



COVER STORY

CANCER

GLOBAL CANCER PROBLEM, CANCER RESEARCH & PLACE, SERVICES, LUNG CANCER SCREENING, WOMEN'S IMAGING, SHEAR WAVE ELASTOGRAPHY, STRUCTURED REPORTING, CARDIO-ONCOLOGY

MANAGEMENT MATRIX
 CT Dose Management
 Point-of-Care Ultrasound
 Appropriate Imaging and Clinical Decision Support
 Iodinated Contrast Media
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In 17 countries of the European Union, cancer has overtaken cardiovascular disease as the leading cause for premature death. In Europe in 2012, there were 3.75 million new cases of cancer, with 1.75 million deaths, equivalent to a cancer death every 20 seconds. Upward pressure on appropriate health spending and the needs of ageing populations need to be factored in, otherwise by 2050 we will face an epidemic of such proportions that in certain countries, a European citizen will die from cancer every five seconds.

The European Cancer Patient Coalition (ECPC) works to ensure that all European cancer patients have timely and affordable access to the best treatment and care available, throughout their life. Policymakers, researchers, doctors and industry should recognise European cancer patients as the most important partners in the fight against cancer and against all the cancer-related issues affecting our society.

One of the biggest struggles we face across Europe and one that all stakeholders in fighting cancer need to meet head on is disparity of care.

The situation in Eastern Europe is particularly challenging, with mortality rates for many cancers above the European average. In Poland for example, lung cancer mortality is 83% while the EU average is 56.4%. In Romania, the mortality rate for cervical cancer is 14.2%, compared with an EU average of 3.7%. But there are also challenges for Western and Northern European nations. Studies such as the International Cancer Benchmarking Partnership (ICBP) have revealed that both the United Kingdom (UK) and Denmark have significantly poorer survival rates, particularly for lung, colorectal and ovarian

cancers, when investigated with comparator nations Norway and Sweden (Coleman et al. 2011). In addition to the significant disparities between European nations, regional intra-country variations are also evident, leading to differences in survival within individual countries.

Our aims are simple: Empowerment of European cancer patients through the dissemination of fundamental information regarding cancer; fostering of cooperation among cancer patients' organisations through joint activities; ensuring that state-of-the-art cancer care practices are shared across the EU; making cancer a priority for action on the European health policy agenda; contributing to change or creating EU and national laws to satisfy cancer patients' needs; calling for research on survivorship issues and advocating for better healthcare and social services for them and, above all, having an active role in shaping European and national healthcare policies that impact on cancer patients.

To this end we were instrumental in setting up the European Cancer Patient's Bill of Rights (BoR), launched in the European Parliament on World Cancer Day 2014. Developed by the European Cancer Concord (ECC), an equal partnership between patients, their advocates and cancer health professionals, the BoR is a catalyst for change which articulates the right of every European citizen to receive the most accurate information and be proactively involved in his or her care, to access optimal, timely and appropriate specialised care underpinned by research and innovation and to receive this care within health systems that ensure improved outcomes, patient rehabilitation, improved quality of life and affordable healthcare.

To strengthen the case for optimal and equitable patient care, ECPC launched the "Europe of Disparities in Cancer" initiative at the European Parliament in January 2015. This is especially critical for patients in countries where the healthcare system is being decimated by economic crisis. While increased spend does not always correlate with improved patient care we have to warn about the additional negative impact of austerity and cost containment measures in a number of European countries. For example, Greece, against EU recommendations, has reduced its screening programmes for breast and cervical cancer, risking an increase in undetected cancers that may lead to increases in mortality.

Patients are central to their cancer care, and for this reason we are advocating for the need for improved cancer health literacy, better patient-adapted information and support and improved access to cancer screening, early detection and treatments — both traditional and innovative. Immediate action is also needed in addressing shortages in cancer medicines, access to innovative treatment approaches, delays to approval, health technology assessment and cancer survivorship and patient rehabilitation.

We welcome this issue of *Health-Management.org The Journal* for putting cancer and all of the issues surrounding this growing illness centre stage. With the disparities that we continue to face, both between countries and within countries, this may translate to a cancer death in certain parts of Europe every five seconds. We need to act now... ■



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Subscription Rates (4 Issues/Year)

One year: Euro 55 + 5% VAT, if applicable
Two years: Euro 90 + 5% VAT, if applicable

Production & Printing

Total classic and digital circulation: 61,500
ISSN = 1377-7629a
Printed in Hungary by ABEL Printing

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PRECISION IN THE FIGHT AGAINST THE GLOBAL CANCER PROBLEM



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Precision in medicine is a popular notion: precision to target an individual, precision to target a tumour, precision to target a molecule within a tumour. On occasion, this notion of precision no doubt evokes a crude analogy with images of the laser-guided missiles of war. As with modern warfare waged on any enemy, the war on cancer will use precision tools in order to win – such is the hope, which is not without reason given some notable successes. However, in both scenarios, the outcomes are not so precise; the reality is somewhat messier. Apart from the side effects (the collateral damage of powerful drugs), a patient developed cancer in the first place because of a specific set of exposures and circumstances and the outcome of treatment will be affected not just by their genome or that of their tumour, but also by their general health status, co-morbidities, lifestyle, as well as access to timely diagnosis, treatment and care, etc. Consequently cancer control must

be considered broadly, embracing the sociopolitical as much as the molecular. In this wider context, if we do permit ourselves to submit for a moment to the legacy of U.S. President Nixon's military terminology, what are our best available weapons to fight the war on cancer? Where precisely do we stand?

Major investment and international cooperation succeeded in yielding the sequence of a typical human genome, emphasising a common heritage. This was followed by coordinated efforts to discover the genetic differences between individuals, revealed as variations in DNA sequence. Attention also turned to differences between the genomes of cancer and normal cells, with mutations revealing the genes and pathways most commonly altered in the progression from normalcy to malignancy. This backdrop of genetic information continues to provide remarkable insights into the previously hidden biology of cancer, opening the potential for drugs to target the molecular Achilles

heel of a particular tumour type and to avoid both the worst of the side effects for the individual patient and crucial loss of time for those whose tumour is not susceptible to the drug concerned. Such is the cornerstone of precision medicine.

Treatment Successes

Treatment of cancer patients has improved remarkably since the 1970s, with major advances in survival for some types of cancer: childhood leukaemia, testicular and breast cancers being notable successes. These initial gains were made, of course, without reference to the sequencing of the human genome and its malignant corollaries. For other cancers progress has been dismally poor. Some of these failures could be overcome as we enter the new era of precision medicine (Collins and Varmus 2015), but identifying the potential therapeutic targets and developing the drugs may be a long, complicated and costly process.

Early examples of success in precision medicine are the targeted treatments for breast and stomach cancers over-expressing the HER2 protein, drugs directed at the altered forms of BRAF protein present in some melanomas and the treatments targeting the BCR-ABL fusion protein in chronic myeloid leukaemia. These therapeutic advances are undoubted triumphs of science and medicine and they merit celebration. And yet there is a disturbing truth to face if the cancer problem is to be controlled, particularly from a societal and global perspective: the number of cancer patients is set to increase and to do so markedly in the coming decades. This is a direct consequence of increasing population size and lengthening lifespan in a majority of countries. As a disease predominantly of ageing, cancer will become more common. There will be more people to treat and to care for — a lot more.

Just 20 years from now, in 2035, there will be an estimated 9 million more people worldwide every year facing a cancer diagnosis: 24 million compared to 15 million today (Stewart and Wild 2014). These projections will be modulated by any alterations in the underlying cancer incidence rates, which depend in turn on changes in the prevalence and level of exposure to risk factors. Overall, the increase in absolute number of cases will place an unprecedented burden on cancer services, presenting a challenge to their sustainability, and resulting in an unmanageable demand in many countries. This is particularly true in the developing world where there is the least capacity to treat and care for patients even at today's levels, let alone those twenty years hence.

The View Ahead

Future planning of cancer service provision must be an integral part of cancer control programmes and despite the challenges for developing countries, significant progress can be made through improved access to effective and affordable treatments (Kingham et al. 2013). Nevertheless, improving access to existing therapies will be an insufficient response for any country. The combination of increased numbers of patients and the spiralling costs of treatment mean that even the richest countries cannot treat their way out of the cancer

problem. Global estimates of the cost of cancer are fraught with uncertainties, but lost productivity and treatment costs amounted to over 1 trillion US dollars (>0.9 trillion Euros) in one assessment for 2010 (Knaut et al. 2014). Among the developing countries, the problem risks being overwhelming. Uganda, for example, will see the annual number of new cases rise from around 33,000 to 70,000 between 2015 and 2035. Progress is being made in cancer services, such as those at the Uganda Cancer Institute — with 80 beds for inpatients and a new outpatient facility having the capacity to treat up to 20,000 patients annually. Many countries in Africa are less advanced in planning, often completely lacking specialised cancer surgery, pathology and radiotherapy services. On a more

approach of aetiology, prevention and treatment. It might be argued that collectively the cancer community has failed to embrace the Burkitt message about the core role for prevention, at least not in terms of prioritised action on a wide scale. We have improved the design of our mops, but forgotten about the tap. Maybe the time is ripe for change.

Focus on Prevention

Figures vary, but one can safely estimate that 40 to 50 percent of cancers could be prevented if the accumulated knowledge about causes could be translated into effective primary prevention (Vineis and Wild 2014). Tobacco remains the pre-eminent culprit, accounting for around 20 percent of cancers globally, while chronic infections are responsible for

“THERE IS A DUTY OF CARE TO THE NEXT GENERATION, TO FREE AS MANY AS POSSIBLE FROM THE EXPERIENCE OF CANCER”

intimate level, among the world's poorest, the out-of-pocket expenses of treatment for one individual can be financially catastrophic for an extended family (ACTION Study Group 2015).

How did we end up here and what might be done better? The late Denis Burkitt used to present one of his illustrations in two stages. First the lower portion of the slide drew an analogy between mopping water and treating disease — showing two men trying to cope with a huge pool of spreading water — emphasising the never-ending nature of the task and Burkitt's own long years as a dedicated 'mopper'. He would then reveal the full slide, with an overflowing sink above the men's heads, taps fully-open, and relate how one day he was struck by the simple question: “Why not turn off the tap?” Burkitt became a great proponent of prevention, conducting the classic geographic pathology studies on the viral aetiology of Burkitt lymphoma. It is sometimes overlooked, however, that he also developed an effective treatment for this childhood tumour. As a surgeon and nascent epidemiologist, Burkitt's thinking was towards an integrated

a further 15 percent. Imbalances in calorie intake and expenditure are adding to the burden, with excess body mass index being linked to around 4 percent of the cancer burden worldwide. Alcohol, excess sunlight, unhealthy diets, environmental contaminants and occupational exposures all contribute. Further inroads are offered by detection of pre-cancerous conditions or early-stage cancers, combined with effective, simple treatment, eg for cervical, breast, colorectal and oral cancers.

Prevention and early detection demonstrably work. In recent years the translation of reduced tobacco consumption into falls in lung cancer rates and the effect of organised screening programmes on cervical cancer incidence and mortality have been documented. Vaccination against hepatitis B virus is beginning to impact liver cancer rates in Asia and this will be followed by the benefits of the more recently introduced vaccines against human papilloma viruses. Estimates of the costs of implementing cancer prevention strategies are difficult to make on a global scale, but are certainly a fraction of the costs of dealing with the consequences of the occurrence of these same

cancers (Knaul et al. 2014). Many of the interventions for cancer prevention, such as tobacco and alcohol control, promotion of healthy weight, healthy diet and physical activity bring additional benefits across a range of non-communicable diseases.

Despite proof and promise, prevention remains too often neglected (Fineberg 2013). Prevention typically attracts less than 5 percent of cancer research funding with vastly greater proportions invested in basic science and clinical translational research. In addition, research into prevention commonly remains at the stage of proof-of-principle, with a failure to implement. When prevention has been promoted it has frequently been focused on individual choices, whereas legislation and policy may be keys to success, offering a sustainable approach and one which contributes to reduced inequalities in society.

What led to this situation? Time may be one factor. The benefits of some (albeit certainly not all) preventive interventions can take several years to manifest, requiring a vision and commitment beyond the timeframe of a typical political mandate. Political inertia may be joined by popular desire, as the support of the general public is attracted more to a cure than a vague promise of future prevention. Economics is also crucial. New therapies attract private sector investment, while preventive interventions may be perceived as an additional cost on health budgets. Complexity may be a further element. Prevention requires a multi-sectoral approach across, for example, health, transport, environment,

agriculture, etc., to address the social determinants or “causes of the causes” (Marmot 2015). There is no simple molecule to ‘knock-out’.

This is a pivotal time for cancer prevention. There are undoubtedly major structural, social as well as scientific barriers to prevention, but equally there is a growing realisation that treatment alone will not suffice. Support for prevention is growing. Furthermore, there is a realisation that advances in cancer biology can bring benefits not only to the patient but also to the population (Wild et al., 2015). Examples include biomarkers which provide more precise exposure assessment, new clues to aetiology from tumour mutation profiles, stratification of cases in relation to exposure information and early detection of pre-cancerous lesions at stages where treatment can be most effective. Aside from the molecular advances, major opportunities exist for implementation research to better identify factors which help or hinder the translation of promising interventions into effective national programmes (Khuahaprema et al. 2014).

From a global perspective the necessity of cancer prevention stares us starkly in the face. However, the response is not to prioritise prevention over treatment but rather to ensure an integrated, balanced approach based on complementarity within overall cancer control planning. Treatment and care is a must for all cancer patients, but there is also a duty of care to the next generation, to free as many as possible from the experience of cancer.

50 Years: A United Fight Against Cancer

The International Agency for Research on Cancer (IARC), the cancer agency of the World Health Organization, is celebrating its 50th anniversary in 2015. Its origins lie with a man who experienced the suffering of his wife following a cancer diagnosis and made a plea for the creation of an international cancer agency to combat the disease. In 1963, twelve French personalities brought the idea to President de Gaulle, with the proposal to finance this new organisation by taking a “derisory” 0.5 percent from the military budgets of the most powerful nations to create an organisation that would be engaged in a “fight for life”. Albeit with a fraction of the proposed budget, the 1965 World Health Assembly approved the creation of IARC (Saracci and Wild 2015).

The founding countries were the USA, USSR, Germany, France, Italy, UK, and Australia, a list not without its symbolism in the post-war era, carrying a vision of what could be achieved by countries fighting together against a common enemy rather than fighting each other. In IARC we find, therefore, a different twist to the metaphor of a war on cancer, one that uses international cooperation as a weapon to fight a global problem. That vision remains as relevant as ever and must play its part in the coming decades, together with the promised advances in precision cancer medicine, if the growing challenge of cancer control worldwide is to be met. ■



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CANCER RESEARCH POWERED BY PLACE

HOW LOCATION AND HEALTH GO HAND-IN-HAND



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Place matters. Everything we do happens somewhere and that place can offer great insights. A place-based approach is powerful. Geography as a science provides both content and context for our work and facilitates our understanding of the world. By linking all sorts of data through their common geography, we can analyse, visualise, and detect patterns that drive informed action. For this reason, place matters in health and, specifically, place matters in cancer.

Brief History of Place and Health

Not surprisingly, the earliest reference documenting a relationship between place and health is with the Father of Medicine himself, Hippocrates, in 400 BCE. In his writings on the effects of air, water, and places on health, he notes, “Whoever wishes to investigate medicine properly, should proceed thus: in the first place to consider the season of the year, and what effects each of them produces for they are not all alike, but differ much from themselves in regard to their changes. Then the winds, the hot and cold, especially such as are common to all countries, and then such as are peculiar to each locality. We must also consider the qualities of the waters, for as they differ from one another in taste and weight, so also do they differ much in their qualities. In the same manner, when one comes into a city to which he is a stranger, he ought to consider its situation, how it lies as to the winds, and the rising of the sun; for its influence is not the same whether it lies to the north or the south, to the rising or to the setting sun.” (Hippocrates 400 BCE) Clearly, Hippocrates recognised that where one lives, works, and plays impacts their wellbeing.

Understanding the relationship between place and health can positively impact decisions, as evidenced with the great Persian philosopher and physician Rhazes (AD 900). When asked to site a

new hospital in Baghdad, he was said to have hung slabs of meat in various places around the city and monitor their level of putrefaction. Ultimately, he recommended that the hospital be built in the place where the meat putrefied slowest, believing that the environment must be healthiest there (Hajar 2013).

Despite the early contributions of Hippocrates and Rhazes, it was not until 1694 that maps were used to visualise the relationship between place and health (see Figure 1). The value of maps as a communication tool blossomed over the next 225 years in the service of understanding and tracking infectious diseases such as yellow fever, cholera and the 1918 influenza pandemic (Koch 2005; United States Department of Health and Human Services nd). But such images fell dormant during the early 1900s, a period referred to as the Modern Dark Ages of Visualisation (Friendly 2009).

By 1950, three major advances revitalised data visualisation. John W. Tukey in the United States developed the science of information visualisation for statistics, and Jacques Bertin in France provided a theoretical foundation for information visualisation, drawing on his experience as a cartographer and geographer. At the same time, computer processing of large volumes of data allowed the ability to generate graphic forms (Friendly 2009). These works underpinned the development of computerised Geographic Information Systems (GIS) in 1960 by Roger F. Tomlinson of Canada. The birth of computer mapping generated several advantages. In contrast to conventional methods, users could produce high-quality maps in a fraction of the time with minimal errors.

Geographic Potential

What exactly is a GIS? It’s like any computerised information system. GIS empowers us to visualise, question, analyse and interpret data to understand relationships, patterns and trends.

The primary differentiator is that a GIS includes geographic information. And it is more than just maps — it’s a platform for decision-making.

GIS answers important questions such as “Where are things located in the world?” You can gain instant perspective when mapping hospital clinics, radiation treatment centres, or mobile breast cancer screening locations. GIS also answers “What’s nearby?” If you understand mammography screening locations, for example, in relation to the proximity of women of screening age, you can gain insights about adequate access to care.

Another question of interest—“How are things connected?” Understanding relationships can facilitate faster, more informed decisions and help health professionals develop strategic interventions. Consider environmental exposures to carcinogens. Ambient factors such as wind and climate may influence the geographic distribution of carcinogens. Then there are people who may be more or less sensitive to exposure. Understanding how and where these components and populations connect can help in better management, monitoring and improvement of the entire system.

