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ReFlections

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LETTER FROM THE EDITOR

Dear readers:

The future of underwriting will no doubt require ongoing consideration of the impact of increasingly complex predictive models. In the previous edition of *ReFlections*, Dave Wheeler outlined what predictive models are, and their potential impact on the insurance industry. In the first article in this edition, Mark Dion will follow up with a much more detailed evaluation of the benefits and risks of the use of predictive modeling.

It is always a pleasure to introduce you to new contributors to *ReFlections* and, in this edition, we have two new contributors. The newest addition to RGA's U.S. medical department, Dr. Allan Brodersen, explains the mortality impact from the use of opioids, an issue that should concern all of us, since these medications are widely used and abused. Another first-time contributor is Dr. Dhiraj Goud, from our operations in India. Dr. Goud will discuss functional MRIs and how they can be used to evaluate various medical conditions.

Finally, this edition will bring you up to date on developments in Electronic Medical Records, provided by Sue Wehrman, and a brief outline of the activities of the Longer Life Foundation.

I hope that you enjoy this edition!

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PREDICTIVE MODELING: IS IT A GAME CHANGER?

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> "Predictive Modeling involves a process by which current or historical facts are used to create predictions about future events or behaviors."
>
> *Tim Rozar, Vice President, Head of Global Research and Development, and Scott Rushing, Vice President and Actuary, Global Research and Development, RGA Reinsurance Company*

Introduction – assessing predictive models

Over the past few years, the concept of predictive modeling (PM) has entered the lexicon of many life insurance underwriting departments. For some, the basic concepts of multivariate regression analysis, generalized linear models, or specific methodologies such as the Cox proportional hazard model might be old news; for the majority it is likely a new area requiring development of a new set of skills or training to fully understand, assess and implement.

Years ago, underwriting saw a game-changing series of events, the HIV epidemic, followed by increased blood chemistry ordering, out of which the concept of preferred risk classification saw fruition. Predictive modeling is a powerful tool; does it have the potential to be a game changer of the same magnitude? If so, should we expect the unexpected?

If we are going to play a statistical game with life insurance, we need to understand how PM fits as a game piece. Where does modeling fit as a business tool? How do the development, assessment and implementation affect the business? What does the company stand to gain, and are there risks? If the risks exist, how do we mitigate them?

Where should we apply predictive modeling resources?

- Lowering price
- Lowering underwriting costs
- Improving placement
- Reducing lapsation
- Fraud detection
- Efficient marketing
- Targeting attending physician's statements

What is the proposed model supposed to predict?

- A client's buying behavior
- A client's response to a direct marketing campaign
- The underwriting department's determination of preferred
- The increased mortality of a subset of clients
- A laboratory outcome
- The likelihood the client, agent or some other entity is committing fraud
- Identifying opportunities for cross selling
- That taking particular medications are predictive of higher than expected mortality

Who developed the model, and who comprised the team, including the mathematical work and the knowledge experts?

- Actuaries or statisticians
- Physicians
- Laboratory experts
- Underwriters
- IT and data professionals

To what purpose was the model developed? Where is the benefit?

- Reduced cost
- Business efficiencies
- Higher placement
- Improved overall mortality
- Better differentiation of the insured population
- Fewer lapses
- Better response rates on a direct marketing campaign

Modeling in life Insurance applies to all of the above in time. U.S. life insurance companies may vary in their current focus, but every day more companies are developing plans to integrate predictive modeling into their business. The business focus is on how to implement models that make business sense and improve overall mortality, or bring business that is more profitable. As an insurance professional, I know that the techniques have far wider application and it is important to know where and how the techniques are used and how effective they may be.

Let us spend some time discussing some of the issues to resolve in assessing the usefulness and the business case for implementing a predictive model into your company's business practices. We can start by discussing modeling's relevance, risks, goals and motivations, and move to a brief discussion of development, assessment and implementation.

Predictive modeling is relevant

Patterns may appear in data that are too subtle to appear in small samples. Data is the critical first component of any model. The use of data-mining techniques allows us to analyze data and plot the data in such a way that we can see patterns not obvious when looking at single variables.

Interactions between variables can become more apparent. The variables, and synthetic variables derived from them, can exhibit subtle changes often only seen, observed, and analyzed in larger portions, from a multi-variate approach.

Models can be more consistent than humans can. Once a model is developed, the variables properly weighted, and the algorithm established, and less prone to human lapses in attention, it should generate consistent results.

Properly implemented models can provide efficiencies and cost savings. Resources are always limited. When models optimize limited resources, the company should gain from those efficiencies. We still must be alert to the risks, and never forget there can be unintended consequences with any new business process.

Predictive modeling use must be cautionary

Models may be consistently right or (sadly) wrong. Predictive models can be a powerful business tool, but like any tool can be misused, misunderstood or misinterpreted. If the developers do not understand the various elements in the same way the knowledge experts do, there is a risk the numbers (data) take on a

life of their own, and fail to represent reality over time. Models are not reality – they are a representation or a surrogate. They can be good representations or bad abstracts. After all, model scores do not tell us facts, they provide us some form of weighted statistical probability that a given situation exists.

So as a way to apply statistical methodologies, or in a sense to influence a 'bet', predictive models also fall under some of the same rules of game theory that other economic predictors do. We will discuss this a bit later.

Predictive models are not ends in themselves, unless you are selling them. Therefore, there are two points to consider here. Going back to the idea of goals and motivations, the model is not the goal. The goals more likely revolve around efficiency, cost savings, or profitability. The second point is that, if you sell a model, it had better meet the client's goals in an understandable way.

Making the business case – establishing the motivation, framing the problem, setting goals

Understand what the model purports to do. Models are surrogates, they are representations based on mathematics and statistical manipulation of data. Underwriters must remember that we underwrite proposed insureds, not scores.

When making a business case regarding the use of predictive modeling, spend most of the process identifying the symptoms or problems you are trying to solve. The time spent identifying the goals and objectives will provide the development team clarity and purpose. Without clear objectives, the model may end up solving the wrong problem.

The predictive model should present a solution to your problem from a particular frame of reference. Predictive models are a tool representing a data-driven and statistical frame of reference. Underwriters, medical directors and actuaries are no strangers to that point of view. That group also understands that models and averages, such as the law of large numbers, do not do a particularly good job at the individual level.

We can argue that using predictive modeling is not too much different from any other new business application. When assessing a newly developed laboratory test, or assessing a new underwriting requirement brought to us by a vendor, we need to perform adequate due diligence before we proceed with a long-term plan.

Development or Application of a model

Build it or buy it; we must first understand it.

Not unlike a software development initiative, or a life insurance company's decision to use an actuarial consulting firm for product development, we have to determine whether we should build or buy. Does the company have the native expertise to analyze the data and develop the model? Does the company have sufficient expertise with the tools of predictive modeling, SAS or R for example? Should the company build the expertise or bring in experts already familiar with the techniques?

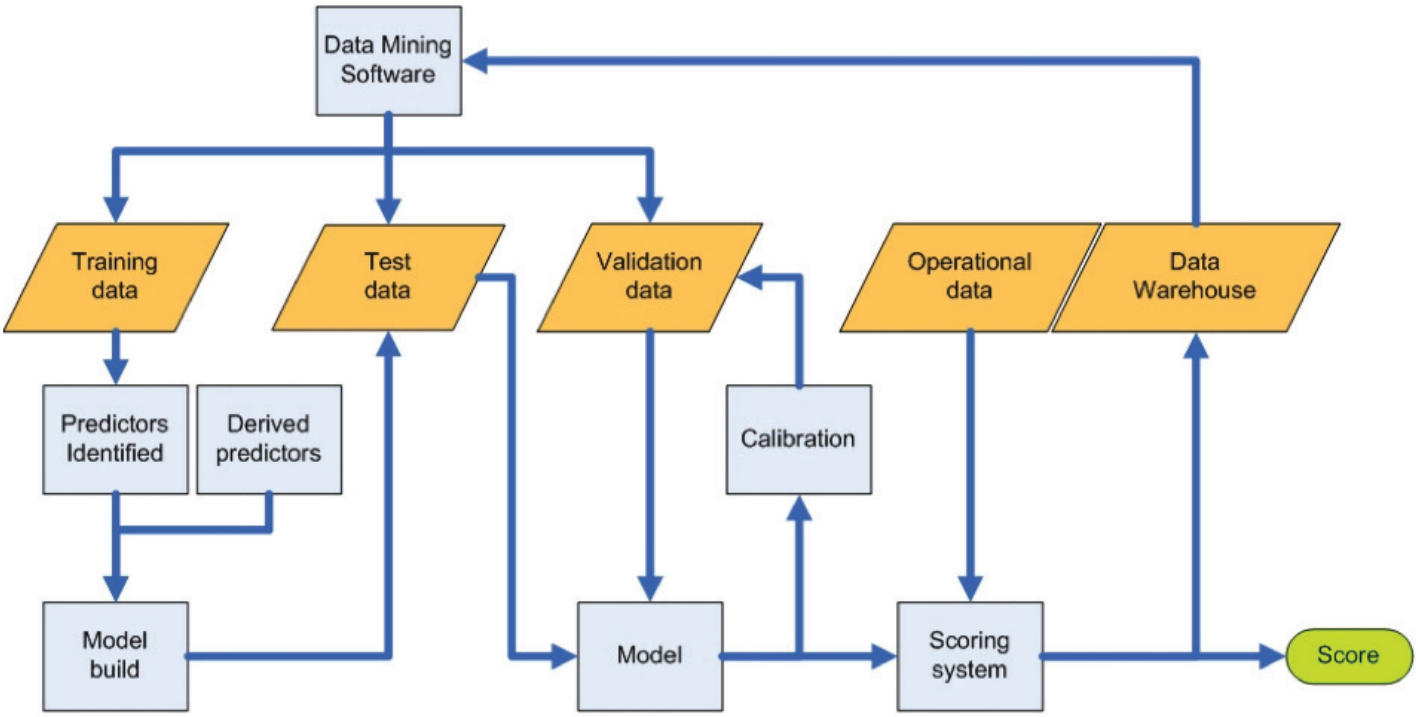
If you build it, you can control and monitor it. If you buy it, you must perform a different set of due diligence. You may own the data, but who owns the model?

