an Electronic Medical Record (EMR) system in a meaningful manner. Following are some of the countries with the highest adoption rates:

Australia: Australia is dedicated to the development of a lifetime electronic health record for every citizen. HealthConnect is the major national EHR initiative in Australia, and is made up of territory, state, and federal governments. MediConnect is a related program that provides an electronic medication record to keep track of patient prescriptions and provide stakeholders with drug alerts to avoid errors in prescribing.

New Zealand: New Zealand is well-positioned in terms of electronic health records, and is considered by some as the country on the verge of making the greatest breakthroughs in healthcare reform. Why? New Zealand has already made progress in some key areas, namely: in the provision of unique patient identifiers, and privacy legislation, two important building blocks needed for the implementation of a national EHR program.²

¹ Eligibility is linked to each provider's percentage of patients eligible for Medicare/Medicaid.

² What Can We Learn from the Rest of the World? A Look at International Electronic Health Record Best Practices by Moya K. Mason



platform for improving health services. EHRs are used for documentation by all physicians and most hospitals (and most ambulances). Hospital use has lagged use in primary care, but EHRs are now used in 97% of hospitals and 100% of primary care clinics. Coordination is mainly achieved at a regional level.³

As you can see, we have merely scratched the surface on a highly complex and evolving issue that will ultimately transform our industry. Watch for more articles in upcoming issues of ReFlections. ■

Navigating the Acronyms

- **Electronic Medical Record (EMR):**
An electronic record on an individual within one healthcare organization.
- **Electronic Health Record (EHR):**
An electronic record on an individual across more than one healthcare organization.
- **Personal Health Record (PHR):**
An electronic record on an individual managed, shared, and controlled by the individual.
- **Health Information Technology (HIT):**
Allows comprehensive management of medical information and its secure exchange.
- **Health Information Exchange (HIE):**
The electronic movement of health information among organizations.

U.K.: In the late 1980s, the United Kingdom initiated a national health information strategy, with an agenda to research, develop, and implement health informatics policies and technologies. For the past six years the National Health Service (NHS) information strategy, Information for Health, has focused on EHRs as one way to transform the healthcare system into a vehicle for patient empowerment.²

Denmark: Nearly all primary care physicians in Denmark have electronic health records with full clinical functionality. These systems are connected to a national network that is operated by a private non-profit organization called MedCom, which enables general practitioners (GPs) to exchange clinical data with specialists, hospitals, pharmacies, laboratories, and other health providers. Most communication among these service providers takes place electronically. The Danish National Health Portal, which was introduced in 2005, gives patients electronic access to their EHRs and facilitates electronic communication between patients and their regional health service.³

Sweden: Sweden adopted a National eHealth Strategy in 2006 for the purpose of improving the safety, accessibility, and quality of care; facilitating patient mobility; meeting growing demands from patients and health professionals; and providing a



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Susan L. Wehrman, Vice President, Electronic Health Record Initiatives, heads RGA's newly created Electronic Health Record (EHR) Initiatives area. This function conducts in-depth research and analysis of this evolving segment and monitors all activity in the U.S. and around the world, with the objectives of positioning RGA as an industry thought leader and better assisting clients with EHR-related issues.

² *What Can We Learn from the Rest of the World? A Look at International Electronic Health Record Best Practices* by Moya K. Mason

³ *Electronic Health Records: An International Perspective on "Meaningful Use"* Bradford H. Gray, Thomas Bowden, Ib Johansen, and Sabine Koch, November 2011

WHAT IS PREDICTIVE MODELING?

By **Dave Wheeler** FALU, FMLI

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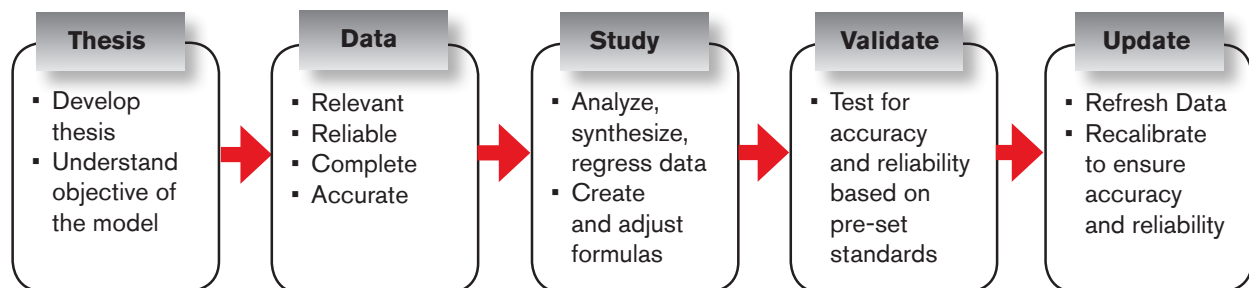
Before we enter into a discussion about predictive modeling and its values to the insurance industry, we need first to understand what we mean by it. In January 2012 the Society of Actuaries published *Report of the Society of Actuaries Predictive Modeling Sub Committee*, which looked into predictive modeling in life insurance. In this they defined predictive modeling as:

“...a process used in predictive analytics to create a statistical model of future behavior. Predictive analytics is the area of data mining concerned with forecasting probabilities and trends. A predictive model is based on a number of predictors, factors that are likely to influence or predict future behavior. The model output is a set of factors that predict, at some confidence level, the outcome of an event.”

Predictive modeling is not new; it is something we know about from our earliest education, daily life and in our industry right now. Predictive models are really an extension of some of the basic principles we learned at school, and predictive modeling is in essence a guessing game – a very sophisticated and scientifically based guessing game that uses algorithms and models to project an outcome.

Always remember that a model is not perfect; it is only numbers and probabilities. While a model can lead to better solutions for making decisions, or better odds at winning, success models are, by definition, predictions or probabilities about future behaviors. They cannot predict an individual behavior or action; they can only suggest the probability of a particular behavior or action, based on past observations.

Creating a predictive model happens in five stages: thesis, data collection, data study, data validation, and updating of the model.



It is essential that the models and underlying data are updated and recalibrated frequently. The frequency required depends on the data and the model. Over time models are accepted (e.g., credit score) or not, but models often must be refined and adjusted before being accepted. Eventually people catch on, thereby turning existing models into the status quo. To keep up and remain relevant and accurate, models must be continually adjusted based on fresh data.

Predictive model hurdles

What are some of the key issues surrounding the use of predictive models in a life underwriting environment?

1. Many people simply do not understand or trust the math, and the 'black box' syndrome leads to skepticism – particularly when the output is adverse.

Additional information about the impact of the model must be understood by a critical mass before being accepted. In the U.S., the credit score was not understood until its impact was felt (by not getting loans, jobs or competitive interest rates). If we cannot explain the decision the math has made, how will the agent and customer feel?

2. The rapidly changing regulatory environment. When can you use data, and will this data be available for continued use?
3. Concerns about privacy affect the acceptance of predictive modeling, but these concerns are really about data collection and sourcing. Collecting data and using it for other purposes without complete transparency causes concerns and conflict and raises the regulatory warning flag.
4. Models are not perfect; they are merely educated guesses. They can only approximate reality because behavior is subject to change. Data can be biased, incomplete or wrong. Data can also overlap and conflict. In addition, models are software-based and subject to defects.

Why are predictive models so prevalent and becoming popular in all forms of business and leisure activities?

Predictive modeling has been around for a long time, but its use in solving real-world problems has accelerated for several reasons.

There is a wealth of information and data available today due to such factors as the proliferation of Internet use, mobile phone apps, social networking, and the conversion of public records from paper to online databases. In 2011, 1.2 trillion GB of data was uploaded (roughly equivalent to 20,400,000,000,000 music albums' worth of information).

The combination of the massive amounts of data and the advancement of technologies to obtain, consolidate and quickly analyze the data, as well as the changing backgrounds of the C-suite (increasing numbers of CFOs, chief risk officers, CIOs on executive committees, and the cross-pollination of executives, especially in property and casualty companies where predictive modeling is more common) all contribute to the growing influence of predictive models in business, as companies seek to capitalize on the possibilities afforded by all this data.

Predictive modeling may be more part of our everyday lives than we currently realize. National Australia Bank is well known to use predictive modeling in marketing campaigns and has won multiple awards from the industry and independent analysts.

Where are we going?

We require a new approach to meet full underwriting pricing in order to meet the constant demand of 'faster, better cheaper.' The adaptation and use of predictive modeling concepts will contribute greatly to delivery into new, untapped or underserved markets.

Possible areas where predictive modeling can benefit life insurance include purchasing and retention, pricing reserving, claims, fraud and underwriting risk selection.

Underwriting-specific uses include screening, anti-selection, evidence replacement, improving the accuracy of underwriting decisions and increasing the decision-making power of underwriting engines.

In addition to models we can create directly, the accelerated use of predictive models in the field of medicine will positively impact life and living benefits insurance. Examples are Humedica's modeling of patients at risk from congestive heart failure, and Harvard Medical School's use of Twitter to model cholera outbreaks.