Current Applications

The ways to leverage geography in cancer work are nearly limitless. Because the modern GIS is available to anyone, anywhere, and on any device, there are vast opportunities to understand cancer and intervene in targeted ways. This growth is evidenced by GIS being identified as a Medical Subject Heading (MeSH) by the United States National Library of Medicine in 2003, demonstrating the increasing importance of the technology in the field. In fact, using GIS and spatial tools is relatively common to cancer research, as cited in health literature. In an article by Lyseen et al. (2014), researchers reviewed and categorised two decades of GIS and health literature. While there was a prevalence of infectious



Figure 1. Map of plague containment zones in 1690-1692 in the province of Bari, Italy, 1694. Tents represent troop deployments on provincial borders. The zone of active plague is clear in the Northeast while a secondary level of containment outlines the area where plague had already occurred. Note also the coastal patrols for the quarantine. This was a major military operation (Koch 2005).

Image credit: Courtesy of the New York Academy of Medicine Library

disease studies, cancer research was the most common non-infectious disease that was analysed with intelligent maps (Lyseen 2014).

Environmental Exposure Assessment

Many cancer researchers employ GIS to illuminate relationships between cancer, environmental exposures and hazards. Spatial analysis can provide insights about geographic patterns and relationships that might otherwise be missed by other types of analyses. Positive correlations have shown relationships between prostate cancer and environmental carcinogens (Jarup 2002); lung and laryngeal cancer and living near a sewage plant (Chellini 2002); and lung and colorectal cancer when living near coal mines (Mueller 2015). GIS tools allow the integration and analysis of large, often publicly available datasets such as climate, pollution, toxic waste sites, soil indices, pesticide applications and others. Even satellite imagery can be used to evaluate crop varieties and other land cover types to estimate potential exposures.

Environmental exposure to health hazards may impact some demographic subgroups more than others, exacerbating health disparities within the population. However, such disparities may

be masked if analysis is not performed across population subgroups at local levels. Wilson et al. (2015) used GIS to analyse the burden of cancer risk on populations of colour and low-income communities in relation to air toxins. By mapping cancer cases and overlaying demographic data for specific locations, they found that sociodemographic factors were strongly associated with cancer risk. Maps revealed that non-white and urban communities were most impacted by cancer risk disparities (Wilson 2015).

Geography itself can also be a barrier to equal access to care. Many studies have analysed travel distance and travel time to primary care, hospitals and specialist facilities. A study in New South Wales found that despite common recommendations for radiotherapy in cancer treatment, the actual rates of treatment are sub-optimal. Driving distance to a radiotherapy department was a major predictor of access to this type of care. In fact patients were 10 percent less likely to receive radiotherapy for each additional 100 kilometres' distance from the nearest radiotherapy department (Gabriel 2015).

Spatial Data Analysis

In a first step to formulating hypotheses about the impacts of location on

health, researchers typically start with mapping traditional statistics. Sample statistics include incidence, prevalence and mortality rates. But when researchers map spatial statistics that evaluate the existence and significance of geographic or space-time cancer clusters, even greater value is produced. According to the Centers for Disease Control and Prevention (CDC), "a cancer cluster is defined as a greater-than-expected number of cancer cases that occur within a group of people in a geographic area over a period of time" (CDC 2013). Cancer cluster analysis led to the 1960s discovery that asbestos exposure in shipbuilding during World War II caused many cases of mesothelioma, a rare cancer of the lining of the chest and abdomen (CDC 2013).

Geography can also be part of multi-level, hierarchical statistical models. These models allow the analysis of individual risk predictors and neighbourhood predictors. Researchers can thus understand a more 'real-world' scenario in which genetic predisposition, behaviours and environmental concerns are addressed. Gomez et al., in a recent review article, recommended that researchers "consider the life-course implications of cancer incidence and survival, integrate secondary and self-report data, consider work neighbourhood environments, and

further develop analytical and statistical approaches appropriate to the geospatial and multilevel nature of the data” (Gomez 2015).

Communicating with GIS

Beyond researchers applying geography to cancer studies, there is a greater need for health professionals to effectively communicate complex ideas, statistics, and models to policymakers, clinicians, patients and the public. Maps in particular are an engaging data visualisation tool for this purpose. With today’s technology, data-driven maps are interactive and allow self-navigated exploration.

The U.S. National Cancer Institute provides a prime example of this with their prostate cancer story map (gis.cancer.gov/mapstory/prostate). The story map shows incidence and mortality rates at state and county levels. Embedded infographics allow comparisons to national rates. Maps like these help explain where and why decisions are made to target cancer control efforts in specific places. Imagine adding consumer-relevant information to these maps, such as screening locations, educational programmes and support groups. Empowering the public with actionable information has the potential to increase participation and improve outcomes.

Future Directions

Cancer is a frightening diagnosis for anyone. Health professionals all want to use the best tools available to decrease the cancer burden in our societies. One

bold example of community advocacy comes from the U.S. Colorectal Cancer Roundtable (NCCRT). The organisation aims to reduce colorectal cancer incidence and mortality by screening 80 percent of the population by 2018 (NCCRT 2015). To accomplish this goal, geographic knowledge will be critical for developing partnerships, planning screening and outreach activities tailored to specific populations and ensuring access to colonoscopies.

New methods are also making the distinction between GIS and spatial quite clear. Imanieh et al. provide an example in the paper, “Spatial modeling of colonic lesions with geographic information systems” (Imanieh 2014). Researchers aimed to study the spatial patterns of pathologic colon lesions in the Iranian population, by actually mapping the polyps on a Cartesian model of the colon. Their work indicated that left-sided lesions are still more common in the Iranian population, but enough right-sided lesions exist to warrant total colonoscopy. No doubt GIS can be used to similarly map other cancers spatially in the body.

Perhaps the most important future directions for the application of geography in cancer control revolve around the methodologic issues that span health research in general. These include the need to balance patient privacy with the value of performing small-area analysis; approaches to address uncertainty; and data standards/guidelines for spatial and spatio-temporal modeling. These kinds of advances, as well as making geospatial data portals more widespread in cancer work, provide decision makers with better information and tools.

Conclusion

Place matters. This has been known since the time of Hippocrates in 400 BCE. Modern GIS technology can assist in cancer control efforts—from basic to advanced statistical analysis, determinations of environmental insults on health, and opportunities to develop strategic interventions. Future work should focus on standardising analytic methods and improving access to geographic information. ■

Key Points

- ✓ The relationship between geography and health has been known since 400 BCE.
- ✓ Applying location is critical to cancer control efforts, including exposure modeling, data analysis and visualisation, and targeted interventions
- ✓ Intelligent mapping technology has evolved so anyone can leverage the power of geography at any time and on any device



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CANCER SERVICES

MATCHING SUPPLY WITH DEMAND



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Redesigning cancer services in the acute setting is the only way to cope with growing demand. A transformation of cancer services in the UK needs to be brought about as a matter of urgency if there is to be any hope of matching current, not to mention future, demand with supply. Incidence of cancer is rising by two to three percent per annum and in some tumour sites the figure is higher. By 2030, there could be four million people living with and beyond cancer across the country (Macmillan Cancer Support 2013). How will the National Health Service (NHS) cope?

There is no shortage of evidence pointing to the need for a change in the delivery of services to meet this growing need. While rates of survival from some cancers, such as breast and prostate, are improving, there is little sign of progress for others, such as lung and pancreas, where symptoms tend to be picked up later.

This picture is confirmed by recent research by the London School of Hygiene and Tropical Medicine, which found that cancer survival rates in England alone are a decade behind other countries with similar healthcare systems (Walters et al. 2015). The study showed that, overall, the proportion of patients living for five years after diagnosis was 5 per cent to 12 per cent lower in England than it was in Australia, Canada, Norway and Sweden, when the same time periods were compared.

With these figures in mind, the report published in July by the Independent Cancer Taskforce — *Achieving world-class cancer outcomes: a strategy for England* (2015), was timely. The taskforce's six strategic priorities are all important, but the first two — to spearhead a radical upgrade in prevention and public health, and to drive a national ambition to achieve earlier diagnosis — may prove to be the most challenging.

In recent years there has been no let

up in attempts to drive home public health messages in key areas such as smoking, drinking and diet, as well as to raise awareness through the "Be clear on Cancer" campaigns, such as "blood in pee" and "been coughing for three weeks? Tell your doctor". However, the jury is still out on how effective these have been. Feedback to date suggests that the campaigns have led to more visits from the worried and increased referrals, but not necessarily better detection rates.

Despite some success in reducing smoking prevalence, other key lifestyle changes are not evident: obesity is an increasing problem, men are still poorer at visiting the general practitioner (GP) and seek diagnosis later than women, and

cancer outcomes, but the acute sector can only stretch its financial and staff assets so far. The answer, not least because funding is so tight, has to be to rethink delivery of services; this is not about adding something on but of doing things in a different way. There is a need to seek capacity, where it is needed and close to where patients live, through buddying and partnering other organisations and creating a new flexibility in the system.

Working in partnerships and networking will improve resilience by creating a way to fill in the gaps that occur, for example when a consultant in rare cancers is on leave. At present, as the survival of some service providers comes under threat, territorial issues and competition can get

“SERVICES MUST UNDERGO A MAJOR TRANSFORMATION TO COPE WITH DEMAND AND TO ENSURE AN IMPROVEMENT IN OUTCOMES”

there are important cultural issues which need to be addressed. How key damaging behaviour is modified remains a major challenge from the provider perspective. What is clear, however, is that everyone, including the acute sector, has a role to play in this by making every patient contact count.

Capacity Shortages

How earlier diagnosis is achieved when there is a manpower and skills shortage is another major conundrum. The aim of offering two weeks for an outpatient appointment and four weeks for diagnosis, as detailed in the Cancer Taskforce recommendations, is laudable and would have a positive impact on

in the way of creating effective partnerships. While this may be understandable, these barriers need to be overcome in the interest of matching supply with demand.

The private sector may be in a position to provide some extra capacity, but its involvement can carry the risk of creating undesirable delays and fragmentation of service delivery unless its providers are committed to delivering the whole cancer pathway. The holy grail for cancer services is to create a slick pathway, which offers the quickest possible diagnosis and treatment. This requires total confidence in areas such as testing arrangements, whoever provides them, to avoid hold-ups caused by the need for re-testing.

Limited Skills Pool

Another potential problem that needs to be recognised is the risk that the NHS and the private sector will end up fishing from the same skills pool, which is at present too small. The NHS spend on cancer is estimated to be 6.7 billion pounds and there is a commitment to double this, with the major investment being made in staff. This is a recognition that it is not lack of equipment, but a shortage of staff with the diagnostic skills to use the equipment, which is creating a problem. We are experiencing a serious lack of radiologists nationally. Without more staff, the ideal of using existing equipment 24 hours a day to improve efficiency and outcomes remains a pipe dream.

Meanwhile, talk of out-of-hours working and weekend working — the seven-day NHS — has to take into account the cost to staff, which currently would be enormous. This level of service provision is simply not sustainable without increasing staff numbers — the unacceptable alternative is to wear staff out. There is already plenty of evidence elsewhere in the NHS to suggest that this is already a problem, with workload of GPs, for example, driving an exodus from the service. It should also be remembered that, currently, in terms of routine diagnosis, the NHS works on a five-day basis.

In the longer term, training more health professionals in the field will help meet the demand for cancer services, but there is still a need to look at opportunities for different professionals doing different jobs, such as clinical nurse specialists carrying out endoscopies and cystoscopies, or Advanced

Pharmacy Practitioners following up patients instead of doctors, or generalists learning specialist cancer skills. Engaging clinicians in new ways of working will be an important job for managers.

New Approach Needed

The development of new drugs and advancements in techniques will play a part in easing the strain on cancer services. One example is hypo-fractionation in radiotherapy which, although it

it in this setting, is another transformation that needs to take place, whilst cancer admissions triage teams staffed by nurses, trained to provide reassurance to patients about normal reactions to treatment and other worries, is a way of keeping patients out of hospital. These and other innovations which support patients are going to be needed to reduce the demand on limited hospital facilities.

Cancer is currently the biggest cause of death from illness or disease in every

"THE HOLY GRAIL FOR CANCER SERVICES IS TO CREATE A SLICK PATHWAY, WHICH OFFERS THE QUICKEST POSSIBLE DIAGNOSIS AND TREATMENT"

increases the length of each patient's visit, reduces the number of visits, so freeing capacity to treat more people. In the past, patients with breast cancer, for example, may have needed 25 treatments, but hypo-fractionation has reduced this to 15.

Robotic surgery may also bring huge benefits by reducing the length of stay in hospital, and in many cases reducing demand for radiotherapy follow-up treatment after surgery. A national tariff to support this growing treatment should be in place by next year. Meanwhile, commissioning and financial arrangements will clearly need to support the use of new technology if its potential is to be fully realised.

Pushing forward community-based chemotherapy, when it is safe to do

age group, with 160,000 people still dying from the disease each year (Cancer Research UK). As people continue to live longer, the problem of increasing incidence is not going to go away. Services must undergo a major transformation to cope with demand and to ensure an improvement in outcomes. ■



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COMPUTED TOMOGRAPHY WITH COMPUTER-AIDED DETECTION FOR LUNG CANCER SCREENING

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Several medical societies recommend annual lung cancer screening with low-dose computed tomography (LDCT) for certain individuals at high risk. However, the value of adding computer-aided detection to improve LDCT screening accuracy remains unclear.

Executive Summary: ECRI Perspectives

- In June 2011, the U.S. National Cancer Institute's (NCI's) National Lung Screening Trial (n = 53,454 current or former heavy smokers aged 55 to 74) reported these findings regarding screening with low-dose helical computed tomography (LDCT) compared with chest x-ray: individuals screened with LDCT had a 15% to 20% lower risk of dying from lung cancer than individuals screened using standard chest x-ray (National Lung Screening Trial Research Team 2011). This means that about 3 fewer deaths per 1,000 people screened occurred in the LDCT group than in the chest x-ray group over a period of about 7 years of observation (17.6 per 1,000 vs. 20.7 per 1,000, respectively).

- Study authors also reported that after 3 rounds of screening, on average, 24.2% of LDCT screens and 6.9% of chest x-rays were positive. These positive results usually led to additional testing.
- The authors also reported that certain types of lung cancer were detected more often at the earliest stage by LDCT (adenocarcinomas and squamous cell carcinomas) than by chest x-ray. However, small-cell lung cancers, which are very aggressive, were not often detected at early stages by either method.
- To improve LDCT screening accuracy, some developers have proposed using a class of pattern-recognition software called computer-aided detection (CADe) to analyse radiologic images. The software is intended to identify patterns suggestive of disease and highlight them for radiologist review. Use of the technology requires additional staff time for interpretation and modestly increased data processing and storage capacity.
- Adding CADe capability to a computed tomography (CT) system could cost up to \$65,000 (€57,250) per license (ie, for each radiologist user), but additional reimbursement for its use is not available, even though CADe has been available since 2006. Two studies report that CADe adds up to 80 seconds for LDCT image review (Matsumoto et al. 2013; Bogoni et al. 2012); additional data storage requirements for CADe use are considered to be small to negligible.
- Although several clinical guidelines recommend LDCT screening in the population defined in the NCI trial, they are silent on the role of CADe to improve LDCT screening

accuracy (Detterbeck et al. 2013; Jaklitsch et al. 2012; Wender et al. 2013; American Lung Association Lung Cancer Screening Committee 2015; National Comprehensive Cancer Network (NCCN) 2015a; 2015b; Moyer VA; U.S. Preventive Services Task Force 2014)

- A primary safety concern about using CADe for LDCT screening is the risk of increasing the rate of false-positive results. False positives often lead to additional testing and potential harm from unnecessary treatment from overdiagnosis of lung lesions unlikely to cause clinical symptoms.
- Clinical trials are needed to determine whether CADe has an appropriate role for improving accuracy of LDCT for lung cancer screening. We identified one relevant ongoing study in China (Shanghai Changzheng Hospital), that may provide data in 2017 to further elucidate the role of CADe in LDCT screening.

Ratings and Rationales of Potential Impact

Note: The following ratings and comments reflect the opinions and consensus of an expert panel convened by ECRI Institute to review information on this topic.

Anticipated Utilisation: 1 (Expected to be used by 0% to 20% of eligible patients)

Clinical guidelines recommend low-dose computed tomography (LDCT) to screen high-risk patients for lung cancer; however, they are silent on enhancing LDCT with computer-aided detection (CADe) systems (Detterbeck et al. 2013; Jaklitsch et al. 2012; Wender et al. 2013; American Lung Association Lung Cancer Screening Committee 2015; National Comprehensive Cancer Network (NCCN) 2015a; 2015b; Moyer VA; U.S. Preventive Services Task



Force 2014). Some manufacturers report that the slow initial adoption is unlikely to change without extra reimbursement or new clinical data showing that CAde improves outcomes or cost-effectiveness of LDCT. Over time, more radiologists might adopt software that automatically tracks changes to radiologist-identified lung nodules to facilitate lung cancer screening. However, that assumption would depend on ultimate patient demand for LDCT screening.

Estimated Adoption Status: 3 (Early adoption occurring – 0% to 25% of facilities that would be expected to adopt have adopted)

Before July 2012, the U.S. Food and Drug Administration (FDA) required companies to submit marketing applications for CAde software products under its premarket approval (PMA) application process. FDA granted Siemens AD (Munich, Germany) a PMA for its syngo LungCAD product in October 2006 (United States Food and Drug Administration 2006). Since the change, FDA has not granted 510(k) marketing clearance to any software products that fully meet its definition of CAde: automatically identifying suspect lung nodules for radiologist review (ie, second reader mode).

Potential Health Impact: 2 (Expected to make a small improvement to patients' health and/or quality of life)

Few data are available to evaluate the potential effect of adding CAde to LDCT in lung cancer screening programmes. Several professional societies recommend LDCT lung cancer screening for certain



ECRI Institute, a nonprofit organisation, dedicates itself to bringing the discipline of applied scientific research in healthcare to uncover the best approaches to improving patient care. As pioneers in this science for nearly 45 years, ECRI Institute marries experience and independence with the objectivity of evidence-based research.

ECRI's focus is medical device technology, healthcare risk and quality management, and health technology assessment. It provides information services and technical assistance to more than 5,000 hospitals, healthcare organisations, ministries of health, government and planning agencies, voluntary sector organisations and accrediting agencies worldwide. Its databases (over 30), publications, information services and technical assistance services set the standard for the healthcare community.

More than 5,000 healthcare organisations worldwide rely on ECRI Institute's expertise in patient safety improvement, risk and quality management, healthcare processes, devices, procedures and drug technology. ECRI Institute is one of only a handful of organisations designated as both a Collaborating Centre of the World Health Organization and an evidence-based practice centre by the US Agency for healthcare research and quality in Europe. For more information, visit www.ecri.org.uk

older smokers and former smokers at highest risk of developing lung cancer. However, these guidelines generally do not address the addition of CAde to LDCT.