Model development – a brief introduction

Before the work of modeling begins, the company must identify the goals and motivations for doing the predictive modeling work in the first place. Increase efficiency? Lower operating costs? Improve mortality? The modeling team will need knowledge experts to provide insights to those goals and motivations, as well as what the individual data elements and variables mean to the experts.

Models begin with data mining. The first diagram on the previous page provides a flowchart of the build process. The subsequent table is draw from several presentations by RGA's Actuarial Research group. Together they provide a bit of visual assistance on how the data feeds the build process, and the steps we need to complete a working model.

Predictive Model Build Process



Modeling Process – another view

The following chart is drawn from various presentations by RGA's Actuarial Research associates. It represents a slightly different presentation of the predictive modeling process.

Define Purpose of the Model	Collect and Prepare the Data	Develop Models	Interpret and Apply Models	Monitor Results and Update
⇨	⇨	⇨	⇨	⇨
Identify business motivations	Gather data	Model type selection	Interpret results	Monitor output and performance
Identify goals of the model	Understand the data	Identify constraints	Communicate and gain acceptance	Test results against objectives
	Clean the data	Train the model	Create rules	Refresh the data
	Transform the data	Test the model	Train staff	Refine the model
	Split the data into training data (70-75%) and validation data (25-30%)	Validate the model	Deploy model	
		Verify model meets requirements		

First, collect the data. Collecting data is something most companies have been doing for decades. We collect data, report management information, and watch trends. However, how often do we look for innovative ways to make the data do useful work? Predictive modeling uses past data, and the numerous variables and elements we mine from it to show where efforts are more effective, are less costly, stay on the books longer and show improved profitability results. However, the models only do that if developed using good technique.

All data requires cleaning and scrubbing. For all our good intentions, we still fail to have the structured data in a pristine format. Omissions, typographical errors, incomplete records, incorrect dates, and obviously inconsistent elements are all roadblocks to successful model development and implementation. We have to face the truth that most data sets need a thorough cleaning. Data-mining techniques require the data to be free of error as much as is possible. Once cleaned, the data will require structure in such a way that statistical analysis and statistical validation flow easily. Separate the data from the statistical noise. When plotted in various ways, patterns of behavior may emerge. Draw data from the same source, at the same time, properly randomized, and divided, through the stages of model development:

1. Assign the data distribution to two (at minimum) or three portions: training, test, validation
2. Use training data to identify factors and predictors
3. Establish the logic and algorithm
4. Develop decision trees
5. Model builds require some trial and error to achieve the most lift
6. Build the model
7. Build multiple models attempting to optimize lift (lift describes how directly the model predicts incremental impact on an individual behavior)
8. Test the models using a portion of the identified data
9. Watch for discordancy
10. Calibrate
11. Validate
12. Scoring system established
13. Implementation, use and maintaining a good model
14. Establish audit procedures and feedback to data warehouse
15. Calibrate again and frequently

Once a model moves to a production environment, the results require regular monitoring and recalibration.

Assessment

The assessment of a model goes beyond whether the model predicts accurately. As a business tool, we need to look at how the model fits into current practice and what change we anticipate after implementing the model. While changes might directly affect the model, they most certainly affect the business.

Bring the assessment resources together. The team should be multi-functional and include many of the company's experts. Analyze the model through various frames of reference and points of view. Underwriters and medical directors, actuaries, marketers, sales, IT, and do not forget to include compliance participants. Application of the model will require a good explanation to all the participants, and also regulators.

Question the development team, to understand the model as completely as possible. Challenge the developers to explain the model in as few words as possible.

Ask yourselves some tough questions, as you would with any new requirement or tool. What is the probability that the underwriter will identify a bad risk? What is the probability that the underwriter will identify a good risk as bad?

Assess the technology necessary to feed the model. Study the economics, the cost benefit analysis and the protective value.

We also have to be sensitive to the credibility of the data. Terabytes of data can be subject to lack of credibility if the data cells are too finely divided or certain classes (variables) under study are infrequently encountered.

Questions to ask the developer or vendor

Now we turn our attention toward predictive models targeting life insurance risk. What are the questions we need to ask when confronted with a new predictive modeling proposal? What critical thinking skills and tools can come to bear on the assessment process? Sometimes we can start with a checklist. For example, RGA has developed a questionnaire to assist in the evaluation of predictive models. Those questions can guide discussions regardless of who develops the model under consideration, whether internal resources or a vendor.

The areas of questioning include:

1. General questions regarding the purpose of the model and the techniques and data used for development
2. Implementation
3. Data and Variables
4. Modeling Approach and Validation
5. Maintenance
6. Liability
7. Future Plans

RGA would be happy to provide you with a copy of the questionnaire, if you contact us.

A good checklist is a start, but there are other modes of assessment. Other statistical approaches and business strategic tools aid in the assessment. We can look at two, Bayesian and SWOT.

A Bayesian perspective

Most readers of *ReFlections* are familiar with the concepts of prevalence, exclusivity, sensitivity and specificity. We would be remiss if we fail to ask ourselves whether the modeling method used can deal with these important concepts. Let us assume the predictive model in question provides a score that we can translate into a relative mortality. Given that models are by their nature developed from experience, we should be sensitive to the bias that comes with that. Using your own data, the model is looking at prior applicants and insured lives. Using an outside source or vendor, the model may have used general population data, their own tested data from multiple clients, or perhaps your company's data. Regardless of the source, we should ask some questions:

1. What is the prevalence of the issue studied in the data set used to develop the model?
2. Can we assume that prevalence is the same in the future applicant pool?
3. Do new marketing strategies that seek new sources of potential clients change the previous answer?
4. How sensitive is the models outcome? Does it 'catch' all of the applicants?
5. How specific is the outcome? Does it 'catch' only the appropriate applicants?
6. What is the positive predictive value?
7. What is the negative predictive value?
8. How many in the potential applicant population are preferred, substandard, or even more significantly impaired?
9. How much exclusivity can we assign to the model alone?
10. Should we be running validation tests on applicants to confirm the score is consistent over time? In addition, what timeframe is reasonable?

Are we prepared to be wrong more often than we are right? As an example, in a test (PM score?) with 99% sensitivity, and 98% specificity, we would be wrong twice as often as we would be right. Imagine we have a test that identifies a disease with a prevalence of one in 1000 of the studied population, and the test is 99% sensitive and 98% specific. When we test 100,000 individuals, we get something like the following results:

- 990 true positives (have the disease and are correctly identified)
- 10 false negatives (have disease, but are missed by the test)
- 1,980 false positives (identified as having disease, but do not)
- 97,020 true negatives (do not have the disease and also test negative)

The number of falsely identified individuals is twice the number of accurately identified individuals. A clinician overcomes this problem by either repeating the test, or performing some other reflexive test. The labs also use reflexive strategies to limit the number of false positives. We need to consider whether we hold predictive model scoring to the same standard.

Of course, we must evaluate each predictive model on its own merits looking at the prevalence, sensitivity and specificity for the modeled population.

SWOT analysis – your analysis may vary

SWOT analysis involves reviewing strengths, weaknesses, opportunities and threats. As a business exercise, it provides a tool for seeking a balanced assessment of a new strategic plan. A company can use the tool to play to its strengths and develop mitigation strategies against its risks.

The following list is offered for consideration without implying comprehensiveness.

The goal of the SWOT analysis is to understand the good and the less-than-good aspects of modeling. While only one managerial approach to assessment, the SWOT can be a powerful tool albeit different than the tools underwriters and actuaries use more routinely – the cost-benefit analysis and the protective value study.

Perform the cost-benefit analysis and protective value study

The complementary tools of our industry, the cost-benefit analysis and protective value studies, have their place in this process as well. Does the cost of development and maintenance of the model provide more benefit than the traditional approach? How much protective value does the score provide exclusively? Theoretically, certain variables in a model would already be factors (right or wrong) in the underwriting process. How do we adjust the model's value in those circumstances?

Do we have enough information to analyze either the cost-benefit or the protective value adequately? Can we determine the exclusivity of the 'new' information the model provides? To what degree does the model actually meet its stated goals?

Problems with modeling techniques

Many of the models currently under discussion in the life insurance industry are generalized linear models, such as the Cox Proportional Hazard model. They are well-studied, and relatively easy to work with. GLM prevail in wide use because of their versatility and applicability. However, like any statistical tool they are not immune to flaws in implementation or design.

While we can summarize a wide variety of outcomes, we can experience problems. The developer/ statistician/actuary is responsible for specifying the exact equation that best summarizes the data. If the GLM does not have the correct specifications, the estimates of the coefficients (the ß-values) are likely to be biased (i.e., wrong). The algorithm that results will not describe the data accurately. In complex scenarios, the model specification problem can be a serious one, difficult to avoid or correct without significant analysis and effort.

The problem of over-fitting

Quoting the omnipresent Wikipedia - The Free Encyclopedia:

> "In statistics, overfitting occurs when a statistical model describes random error or noise instead of the underlying relationship. Overfitting generally occurs when a model is excessively complex, such as having too many degrees of freedom, in relation to the amount of data available. A model, which has been overfit, will generally have poor predictive performance, as it can exaggerate minor fluctuations in the data."

One of the principle reasons to parse data into specific portions is to avoid this problem. Using all the data available to build the model might initially sound wonderful and it might be possible to describe perfectly the data with some algorithm. However, such models might become very complex as the developer tries to fit each record into the model. A wonderful way to describe what has been, but questionable on how accurately it will describe what will be.