Conclusion

Adopting predictive modeling capabilities into our practices is critical to our future offerings and key to our ability to thrive in a competitive marketplace. Reinsurers need to focus on how we can add value to our clients and answer the looming question, "How will this technology and information affect our price?"

Here are some final thoughts on predictive modeling:

- Make predictive modeling a high-priority initiative
- Continue current activity and plan for future predictive modeling work
- Add to staff, skills and experience. ■



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Dave Wheeler is Senior Vice President, U.S. Underwriting and Head of Global Mortality Markets Underwriting for RGA Reinsurance Company. In this role, Dave is responsible for ensuring best practices worldwide by all the teams of RGA underwriters, medical directors and professional and operational support associates who assess, underwrite, and process facultative business.

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LONGER LIFE FOUNDATION



The **Longer Life Foundation** is a not-for-profit partnership between RGA and the School of Medicine at Washington University in St. Louis. The mission of the Foundation is to fund studies that may help people live longer and better-quality lives and to find better ways to prognosticate disease, which is of benefit to both public health and the insurance industry.

In 2011, the Foundation provided USD \$297,182 in grants to fund the following five studies:

Does a Low-Protein Diet Slow Aging, Protect Against Cancer and Inhibit Prostate Cancer Growth? (2nd year), John O. Holloszy, M.D., Director; Luigi Fontana, M.D., Ph.D. Associate

Caloric Restriction (CR) has been shown to have major health and anti-aging benefits, but it also has unpleasant side effects, and there is question of whether CR has the same life-extending and anti-cancer effects for humans as it does for laboratory rodents. It has also been shown that reducing protein intake by about one-third resulted in a beneficial decrease in plasma IGF-1 and this might prove to be as, or more, effective than total CR in slowing aging and protecting against cancer. Protein restriction has the advantage that it is much less difficult to practice than CR, and does not have CR's unpleasant side effects.

This study will test the effect of protein restriction on prostate cancer prognosis in humans. The study will also assess whether protein restriction slows aging and/or extends maximal lifespan and protects against cancer in laboratory rodents.

Determination of the Genetic Contribution to Glycemic Control and CAD Outcomes in Patients with DM2 and CAD (2nd year), Sharon Cresci, M.D.

Diabetes mellitus (DM) currently affects more than 220 million people worldwide, with its prevalence increasing. Among persons with DM, complications of accelerated atherosclerosis, particularly acute coronary events, are the principal causes of death.

This study will use genetic samples from Bypass Angioplasty Revascularization Investigation 2 Diabetes trial participants to examine the PPARalpha gene to determine if specific gene sequence differences can prognosticate these diseases and predict better or worse patient responses to certain treatments for DM or CVD.

Assessment of Potential Novel Immune Biomarkers to Identify Obese Persons at Increased Risk for Cardiometabolic Disease (2nd year), Elisa Fabbrini, M.D., Ph.D.

Obesity is associated with a multitude of health complications, including diabetes, alterations in blood lipids, inflammation, and heart disease; however, not all obese individuals are at risk, and approximately 30% of obese adults do not experience these complications.

The purpose of this study is to try to understand the reasons why only some obese individuals develop metabolic complications and, if possible, to see if specific blood tests can help identify those patients who are at highest risk of the ill effects associated with obesity.

CD36 Variants and Stroke Risk Factors,
Latisha Love-Gregory, Ph.D.

Persistently high blood cholesterol and postprandial triglycerides are risk factors for stroke and other cardiovascular diseases. Preliminary data strongly support the concept that genetic variants in CD36 contribute to individual differences with respect to basal and postprandial cholesterol and triglycerides.

The first aim of this study is to determine the impact of these genetic variants on blood lipids before and after a fat meal and before and after treatment with fenofibrate. In the second aim, we will test the impact of these variants on the metabolism of immune cells isolated from carriers versus non-carriers of these genetic mutations.

Improving Presymptomatic Detection of Impending Alzheimer's Disease,
Catherine Roe Ph.D.

It has been shown that Alzheimer's Disease (AD) pathological changes can be seen in the brain at least 10 years before the patient develops dementia. Once people start showing symptoms of dementia, the brain has already suffered substantial damage possibly explaining why current AD therapies are not very effective.

This study will develop computer models that will incorporate individual attributes of patients together with imaging and CSF biomarkers to predict who will develop cognitive impairment and AD.

The Foundation is currently in the process of developing its 2012 grant program. For more information, please visit www.longerlife.org



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