Potential Financial Impact: 2 (Expected to have a small financial impact)

Implementing CAde capability to a computed tomography (CT) system could cost up to \$65,000 (€57,250) (PricePaid 2014), which is small relative to the overall cost of a CT system. Adding CAde to LDCT exams would likely lead to only a modest increase in data storage requirement. Additional reimbursement for adding CAde to LDCT exams is unlikely from third-party payers.

Potential Process and Infrastructure Impact: 2 (Expected to have a small process impact)

Adding CAde to LDCT exams is unlikely to cause major changes to existing lung cancer screening programmes. Implementing CAde for LDCT could incrementally increase radiologist workload by lengthening reading time per case. Increased data handling and storage requirements would likely be small. However, the potential downstream impact could be considerably greater if widespread use of CAde for LDCT lung cancer screening increases the number of false-positive findings, resulting in unnecessary additional testing and lung biopsies.

Note

The full article including overview, references and trial information is available through ECRI's Health Technology Assessment Information Service (HTAIS). ■

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WOMEN'S IMAGING

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As the debate continues over optimal mammographic screening ages and intervals, technology is moving apace. Tomosynthesis is being rapidly adopted by healthcare providers, who either upgrade existing 2D units or purchase new 3D units. The market is also becoming more consumer-driven due to increased patient awareness of breast density and breast cancer risk factors and breast density legislation in many states. "Patients are knowledgeable about women's imaging and are seeking out healthcare organisations that use top-performing equipment for their procedures", says report author Monique Rasband. "Patient satisfaction is driving industry innovation and leading organisations to proactively inform the public now about their updated imaging technology."

Are these new women's imaging technologies living up to their promise? KLAS Research spoke to healthcare providers, and their new report is *Women's Imaging: Are the New Technologies Delivering Promised Benefits?*

3D Tomosynthesis

Hologic, as the first to the U.S. Market, is the dominant vendor. Hologic is well regarded for innovative technology, high image quality and its C-view dose-reduction technology. Siemens and GE are beginning to compete after GE's

offering was approved in August 2014 and Siemens in April 2015. Siemens sites report smooth implementation and high image quality. GE sites have reported integration issues that delay implementation.

Ultrasound

Toshiba received the highest overall satisfaction score due to their development of new technology, engaged support and adequate image quality and workflow with the breast application. Philips is highly regarded for breast ultrasound image quality in the EPIQ and iU22 systems, and providers report that the workflow is improving. Siemens' image quality meets most providers' needs, and another strength of Siemens is its diverse applications overall. GE Healthcare's LOGIQ series delivers consistent image quality.

Automated Breast Ultrasound

GE's Invenia ABUS system is highly regarded, scoring 8.1 for image quality and workflow. However, healthcare providers cannot easily justify purchase of an ABUS system, when general ultrasound is so competitive. Siemens' customers are interested in its system that can combine general and automated breast ultrasound into one unit.

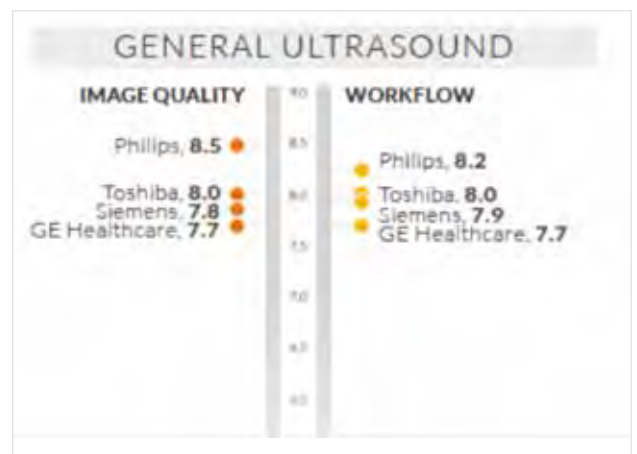
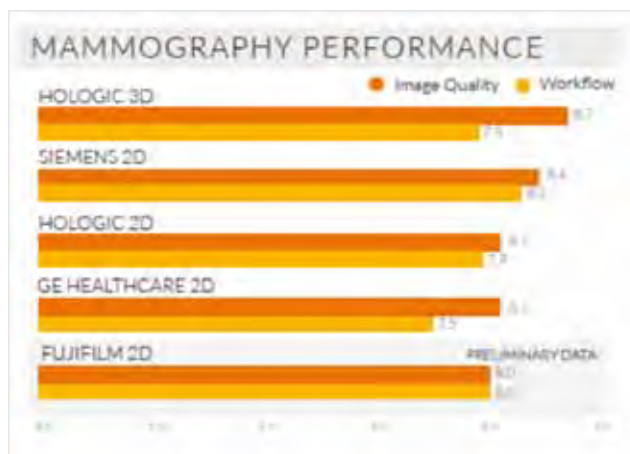
The full report by Monique Rasband, *Women's Imaging: Are the New Tech-*



nologies Delivering Promised Benefits? is available from KLAS Research, klasresearch.com

About KLAS Research

KLAS is a research and insights firm on a global mission to improve healthcare delivery by amplifying the provider's voice. Working with thousands of healthcare professionals and clinicians, KLAS gathers data and insights on software, services and medical equipment to deliver timely reports, trends and statistical overviews. The research directly represents the provider voice and acts as a catalyst for improving vendor performance. ■



NEW BREAST CANCER DETECTION MODALITIES

IMPLEMENTATION IN A BUSY BREAST UNIT



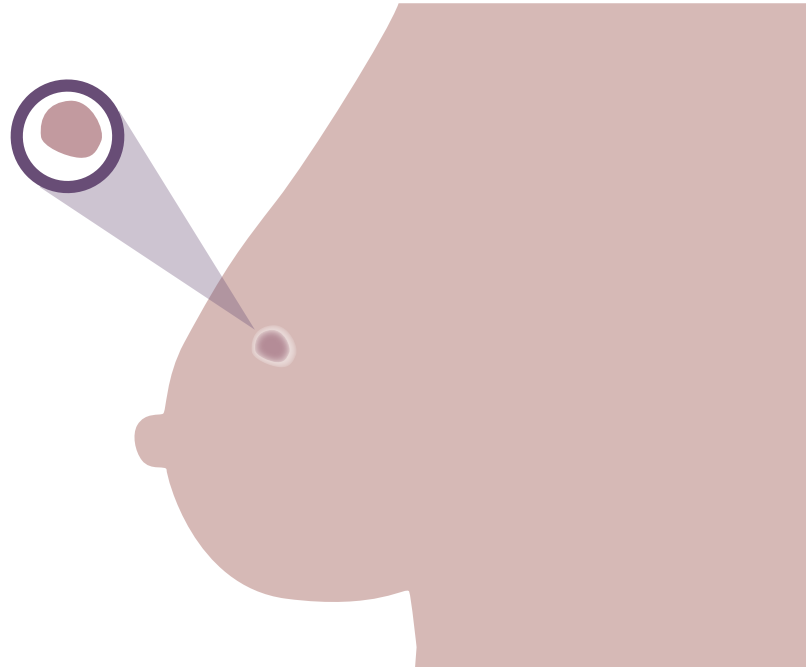
Whilst mammography remains the most consistent modality for breast cancer detection, it is neither foolproof nor perfect. Additional modalities are required to supplement mammography in order to further increase accurate detection of breast abnormalities. Targeted breast ultrasound and MRI are modalities that are used currently as an adjunct to mammography, and again these are not without limitations.

Some breast cancers can be clinically abnormal, and yet be mammographically occult. In these cases adjunct modalities can be utilised. Current practice within UK breast units is for symptomatic referrals to be triple assessed, ie clinically examined, with any imaging and biopsy performed all in one visit (known as a 1-Stop Clinic). This can lead to a pressured environment for both patient and clinician alike.

Three years ago, Kettering Breast Unit, at Kettering General Hospital, acquired three digital breast x-ray units that include digital breast tomosynthesis (DBT) and contrast-enhanced spectral mammography (CESM) capability, thereby introducing two further adjunct modalities into breast imaging assessment.

DBT produces images that are in essence 'slices' of the breast obtained at different angles producing a 3D image of the breast. This enables the radiologist to differentiate abnormalities from the composite effect of overlapping normal structures within the breast; this is especially beneficial for women who have dense breasts. CESM works in conjunction with normal mammography, and the use of iodinated contrast media. Much the same as we are all familiar with use of contrast in CT scanning, CESM uses the same principles to produce a subtracted image that shows areas of increased contrast uptake, which can highlight areas of increased angiogenesis that otherwise may not be seen.

Radiographers and breast radiologists at KGH have been trained in using



both of these new modalities, and these services were introduced with strict local protocols and guidelines. All radiographers review the symptomatic referrals to assess eligibility for these new modalities, and will present them to the supervising radiologist prior to any examination being performed. This practice reduces patients being exposed to unnecessary radiation from multiple examinations.

DBT is used for abnormalities clinically assessed as P3, when mammography is unremarkable, or in women with a dense background pattern. It is also used for P1-P2 findings where the mammography has demonstrated an abnormality. CESM is used as a first line imaging tool where there are clinically suspicious P4-P5 findings, provided that the patient has no contraindications to the use of contrast media. Extent of disease and additional non-palpable foci are easy to interpret with the use of CESM, and as a result of this specificity, targeted ultrasound and biopsy is much improved within the parameters of a one-stop service.

The addition of these new modalities has proved to be invaluable to our breast service. Currently they are only available for symptomatic patients through the general practitioner (GP) referral pathway. The use of DBT in National Health Service Breast Screening Programme women is currently undergoing the national approval process, but approval is expected in the near future.

Due to the incorporation of robust protocols and guidelines combined with cohesive team-working strategies, there is no evidence to suggest that incorporating these new modalities has caused any delays to the symptomatic one-stop service. Preoperative diagnostic output is improved, with patient delays for examinations reduced.

The lack of appropriate coding and insufficient reimbursement for the use of these new and innovative breast cancer detecting modalities is an issue that needs to be addressed at both local and national level as these modalities are utilised more widely. ■



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SHEAR WAVE ELASTOGRAPHY IN BREAST IMAGING

PROVIDING BENEFIT TO CLINICIANS AND PATIENTS



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Shear wave elastography (SWE) has become widely accepted in clinical practice at breast centres around the world. Studies have demonstrated that SWE has reduced the number of unnecessary biopsies, helped prevent false negative diagnoses, and improved overall diagnostic confidence and patient management (Berg et al. 2012; Evans et al. 2012).

With data from over 60 peer-reviewed publications, shear wave technology has proven benefits. In clinical practice, the benefits continue to be seen every day, impacting clinician and patient alike.

Technology

Shear wave elastography is a technological advancement that provides additional, important quantitative information about tissue elasticity to ultrasound imaging. Unlike conventional elastography methods, which rely on manual compression and measure tissue displacement, SWE requires no manual compression. Shear wave propagation speed is calculated and a colour-coded, real-time SWE map is produced showing quantitative (in kilopascals or m/s), local tissue stiffness.

Clinical Benefits

Tissue stiffness or hardness of a mass provides important information to the clinician. When the stiffness of the lesion and its surrounding tissue are quantified, a physician can use that information for more accurate diagnosis and planning. The information plays a critical role, as it offers meaningful information about the Breast Imaging-Reporting and Data System (BI-RADS®) classification, location and morphology of a specific lesion.

In our breast centre, SWE is used routinely on every suspected lesion. The technology is of particular benefit for classification of difficult category 3

and 4 lesions on the BI-RADS scale. The technology allows us to confidently downgrade a suspicious lesion from one of highly suspicious and requiring biopsy to one of low suspicion and thus not requiring biopsy, ultimately reducing the number of unnecessary biopsies. The same can be said of the decision to upgrade and biopsy. SWE increases overall diagnostic confidence.

This case further validates research I conducted in which real-time SWE added to second-look ultrasound after MR imaging increased the detection rate of cancers and helped target cancers for ultrasound-guided biopsy (Plecha et al. 2014).

The image quality that SWE produces is a major clinical benefit. Both MRI and tomosynthesis are noted for their image

“IMAGE QUALITY IS A MAJOR CLINICAL BENEFIT”

This experience is not unique; a prospective multicentre study of 958 women confirmed that adding SWE improved specificity of ultrasound mass assessment without loss of sensitivity (Berg et al. 2012).

Another important benefit of SWE is its role in biopsy guidance in real time. In a recent case at our centre (see Figure 1), a patient had an area of subtle distortion that was detected using digital breast tomosynthesis. It was confirmed, located and documented on shear wave elastography. When the patient came back for biopsy, b-mode alone failed to visualise and detect the lesion. With the addition of SWE, we were able to clearly identify the lesion, correlating it with tomosynthesis. During this procedure, real-time SWE identified the stiffest portion of the lesion for targeting and guidance. The result was the discovery of a small invasive cancer, which might have been missed using conventional b-mode ultrasound.

Without SWE, a tomo-guided needle biopsy, a stereotactic biopsy or even surgical biopsy may have been required.

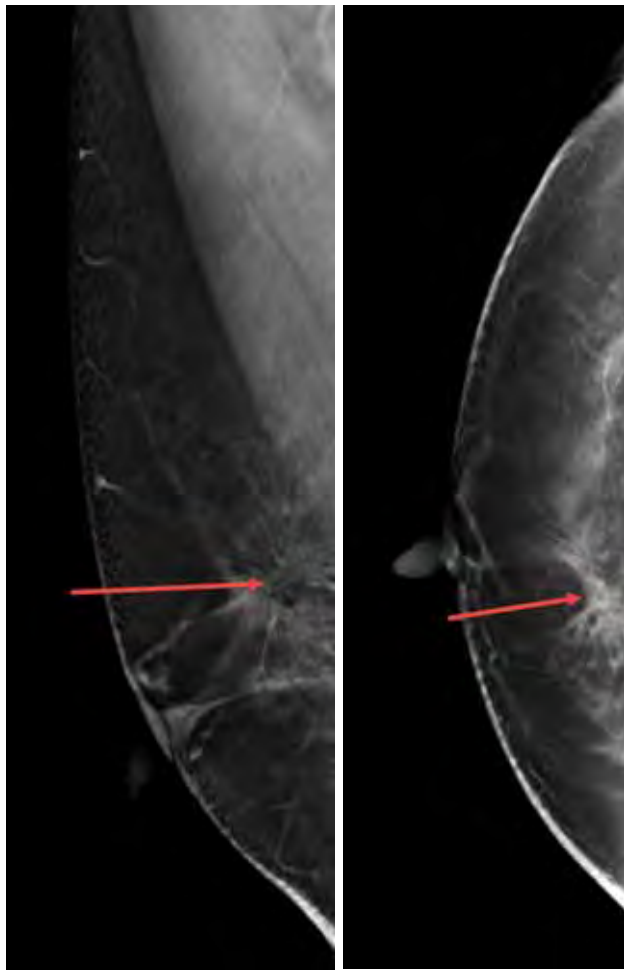
quality, but the addition of SWE provides unparalleled clarity and definition of borders. This allows for the improvement in locating lesions, classifying lesions and targeting lesions during biopsy.

Improved Patient Management and Workflow

The clinical benefits previously discussed have an impact on the overall breast centre function, from both a patient and workflow perspective.

The ability to classify lesions more confidently, avoid false positive as well as false negative diagnoses, and improve locating and targeting during biopsy have a profound impact on the patient and breast centre.

With SWE, we are able to quickly identify those patients requiring or not requiring biopsy. For the patient not requiring a biopsy, anxiety is immediately reduced. In addition, these patients are able to avoid lost time and cost burdens. For the patient who does require a biopsy, the ability to quickly classify the need for biopsy, as well as efficiently and accurately conduct the biopsy, helps alleviate



a. 1mm tomosynthesis slice images (RCC and RMLO)



b. Subtle cancer using b-mode scanning



c. Subtle cancer using b-mode scanning



d. Subtle right breast cancer identified using shear wave elastography

Figure 1. Case Study

This is a case of a subtle cancer seen on tomosynthesis images in the right breast. The cancer is seen as distortion on the tomosynthesis images. Scanning in real time with shear wave elastography helped to find the cancer, which was not seen on initial b-mode scanning.

the stress associated with the procedure. As a result, the overall patient experience is improved.

The breast centre as a whole benefits as well. Clinician and technologist time is allocated appropriately, and this helps the centre run more efficiently.

Conclusion

The information that shear wave elastography provides helps to improve diagnostic confidence. Improved diagnostic confidence has a profound impact across the continuum of care, limiting unnecessary care, directing resources to the

patients who need it, avoiding unnecessary burdening of the patient, time lost to follow-ups, and needless costs.

SWE continues to be more broadly adopted into the daily workflow, and as confidence grows, the use of SWE will certainly expand. ■



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STRUCTURED REPORTING IN CANCER IMAGING

REACHING THE QUALITY DIMENSION IN COMMUNICATION



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Medical imaging is uniquely positioned to play a pivotal role at many points in the cancer patient journey, from early detection as part of screening through to survivorship and/or end of life care. Reliance on imaging to contribute to decision-making is substantive; a review of Cancer Care Ontario's Lung Diagnostic Pathway revealed 22 touch points where a patient may have imaging as part of their diagnostic work-up (Cancer Care Ontario 2012a).

The value of radiology depends not only on the image produced, but also on the contribution to patient management decisions and clinical outcomes. To improve outcomes and to enhance patient care, we need to ensure that the end product of an imaging examination — the report — provides the information needed for optimum patient management. Although medicine is constantly evolving, radiological reporting has remained virtually unchanged. The format and quality of radiological reporting needs to evolve. Pathology reporting and surgical reporting are already undergoing changes (Cancer Care Ontario 2012b; Canadian Partnership Against Cancer 2012; Simpson et al, 2015). The time has come for quality improvement of radiology reporting related to cancer patients.

Radiology Report

Over the last 120 years report generation by radiologists has evolved from handwritten, to transcribed, to voice recognition formats, with little change in content and structure. The earliest known x-ray report (Reiner and Knight 2004) could easily be mistaken for a report created in 2015.

The radiology report is the primary communication tool between the radiologist and the referring physician, other radiologists who may reference the report during follow-up exams, and — increasingly — the patient. To

facilitate clinical decision-making, the report must contain accurate information and address any specific clinical questions in language that is clear and understandable (American College of Radiology (ACR) 2014a). For efficiency and clarity, this information needs to be easily extracted from the report.