Predictive modeling and the Theory of Games

Until the movie *A Beautiful Mind* was released in 2001, few people outside the economics profession had heard of game theory. When future Nobel Laureate John Nash, portrayed by Russell Crowe, was describing to his friends why it didn't make sense for each of them to try to date the most beautiful girl in the bar he was describing a game theoretical approach toward obtaining a limited resource, in this case 'dates'. He showed that when every one of his friends pursued the most beautiful girl they would block each other and fail. They would then also fail with her friends. The only way to 'win' as a group was that they should ignore girl number one, and each pursue a different girl. Therefore, the game had a goal, and each of his friends wanted to win, yet by all seeking the exact same goal at best only one could win and in his suggested scenario, all of his friends get dates. This is a solution to the Nash Equilibrium problem. By the way, the solution in the movie is not the only solution, not even the only optimal solution. It did make for an interesting bar scene with a table full of math geeks.

In the movie *Moneyball*, predictive modeling and game theory provided a means to optimize players as a group rather than viewing them as individuals. By looking past traditional ways of ranking players, the Oakland A's baseball team was able to develop a technical advantage, albeit relatively short-lived, in order to put together a winning team. Today many teams use the "Sabermetrics" analysis process to assess players, prospects and the team.

One of the principle goals of game theory is to optimize results, for the individual and the group. I propose that predictive modeling, if properly applied, can in fact optimize results for all parties involved; however, it takes work. We start that work by realizing that the company, by being efficient in its process, can and should bring some additional benefit to the other interested parties. Given enough time and analysis, is it possible to optimize underwriting by finding the best strategy for underwriting and acceptance of risk, declination of risk, underwriting cost, percentage of preferred issues, the optimal lapse rate, etc. to maximize the company's profit? Probably not in these early days, but as we improve at these skills, who knows what will become possible?

While there are many players in the game of life insurance, let us limit our review to two – the company underwriter and the proposed insured.

In our game, we have asymmetric information. The two parties know different things, and may not be privy to what the other 'player' knows. Generally, we argue the advantage goes to the proposed insureds who know more about themselves, their medical history, and their life styles than we do. We combat that advantage with sentinels, MIB, examinations, blood chemistry, urinalysis and pharmacy record checks. In a few cases, we have access to information the client does not know or has forgotten. After all, many physicians do not open their charts to their patients.

If companies begin using predictive modeling to uncover unrecognized factors or variables unknown to the client, they shift the asymmetric information

equation a bit their way. Fair enough, we should be able to shift the balance assuming no intervention from regulators or compliance if the equation suddenly shifts in the company's favor.

From another viewpoint, if the model actually improves the client's price or opportunity to buy, we might optimize the game so that everyone wins. "Everybody wins" is usually a good long-term strategy from an economic standpoint.

There is a possible downside to using models, whether complicated or not. The sentinel effect whereby the client's knowledge that the company is screening for some factor will cause certain people to take their business elsewhere may not be as helpful in a predictive modeling environment. Would the average applicant understand the complexity of a model?

The topic of integrating a model in light of game theory could actually extend this discussion for some time, so we will return to it another day.

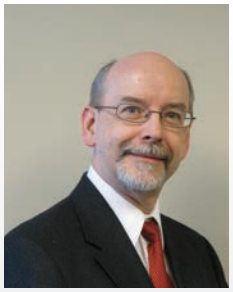
Summary

Predictive modeling is here to stay. In the future, we will see models in a realistic light and with reasonable expectations of performance. While modeling will change the game in some ways, life insurance must still be properly priced and underwritten. Modeling is a new game piece, and as in chess, all the game pieces have their individual strengths and weaknesses. The pieces are strongest when applied in the correct way, and in combination to provide an optimal multi-faceted solution.

The scores and outcomes of predictive models promise a new approach to this game we hope to improve. New tools provide new insights, and new opportunities, many of which we cannot foresee. It should be an exciting time. As we begin the application of predictive model scores, critical thinking, assessment and preparation by all involved will guide success with the new rules of the game.

I will close with one thought that should be foremost in our minds and close to our hearts, lest we forget:

To paraphrase Dr. Holowaty, "We underwrite individuals, not predictive model scores." ■



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PRESCRIPTION OPIOID ABUSE: USING PRESCRIPTION DATABASE INFORMATION TO ASSESS MORTALITY RISK

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Introduction

Prescription opioid abuse is increasing at an alarming rate in the U.S. as is the incidence of fatal overdose. The issue has captured the attention of the medical literature as well as the lay press and poses a legitimate concern for those involved in life underwriting. In this article we will define the scope of the problem, provide a rational approach to underwriting and explore the resources available to aid in risk classification focusing on prescription database information.

Scope of the problem

The number of prescriptions written for opioid pain relievers (OPR) has increased significantly in recent years. Commensurately, the numbers of emergency department (ED) visits and deaths related to OPR have also increased. Sales of OPR in 2010 were four times what they were in 1999. By weight this amounted to 710 mg for every man, woman and child in the U.S. This amount could provide a typical dose of 5 mg of hydrocodone every 4 hours to every adult in the U.S. for an entire month.[1]

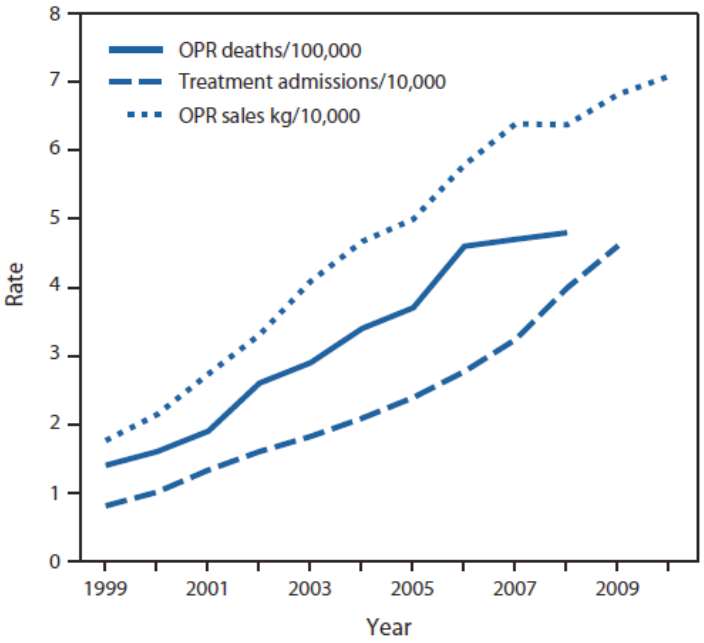
1.2 million ED visits in 2009 were for prescription drug problems, many of which were for OPR, which was double the rate in 2004. 4.8% of Americans age 12 or greater have used OPR non-medically.[2] In a report of California Workers Compensation claims, 3% of physicians accounted for 62% of OPR prescriptions.[3]

Neonatal abstinence syndrome, a postnatal drug withdrawal syndrome caused by maternal opiate use, has almost tripled in incidence from 2000 to 2009 as measured by cases per hospital births per year.[4]

Deaths related to OPR totaled 14,800 in 2008 and this number has quadrupled since 1999 and now exceeds the number of deaths related to heroin and cocaine combined.[1]

Figure 1 illustrates these points.

Figure 1



Paulozzi M, Jones CM et al MMWR Nov 4, 2011 60 (43) 1487-92

Commonly prescribed OPRs are listed in table 1 below.

Table 1

Commonly prescribed opiate pain relievers, trade names, typical daily dose and morphine equivalent:		
Drug (Trade name)	Dose	Morphine equivalent
Morphine (MS Contin)	30 mg 2 x daily (oral)	60 mg/d
Hydromrphone (Dilaudid)	4 mg 4 x daily (oral)	64 mg/d
Oxycodone (Percodan, Oxycontin)	10 mg 4 x daily (oral)	80 mg/d
Oxymorphone (Opana)	5 mg 4 x daily (oral)	60 mg/d
Fentanyl (Duragesic)	50 ug/hr (patch)	150 mg/d
Hydrocodone (Vicodin, Lortab, Norco)	5 mg 6 x daily (oral)	30 mg/d
Codeine	30 mg 4 x daily (oral)	20 mg/d
Propoxyphene (Darvon)	100 mg 4 x daily (oral)	60 mg/d
Tramadol (Ultram)	50 mg 2 x daily (oral)	10 mg/d
Merperidine (Demerol)	100 mg 4x daily (oral)	40 mg/d
Methadone (Dolophine)	20 mg 3 x daily (oral)	150 mg/d

Approach to underwriting

Prescribing physicians face a challenge in providing appropriate pain relief without causing long-term problems. Likewise, underwriters face a challenge in distinguishing appropriate from problematic OPR use. The approach to each proposed insured must be individualized and viewed in the entire context of the case. The typical requirements include attending physicians' statements, financials, motor vehicle reports' laboratory data and pharmacy database reports. From this information it is important to note if treatment is temporary or chronic, if there is any criticism or suggestion of abuse, if there are multiple prescribers or prescriptions or if there is concomitant use of other drugs or alcohol. Depression is common in individuals with chronic pain and any history of mood disorder and/or suicide attempts must be taken into account.

Pain management clinics and specialists are commonly seen involved in the care of these patients though data regarding their effect on mortality are lacking and it is likely any studies that would be forthcoming would have to take referral bias into account.

Numerous "red flags" for problem use have been noted and are listed in table 2.

Table 2

Red Flags for problem OPR use
Individual requests more pills than doctor is willing to prescribe
Individual 'loses' a prescription
Individual uses other people's medications
'Allergies' to medications other than the individual's drug of choice
Past history of drug or alcohol abuse or psychiatric problems
Multiple driving infractions
Accidental injuries
Young male, affluent, high profile
Erratic behavior with problems at school or work or with finances
Arrhythmias

Drug diversion for non-clinical purposes accounts for a substantial portion of deaths from overdose.[2] While actual drug diversion for non-clinical use is sometimes difficult to identify in either a clinical or underwriting setting, the above information does lend insight, as do prescription database checks.

Prescription databases

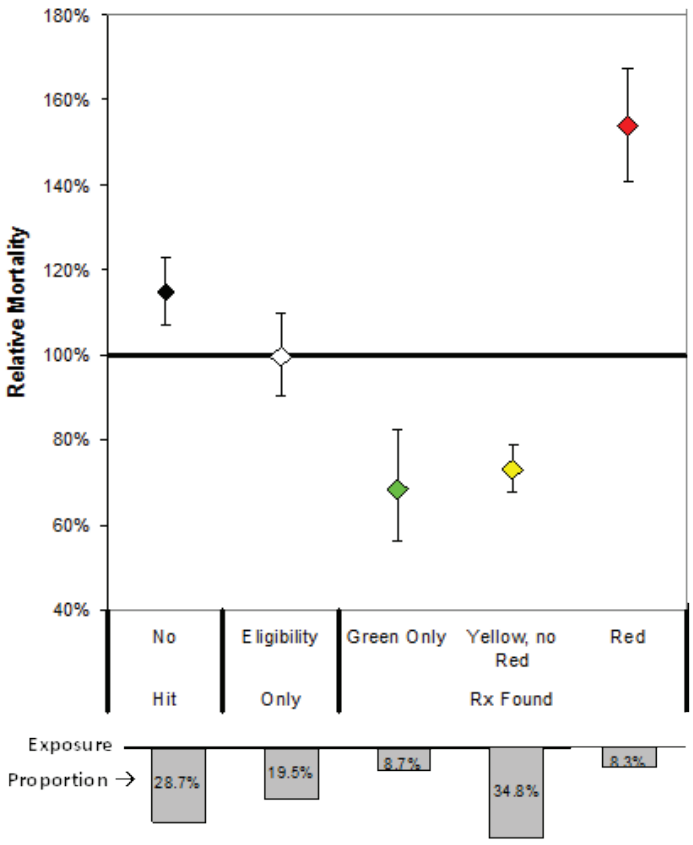
Prescription database information is a useful adjunct to mortality risk assessment in OPR users. When available, this yields information regarding not only the OPR but other medications that might interact and potentiate OPR effects. It is not uncommon to see prescriptions for multiple different narcotics and the risk of overdose is increased in this context. Additionally, it is important to note the dose intensity, the pattern of prescription and the frequency of prescription fills, all of which correlate with mortality.

Dunn et al[5] examined a cohort of patients in a large health maintenance organization in Washington state. They found mortality from opiate overdose increased with the amount of drug prescribed with a hazard ratio of over 3 for individuals prescribed a morphine equivalent of 50-100 mg per day and over 11 for individuals prescribed 100 mg or more per day.

Bohnert et al also reported a direct correlation between the maximum dose of opioid prescribed and death from overdose.[6] They also found the highest rate of overdoses occurred in individuals with both scheduled and as-needed dosing regimens as opposed to either as-needed or regularly scheduled alone.

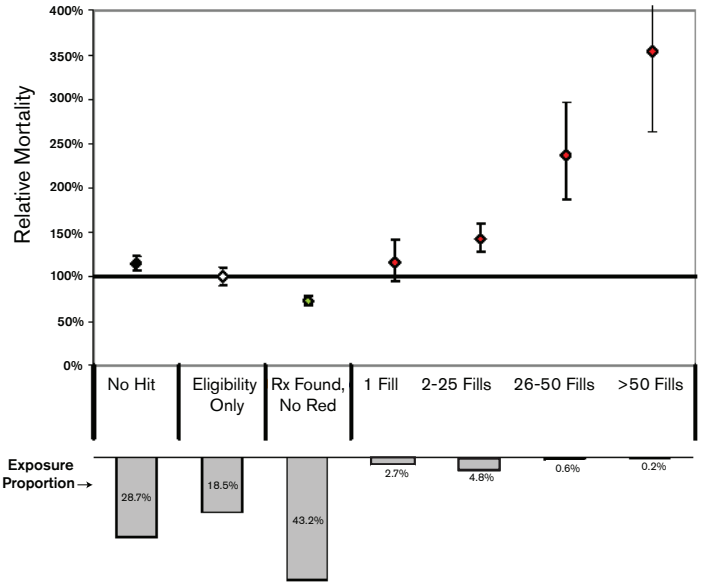
RGA has also conducted a study using prescription databases to predict mortality.[7] Drugs were stratified into color-coded risk categories. Mortality was slightly elevated in the group of individuals who had no pharmacy data available, but significantly elevated in the high-risk or "red" group that included narcotics as well as other drugs. This is illustrated in figure 2.

Figure 2



Mortality Mortality also correlated with the number of prescriptions filled as illustrated in figure 3.

Figure 3



It is therefore important when using prescription databases to note the dose, the pattern of dosing (scheduled, as-needed or both) and the total number of prescriptions, as these factors all correlate with death from overdose.

One potential limitation of prescription checks as obtained commonly in life underwriting settings is that they may not necessarily include prescriptions written by dentists. The vendor providing the information should be able to verify whether or not dental prescriptions are captured in the data they provide.

Summary

OPR abuse continues to increase rapidly associated with increasing deaths from overdose. Underwriting individuals on these medications is challenging and requires an individualized approach utilizing multiple sources of information as well as the entire context including other medications and alcohol use.

Prescription database information is useful in assessing mortality risk as deaths from overdoses correlate with the amount of OPR prescribed the pattern of prescription and the number of prescriptions.

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Magnetic resonance (MR) imaging has become well-established as a diagnostic as well as a research tool in many areas of medicine because of its ability to provide excellent soft-tissue delineation of different areas of interest.

In addition to treating the diseases of the brain, for many years now, people have also aspired to understand and control the functions of the mind and brain. Functional MRI (fMRI), one of the newer applications of MRI, shows significant promise in this direction.

Image 1. fMRI brain scanner: someday this may not be as large as it looks today.

fMRI images physiological changes of the brain rather than structure. With fMRI it has also now become possible to image the functioning of the human brain in real time.

During the past twenty years there has been a revolution in the understanding of the human brain and the localization of processes that were largely outside the bounds of biological science a generation ago, such as executive function, mental imagery, emotion and conscious experience.

In this article, we have tried to describe this new technology of MRI in short and its possible applications in the foreseeable future in clinical as well as insurance medicine.

Introduction to physics

Magnetic resonance imaging (MRI) uses the magnetic properties of hydrogen and its interaction with both a large external magnetic field and radio waves to produce highly detailed images of the human body. This is based on the principle that there are protons in the body, positively charged and spinning about their axes that act like tiny magnets. They are randomly oriented so that their magnetic fields do not sum but rather cancel out. When these protons are placed in a strong magnetic field, some will tend to align in the direction of the magnetic field and some will tend to align in a direction opposite to the magnetic field. The magnetic fields from many protons will cancel out, but a slight excess of the protons will be aligned with the main magnetic field, producing a “net magnetization” that is aligned parallel to the main magnetic field. This net magnetization becomes the source of the MR signal and is used to produce MR images1.

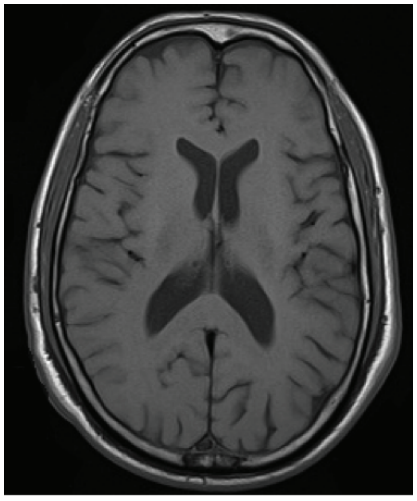


Image 2. T1 weighted MR image of the brain shows cortex

The basic sequences of MRI are T1 and T2 weighted imaging. In addition, many specialized MR techniques have been designed to extract metabolic or biophysical information. Diffusion-weighted imaging provides insight into the movement of water molecules in tissue, and diffusion-tensor imaging can reveal fiber orientation in the white-matter tracts. Metabolic information about the object of interest can be obtained with spectroscopy of protons, in addition to imaging of other nuclei, such as sodium. Dynamic contrast material–enhanced imaging and, recently, proton spectroscopy play an important role in oncologic imaging.

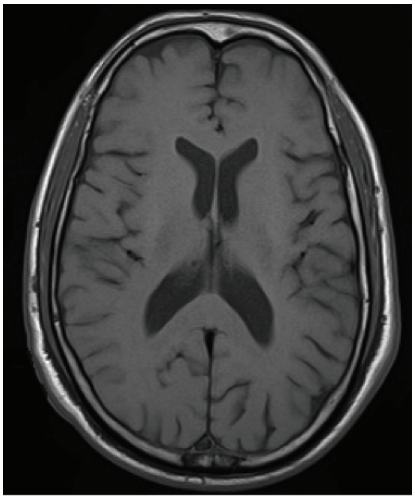


Image 3. T2 weighted MR image of the brain shows cortex

fMRI is also one such specialized technique of imaging. It refers to the demonstration of the brain function with neuro-anatomic localization on a real-time basis. It is based upon T2* weighted# blood-oxygen-level-dependent (BOLD) contrast mechanism which is dependent on both the underlying physiological events and the imaging physics.

Principles

Oxyhemoglobin is diamagnetic, while deoxyhemoglobin is paramagnetic relative to surrounding tissue. Deoxyhemoglobin causes a reduction in signal by creating microscopic field gradients within and around the blood vessels.[2] Stimulation of a brain area causes increased cerebral blood flow in the activated region in excess of the cerebral metabolic rate of oxygen utilization. Because the local blood is more oxygenated, there is a relative decrease in deoxyhemoglobin and a slight increase in local MR signal. This phenomenon is called the blood oxygen level dependent effect.[2] The basic effect of deoxyhemoglobin causing microscopic field variation in and around the microvasculature leads to a reduction of T2*.[2] The blood oxygen level–dependent effect is reduced during activation, and this leads to an increase in local T2* caused by less deoxyhemoglobin. The signal intensity change caused by the change in oxygen saturation is depicted by using a fast GRE sequence, such as echo-planar imaging, and is used to detect the area of the brain controlling a particular activity or sensation.