Current reporting standards for cancer or other indications are narrative; reports are created, stored and viewed as free text. Details are hidden within the report and can only be found by reading the report in its entirety. There is considerable variability in how radiologists report the same types of examinations (Goergen 2011). This makes extraction of key clinical information difficult and time-consuming, and may lead to miscommunication of information and suboptimal patient care. Deficiencies in radiology reports have been identified and attributed to lack of organisation, clarity, succinctness and completeness (Johnson et al. 2004). Information that is necessary for decision-making can be missing (Naik et al 2001). To help alleviate some of the issues of miscommunication and/or completeness, referring physicians have indicated a preference for structured reports (Naik et al. 2001; Schwartz et al. 2011).

If the radiology report is lacking information or lacks clarity, the test cannot fulfil the functions outlined in the definition of appropriateness. The examination may be appropriately ordered, but if the needed information from the examination is not extracted and not reported than the expected impact on patient outcomes cannot be achieved.

In attempts to improve quality, various organisations have produced guidelines that outline the essential components of a report (Hall 2000; Stolberg 2002; Ridley 2002; ACR 2014a; Goergen 2011; Kahn et al. 2009). Based on these guidelines, a list of report content elements common to all radiologists' reports has been compiled and grouped into four categories:

1. Demographics;
2. Relevant clinical information;
3. Body of the report;
4. Impression (conclusion or diagnosis).

Although these guidelines define the high-level content areas of a quality-radiology report, there is limited or a complete lack of direction regarding how to most effectively convey this information to the referring physician.

Stakeholders

If we map what happens to a cancer imaging report we see that the contents are needed by more than just the referring physician. Stakeholders include patients and family members, family doctors, oncologists, the healthcare team, pathologists, radiologists, multi-disciplinary tumour boards, collaborative staging, etc. As an example, a CT lung cancer staging report may be used by up to 16 stakeholders (see Figure 1), creating 16 opportunities for information to be erroneously interpreted. Each stakeholder may also have specific needs regarding the content.

Radiology Communication Matrix

The clinical expectations and the information provided or not provided in the radiology report can be presented in a communication matrix (see Table 1). One dimension is the clinical expectation — what information stakeholders do or do not need. The second dimension is the information provided or not provided in the radiology report.

Ideally the radiology report would provide all the information needed by the stakeholder. Information provided in the report but not needed is relative and can vary between stakeholders.

The radiology report is expected to provide the information that will impact on the clinical management decision at every point of the cancer journey in which imaging is required. However, recent literature demonstrates that this is not occurring a substantial portion of

the time. Marcal et al. (2015) assessed the content of radiology reports for pancreatic cancer and noted many instances where the required information was not provided (see Table 2).

Similar observations have also been made by Sahni et al. (2015) for rectal cancer (see Table 3).

Structured Reporting

To decrease variability and improve quality of radiology reports, structured reporting is advocated (Schwartz et al 2011). The terms **structured** and **standardised** reporting have been used interchangeably in the literature and are a source of confusion. Even more confusing is the use of the following additional terms: standardised structured reporting, standardised electronic reporting, synoptic, proforma, itemised reporting, checklist reporting and template reporting.

Structured reporting uses elements arranged in a pattern of organisation, headers, that form the foundation of the report (Weiss et al 2008). These can be elementary to use — only subject headers — or be more advanced to include subsections, ie organs and measurements. To the structured reports can be added **standardised elements** – components of the report that can be expected to be reported in the same way across radiologists.

Synoptic reports are structured reports in which the various structured and standardised elements are found in discrete minable fields. At Cancer Care Ontario, synoptic reporting pertaining to pathology is described as reporting that uses an “...electronic report in discrete data field format (ie each type of information has a specific place and format in the report) that allows for the standardised collection, transmission, storage, retrieval and sharing of data between clinical information systems” (Cancer Care Ontario 2012b).

In the absence of consensus-based definitions for levels of structured reporting in radiology, we propose the following as working definitions (see Table 4). Having a spectrum from Level 1 to Level 6 with clearly distinguishing characteristics (describing content structure and content governance) is helpful in understanding the current status of reporting and in planning for the future.

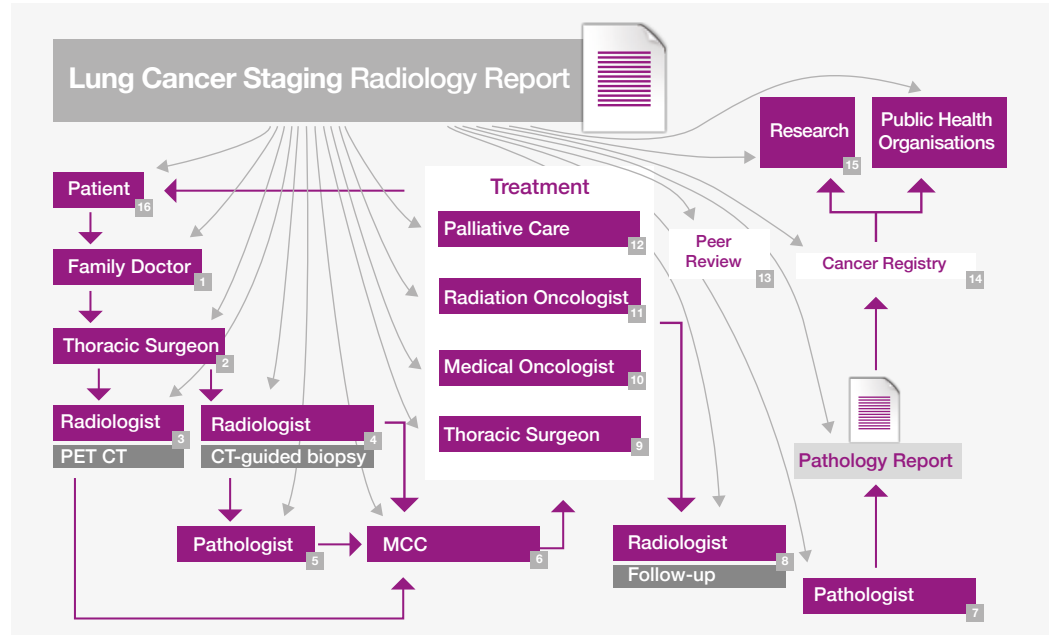


Figure 1. Stakeholders Requiring the Lung Cancer Staging Radiology Report

Table 1. Radiology Communication Matrix

	Radiology Report	
Clinical Expectation	Info provided	Info not provided
Info needed		
Info not needed		

Table 2. Radiology Reports for Pancreatic Cancer (Marcal et al. 2015)

Info needed	Info provided	Info not provided
Location of primary tumour	93.9	6.1
Size of primary tumour	69.8	30.2
Nature of local spread of primary tumor beyond pancreas	44.4	55.6

Similar observations have also been made by Sahni et al. (2015) for rectal cancer (see Table 3).

Table 3. Radiology Reports for Rectal Cancer (Sahni et al. 2015)

Info needed	Info provided	Info not provided
Rectal localisation	76.9	20.1
Tumour length	63.5	37.5
Extramural venous invasion	7.7	92.3

The implementation of voice recognition software has allowed for the development and use of structured elements or templates. These templates allow for consistent format. At this time there are limitations with these systems with respect to moving from ‘structured’ to ‘synoptic’. However, enhanced

data usage to benefit patient care (eg, real-time clinical staging or the contribution of specific imaging results in ‘personalised’ approaches to care) and interest in quality improvement activities such as peer review or correlation with synoptic pathology data is helping to move the field forward.

Table 4.

Level 1	No structure, no standardised elements
Level 2	Structure with section headers, no structured elements
Level 3	Structure with section and subsection headers, no structured elements
Level 4	Structure with section and subsection headers, structured elements
Level 5	Structure with section and subsection headers, Use of jurisdictional evidence-based expert panel derived structured elements
Level 6	Structure with section and subsection headers, Use of jurisdictional endorsed evidence-based expert panel derived structured elements and saved in discrete data elements – synoptic

Benefits and Potential of Structured Reporting

Structured reporting has benefits for various stakeholders:

Patients

- Facilitates decision-making for treatment, ensuring communication is complete and efficient.
- Important information is highlighted, facilitating direct, meaningful discussion with the referring physician in an environment where time is often limited.

Referring Physicians

- Improved communication (Al-Sukhni et al. 2013) allows for quick and accurate review of the complete radiological information needed for decision making.
- Provides a consistent format for discussion at multidisciplinary case conferences and comparisons over time (eg, treatment response assessment, monitoring progression, etc).

Radiologists

- Improves report completeness.
- Increases efficiency by decreasing the frequency of interaction with referring physicians due to “missing information” and decreasing the need for second reads.
- Easier to compare to previous reports and to follow effectiveness of treatment.

System

- Provides a foundation to facilitate system-level quality improvement oversight — eg, identification of patterns of care, outcomes, and data-driven system oversight (eg, appropriateness, system-level peer review).

- Discrete (synoptic) data fields enable tailored reporting to meet the needs of individual stakeholders; a single report can look different depending on the end user.
- Educational guidance through pre-defined standardised elements; structured reports provide a resource to radiologists to guide in the reporting of less common pathology, as well as a consistent standardised format for radiology residents to learn about and to understand the important elements of the radiology report.
- Additional benefits can be gained by linking radiology, pathology and surgical standardised (synoptic) reports. Creating a common, automated, interoperable informatics data model would allow for near real-time staging with timely decisions for patient management. Enhancing the electronic automation of staging data collection and combining radiologic and pathologic data leads to timely surveillance and

of care, practice variations, response rates, outcomes, costs, and various demographic and genetic effects.

Cancer Care Ontario Cancer Imaging Structured Report Development

In 2009 the Cancer Imaging Program (CIP) was established at Cancer Care Ontario to improve the quality of cancer imaging. The opportunity to improve quality through better reporting and communication by the use of synoptic radiology reports led to the addition of “Synoptic Radiology Reporting” as a programme priority. The initiative is leveraging the knowledge gained from the development and implementation of provincial synoptic reporting for pathology, as well as the development of a synoptic report for pre-surgical staging of rectal cancer with MRI, a collaborative initiative between Cancer Care Ontario and Canadian Cancer Society (Spiegle et al. 2009).

To provide expert, interdisciplinary guidance regarding clinical content

“THE TIME HAS COME FOR QUALITY IMPROVEMENT OF RADIOLOGY REPORTING RELATED TO CANCER PATIENTS”

planning analysis within the cancer system. Linking the data will result in improved assessment of tumour burden, tumour aggressiveness and tumour characteristics. Comparing linked fields will identify discrepancies and allow for feedback to both radiologists and pathologists. An automated, interoperable data model enables the development of radiology and radiology/pathology quality indicators, ie comparison of clinical and final pathological stages as a quality indicator (does it correlate with time interval between suspicion and treatment?; is the radiological staging appropriate?)

- More accessible data, facilitating secondary use of clinical data and data mining: increases the efficiency of central cancer registry data collection; improves population-based research, and supporting informatics assessments of quality

standards, the Synoptic Radiology Reporting Clinical Advisory Panel was established in 2013. This panel determined the need for the creation of a document that would be used by disease-site and/or modality-specific expert subcommittees to guide the creation of cancer imaging synoptic reports. Two white papers were developed on the architecture of the synoptic report (Cancer Care Ontario 2014a) and on governance (Cancer Care Ontario 2014b).

The Synoptic Radiology Reporting Clinical Advisory Panel recommends that the synoptic reports should:

1. Be created by multidisciplinary expert groups.
2. Have content informed by evidence where this evidence is available.
3. Be aligned with appropriate overall clinical practice, as identified in disease pathways where they exist (eg, Cancer Care Ontario's disease pathways).

4. Contain minimum mandatory elements needed to support clinical decision-making. Optional elements may also be recommended, but should be identified as such.
5. Be clear and usable, and consider cross-referencing of data elements where applicable (eg, previous imaging studies or pathology synoptic reports).

Radiology Structured Reporting Initiatives

Structured reports are not new to radiology. Modern radiology reporting is adopting more structured organisation and language, led by breast imaging reporting:

- **Breast imaging:** The BI-RADS® Atlas provides standardised breast imaging findings terminology, report organisation, assessment structure and a classification system for mammography, ultrasound and MRI of the breast. Breast imaging reporting quality has improved through the use of the Breast Imaging Reporting and Data Systems (BI-RADS®) reporting format and lexicon (ACR 2013a);
- **Liver imaging:** The Liver Imaging Reporting and Data System (LI-RADS) was created to standardise the reporting and data collection of CT and MR imaging for hepatocellular carcinoma (HCC) lexicon (ACR 2013b);
- **Prostate imaging:** Reporting and Data System (PI-RADS) for prostate cancer (ACR 2015);
- **Lung imaging:** The ACR Lung Imaging Reporting and Data System (Lung-RADS™) (ACR 2014b) for lung cancer screening.
- **Report templates:** Société Française de Radiologie (SFR) has published cancer reporting templates (SFR 2015). The Radiological Society of North America (RSNA) Reporting Initiative is an online library of best-practices radiology report templates including cancer-related reports (RSNA 2015).

Governance is an important consideration for quality report generation. To ensure structured radiology reports guide radiologists to provide all information required to meet the needs of all stakeholders, templates should be developed by multidisciplinary expert panels, guided by the best-available evidence. Breadth of jurisdictional

representation (eg, regional to — potentially — international) is also a consideration, depending on disease site and intended usage.

The list above provides examples of various initiatives intended to improve the quality of radiology reporting for select sites. However, fundamentally, the quality of all radiology reporting related to all cancer patients needs to improve.

Moving Forward with Cancer Imaging Structured Reporting

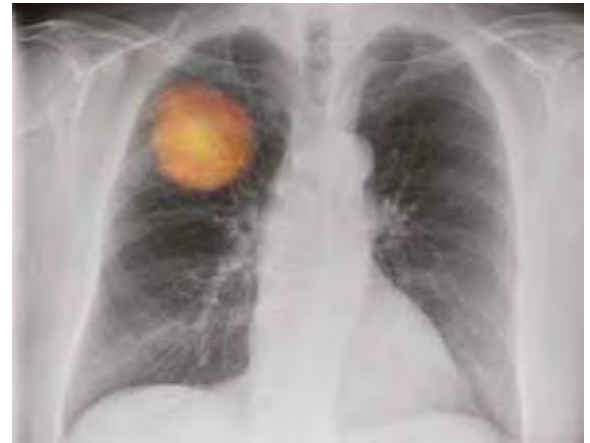
For structured reporting to gain acceptance in the broader radiology community will depend on governance, technology and mandatory use of structured reports.

Structured reporting of cancer imaging needs a home where there are clear guidelines for development of structured reports and clear mechanisms for updating of the reports as new evidence emerges. In pathology, Cancer Care Ontario's success can be attributed in part to the development and maintenance of the cancer checklists by the College of American Pathologists (Simpson et al 2015). Radiology needs to find a similar mechanism of creation and maintenance of evidence-based structured reports.

Reporting technology also needs to evolve, with seamless, effective integration of structured reporting into the radiologist workflow. This is key to ensuring success. Although many systems support templates, constructs such as conditional logic (eg, hiding options if not relevant) are not available, greatly impacting radiologist workflow. Additionally, the full benefit of synoptic reporting and data capture cannot be realised, as regardless of report 'input,' downstream systems such as the radiology information system (RIS) or hospital information system (HIS) only accept narrative-style reports.

The willingness of hospitals, health organisations, and/or government to mandate the use of structured reporting will also impact success. Sahni found that voluntary implementation of structured reporting resulted in a 80% uptake (Sahni et al. 2015). Voluntary implementation of the rectal cancer staging MRI structured report resulted in a 60 percent uptake (Sahni et al. 2015).

Cancer patients require 100 percent uptake.



Conclusion

Structured reporting is not new in medical imaging and its use to improve quality is gaining momentum. Widespread acceptance of structured reporting will not be easy with the current barriers. As more high quality evidence-based structured reports are created and disseminated, as technology evolves, and as appropriate governance structures are developed the pressures for use of structured reporting will continue to grow. Radiologists can take the lead and work with industry to design reporting systems that are more efficient and systems that integrate the reporting process with the picture archiving and communication system (PACS) and the image review process.

It is time for the radiology community, in collaboration with referring physicians, to move towards reporting that meets the needs of the 'report reader', who is making decisions regarding patient care, versus the 'report generator'. This is our opportunity to improve the quality of care and make a real difference in patient outcomes. ■

Acknowledgements

We gratefully acknowledge the helpful discussions and technical contributions of the Structured Data Team and the Pathology Electronic Reporting Committee at the College of American Pathologists (CAP). In particular, we acknowledge the contributions of Drs. Jaleh Mirza, Richard Moldwin and Samantha Spencer at the CAP. We also gratefully acknowledge the contribution of our Cancer Care Ontario team including Deanna Langer, Colleen Bedford, Priyanka Jain, David Kwan and Gemma Lee.

For full references, please email editorial@healthmanagement.org, visit www.healthmanagement.org or use the article QR code.



CARDIO-ONCOLOGY

A DEVELOPING SPECIALTY FOR COMPREHENSIVE CARDIAC CARE BEFORE, DURING AND AFTER CANCER THERAPY



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Over the past several decades there have been significant and important improvements in the care of patients diagnosed with cancer, and there are currently an estimated 14.5 million survivors of cancer in the U.S., or approximately 4.5% of the total population (DeSantis et al. 2014). One unintended consequence of this success is a growing population of patients with cancer treatment-related cardiovascular toxicity (CTCT). Survivors are at increased risk for cardiovascular complications, including heart failure, myocardial ischaemia, valvular disease, pericardial disease, hypertension, arrhythmias and thromboembolism (Yeh and Bickford 2009; Mulrooney et al. 2009), with up to 50% of disease being asymptomatic (Carver et al. 2013). The leading cause of both morbidity and mortality in survivors of many cancers is cardiovascular disease; for example, childhood and young adult cancer survivors are 5-6 times more likely than sibling controls to develop cardiovascular sequelae (Mulrooney et al. 2009).

To meet the growing needs of the population of cancer survivors with CTCT, a number of cardio-oncology (or onco-cardiology) programmes have emerged at tertiary and quaternary hospitals in the U.S. and Europe. In addition, national and international organisations have established dedicated groups to address all facets of cardio-oncology, one of the most recent being the Cardio-Oncology Member Section of the American College of Cardiology (ACC), intended as a home for health-care providers and researchers interested in cardio-oncology within one of the leading cardiology organising bodies worldwide. The overarching goal of these various programmes and organisations is to advance patient care in cardio-oncology by meeting the professional need in clinical guidance and training, advancing education, research and advocacy (Barac et al. 2015).