Technique

Functional MR imaging (fMRI) involves a paradigm in which the patient is asked to perform, for example, a motor activity such as finger tapping or is given visual or auditory stimuli, and the brain is then imaged with a fast T2* sensitive sequence such as GRE echo-planar imaging. Paradigms include active motor, language, or cognitive tasks and passive tactile, auditory, or visual stimuli.[3] Data are averaged to improve the signal intensity. Statistical processing is performed to convert signal intensity change into color maps that are overlaid onto anatomic images. Activation indicates the location of eloquent cortex.[Φ]

#T2 weighted image (also called T2 Star) is composed of molecular interactions (spin spin relaxation) and local magnetic field non-uniformities. Caused by this the protons precess at slightly different frequencies. The T2* effect cause a rapid loss in coherence and transverse magnetization. The T2* time is less than the T2 time.*

[Φ] Eloquent cortex essentially is a name used by neurologists for areas of brain cortex that — if removed—will result in loss of sensory processing or linguistic ability, minor paralysis, or paralysis. The most common areas of eloquent cortex are in the left temporal and frontal lobes for speech and language, bilateral occipital lobes for vision, bilateral parietal lobes for sensation, and bilateral motor cortex for movement.

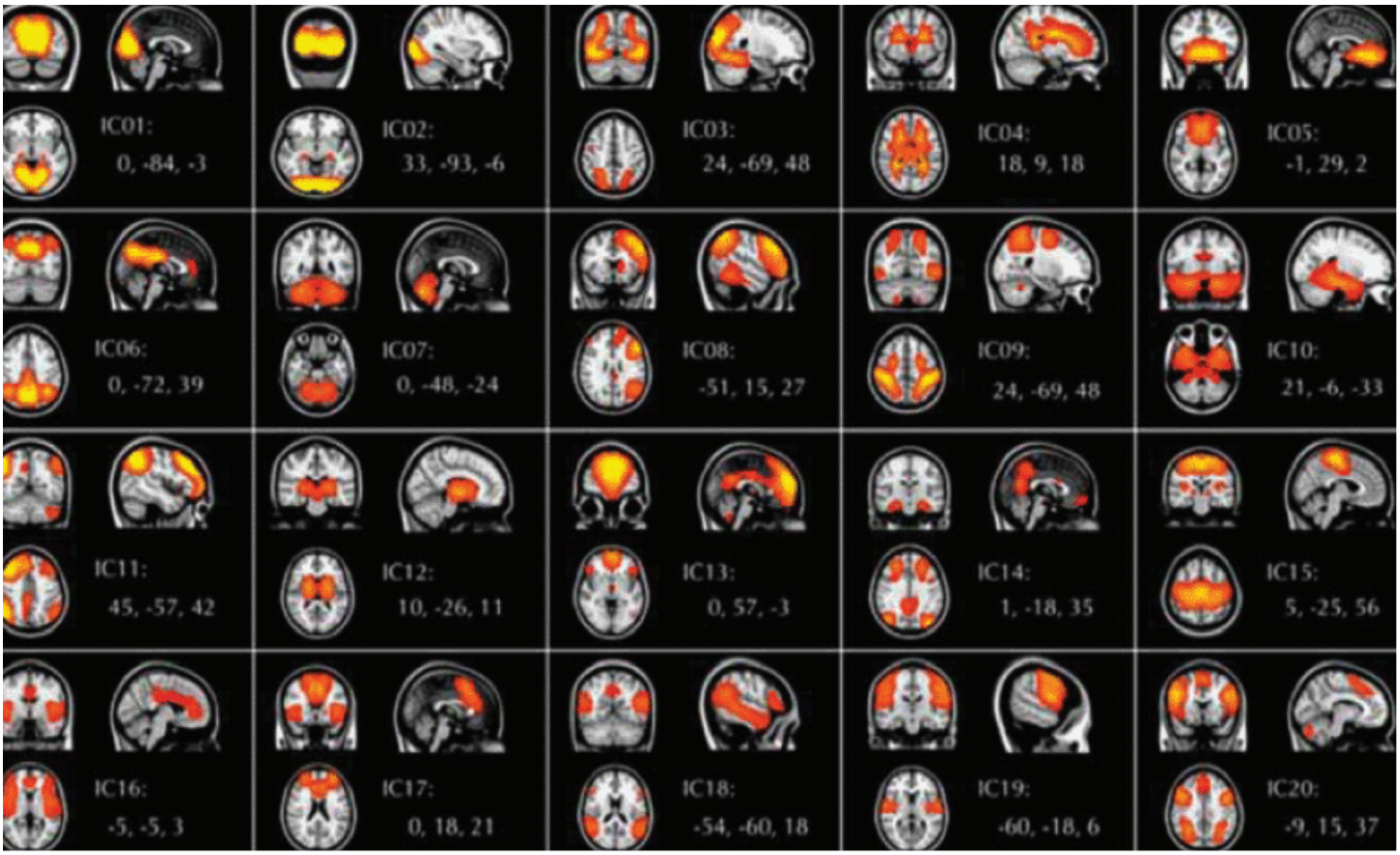


Image 4. Resting-state functional magnetic resonance imaging (R-fMRI) showing brain circuits that can be identified when people are alert but not performing any particular task. Analyses of scans from more than 1,000 healthy adults revealed 20 resting-state brain networks. Each one is shown here in coronal, sagittal, and transverse views. The colors in these composite images show the statistical robustness of these patterns in each brain region, with yellow indicating the greatest statistical significance; orange, an intermediate level; and red, the least. From the Supporting Information to Proceedings of the National Academy of Sciences Biswal et al. 10.1073/pnas.0911855107.

Paradigms

A paradigm typically consists of active and control conditions. A rough distinction can be made between paradigms that are 'blocked' and those that are 'event-related'.[4]

'Blocked' paradigms consist of a sequence of blocks, each of which constitutes an active or task condition and a control or rest condition alternating every 20–40 seconds. The control is chosen such that it activates all the neural processes common to the stimulus task with the exception of the cognitive process of interest. By subtracting the brain regions recruited during the performance of the control task from the brain regions recruited during the test condition, the areas of the brain whose activity is associated specifically with the cognitive process of interest can be identified. Blocked paradigms are statistically robust, since the signal acquired for each condition is high, but are restrained, leaving little room for unexpected or short stimuli.

'Event-related' designs use very brief, random stimuli; during individual trial events, each representing a specific condition, presented in random order and rapid succession. Therefore, an event-related design allows the presentation of unexpected stimuli as well as many different conditions, rendering the paradigm highly flexible but statistically less robust because the signal that is acquired for each condition is generally low.

In clinical fMRI procedures, the block design is usually used as it is easy to implement, interpret, and analyze and gives rise to robust activation patterns.

Clinical applications

fMRI is used to map brain function and eloquent cortex in relationship to intracranial tumors, seizure foci, or vascular malformations. Eloquent cortex can become displaced or disorganized by these pathologic processes, and mapping with fMRI helps to determine and potentially minimize the risk for performing surgical excision.[3,5] fMRI is also used to determine the need for intraoperative mapping during excision and to select the optimal surgical approach to a lesion[6].

Planning before tumor resection

fMRI imaging can be used to identify eloquent cortical regions,[7,8] particularly when these cortical regions are displaced or reorganized secondary to pathologic processes,[7,9–11] and can facilitate the assessment of potential neurosurgical risks.[12] fMRI may provide additional information regarding surgical approach and the selection of patients for invasive functional mapping.[13] The results of numerous studies have shown agreement between fMRI localization of sensory motor function and localization by means of invasive neurosurgical methods.[14–16] fMRI has been shown to have high sensitivity (81%–92%) for the mapping of language areas in comparison with intraoperative electro cortical stimulation.[17]

A study was conducted by Jeffrey R. Petrella et al at the Duke Medical University, Durham.[18] The purpose of the study was to prospectively evaluate the effect of preoperative fMRI localization of language and motor areas on therapeutic decision-making in patients with potentially resectable brain tumors. In the study patients were subjected to block design paradigms wherein they were instructed to perform language and motor tasks that reliably activated the language and hand sensory motor areas. They concluded that fMRI has a significant effect on therapeutic planning in patients with potentially resectable brain tumors by altering the treatment plan – most often to a more aggressive approach – in a significant number of patients. In certain patients, surgical time may be shortened, the extent of resection may be larger, and the craniotomy size may be smaller.

Pre-operative fMRI images of two patients with space-occupying lesions to evaluate the involvement of the sensory and motor speech areas.

Patient 1

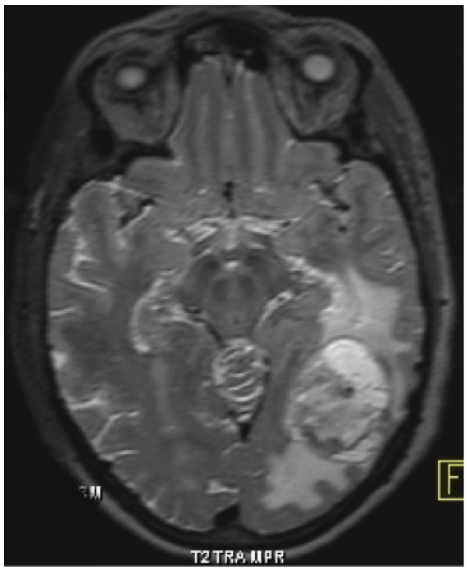


Image 5a. T2 weighted axial View showing a Glioma in the left temporal lobe.

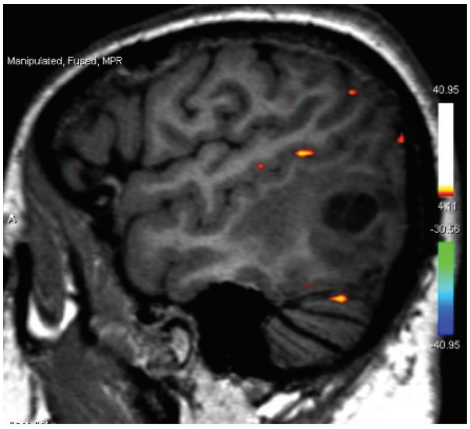


Image 5b. fMRI Sagittal view showing Wernicke's[α] area unaffected prior to a surgery.

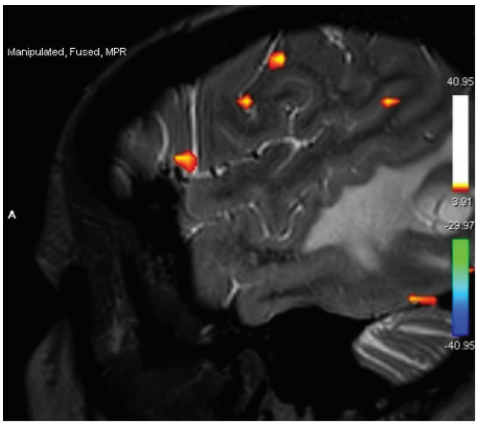


Image 5c. fMRI sagittal view showing Broca's[α] area sparing prior to a surgery.

Patient 2

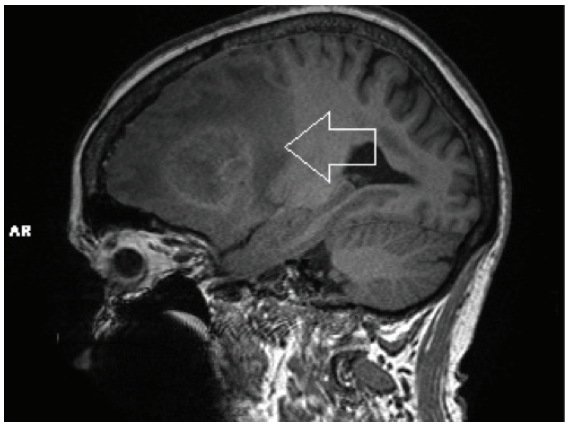


Image 6a. T1 weighted sagittal image showing a Glioma in the left frontal lobe.

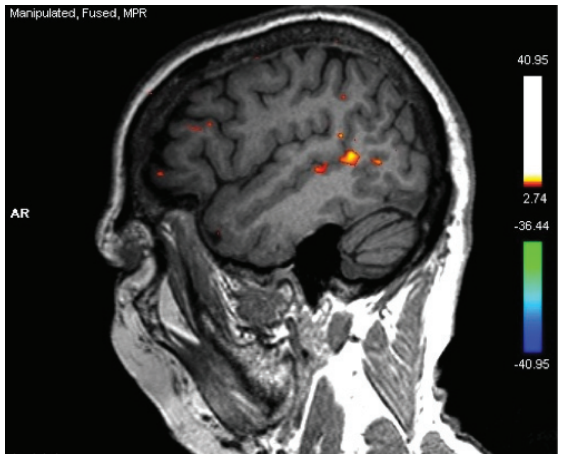


Image 6b. fMRI Sagittal view showing sparing of Wernicke's[α] area.

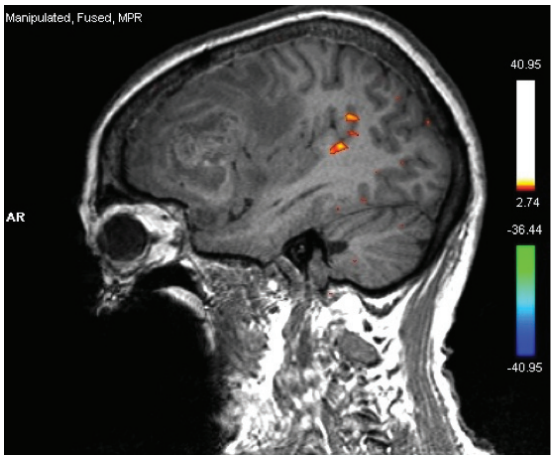
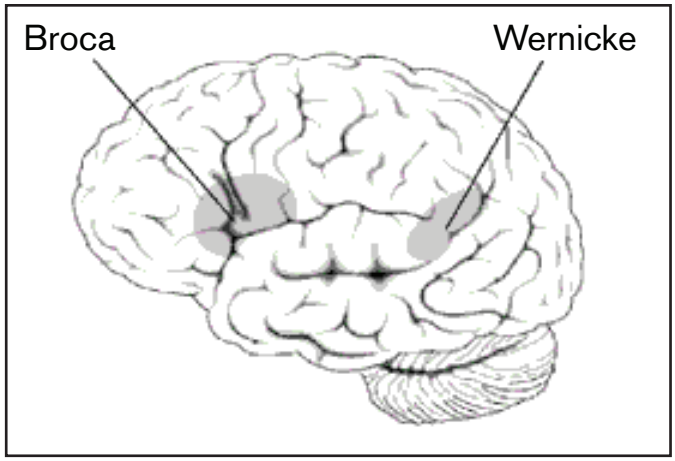


Image 6c. fMRI sagittal view showing displacement of Broca's[α] area by the Glioma.



[α]*Broca's and Wernicke's areas are the motor and sensory speech areas, respectively, located in the cerebral cortex of the brain.*

Role of fMRI in seizure disorders

Epilepsy surgery is an important tool for the treatment of patients with medically refractory seizures especially in patients with medial temporal lobe epilepsy (MTLE). These patients have complex partial seizures originating from a sclerosed hippocampus. The challenge in epilepsy surgery is to resect the seizure focus completely without causing significant post-operative neurological deficits. Patients with long-standing epilepsy may have variable anatomic localization of neurologic functions like memory because of cerebral reorganization induced by the disease process. Understanding this functional anatomy prior to the surgery becomes vital and hence comes the role of fMRI.[19]

A.J. Golby et al in their study at Stanford University determined the utility of fMRI in lateralization of memory in patients with MTLE. The block design paradigm was used wherein the patients were presented with four different types of visual stimuli. The responses were recorded and analyzed according to predetermined parameters. At the end of the study it was concluded that fMRI is a valid tool for assessing of memory lateralization in patients with MTLE and may therefore allow non-invasive preoperative memory lateralization. fMRI revealed that memory maybe reorganized to the contralateral medial temporal lobe in patients with MTLE.

Prospective study conducted by Medina et al evaluated the effect of fMRI in patients with seizure disorders.

Patients included in the study had a history of seizures due to various causes including cortical dysplasia, neoplasm, Sturge-Weber disease and Rasmussen Encephalitis. They concluded that fMRI influenced diagnostic and therapeutic decision-making of the seizure team. It also altered the intraoperative mapping and surgical approach.[25]

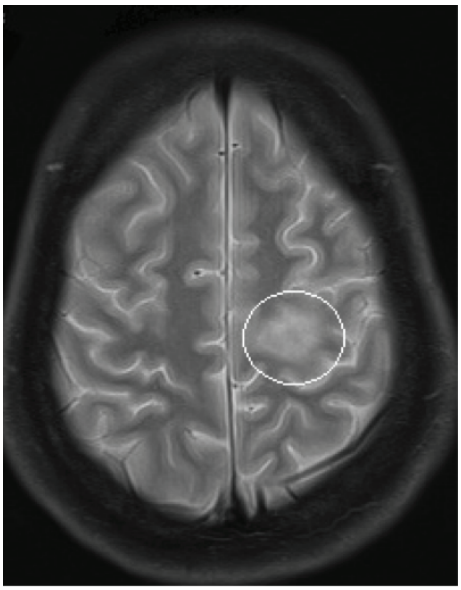


Image 7a. T2 weighted axial image showing focal cortical dysplasia (encircled in white).

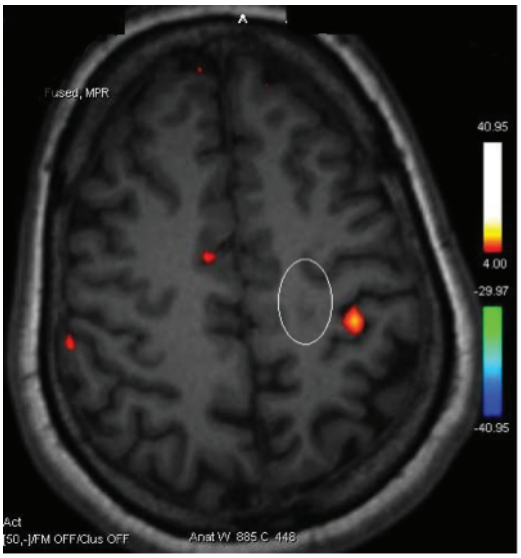


Image 7b. (lesion is encircled in white).

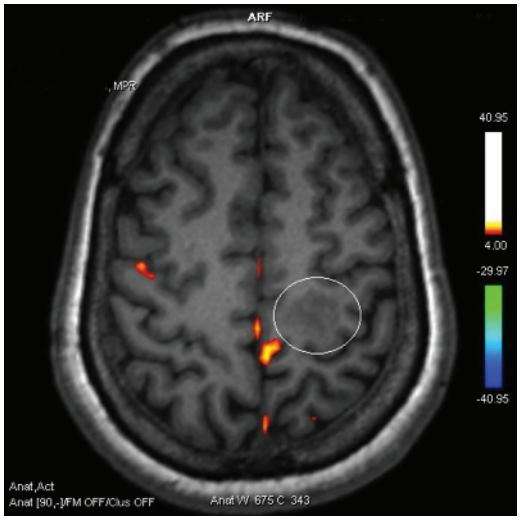


Image 7c (lesion is encircled in white).

In images 7b and 7c fMRI shows BOLD signal in left paracentral lobule and left precentral gyrus with motor tasks for hand and leg respectively. The signal is seen at margins of dysplastic cortex.

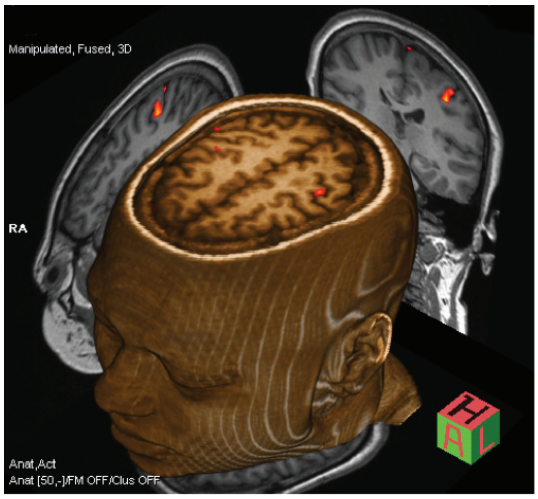


Image 7d: 3D reconstruction of the fMRI images preoperatively.

fMRI in evaluation of psychiatric conditions

Psychiatric illnesses are perceived as fundamentally different than common medical disorders. This arises from the fact that the structural, biochemical and/or functional abnormalities underlying the psychiatric disorders are not exactly known. The current lack of strong biologic markers for psychiatric diseases makes MR imaging research in psychiatry all the more important.