Comprehensive Cardiac Care Throughout Treatment

The first evidence for CTCT became apparent shortly after introduction of anthracycline chemotherapy in the late 1960s, with invasive and noninvasive evidence for cardiac injury and dysfunction clearly demonstrated in the mid-1970s (Rinehart et al. 1974; Bristow et al. 1978). Early efforts focused on management of symptomatic heart failure in survivors, but that shortly shifted to prevention. The current model for comprehensive cardio-oncology care begins with cancer and cardiovascular screening before any diagnosis is made, and continues through long-term survivorship (see Figure 1).

While primary cardiovascular prevention falls under the domain of the primary care provider, once a diagnosis of cancer is made there is a role for the cardio-oncology specialist. Risk stratification is key early on, with clear risk factors identified for CTCT from anthracyclines, although many other chemotherapeutic and novel targeted agents, as well as radiation therapy, pose risks (Carver et al. 2013). Of particular importance is a role in determining the appropriate treatment regimen for the patient with a pre-existing cardiovascular condition, as this is a known risk factor for CTCT. The method of delivery, formulation of medication and utility of protective treatments have been the subject of in-depth analysis, particularly with respect to anthracyclines, with some promise for approaches to reducing CTCT (van Dalen et al. 2011; 2010; 2009). More recently, the identified risk factors for CTCT have grown to include certain genetic markers, with new members regularly added.

Once on treatment, appropriate surveillance for development of CTCT is necessary. Guidelines for this surveillance are scarce and vary widely across different cancer types and patient populations. Recent data demonstrate the importance of early diagnosis and treatment of cardiac injury that may prevent

development of clinical cardiovascular toxicity and improve patient outcomes, thus highlighting the need for investigations of standards of cardiac monitoring and prevention strategies during the cancer treatment period (Cardinale et al. 2015; 2010). The application of specialised imaging techniques (eg myocardial strain) and serum biomarkers (eg troponin, brain natriuretic peptide) have proven useful in tracking the degree of injury and stress during treatment, and in some cases are useful in predicting patients at greater risk to develop CTCT (Thavendiranathan et al. 2014; Ky et al. 2014). Beyond the risk to develop long-term CTCT, patients undergoing treatment, particularly with anthracyclines, are also at risk to develop acute CTCT, which can be life-threatening. A close working relationship between oncologists and cardiologists allows quick recognition of this development, and appropriate management to bridge the patient through what is often a recoverable process.

After treatment is complete, the period of survivorship begins. Paediatric literature, where survivorship of childhood and young adulthood cancers has seen a steady increase over years, provides invaluable amounts of cardiovascular data stemming from long-term survivorship cohorts that housed the bulk of efforts for research and clinical care. Awareness of cardiovascular disease risk among adult cancer survivors has seen an impressive surge, paralleling recent advances in cancer treatments that offer long survivorship, particularly for some cancers such as breast. Providers need to understand that symptomatic heart failure is not the only CTCT of concern. Increased occurrence of myocardial infarction, valvular disease, pericardial disease, hypertension, vascular disease, arrhythmias and obesity has also been reported. According to American Heart Association (AHA)/ACC heart failure guidelines, patients who have received potentially cardiotoxic therapy would be classified within,

at a minimum, the stage A heart failure category (see Table 1), with the goal of surveillance and therapy being to prevent progression to stages B-D (Carver et al. 2013). While it may not be necessary for all survivors, certainly some should have lifelong follow-up with a cardiologist who understands the issues at hand. Approaching cancer therapy as an additional risk factor may have a profound influence on how a patient is followed, and what kind of surveillance may be needed relative to someone without this risk factor.

Special Considerations: Paediatrics and Advanced Cardiac Therapies

Paediatric and adolescent patients have been an important part of the story in defining CTCT, and many of the data regarding long-term survivors are from this population (Lipshultz et al. 2013). The Children's Oncology Group has detailed guidelines regarding screening for CTC in survivors, based on age at treatment, dose of anthracycline and concomitant radiation therapy (survivorshipguidelines.org). Individual chemotherapy protocols also generally include some level of screening during treatment. However, involvement of a cardiologist is often reserved for a time when ventricular dysfunction or clinical heart failure is apparent. This approach may miss the opportunity to intervene with early changes or to be involved in risk assessment and treatment planning. The low incidence of existing cardiovascular disease in children going into therapy when compared to adults, and/or the desire not to introduce the spectre of additional poor outcomes, may be the explanation of the current strategies. However, early introduction could help identify additional risk factors not previously appreciated, open avenues for collaborative research in early prevention strategies, and establish a relationship that would ease introduction of a new care team if needed.

When patients with CTCT become refractory to standard medical therapy they may be considered for advanced therapies such as heart transplantation or mechanical circulatory support. Traditional recommendations have been for a patient to be off chemotherapy and in remission for 1-5 years, depending on the malignancy and prognosis, before being considered for transplantation. In general reported transplant outcomes have not significantly differed from those

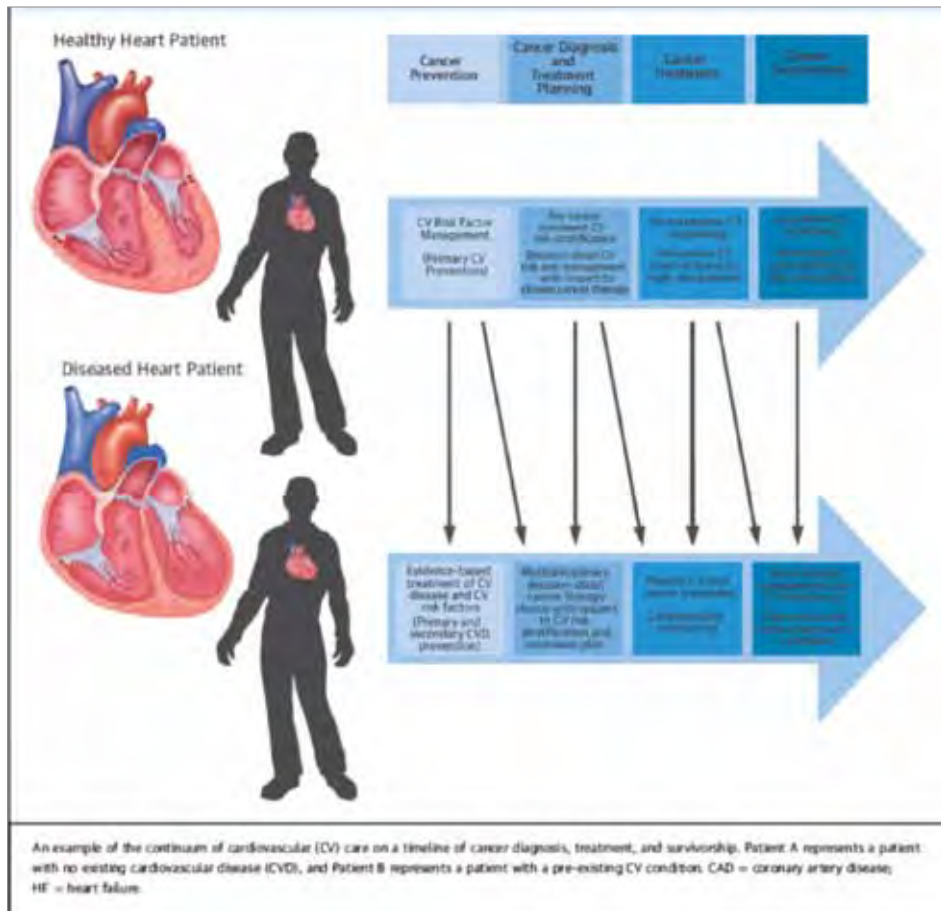


Figure 1. Continuum of Care in Cardio-oncology.

Reprinted from Journal of the American College of Cardiology, Vol. 65(25), Ana Barac, Gillian Murtagh, Joseph R. Carver et al., Cardiovascular health of patients with cancer and cancer survivors: a roadmap to the next level 2739-46, Copyright (2015), with permission from the American College of Cardiology Foundation.

in patients without CTCT (Oliveira et al. 2012). For those patients not outside of the window of observation, mechanical circulatory support in the form of a ventricular assist device may allow recovery of function or serve as a bridge to the time at which evaluation would be appropriate. In cases that a patient is not expected to be eligible for transplantation, device therapy as a destination may be appropriate. Indeed, introduction of targeted therapy and significant improvement of expected survival in some forms of stage IV cancers is challenging our practice of excluding patients with cancer from advanced heart failure therapies. For example, in patients with metastatic HER2-positive breast cancer, where expected survival is measured in years, mechanical support devices may have the potential of meaningfully extending and improving quality of life. Active collaboration between the oncology, cardiology and advanced heart failure teams, with considerations of the risk for bleeding, thrombus, and infection, will be critically needed in this decision process.

Research and the Road to Reducing Cardiovascular Toxicity

As with all clinical advances, research holds the key to making improvements in clinical care for patients with CTCT. Identifying patients at risk, treatment factors involved, improved methods of surveillance, protective strategies and appropriate treatment once disease is discovered are all top priorities for the field of cardio-oncology (Shelburne et al. 2014). Some of the key challenges include lack of precise cardiovascular phenotypes, as well as unavailability of prospectively defined and collected cardiovascular outcomes in a broad population of patients who are receiving or have received cancer therapies. Creation of cardiovascular registries specific for these patients and cancer-treatment type would inform clinical practice and direct research. Close collaboration between cardiology and oncology professional organisations offers an opportunity for implementation of tools and resources already existing in cardiology clinical

practice and rapidly advancing this field. For example, the ACC's National Cardiovascular Data Registry (NCDR®) has been used in diverse areas of cardiovascular care, representing a standard for data collection and performance measures in cardiovascular medical therapies, procedures and devices. Expansion of this registry model to identify and follow cardiovascular outcomes in patients receiving cancer treatment would provide a powerful platform for advancement of cardio-oncology.

Establishing a Dedicated Cardio-oncology Programme

The team approach is key in establishing clinical and research programmes to care for cardio-oncology patients. Beside the obvious need for interested and invested cardiologists and oncologists, other key elements are institutional support, dedicated clinical staff, and appropriate education of ancillary services such as cardiovascular imaging, pharmacy and laboratory capabilities. The role of professional societies in this arena

Table 1. ACC/AHA Stages in the Development of Heart Failure

ACC/AHA Stage	Description
A	At high risk for heart failure, but without structural heart disease or symptoms.
B	Structural heart disease, but without signs or symptoms of heart failure.
C	Structural heart disease with prior or current symptoms of heart failure.
D	Refractory heart failure requiring specialised interventions.

Adapted from Hunt et al. (2005)
ACC = American College of Cardiology; AHA = American Heart Association.

is to develop competency statements and provide training opportunities for all team members. Continuous education programmes for trainees and hospital staff, patient education and advocacy, and dissemination of information through local, regional, and national forums are all vital to a successful programme (Okwuosa and Barac 2015).

Moving Forward

The field of cardio-oncology is at the beginning of what promises to be an exciting and productive period that will benefit patient care for years to come. While established cardiology programmes nested within tertiary institutions with a primary cancer focus represented cardio-oncology for years, the new era is marked by cardio-oncology clinics emerging in small and medium-size hospitals and community health offices. This is a reflection of the oncology care pattern, and has created a critical need for training of cardiovascular health care practitioners in this field. A recent ACC member survey showed that >70% of the respondents perceived cardiovascular effects of cancer

treatment were very important, and 65% felt that access to specialised consultants would provide an advantage to caring for such patients. However, nearly 30% of respondents reported that they had to rely on a single provider with expertise or had no cardio-oncology services available (Barac et al. 2015). There is clearly a need to provide not only clinical training and services, but also educational opportunities for interested providers. Professional organisations offer unique resources to provide a framework for such efforts through development of clinical content standards and competencies, creation of clinical training curricula for cardiovascular trainees, and distribution of education and knowledge through workshops and conferences. The dynamic nature of this field will continue to be influenced by developments in the fields of oncology and cardiology. Ongoing collaboration at the level of providers, divisions, institutions and professional organisations will be critical, with each enhancing the ability of the other to care for this complex and potentially fragile patient population. ■

Key Points

- ✓ Cancer therapy-related cardiovascular toxicity is a limitation of treatment.
- ✓ Patients need screening before, and surveillance during and after treatment.
- ✓ Cardio-oncology programmes are emerging to meet clinical and research needs.
- ✓ Support for cardio-oncology efforts from professional organisations is vital to their success.



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CANCER



CANCER FREQUENCY (2012)

Rank Country Age-Standardised Rate per 100,000

1	Denmark	338.1
2	France (metropolitan)	324.6
3	Australia	323.0
4	Belgium	321.1
5	Norway	318.3
6	United States of America	318.0
7	Ireland	307.9
8	Korea, Republic of	307.8
9	The Netherlands	304.8
10	New Caledonia	297.9

Source: World Cancer Research Fund <https://iii.hm/15t>

WORLD CANCER DAY

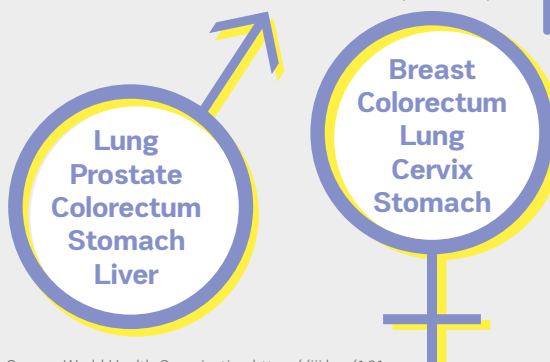
4 FEBRUARY 2016

#WorldCancerDay #WeCanICan

worldcancerday.org



MOST COMMON CANCERS (2012)



Source: World Health Organization <https://iii.hm/161>

EUROPEAN UNION

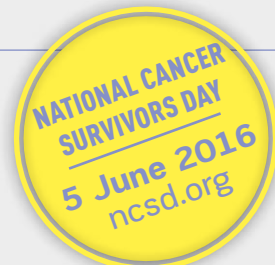
No. 1 cause of premature death in 17/28 EU countries (after cardiovascular disease)

No. 1 cause of death by disease in children 1 year +

No. 2 most common cause of death in the EU

More than 300,000 European citizens are paediatric cancer survivors

Sources: European Cancer Patient Coalition <https://iii.hm/15z>; SIOPE - European Society for Paediatric Oncology <https://iii.hm/160>; EU Action on Cancer <https://iii.hm/15v>



89%

health professionals who regularly deal with cancer patients agree friends and family caring for someone with cancer often neglect their own health

Source: Macmillan Cancer Fund <https://iii.hm/15u>

“always consulting the other disciplines ...it’s now an established standard of care ...it changed the culture ...”

Source: National Breast and Ovarian Cancer Centre (2005) Multidisciplinary meetings for cancer care: a guide for health service providers. Camperdown, NSW: National Breast Cancer Centre. <https://iii.hm/15w>

MULTIDISCIPLINARY CANCER CARE

- Ethical priority
- Appropriate clinical decisions
- Clinical leadership
- Structured interprofessional collaboration
- Crucial to survivorship

Multidisciplinary teams (MDTs) are an alliance of all medical and health care professionals related to a specific tumour disease whose approach to cancer care is guided by their willingness to agree on evidence-based clinical decisions and to co-ordinate the delivery of care at all stages of the process, encouraging patients in turn to take an active role in their care.

Source: European Partnership for Action Against Cancer consensus group (2014) Policy statement on multidisciplinary cancer care. Eur J Cancer, 50(3): 475-80.

1 in 3

cancers is preventable

Source: EU Action on Cancer <https://iii.hm/15v>

CANCER MYTHS

- Myth 1** ✓ Cancer is a man-made, modern disease
- Myth 2** ✓ Superfoods prevent cancer
- Myth 3** ✓ ‘Acidic’ diets cause cancer
- Myth 4** ✓ Cancer has a sweet tooth
- Myth 5** ✓ Cancer is a fungus – and sodium bicarbonate is the cure
- Myth 6** ✓ There’s a miracle cancer cure...
- Myth 7** ✓ ...And Big Pharma are suppressing it
- Myth 8** ✓ Cancer treatment kills more than it cures
- Myth 9** ✓ We’ve made no progress in fighting cancer
- Myth 10** ✓ Sharks don’t get cancer
- Myth 11** ✓ We don’t need to talk about cancer

Sources: 1-10 - Cancer Research UK <https://iii.hm/15x>; 11 - World Cancer Day <https://iii.hm/15y>



CT DOSE MANAGEMENT

A PAN-EUROPEAN STRATEGY



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Computed Tomography (CT) ranks as one of the top five medical developments of the last 40 years, with its inventors being awarded the Nobel Prize in Medicine in 1979 (Radiologyinfo.org 2011). From the first generation of CT scanners in the 1970s to the fourth generation scanners of today, the technological improvements of CT in speed, resolution and patient comfort have been immense. Owing to technological developments and to broader indications, the use of CT has notably increased around the world and its contribution to the collective dose has risen from five percent to 46 percent from 1996 to 2009 (Fazal et al. 2009). The increase in CT use and in the exposure of the population and patients as well as other factors led to the EURATOM 2013/59 Directive (Council Directive 2013) and the need for dose management.

In March 2014, Affidea, a Dutch holding company, which is one of the largest healthcare investors and operators through Private Public Partnerships (PPP) in Europe, launched a CT Dose Excellence Campaign across its network. The main goals of the campaign are to:

- Make dose awareness a habit;
- Educate radiology personnel, patients and referring clinicians;
- Track, record and analyse CT dosimetric data;
- Justify and minimise the number of high-level dose examinations;
- Standardise and optimise CT protocols and practice;
- Create global network CT Dose Reference Levels (DRLs);
- Promote best practices in CT;
- Comply to the EURATOM 2013/59 Directive (Council Directive 2013).

Materials

- 7 countries: Greece, Hungary, Italy, Poland, Portugal, Romania, Switzerland
- Number of multiple detector computed tomography (MDCT) scanners: 39
- CT vendors: Vendor 1 - 82%, Vendor 2 - 13%, Vendor 3 - 5%
- CT scanners: 6 to 128 detector rows
- MDCT models: 17

- MDCT scanners with dose reduction algorithm: 28
- Dose tracking software

Methodology

I. Human Resources

To plan and implement the Dose Excellence Campaign with a broad scope, multidisciplinary teams have been assigned at different levels (see Figure 1). Multidisciplinary teams provide assurance that the strategy, communication between the teams and implementation are clear and straightforward.