One of the major theories regarding the cognitive dysfunction in schizophrenia has been the presence of

hypofrontality – that is, underactivation of the prefrontal cortex. fMRI examinations, however, have revealed both hypoactivation and hyperactivation of the prefrontal cortex. The discrepancies in findings may be due to a number of factors – many studies have had small patient numbers. The recruited patients may have had different levels of severity of symptoms and thus may have been taking different medications.[20]

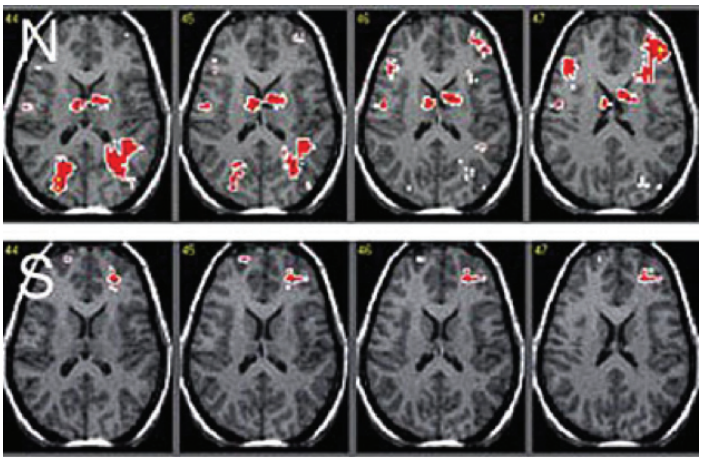


Image 8. Decreased brain activity in schizophrenia subjects (S) compared to normal controls (N) in an fMRI study examining executive functioning. Image courtesy of Prof. Philip Ward, NISAD Cognitive Neuroscience Research Panel; Source: http://www.schizophrenia.com/disease.htm.

Reduced activation of subregions of the prefrontal cortex and parietal cortex has been reported in the first-degree non-affected siblings of patients with schizophrenia and in discordant twins, leading to the proposal that an aberrant prefrontal cortex could be an early biomarker of schizophrenia. [21, 22]

Similarly, fMRI can help localize other psychiatric disorders like major depressive disorder, mood disorders to certain areas of the brain.

Pharmacological fMRI

As per the review publication by Paul M. Matthews et al. on 'Applications of fMRI in translational medicine and clinical practice',[24] fMRI could be used in the direct assessment of drug action and phMRI could soon assume important roles in drug development. Pharmacodynamic data (that is, establishing that a drug has an effect on brain function) can be obtained from: the analysis of brain changes with the administration of drugs (for example, nicotine);[27] the correlation of brain activity with the behavioral effects of drug administration (for example, methamphetamine); [28] or the characterization of the way in which the activity of a probe task is modulated by a drug[29-32](Image 9). In early drug development this can inform dose-ranging studies. The functional-anatomical information also shows sites of drug action to provide biological proofs of principle (although these fMRI responses need to be interpreted cautiously, as they could be either direct or indirect).[33]

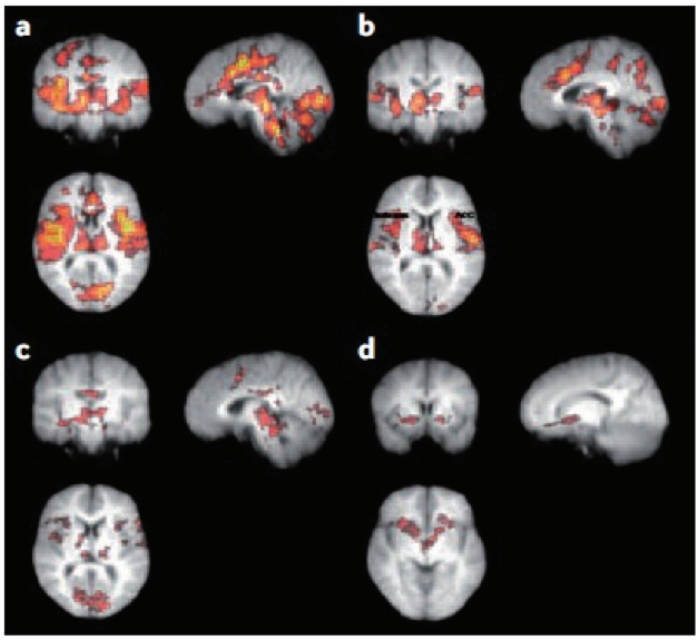


Image 9. Pharmacological functional MRI (phMRI) allows drug effects in the brain to be defined from their modulation of activity. In this example, brain activity with a noxious thermal stimulus applied to the skin relative to that with a non-painful warmth was mapped during the infusion of increasing concentrations of remifentanil, an opiate analgesic saline placebo (a); 0.5 ng/ ml (b); 1.0 ng/ml (c); 2 ng/ml (d). The decrease in the functional MRI signal provides an objective measure of decreasing central pain response with higher doses of the drug. This provides a tool for both pharmacokinetics and pharmacodynamic studies 26. Images courtesy of I. Tracey and R. Wise, Oxford Centre for Functional Magnetic Resonance Imaging of the Brain. Source: Paul M. Matthews, Garry D. Honey and Edward T. Bullmore: Applications of fMRI in translational medicine and clinical practice, 2006.

Limitations

For fMRI to become a diagnostic tool, the findings in psychiatric disorders would have to be validated in larger samples of homogeneous patient populations by using comparable methods (acquisition and post processing). A number of factors are responsible for the heterogeneity of MR data in psychiatry and consequently lead to inconsistent and non-comparable results. Patient characteristics, such as medication status (i.e., non-medication, single-medication, or multiple-medication user), IQ, social status, age at

onset of disease, and family history, and the presence of comorbidity and substance abuse can stand in the way of a meaningful interpretation of results. In addition, the clinical severity of psychiatric symptoms is variable.[20] Also, patients with the same disease can present with different clusters of symptoms. Imaging characteristics, functional MR imaging is based on a subtraction analysis in which it is assumed that the baseline and activated states can be separated into mutually exclusive components.[23]

Conclusion and impact on confidentiality and insurance

The use of fMRI has come a long way from use in basic cognitive neuroscience to clinical investigation. Though some practical limitations remain, at present, it is being considered for use in neurosurgical planning, disease characterization, drug pharmacokinetics, pharmacodynamics, and in the better prediction of treatment outcomes. It might also contribute to an earlier, more-specific and more-confident diagnosis of functional brain disorders. It is clear that widespread introduction of clinical fMRI will demand new skills and an even closer integration of neuroimaging with medical care. It should help to hasten the introduction of more quantitative approaches in neuroradiology. Potentially, the greatest long-term impact could be the ability of fMRI to define disorders of mind and cognition in the context of the range of human behaviors in the broader population. This will foster more effective approaches to addressing problems associated with the management of personally or socially limiting behaviors (for example, addiction, compulsive behaviors and autistic syndromes), on the basis of an appreciation of potentially modifiable consequences of the interaction between individual neurobiology and the environment.[24]

fMRI is also being explored for many more practical applications such as reading of brain states, brain-computer interfaces, communicating with locked-in patients, lie detection, learning control over brain activation, etc., but it is very early days for these applications.

The potential power to read information from a person's brain also leads to the question of personal confidentiality. The foreseeable ability to read the state of a person's brain and thereby to know aspects of their private mental experience, as well as the potential to incorrectly interpret brain signals and draw spurious conclusions, raises important new questions for the nascent field of neuroethics.

As has been true in many fields of life science and biotechnology when a potentially powerful new technology has been developed, dialogue with the public, caution and careful consideration of ethics will be important, particularly among investigators and technology developers, whereas alarmist rhetoric will probably not be productive. As research in this area continues, the potential benefits of each application will need to be weighed against potential harm as data regarding utility accumulate.

Some of the questions that may require some thought and which may be answered sooner rather than later:

- Will there be a day when these findings will be used in ways that the person may not approve?
- Who should control a person's fMRI data and the circumstances under which someone might be compelled to submit to an fMRI exam?
- Finally, the reason this topic is selected for presentation – can or will this technology be used to know the state of the brain and mind before an insurance application is considered?

Important definition

Precess:
When a magnetic moment (e.g., hydrogen nuclei) is placed within an external magnetic field, it begins to oscillate about the direction of the field; this motion is called **precession**.

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HARNESSING EMRs: THE CONTINUITY OF CARE DOCUMENT (CCD)

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In the previous issue of *ReFlections*, we highlighted the enormous amount of data contained in an Electronic Medical Record (EMR). To put this in perspective: I recently perused a 600+page EMR that represented a mere five years of medical history for one individual. The file was comprised of hundreds of encounters over this time period – mostly related to the patient's knee surgery and subsequent twice-weekly physical therapy visits – but there were a few other items sprinkled throughout the file. Aside from his recurrent sinusitis and back troubles, he also had hypertension and elevated cholesterol. How will our underwriters and medical staff ever keep up with case loads and turnaround times if the average file grows to several hundred (or thousand) pages?

The answer could be the Continuity of Care Document (CCD). You may have you noticed that some of the medical records in your files are preceded by a two-three page 'cover sheet'. Or perhaps the last time you visited your own physician you were sent home with something similar? This is likely the Summary of Care – or CCD.

What is the Continuity of Care Document (CCD)?