II. Steering Committee Role

The Steering Committee defines the Dose Excellence Strategy, drives the project and collaborates with the country, site and third party teams to implement the strategy. The tasks of the Steering Committee are listed in Table 1.

III. Software to Track, Archive, Report and Analyse Dosimetric Data

The software used has proven to be an excellent tool for the handling of dosimetric data. It is compatible with the CT systems of all three vendors, easy to set up and use, and provides the following tools to assist in the Affidea Dose Excellence Campaign:

- RadLex® Playbook (rsna.org/RadLex_Playbook.aspx) to map the CT protocols used in the departments to a specific identification number defined in the Affidea Standardised CT Protocols list.
- Detailed acquisition parameters and dose report for each patient study.
- Database export in Microsoft Excel format for further handling.
- Automated monthly reports that are sent via email.
- Automated alerts for high-level dose studies that assist in the fostering of dose awareness of the CT operators. The system provides a justification process for the alerts that allows the users to assess the centring of the patient, the function of the current modulation and the recording of the cause that produced the alert.

IV. Country/Site initiation process

Step 1: Verify the quality assurance tests of the CT scanners.

Step 2: Connect the CT systems to dose tracking software.

Step 3: Launch a data collection period of at least 4 weeks.

Step 4: Assign the relevant multidisciplinary teams at country, site and third party level.

Step 5: Assess the current department practice, workflow and level of dose awareness.

Step 6: Project kick-off meeting with country team to present the strategy and team tasks.

Step 7: Project kick off with site teams to present the strategy, team tasks and justification, standardisation and optimisation (JSO) results.

Step 8: Launch the educational material.

Step 9: Monthly follow-up by the Steering Committee of the project Progress.

Step 10: Launch monthly site team meetings to discuss the JSO report results.

Step 11: Follow-up site visit in 2 months period from kick off, to physically assess progress.

Step 12: Launch bimonthly country team meetings to discuss the progress of each site.

Step 13: Perform image quality tests on the optimised CT protocols.

Step 14: Introduce the Dose Excellence campaign material for patients and referring doctors, once the goals for JSO have been reached.

Results

Building dose awareness and the acceptance of change in the procedures, practices and protocols of a radiology department is a long and challenging process. The collaboration between the teams inside a department, between teams from different sites in a country, as well as between countries, requires time, trust and effort from all involved parties. Adding to that one needs to take into account:

- Each National Health System's rules

Dose Excellence Campaign Teams

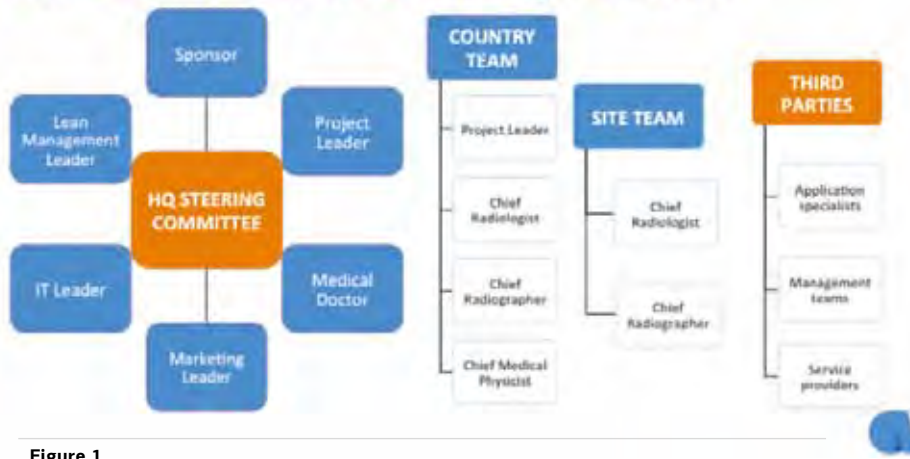


Figure 1

Table 1. Steering Committee Tasks

- Foster a dose awareness culture.
- Create a standardised list of CT protocols that includes all anatomic areas and clinical indications of examinations performed in the network.
- Assure that the dosimetric data used for comparison originates from protocols for the same clinical indication.
- Assign global network DRLs for volume computed tomography dose index (CTDIvol) and dose length product (DLP) for all standardised CT protocols.
- Set thresholds for dose alerts per study type.
- Define the parameters for the analysis report of the recorded data for justification, standardisation and optimisation (JSO report).
- Define the needs and create education material for radiology personnel.
- Create a CT quality assurance programme.
- Create a reporting tool for the monthly follow up of the project tasks and goals.
- Assist the countries in change management.
- Organise global Dose Excellence team meetings and workshops for the exchange of experiences, educational purposes and team building.
- Create the material to be distributed to patients and referring doctors for the Dose Excellence Campaign.
- Create the image quality testing procedure for the CT protocols, with the use of anthropomorphic phantoms as well as clinical data.
- Define the protocol optimisation procedure guideline.
- Create the CT protocols best practice guideline, including clinical information and technical parameters for all the CT models.
- Lead the implementation of best practices in CT.

and country legislation. For instance, the variations between countries in the reimbursement system that affects the frequency of examinations; the referral criteria that affect the imaging modality choice.

- Differing perceptions of radiologists, referring physicians and patients of CT dose, between countries.
- Differences in workload, study types and patient's condition between private diagnostic centres and public and/or private hospitals.
- Differences in mentality between the generations of radiologists and radiographers.

for 'big data' analysis to look at pan-European imaging trends.

With the dose tracking software and the vendor's team collaboration, Affidea has created a monthly data analysis report called JSO, that:

- Records and analyses the percentage of alerted high-level dose studies and the percentage of justified alerts;
- Records and analyses the percentages of examinations performed according to the Standardised CT protocols list rules;
- Records and analyses the percentage of protocols performed that are above, within or below the DRLs.

The JSO report results assist in practice optimisation and protocol parameters optimisation. Affidea is in the process of consolidating the data to a single database that will provide the global network results analysis. The goal is to include all the CT systems of the Affidea network in the Dose Excellence Campaign, with a further 15 systems being currently implemented.

Conclusion

The importance of dose management is unquestionable. But one should not allow oneself to forget that the purpose a CT scan is performed is the diagnosis of a patient's clinical state and that radiologists are the ones who have the legal responsibility for this diagnosis. A dose management strategy has to respect their concerns and proceed with caution in every step. ■

Key Points

- ✓ The amount of ionising radiation exposure from CT is increasing, and there is great variability between patients and geographies for similar examinations.
- ✓ A rational strategy is required to both reduce and standardise patient dose over the full range of examination types.
- ✓ Affidea, a pan-European medical imaging services provider, has implemented a Dose Excellence Campaign across 7 European countries, involving approximately 190 people.

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POINT-OF-CARE ULTRASOUND

A NEW SERVICE DELIVERY MODEL



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Medical care in the Netherlands is organised through a gate-keeper, the general practitioner (GP). Originally, the GP would take care of the entire spectrum of medical care personally, in his or her office, often aided by a partner. When time and paperwork constraints made this more difficult, organisations sprang up that centralised medical diagnostics services regionally for groups of GPs.

In the Netherlands, eight such regional organisations offer a broad package of support, such as blood tests, visualising retina tests, electrocardiograms, lung function tests and biometrics. Each region developed a well-organised infrastructure that picks up blood samples and delivers laboratory results efficiently and in a timely manner.

In the last two decades imaging, particularly screening indications, became an issue for GPs as waiting lists in the regional hospitals grew, leading to delay in diagnosis. GPs increasingly wanted immediate and easily accessible imaging services, ranging from conventional radiographs to ultrasound. Demand for these services grew such in the last decade that it became a priority of the eight regional diagnostic centres.

Materials and Methods

One of the diagnostic GP support organisations, SHO, currently serves approximately 700 care providers. Increasingly GPs needed imaging support in making the decision to refer patients to hospital

or not. In 2008 the wait for an ultrasound appointment could be up to two to three weeks or more in the local community hospitals.

A business case was developed to offer point-of-care (POC) ultrasound capability within 24 hours of the request. A uniform requisition was developed, appointments were to be made centrally and a standard template ultrasonographic (US) exam was coupled to a clinical indication.

The aim was to serve many GP practices with a hub-and-spoke model. The hub is the place of US investigation at or within easy reach of the GP practices (spokes). If a practice or group of practices could guarantee a minimum of 10 requests per half day, we could offer this POC service on a certain day each week to fulfill those requests. We would bring the US equipment and operators.

Transporting the US equipment was easy, as the infrastructure was already in place for transporting medical diagnostic equipment, blood samples and other laboratory tests. We simply 'piggy-backed' the US equipment on to existing routes so that five days a week up to 36 different locations could be served. Depending on the number of requests US equipment is delivered to each site prior to the start of the appointments, either morning or afternoon, to be met by an ultrasonographer. The ultrasonographer performs the exams following a standardised protocol, fills out a preliminary report using a template (American College of Radiology (ACR)-based), and takes care of add-on exams if needed. Every day a radiologist is responsible for providing back up to the sonographer. The radiologist can be reached by telephone and is able to view the images via remote on demand.

Staffing and Equipment

The ultrasonographers are employed part-time, and benefit from fixed working days and no night shifts. A cadre of radiologists was recruited with virtually the same 'benefits': part-time, work from home the majority of time, paid by the case.

The equipment consists of six ultrasound units, five mobile and one laptop. There is a central reservation number and all scheduling is done centrally. Paperless, structured indications and structured reporting digitally handled allow for timely and efficient reporting.

The business plan was based on bringing the imaging to the patient, and enabling a decision on whether the exam was normal or not. In the latter instance, further imaging might need to be considered, and the majority of clinicians very much appreciated suggestions as to what might be indicated to further elucidate the abnormality found. We conduct standard examinations of the abdomen, kidneys, pelvis, neck, scrotum, musculoskeletal (MSK) indications, such as developmental dysplasia of the hip, shoulder, elbow and knee, and soft tissues including ultrasound of breast lesions for patients under 21 years of age.

Standardised reporting is performed by the ultrasonographer on site, using an ACR-based template. This is saved as a preliminary report on the central server. These are then reviewed and finalised near instantly (online) by the radiologist of the day. The entire work list is finished by 9:00 pm local time so that the referring doctor has an authorised report in his/her possession by 7:00 am the next morning, by an Electronic Data Interchange For Administration, Commerce and Transport (EDIFACT) message, a secured encrypted mail.

Quality Control

Quality control measures consist of following protocols, standardised reporting and radiologists in a peer-reviewed setting. The radiologist on call also adheres to a 'visitation' schedule, spending the day supervising the sonographers. Quarterly feedback from the GPs has been actively sought. This includes attending their local meetings where the imaging is critically evaluated as to timeliness, appropriateness and ease of access.

Key Points

- ✓ General practitioners and patients in the Netherlands benefit from a regionalised point-of-care ultrasound (US) service.
- ✓ The service delivers US equipment to each centre, where an ultrasonographer receives it.
- ✓ There is a uniform requisition, appointments are made centrally and a standard template ultrasonographic exam is coupled to a clinical indication.
- ✓ The supervising radiologist is available by phone and can view images remote on demand (web-streaming in progress).
- ✓ Feedback on the service is good; reports are received in a timely manner, and patients can book convenient appointments, often within 24 hours.

Results

The objective is to prevent medicalisation, ie weed out those patients that do **NOT** need further therapy. bringing the ultrasound study **TO** the patient. We have succeeded in this. The advantage of POC ultrasound examinations is that patients can stay close to home, and in a large percentage of patients extramural, virtually immediate care can be given. Inpatient care after all is more expensive and time-consuming.

Implementation of this system did not go completely without objections. The local hospitals have seen their ultrasound volume decrease (we do approximately 8,500 exams a year). From time to time the local hospitals would change their hours of operation and use other methods trying to capture this lost population, but they never succeeded. Nationally, the Dutch radiological society has clinical practice guidelines that insist on radiologists being present at every exam and that ultrasonographers should not work on their own (Radiological Society of the Netherlands 2015).

We have consistently maintained that a well-trained, certified ultrasonographer is basically the right hand of a radiologist and therefore should be able to practise independently with occasional supervision. Ultrasound is a risk-free, complication-free imaging modality. Supervision is not physically present, but is available both by phone and on remote report station.

When we were just starting out, collaboration with the hospitals was difficult or even impossible. Examinations were deemed suboptimal and results were challenged. After several years there is now a noticeable change. We are now getting feedback on the given diagnoses and positive comments about the structure of the reports. We have taken these issues seriously. Upon review, the consequences ranged from updating the MSK protocols for reporting joint findings to proving that at most findings could be inferred, and consequently none have affected clinical care. We continuously work with referring specialists to optimise our reporting clarity. For example, some

clinicians appreciate advice on the need to follow up, others do not. This has led to our reporting being able to be targeted, a service that is much appreciated.

It is interesting to note that more than half of beginning medical students in the United States get a tablet with an ultrasound transducer attached to it instead of the time honoured stethoscope on their first day of medical studies. The University of Rochester will start this with their next incoming class, September 2016. Learning anatomy, also quick US evaluation in the emergency room or on the clinical ward is becoming commonplace. US has come of age...

Conclusion

Overall satisfaction with this point-of-care ultrasound organisation has been high, as our ever increasing annual totals illustrate. We are growing, and we have been asked to perform these services in three other regional organisations. Putting the patient first has been a rewarding endeavour. ■



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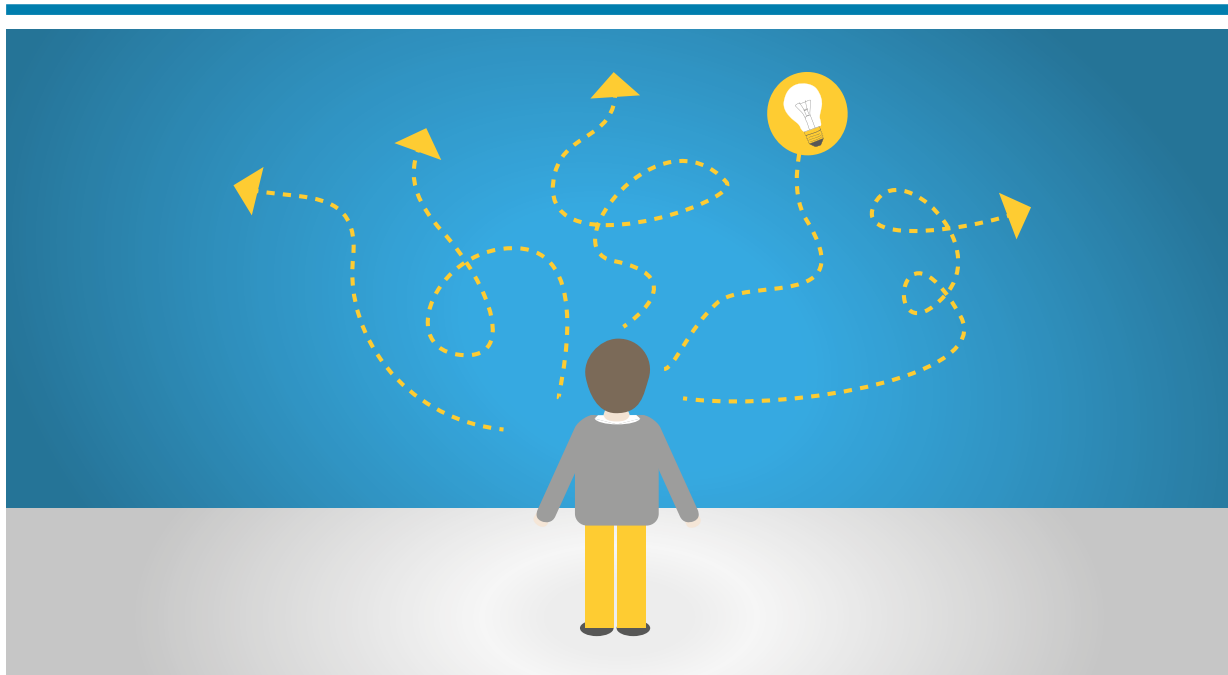
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APPROPRIATE IMAGING AND CLINICAL DECISION SUPPORT



"We shape our tools, and thereafter our tools shape us" (McLuhan)



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Wasteful, unhelpful imaging helps nobody, and may be associated with patient harms through unneeded and unwanted intervention. Appropriate imaging through referral guidance is advocated through the Bonn Call-for-Action (International Atomic Energy Authority and World Health Organization 2013), with supporting tools such as clinical decision support (CDS). Improving practice through delivery of evidence-based guidance in workflow is laudable, but there are difficulties. Evolution of CDS should address pitfalls of inadequate coverage of clinical scenarios, conflict of guidance, susceptibility to gaming and the need for user-friendliness of the technology. Metrics for monitoring are important to improve use, and shape a better tool for clinicians and patients.

Awareness appropriate and audit – the principle first advocated by the International Atomic Energy Agency (IAEA) has gathered momentum, with adoption by many organisations and professional societies. This was the thrust of the first point of the Bonn Call-for-Action

(International Atomic Energy Authority and World Health Organization 2013), which reiterates the need for evidence-based imaging referral guidelines and tools for implementation, including clinical decision support (CDS). Furthermore, the need for such guidance has gone beyond the traditional clinical scenario of consultation between referring doctor and patient to patients' *self-presentation for individual health assessment*. With complex, new imaging procedures, now more than ever we need to offer guidance aligned with best clinical practice to ensure patients get the best test first and to avoid wasteful, unhelpful imaging, which may lead to increased risk or even patient harms. For example, in patients with low clinical probability for pulmonary embolism, the false-positive reports in 25-42% of CT pulmonary angiograms may lead to unnecessary anticoagulation (Ranji 2006; Hutchinson 2015).

Clinical Decision Support: Principles, Benefits and Shortcomings

The application of a computerised system to aid medical decisions needs to be

balanced against the intricacies of an individual patient, his/her condition and co-morbidities. There are several examples where CDS is advantageous. In prescribing, the cost of non-generic drugs can be mitigated through suggestions for change to generic where such an alternative is possible and desirable. What differs in imaging is the need for justification of an imaging procedure at the individual level (International Commission on Radiological Protection 1996). It is essential to take into account the sensitivity of the patient, eg during pregnancy; incompatibilities, eg non-MRI-compatible pacemakers; and coexisting conditions such as renal failure. Whereas there will be some choices which are clearly improved with decision support, eg ultrasound rather than CT for paediatric abdominal pain, there will be other decisions which are more complicated, such as the investigation of the pregnant woman for suspected pulmonary embolism where perfusion lung scintigraphy is the best choice.

Guidance is mainly for clinicians in primary care and emergency care, where

presentations are diverse and not always familiar to the referrer. The challenges are to provide guidance where guidance is needed, available and applicable to the patient. In years gone by such guidance may have been through the guiding hand of an experienced colleague, a professional society or the health authority. The disadvantage of such advice is that, although valuable, this did not always reach the patient and his/her doctor in time to influence the decision to investigate or which investigation to undertake. Furthermore the advice may not have been uniformly available. A third concern was that advice from different sources may be discordant, leading the referrer to disregard any guidance given now or in the future.

The challenge with CDS is to provide timely and relevant advice with uniformity across a district, country or region. Such advice should guide both the immediate decision and referral behaviours. Systematic review of primary research identified four essential features, which will promote success in any CDS system (see Table 1) (Kawamoto et al. 2005).

In radiology there are only a limited number of working CDS systems. Perhaps the one with more experience is from the joint venture between the American College of Radiology and the National Decision Support Company, ACR Select (acrselect.org/contact.html), which has been in use for a few years in North America. Use of such a CDS system has been mandated in the USA for implementation in the next two years (United States Government Printing Office 2014). In Europe, the European Society of Radiology (ESR) is working with the ACR and National Decision Support Company on a project, the *ESR iGuide*, which has been piloted in Barcelona. The evidence to support the value of CDS is in part due to the reduction in growth in requests, which for CT is estimated at ten percent per annum (NHS England 2014). Although numbers are not actually reduced the rate of growth is reduced, possibly to lie in line with technological advance and appropriate indications (Sistrom et al. 2009).

Perhaps the overriding evidence in favour of CDS is conferment of a higher level of appropriateness of the imaging modality for the clinical scenario. If there is a real saving to be made this may be through avoiding inappropriate investigations along the way. A further

Table 1. The Four Evidence-Based Features Strongly Associated with a Decision Support System's Ability to Improve Clinical Practice

- **Decision support provided automatically as part of clinician workflow.** The advice should be given before the decision is first made. Turning back is a poor option.
- **Decision support delivered at the time and location of decision making.** This usually means that CDS should be available at the point-of-care.
- **Actionable recommendations provided.** When the decision has been reached an efficient method of providing the imaging request should be incorporated.
- **Computer-based.** The need to work through the referrer's normal operating system may require a broker to interface with the electronic requesting systems as well as the CDS system.

Adapted from Kawamoto et al. (2005)

Table 2. Selected Findings and Recommendations from the Medicare Imaging Demonstration (MID) Evaluation of Decision Support for Imaging

Findings

- **Improvement in appropriate ordering** shown between baseline and intervention. *Ordering of rated* exams initially 61.5 – 81.8 percent appropriate improved to **75.1 – 83.9 percent appropriate**.
- **Minority of orders were covered by guidelines** with only a mean of **35 percent rated**.
- **Low uptake.** Most referrers placed fewer than 20 *orders*, or less than 1 per month.
- Exposing ordering physicians to appropriateness guidelines for advanced diagnostic imaging over the course of two years had **no effect on utilisation**.
- Receiving feedback on inappropriate orders in the context of this MID did not result in reductions in advanced diagnostic imaging utilisation.
- CDS helped some clinicians explain why some investigations requested by patients may be inappropriate according to national guidelines. Patient focus groups were generally favourable toward their doctors' use of computers.
- Some clinicians worried that the longer time spent on requesting imaging might be misconstrued by patients as more attention paid to electronic records rather than to addressing patients' concerns.
- *Gaming.* Some clinicians changed either symptoms or diagnoses so the order would be re-rated as appropriate.

Recommendations

- Further involvement of clinical stakeholders in CDS implementation, including training.
- Technical realignment of workflow, health records and imaging requesting through CDS.
- Overcoming discrepancies between national and local guidance, and between clinical and imaging guidance
- Management of CDS imaging requests out with guidelines.

Source: Timbie et al. (2014)

advantage is the availability of auditable data, which may be fed back to clinicians to influence referral behaviour, leading to shared responsibility for a radiation safety culture. As systems grow more sophisticated the opportunity arises for machine learning to identify clinicians' normal working practice and predict scenarios as well as mining of big data to identify useful information such as previous investigations and renal function assessment, tasks that referrers may otherwise need to do manually.

Formal assessment of national CDS implementation is limited. The Medicare Imaging Demonstration (MID) Final Evaluation report to the United States (U.S.) Congress was published by the Rand Corporation in 2014 (Timbie et al. 2014). This evaluated advanced diagnostic imaging orders, which were entered into and rated by a DSS for appropriateness. Findings are summarised in Table 2. Following amendment of the

Protecting Access to Medicare Act in April 2014, ordering professionals in the U.S. would have to consult a qualifying decision support mechanism equipped with appropriate use criteria, starting in 2017 (United States Government Printing Office 2014).

nudging the healthcare professional along best practice, preferably through an electronic health record. In Europe, referral guidance is viewed by legislators and regulators as a professional matter and guidelines should be advisory, not mandatory. Furthermore, there may be

“MORE THAN EVER WE NEED TO OFFER GUIDANCE ALIGNED WITH BEST CLINICAL PRACTICE”

Discussion

In making a choice as to where to go with CDS, local working practices and regulations should be taken into account together with clinician and patient preferences.

Four phases are recognised in the development of CDS systems. The first is standalone; the second supports integration with other medical systems; the third is standards-based; and the fourth is service model-based with intelligent function across systems.

In practice, there are three basic methods of providing decision support. The simplest is to make guidance available passively either through print copy, posters or hyperlinks. This has been used for many years and is of limited efficacy. The second model is to provide active guidance through a rule-based system, which may either be a standalone CDS system or an 'add-on' CDS to electronic requesting systems, such as ACR Select. The third model (currently only used for some clinical practice guidelines) is for intelligent guidance to be provided only when such guidance is available,

10-20 percent of cases in which decisions for the preferred modality fall outside guidance, usually due to good reasons, eg pregnancy or pacemaker (Remedios et al. 2014; Almén et al. 2009). Any system must allow for this level of compliance in auditable standards. Metrics should preferably consider surrogates of outcome rather than just organisation and process.

Conclusions

Evidence-based referral guidelines remain necessary behind any CDS system. To succeed, such imaging referral guidance should be concordant with clinical practice guidance. Awareness and education of clinicians and the public remain challenges, which could be addressed in part by campaigns such as *Choosing Wisely*, which receive support by patient advocates as well as clinician groups and departments of health (Academy of Medical Royal Colleges 2015). The area which may need more attention is monitoring through clinical audit for better use of referral guidance and to help reshape guidance to support the needs of both clinician and patient. ■

Key Points

- ✓ Clinical decision support (CDS) should be in clinician workflow to succeed.
- ✓ Existing CDS systems can improve appropriateness of imaging for the clinical scenario, but do not reduce numbers of imaging procedures.
- ✓ Areas for improvement are: stakeholder involvement; technical alignment for efficient use in workflow; overcoming discrepancies between different guidelines for the same scenario; and satisfactory management of recurrent requesting outwith guidance.
- ✓ Need for monitoring (through clinical audit) of guidance for better use of CDS and for systems improvement to support decisions by clinicians and patients.



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IODINATED CONTRAST MEDIA RISKS AND BEST PRACTICE



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The aim of administering contrast media in medical imaging is to improve image contrast and the diagnostic efficacy of the imaging examination being undertaken. Developments in the manufacture of iodinated contrast media have led to an increase in safety standards. However, the administration of iodinated contrast media still provides a potential small risk to the patient.

The purpose of this review is to provide awareness about:

- Adverse side effects from the administration of iodinated contrast media;
- Preparation and planning for reducing and treating adverse effects of iodinated contrast media;
- Quality assurance and quality improvement programmes for the administration of iodinated contrast media.

The use of iodinated contrast media during imaging examinations has increased considerably in recent years. Administration of iodinated contrast media carries the risk of contrast-induced acute kidney injury (CI-AKI) and non-renal adverse reactions. The minimal possible risks associated with the use of iodinated contrast media should be assessed against the benefits of their use in providing the required diagnosis and eventual appropriate patient management (Royal College of Radiologists (RCR) 2015; American College of Radiologists (ACR) 2013; Royal Australian and New Zealand College of Radiologists (RANZCR) 2009). Alternatives, which could provide the same or better diagnosis and justification based on accurate clinical indications, should be considered (RANZCR 2009).

Guidelines on the safe use of iodinated contrast media have been published with the aim of reducing the risks during their administration (RCR 2015; ACR 2013; RANZCR 2009).

Documented incidence of adverse reactions due to the administration of iodinated intravenous contrast is low (ACR 2013), and therefore the need for informed consent varies in different

countries. Policy on informed consent should be based on the legal requirements of the country and institutional and departmental policies (ACR 2013).

Adverse Effects of Iodinated Contrast Media and Their Management

Adverse effects from the administration of iodinated intravenous contrast media vary from mild reactions to rare but severe life-threatening situations.

adverse effect that may permanently impair renal function, increase the length of hospital stay and hospital costs as well as a predictor of future adverse cardiovascular events and mortality (RCR 2015; Richenberg 2012).

Acute Reactions

Acute reactions are those which take place within 60 minutes of the administration of iodinated contrast media. The majority of acute reactions are anaphy-

“ADMINISTRATION OF IODINATED CONTRAST MEDIA PROVIDES A POTENTIAL SMALL RISK TO THE PATIENT”

Contrast-induced Acute Kidney Injury (CI-AKI)

Contrast-induced acute kidney injury (CI-AKI) has replaced other terminology such as contrast nephrotoxicity, contrast-induced nephropathy (CIN) or radio-contrast nephropathy (RCN). CI-AKI is the third leading cause of hospital-acquired acute renal failure (Kagan 2010). It is an iatrogenic disease, which may cause long-term morbidity or death. CI-AKI is defined when one of the following criteria is met:

- serum creatinine rises by $\geq 26 \mu\text{mol/l}$ within 48 hours after administration of contrast medium compared to baseline creatinine values;
- serum creatinine rises ≥ 1.5 fold from the baseline value, which is known or presumed to have occurred within one week after administration of iodinated contrast medium;
- urine output is $< 0.5 \text{ ml/kg/hour}$ for more than 6 consecutive hours;
- when alternative explanations for renal impairment have been excluded.

These variable definitions make it difficult to predict the long-term clinical outcome of CI-AKI. CI-AKI is both an

lactoid, are not dose-dependent, and involve the release of histamine along with other active biological chemicals. Acute reactions may be classified as mild, moderate and severe (RCR 2015):

- **Mild reactions** may be experienced by up to three percent of patients following iodinated contrast media administration. Such reactions usually resolve without the need for any treatment, and include nausea, pruritus, vomiting, marked urticaria, headache, and mild urticaria (RCR 2015; ACR 2013; RANZCR 2009; Bettmann 2004).
- **Moderate reactions** may require specific treatment, and include severe vomiting, marked urticaria, bronchospasm, facial/laryngeal oedema and vasovagal attacks (RCR 2015; ACR 2013; RANZCR 2009; Bettmann 2004).
- **Severe reactions** occur in 0.04% to 0.004% of iodinate contrast media administrations, with the risk of death being rare. Severe reactions include hypovolaemic shock, respiratory arrest, cardiac arrest, pulmonary

oedema and convulsions (RCR 2015; ACR 2013; RANZCR 2009; Bettmann 2004).

Delayed Reactions

Delayed reactions, which account for less than four percent of reactions, take place between one hour to one week after the administration of iodinated contrast media. Delayed reactions most commonly present as skin reactions with a maculopapular rash. Less frequent skin reactions include angioedema, urticaria and erythema (RCR 2015; ACR 2013; RANZCR 2009; Bettmann 2004). Table 1 presents the types of iodinated contrast media reactions and suggested patient management.

Minimising the Risks of Iodinated Contrast Media Administration

True CI-AKI is defined when there is a permanent reduction in renal function as opposed to a temporary alteration of renal function post iodinated contrast medium administration. True CI-AKI is rare and usually confined to individuals with pre-existing renal dysfunction. The risk of CI-AKI is 0.6% to 2.6% in the general population, but rises to 4.7% in patients with pre-existing renal impairment. Renal impairment, measured best by estimated glomerular filtration rate (eGFR), is the only risk factor predictive of CI-AKI. Patients who have a high risk for CI-AKI need to be identified prior to iodinated contrast media administration through measurements of eGFR. Renal impairment is considered in patients with an eGFR <60ml/min/1.73m². However, the Contrast Media Safety Committee of the European Society of Urogenital Radiology, in their updated guidelines, agreed that the risk of CI-AKI is lower after intravenous than after intra-arterial administration of contrast media. They considered that only patients with an eGFR of <45ml/min/1.73m² are at risk from CI-AKI after intravenous administration. Other risk factors, such as age over 75 years, diabetes, metformin use, congestive heart failure, gout and collagen vascular disease should also be considered (Richenberg 2012; Stacul 2011).

To reduce the risk of CI-AKI, eGFR measurements should be available for all non-emergency cases. An eGFR within the previous three months is satisfactory for patients in a stable condition. Patients with known renal disease should have an

Table 1. Types of Iodinated Contrast media Reactions: Symptoms and and Patient Management

Reaction Type	Symptom	Patient Management
Mild	Nausea / Vomiting	Supportive measures Antiemetics if prolonged vomiting
	Urticaria (mild)	Supportive measures
Moderate	Urticaria (protracted)	Antihistamine (oral or intramuscular depending on severity)
	Marked Urticaria	Antihistamines Consider use of Adrenaline
	Bronchospasm	Oxygen by mask β - 2 antagonist metered dose inhaler (In more severe cases given by nebuliser) Consider Adrenaline
Severe	Isolated Hypotension	Elevate patient's legs Oxygen by mask Intravenous fluids If unresponsive: Adrenaline
	Vasovagal	Elevate patient's legs Oxygen by mask Atropine Intravenous fluids
	Generalised Anaphylactic	Stop contrast administration Call resuscitation team Suction and maintain airway Oxygen by mask Adrenaline Intravenous fluids Ventilate patient if respiratory and circulatory collapse Additional measures: • Bronchodilators • Corticosteroids • Nebulised Adrenaline Supportive measures: • Observe vital signs • ECG monitoring • Pulse oximetry

Sources: Royal College of Radiologists (2015); American College of Radiology (2013); Royal Australian and New Zealand College of Radiologists (2009)

Table 2. Stages of Chronic Kidney Disease

Stage	eGFR ml/min/1.73m ²	Type
1	90+	Abnormal kidney function; Urine findings, structural abnormalities, genetic trait indicate kidney disease.
2	60 - 89	Mildly reduced kidney function; Other findings (as in stage 1) indicate kidney disease.
3A 3B	45 - 59 30 - 44	Moderately reduced kidney function.
4	15 - 29	Severely reduced kidney function.
5	<15 or on dialysis	Very severe or end stage kidney failure.

Table 3. Information Required before Iodinated Contrast Media Administration and Precautionary Measures Undertaken

Information required	Precautionary measures
<p>History of renal disease and conditions predisposing to renal impairment:</p> <ul style="list-style-type: none"> • Previous renal surgery; • Diabetes Mellitus; • Proteinuria; • Hypertension; • Gout; • Recent nephrotoxic drugs; • Dehydration; • Cardiac failure. 	<ul style="list-style-type: none"> • In the presence of renal impairment, all contrast media are nephrotoxic; • The risk of CI-AKI is related to pre-existing renal impairment, dose of contrast and patient hydration; • Renal impairment together with Diabetes Mellitus carries a significant risk; • Congestive heart failure, old age together with administration of nephrotoxic drugs are also risk factors for contrast nephrotoxicity. • eGFR should be used to identify patients at risk of contrast nephrotoxicity: (eGFR below 60 ml/min/1.73m² has been used, as evidenced by literature, to indicate renal impairment. The Contrast Media Safety Committee of the European Society of Urogenital Radiology updated their guidelines and agreed that the risk of CI-AKI is lower after intravenous than after intra-arterial administration of contrast media and considered that only patients with an eGFR of <45ml/min/1.73m² are at risk from CI-AKI. The threshold selected to trigger special precautions may be set locally after discussions involving radiologists and nephrologists); • Administer the smallest possible dose of iodinated contrast-based clinical indications and patient's body weight; • Ensure patient is well hydrated before and after the administration of iodinated contrast (orally or intravenously); • General precautionary measures.
<p>Current drugs which may cause reactions in association with iodinated contrast:</p> <ul style="list-style-type: none"> • Metformin; • β -adrenergic blockers. 	<ul style="list-style-type: none"> • eGFR should be used to identify patients at risk of contrast nephrotoxicity (There is no need to stop metformin after iodinated contrast administration with patients having normal eGFR. If patient has abnormal eGFR, any decision to stop Metformin for 48 hours should be made in consultation with the referring clinician); • General precautionary measures.
<p>Other medical conditions:</p> <ul style="list-style-type: none"> • Hyperthyroidism; • Sickle cell disease; • Myasthenia Gravis. 	<ul style="list-style-type: none"> • Intravenous iodinated contrast should not be administered to patients suffering from hyperthyroidism as this precludes therapeutic radio-iodine treatment for 2 months; • General precautionary measures.
<p>History of previous moderate or severe reactions to iodinated contrast</p>	<p>Determine the contrast medium used</p> <ul style="list-style-type: none"> • General precautionary measures; • Use a different iodinated contrast medium.
<p>History of multiple allergies</p>	<p>Determine the nature of the allergies and their sensitivity</p> <ul style="list-style-type: none"> • General precautionary measures.
<p>History of asthma</p>	<p>Determine whether:</p> <ul style="list-style-type: none"> • It is true asthma or • Chronic obstructive airway disease (COPD) <p>(If patient is wheezing, defer examination and refer patient for appropriate treatment).</p> <p>If asthma is well controlled:</p> <ul style="list-style-type: none"> • General precautionary measures.

eGFR measurement from the previous seven days, which can be compared against a baseline. In the presence of chronic kidney disease (eGFR<40ml/min/1.73m²), one should consider temporarily stopping angiotensin-converting enzyme (ACE) inhibitors and angiotensin II receptor blockers. Consultation with a nephrologist has been shown to be beneficial for patients at risk of CI-AKI (RCR 2015; Lewington, 2013). (See Table 2 for stages of chronic kidney disease).

To date, the best known preventive measure to reduce the risk of CI-AKI is hydration. The smallest dose of low osmolar non-ionic monomeric or iso-osmolar non-ionic dimeric contrast medium should be used. There is insufficient evidence to suggest routine use of any other pharmacological agent in attempting to reduce CI-AKI (RCR 2015).