The CCD is one type of clinical summary that contains a core data set of the most relevant and timely facts about a patient's healthcare. It includes a summary of the patient's health status (e.g., problems, medications, allergies) and basic information about insurance, advance directives, care documentation and care plan recommendations. It was developed to eliminate data inconsistencies when patients were referred from one provider to another. In the past, a letter describing the patient's case was dictated from the patient's referring physician. There was no consistency across physicians as to what might be included in the referral letter. To eliminate this problem, the CCD standard recommends specific categories of information to include in referral letters. It is an industry-accepted standard that provides a "human-readable" and a "machine-readable" (XML) summary of patient data that can be shared electronically.

Summaries of care are a key component in satisfying several important measures within Meaningful Use and the federal government has chosen the CCD as one of two formats required to meet certain requirements. The CCD has been designated as the standard for clinical data exchange in the Meaningful Use regulations by the Healthcare Information Technology Standards Panel (HITSP). Additionally, in order to be certified, EMR software products must be capable of sending and receiving documents in CCD format.

CCDs are organized through a series of templates that each pertain to specific sections of the document. While there are numerous sections, only five are required for Meaningful Use: Allergies, Immunizations, Medications, Problems, Procedures, and Results.

Underpinning each section are specific, standardized vocabularies:

Section	Vocabulary
Demographics	HITSP Harmonized code sets for gender, marital status
Problem List	ICD-9* or SNOMED-CT
Procedures	CPT-4 or ICD-9*
Medications	RxNorm and Structured SIG
Allergies	UNII for foods and substances, NDF-RT for medication class, RxNorm for Medications
Immunizations	HL7 CVX
Vital Signs (Height, Weight, Blood Pressure, BMI)	SNOMED-CT or LOINC
Progress Notes and Other Narrative Documents (History and Physical, Operative Notes, Discharge Summary)	CDA Templates
Departmental Reports (Pathology/Cytology, GI, Pulmonary, Cardiology, etc.)	SNOMED-CT
Lab Orders and Results	LOINC for lab name, UCUM for units of measure, SNOMED-CT for test ordering reason
Microbiology	LOINC for lab name/observation
Administrative Transactions (Benefits, Referrals, Claims)	X12, CAQH CORE

Although the CCD specification contains U.S.-specific requirements (and its use is therefore limited to the U.S.), it is derived from HL7's Clinical Document Architecture (CDA) standard which is at the heart of every standards-based exchange architecture (including Asia Pacific, U.K., Europe, Canada and Mexico). For example:

- **Argentina:** CDA solves immediate interchange requirements, will scale as resources become available.
- **Canada:** CDA is the electronic source for claims adjudication.**
- **Finland:** Adopted CDA Release 1 in 2000; exchange network covers most of the country; experimenting with distributed decision support using CDA Release 2.
- **France and Italy:** CDA documents are the core of patient-controlled health information accounting.
- **Greece:** Using sophisticated satellite-based telemedicine system using CDA, web services.
- **U.K.:** CDA is the core component of the National Health Service (NHS) strategy for interoperability.

The CCD is only one of several CDA derivatives. Others include Discharge Summaries, History and Physical (H&P), Procedure Notes, Progress Notes, Operative Notes, Consultation Notes, and Diagnostic Imaging Reports.

** ICD-10 eff. October 2014*

*** HIMSS - EHRVA HL7 Implementation Guide: CDA Release 2 – Continuity of Care Document (CCD)Quick Start Guide*

When a Standard is not really a Standard

While the CCD is certainly good news for our industry, as with EMRs in general, it still has a way to go. You'll note the statement above: "…the CCD standard recommends specific categories of information …." While Meaningful Use mandates the use and exchange of CCDs, it outlines expectations and capabilities which incorporate wording like, "we expect the [CCD] to include health information that is coded, where applicable, in accordance with adopted vocabulary standards" and "eligible professional (or eligible hospital) would be permitted to map or crosswalk local/proprietary codes to the adopted vocabulary standards". This means that the 'standard' is subject to interpretation and its execution depends on individual developers. Sections and tags (field names) in the document are standardized, but the values (content) and data mapping can vary widely.

Information found in the CCD can vary depending on where it is generated and for what purpose. For instance, multiple vocabularies are allowed; Problem Lists may be encoded with ICD-9 or SNOMED-CT. Medications are mandatory while other related data elements such as dosage and route of administration are optional. Even when included, they may not be populated consistently (e.g., 'tablet', 'Tablet', 'tab', 'tab(s)', etc.). When transforming data, these seemingly subtle differences can break an automated process. Another challenge relates to the exchange of CCDs. Individual providers use different EMR systems and getting these systems to communicate with each other is a major stumbling block.

The CCD is not a complete patient record; it is merely a snapshot in time and is currently limited to a single provider. The standard offers hope that multiple CCDs will be able to be integrated across providers creating a 'summary of summaries'. Still, even a single CCD could play an important role in life underwriting – perhaps as an additional evidence source in Simplified Issue programs, case triage for workflow, or serving as the basis for requesting exams and physician statements – among other things. Only time (and experimentation) will tell.

GOOD HEALTH SUMMARY

Patient	Mr. Adam Everyman		
Date of Birth	11/25/1954	**Sex**	Male
Race	White	**Ethnicity**	Not Hispanic or Latino
Contact Info		**Patient IDs**	237320435
Document ID	7280325058175544		
Document Created	March 29, 2005, 17:15:04 +0500		
Document maintained by	Good Health Clinic		
Contact info:			

Allergies, Adverse Reactions, Alerts

Substance	Reaction	Status
Penicillin	Hives	Active
Aspirin	Wheezing	Active
Codeine	Nausea	Active

Medications

Medication	Directions	Start Date	Status	Indication	Fill Instructions
Proventil 0.09 MG/ACTUAT Inhalant solution	2 puffs QID PRN wheezing	03/01/2011	Active	Bronchitis (32398004 SNOMED CT)	Generic Substitution Allowed

Problems

1. Pneumonia: Resolved in March 1998
2. ……

Procedures

Procedure	Date
Colonic Polypectomy	1998

Results

LABORATORY INFORMATION

Chemistries and drug levels

HGB (M 13-18 g/dl; F 12-16 g/dl)	13.2
WBC (4.3-10.8 10+3/ul)	6.7
PLT (135-145 meq/l	123 (L)
etc.	
Liver Functions and Other Laboratory Values	
ALT (SGPT)	31.0
AST (SGOT)	18.0
etc.	

ELECTROCARDIOGRAM (EKG) INFORMATION

EKG	Sinus rhythm without acute changes

Advance Directives

Directive	Description	Verification	Supporting Documents
Resucitation status	Do not resuscitate	Dr. Robert Dolin, 11/07/1999	Advanced directive

Encounters

Encounter	Performer	Location	Date
Examination	Name	Good Health Clinic	04/07/2000

Family History

Father (deceased)

Immunizations

Vaccine	Date	Status
Influenza virus vaccine, IM	Nov 1999	Completed
Influenza virus vaccine, IM	Dec 1998	Completed
Pneumococcal polysaccharide vaccine, IM	Dec 1998	Completed
Tetanus and diphtheria toxoids, IM	1997	Refused

Medical Equipment

Supply/Device	Date Supplied
Automatic implantable cardioverter/defibrillator	Nov 1999
Total hip replacement prosthesis	1998
Wheelchair	1999

Insurance Providers

Payer Name	Policy type / Coverage type	Policy ID	Covered party ID	Policy Holder
Good Health Insurance	Extended healthcare / Family	Contract Number	1138345	Patient's mother

Plan of Care

Planned Activity	Planned Date
Colonoscopy	04/21/2000

Social History

Social History Element	Description	Effective Dates
Smoking	1 pack per day	1970 - 1972
Smoking	None	1973 -
Alcohol consumption	None	1973 -

Vital Signs

Date / Time:	11/14/1999	04/07/2000
Height	177 cm	177 cm
Weight	86 kg	88 kg
Blood Pressure	132 / 86 mmHg	145 /88 mmHg

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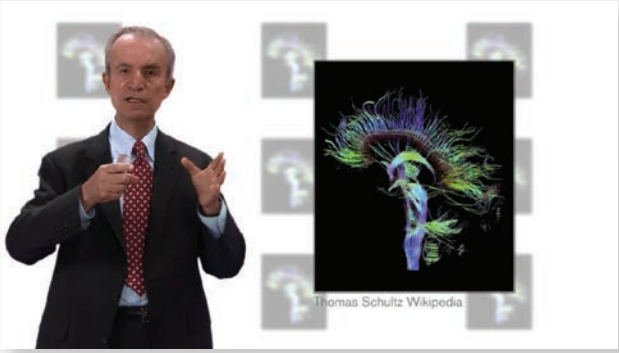
Susan L. Wehrman, Vice President, Electronic Health Record Initiatives, heads RGA's newly created Electronic Health Record (EHR) Initiatives area. This function conducts in-depth research and analysis of this evolving segment and monitors all activity in the U.S. and around the world, with the objectives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

ON DEMAND WEBCASTS

RGA and industry experts discuss the topics below in our upcoming 2012 webcasts.

Available On Demand on September 18:



Advances in Cancer
(in English and Spanish)
Presenter: Dr. Oscar Cartaya, Vice President and Medical Director, RGA Reinsurance Company

Moderator: Dr. Carl Holowaty
Senior Vice President and Chief Medical Director
RGA Reinsurance Company

COMING SOON

Mortality Improvement
Presenters: Peter Banthorpe
Head of Actuarial Research
RGA UK Services Limited

Derek Kueker
Actuary
RGA Reinsurance Company

Moderator: Jonathan Porter
RGA Reinsurance Company

Underwriting Fraud Prevention
Presenters: Rick Gordon, Second Vice President, Mortality Management, Sammons Financial Group, Midland National and North American

Lynn Patterson, Chief Underwriter, ING

Moderator: Mark Dion
RGA Reinsurance Company

Electronic Health Records
Presenters: Dr. Carl Holowaty, Senior Vice President and Chief Medical Director
RGA Reinsurance Company

Dr. Phil Smalley, Vice President and Medical Director, RGA Reinsurance Company

Moderator: David Atkinson
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NOTES

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