Mild reactions to iodinated contrast are relatively common, but are mostly self-limited and of no consequence. Severe reactions, although rare, can occur in the absence of any specific risk factor with any type of contrast media (RCR 2015; ACR 2013; RANZCR 2009). Therefore the aims during the administration of iodinated contrast are to:

1. Ensure that the administration of iodinated contrast is appropriate for the patient and the clinical indication;
2. Reduce the possibility of a reaction;
3. Be fully prepared to promptly recognise and treat a reaction if this occurs.

General safety considerations during the administration of iodinated contrast include the availability of an appropriately trained doctor, who can promptly deal with a severe reaction. Those administering iodinated contrast media should be able to identify the symptoms of severe reactions. Patients should be well hydrated prior to iodinated contrast media administration. Facilities for the treatment of acute reactions should be readily available and regularly checked. No patient should be left unsupervised within the first five minutes post administration of iodinated contrast. It is good practice for patients to remain on the premises for at least 15 minutes post administration of iodinated contrast as, based on evidence, most severe reactions occur during this period (RCR 2015). This period should be 30 minutes for individuals who are at an increased risk of adverse reactions. All types

Sources: Royal College of Radiologists (2015); American College of Radiology (2013); Royal Australian and New Zealand College of Radiologists (2009).

of reactions should be reported and documented for future reference (RCR 2015; ACR 2013; Richenberg, 2012; Owen et al. 2014; RANZCR 2009; Bettmann 2004).

Whilst there is always a potential risk for all individuals undertaking iodinated contrast media examinations, there should be a system whereby individuals who pose an increased risk can be identified so that adequate planning and precautionary measures can be taken before their administration. In the presence of an increased risk, the decision about iodinated contrast media administration should be taken by the supervising radiologist based on adequate information (Royal College of Radiologists 2015; American College of Radiology 2013; Owen et al., 2014; RANZCR 2009). Information aiding the identification of individuals who pose an increased risk from the administration of iodinated contrast together with precautionary measures for each case is presented in Table 3. For all such cases, if administration of iodinated contrast is still considered necessary, the following general precautionary measures should be taken:

- Supervise patient continuously;
- Leave cannula in place for at least 30 minutes post administration;
- Ensure availability of emergency drugs and equipment.

Specific precautionary measures are also included in Table 3.

If iodinated contrast administration is necessary during pregnancy, there is a small risk of thyroid suppression to the fetus, and therefore a thyroid function test should be performed during the first week after birth (Royal College of Radiologists 2015).

A small percentage of iodinated contrast is passed on to breast milk in lactating mothers. However, no specific precaution is necessary and mothers may continue to breastfeed their infants without any significant risk (Royal College of Radiologists 2015).

Preparation for the treatment of iodinated contrast media reactions must include preparation for the whole variety of possible reactions and include availability of appropriately trained personnel, medications and equipment (RANZCR 2009).

Quality Assurance and Quality Improvement Programmes

In terms of the administration of iodinated contrast media, quality assurance relates to the systematic monitoring and evaluation of the various aspects of administration, to ensure that required standards of quality are being met and continuously maintained. To ensure patient safety during the administration of iodinated contrast, resuscitation equipment, and medications for the treatment of complications should be made readily available

and regularly checked and maintained (RANZCR 2009).

All personnel who perform venepuncture for the administration of iodinated contrast should be well trained in: (Royal College of Radiologists 2015)

- Venepuncture procedures and have received formal certification of their competence;
- The recognition of iodinated contrast reactions and the procedures for their treatment;
- Cardiopulmonary resuscitation (CPR).

The competencies of personnel should be updated and maintained through training programmes as part of their continuous professional development (CPD).

Conclusion

Recognition of the early signs of iodinated contrast media adverse effects, the risk of reactions to pre-existing conditions, taking adequate precautions to minimise risks and provision of prompt and adequate treatment ensures optimal patient safety and care. ■

Key Points

- ✓ Iodinated contrast media adverse effects and risk recognition;
- ✓ Precautions to minimise risks;
- ✓ Preparation and planning for reducing and treating adverse effects.



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ANTIMICROBIAL COPPER TOUCH SURFACES

REDUCE INFECTIONS, LIBERATE RESOURCES AND CUT COSTS



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The role of the environment in the transmission of healthcare-associated infections (HCAs) is increasingly recognised, requiring a new approach to the selection of materials for objects frequently touched by healthcare workers, patients and visitors that can serve as reservoirs of infection.

There are many technologies and materials on the market, but none are as effective under typical indoor conditions as copper, and its hygienic properties are far from new to us. The Ancient Egyptians, Greeks and Romans used copper-based preparations to treat ailments and prevent wound infections, and in India drinking water is traditionally stored in pots made of brass — an alloy of copper and zinc.

Evidence shows that upgrading the most frequently-touched surfaces in a healthcare environment to antimicrobial copper can reduce the spread of costly infections and improve patient care. This article explores the growing body of research — from laboratory tests and clinical trials — and considers the practicalities and economics of upgrading key surfaces to copper.

Effective Under Typical Indoor Conditions

Copper's antimicrobial properties have been documented in scientific literature for more than a century, but it was not until 2000 that its efficacy against the pathogens responsible for HCAs began to be assessed.

Fifteen years on, more than 60 papers report copper's broad-spectrum, rapid efficacy against bacteria, viruses and fungi — including MRSA, E. coli, Influenza and norovirus. No pathogen tested has been able to survive on copper.

Claims of antimicrobial efficacy made for many antimicrobial products are based on Japanese Industrial Standard (JIS) Z 2801, *Antibacterial products - Test for antibacterial activity and efficacy* (Japanese Standards Association 2012) and International Organization for Standardization (ISO) 22196: 2011

- *Measurement of antibacterial activity on plastics and other non-porous surfaces* (ISO 2011) tests, conducted at >90 percent humidity, 35°C and over 24 hours under a plastic film. These basic tests are described as a proof of principle and do not indicate how a material will perform in the field.

To better represent actual in-use conditions when testing copper, researchers developed new protocols to reflect typical room temperature and humidity and used representative contaminants.

on the stainless steel control (Michels et al. 2008).

Laboratory research on the antimicrobial efficacy of copper and copper alloys has been carried out and verified at institutions around the world, with results peer-reviewed and published in respected journals. They exhibit efficacy under typical indoor conditions, unlike silver-containing materials and triclosan, which showed no antimicrobial efficacy under these conditions, as shown in Figure 2 (Michels et al. 2009).

"THE ANCIENT EGYPTIANS, GREEKS AND ROMANS USED COPPER-BASED PREPARATIONS TO TREAT AILMENTS AND IN INDIA DRINKING WATER IS TRADITIONALLY STORED IN POTS MADE OF BRASS"

The U.S. Environmental Protection Agency (EPA) approved one such test method and developed further protocols — including a challenging recontamination test — leading to the registration of hundreds of copper alloys to be marketed in the U.S. with public health claims. These were the first solid materials to achieve such recognition. As a general rule, alloys should have a minimum 60 percent copper content, and the higher the copper content, the faster the kill (in laboratory tests).

Figure 1 shows the results of an EPA recontamination test simulating a splash or sneeze — a 'wet' contamination event — with MRSA applied every three hours over a 24-hour period at room temperature and humidity. The number of MRSA used (1 million colony forming units per square inch) is far higher than would be found in a typical contamination event. On copper, the MRSA are totally eliminated before the next recontamination, while there is survival and significant growth

Simulations of 'dry' touch contamination events have also been developed, and these tests show an even more rapid kill, with 106 vancomycin-resistant enterococci (VRE) killed in less than 10 minutes on 1cm² copper (Warnes et al. 2011).

A leading researcher in this field is Professor Bill Keevil, Chair in Environmental Healthcare at the University of Southampton, and his work includes investigation of the mechanisms by which copper exerts its antimicrobial effect.

For bacteria, the current consensus among researchers is that there are several probably interacting mechanisms, including:

- Causing leakage of potassium or glutamate through the outer membrane of bacteria;
- Disturbing osmotic balance;
- Binding to proteins that do not require copper;
- Causing oxidative stress by generating hydrogen peroxide;
- Degradation of bacterial DNA.



The Bostonian Sleep Clinic - UK
Image credit: Brass Age



Isku Medical Centre - Finland
Image credit: Copper Development Association



Ralph H. Johnson VA Medical Center
1- US - Clinical Trial Site

There is also agreement that bacteria will not develop resistance to copper. Professor Keevil explains: "Copper works in completely different ways to antibiotics or common biocides. It punches a hole in the cell membrane, like a balloon, and the bacteria collapse. It stops them respiring, goes into the cell and destroys their DNA.

Mutation happens because you get small changes in DNA in cells. The beauty of copper is it destroys the DNA; there is nothing left. We've shown this for bacteria, fungi and viruses. They can't mutate. They have no time."

Most recently, the Southampton team has investigated the contribution antimicrobial copper surfaces can make to combating the rise of antibiotic resistance, assessing the ability of two different strains of bacteria to pass genetic material conveying antibiotic resistance between them on copper and stainless steel. While this took place on stainless steel, it did not happen on copper (Warnes et al. 2012).

Copper can therefore contribute to the fight against antibiotic resistance in two ways: by reducing the spread of infections and thus the need for antibiotics and by preventing the transfer of resistance between bacteria on surfaces.

Proven Under Challenging Clinical Conditions

Having established the inherent ability of copper to eliminate bacteria and viruses in the laboratory, the next logical step was to discover how this would translate into real clinical environments. It is important to note that trials have used solid materials, as the effective surface will not wear away or be susceptible to reduced efficacy over time, as with coatings and composites.

Pathogens persist on standard clinical touch surfaces, creating reservoirs of

infection that pose a risk to patients, staff and visitors, for days, weeks or even months. The first clinical trial – undertaken at Selly Oak Hospital in Birmingham, UK – found that antimicrobial copper taps, toilet seats and door handles on a general medical ward had 90 to 100 percent fewer bacteria on them than the same items made from standard materials (Casey et al. 2009).

Numerous trials have since been conducted in different healthcare systems – including the U.S., Germany and Finland – and different clinical environments such as nephrology, geriatric and ICU wards. They have similarly reported significant and continuous bioburden reduction, with trial leaders concluding that antimicrobial copper surfaces can provide an additional measure to reduce the spread of HCAs.

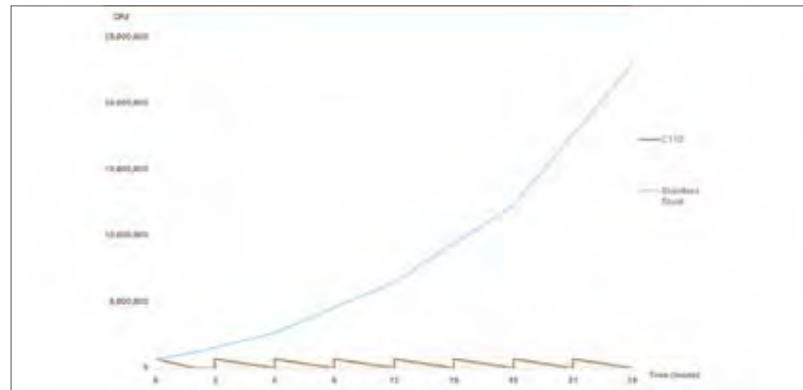


Figure 1. EPA Recontamination Test to Simulate a Busy Ward: 1 million CFUs of MRSA every 3 Hours on Copper (C110) and Stainless Steel
Source: Grass et al. (2010)

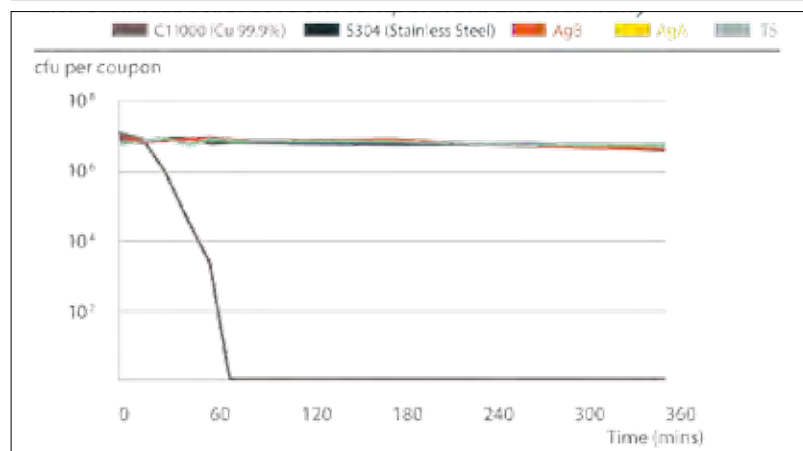


Figure 2. MRSA Viability on copper, silver- and triclosan-coated materials and stainless steel at room temperature and humidity
Source: Michels et al. (2009)

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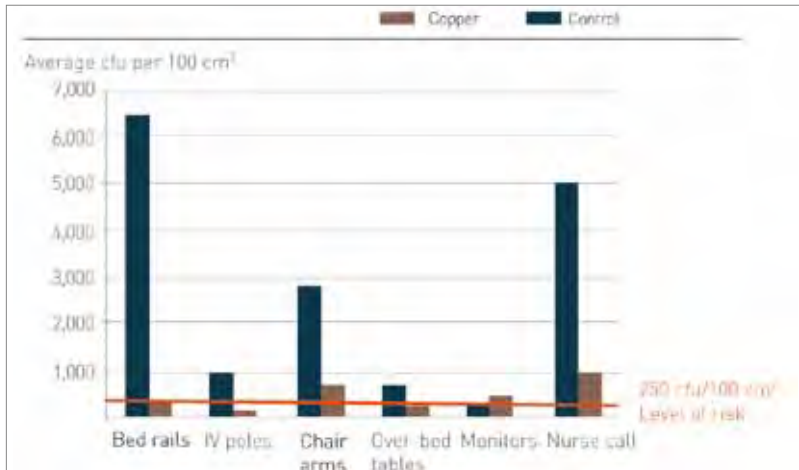


Figure 3. Sustained Reduction of Microbial Burden on Hospital Surfaces Through Introduction of Copper
 Source: Schmidt et al. (2012)



Figure 4. Quartile Distribution of HCAs Stratified by Microbial Burden
 Source: Salgado et al. (2013)

A multicentre clinical trial in ICUs, funded by the U.S. Department of Defense, took the research one step further and asked the question "Will the bioburden reduction associated with the installation of copper surfaces reduce the number of infections?" Led by Dr. Michael Schmidt, Professor and Vice Chair of Microbiology and Immunology at the Medical University of South Carolina, the trial team found that replacing just six key, near-patient touch surfaces reduced the incidence of infections by 58 percent (Salgado et al. 2013). Figure 3 shows the accompanying reduction in microbial burden on

the six surfaces (Schmidt et al. 2012).

Just 10 percent of touch surfaces were upgraded to antimicrobial copper, yet the impact was significant. This study is the first to report a correlation between environmental bioburden (whether in copper or control rooms) and the risk of acquiring an infection, and to show a reduction in that risk due to a minimal intervention with an effective antimicrobial material.

Figure 4 demonstrates this correlation, with quartile distribution of HCAs stratified by microbial burden measured in the ICU room during the patient's stay. There was a significant burden association

between burden and HCAI risk, with 89 percent of HCAs occurring among patients in rooms with a burden of more than 500 colony-forming units (CFU) per 100 cm² (Salgado et al. 2013).

Key healthcare watchdogs and horizon scanning bodies around the world, including ECRI Institute (2014) and the Canadian Network for Environmental Scanning in Health (Ndegwa 2015) have recognised the growing body of evidence for copper's potential to boost infection control. It has also been acknowledged in the evidence-based epic3 guidelines, which included copper as an emerging technology in 2014 (Loveday et al. 2014).

With this proven efficacy in mind, the next question arising will naturally concern the cost of installing antimicrobial copper touch surfaces.

Cost Benefits of Upgrading to Copper

HCAIs are very common and very costly, both financially and in terms of human life. Approximately 20 percent of ICU patients in European hospitals get HCAs, and in 2011 they affected 4.1 million patients, necessitating 16 million extra days in hospital. Thirty-seven thousand deaths were recorded as being caused by HCAs, plus 110,000 deaths where they were a contributing factor, and they had a direct clinical cost in excess of 7 billion euros (World Health Organization 2011).

York Health Economics Consortium (YHEC), a group of leading global health economists based at the University of York in the UK, developed a fully-referenced cost benefit model for hospital managers to illustrate the economic rationale of an antimicrobial copper installation (Taylor et al. 2013). The model is based on the cost of installing antimicrobial copper touch surfaces and the balancing cost savings resulting from reduced infection rates. The model allows local data to be entered for site-specific evaluations, but is populated with default data for the UK as an illustration.

Table 1

Medical Equipment & Furniture	Fixtures & Fittings	
Bed rails*	Cabinet handles*	Light switches*
Chairs*	Counter tops	Push plates*
Dressings trolleys	Dispensers	Sinks*
Input devices/nurse call buttons*	Door handles*	Switched sockets
IV poles*	Grab rails*	Taps
Over-bed or tray tables*	Hand rails	Toilet seats and flush handles*

Source: Copper Development Association (2014)

How Copper can Help Protect Your Patients

By choosing touch surfaces made from antimicrobial copper, you can continuously kill pathogenic microbes, boosting hand hygiene, cleaning and disinfection measures and creating a safer environment for your patients. This novel approach works 24/7 and requires no routine maintenance, just standard cleaning. Antimicrobial copper surfaces are made from solid, eco-friendly metals with intrinsic antimicrobial properties that last the lifetime of the product.

Antimicrobial copper touch surfaces offer:

- Continuous and significant bioburden reduction
- Improved patient outcomes
- A supplement to standard hygiene practices
- Simple, cost-effective intervention
- Payback in less than one year



Online Product Directory



Hospital Manager's Guide to Antimicrobial Copper

www.antimicrobialcopper.org

Antimicrobial
Copper



Using UK data for cost of infection, industry data for cost of antimicrobial copper and standard components, and a conservative infection rate reduction of 20 percent (where the U.S. trial reported a 58 percent reduction), the model considers a planned refurbishment or new build. It predicts that the cost of replacing the six key touch surfaces in a 20-bed ICU with antimicrobial copper equivalents will be recouped in less than two months, based on fewer infections and the resulting shorter lengths of stay. It also calculates a positive impact on bed days and quality-adjusted life years offered by antimicrobial copper.

Dr. Matthew Taylor, YHEC's director and one of the model's authors, concludes: "After the initial two months, ongoing cost savings will accrue from the reduction in blocked beds and better directed staff resources."

Specifying Copper

There is an ever-expanding range of products on the market as the supply chain responds to growing demand, so

how does one get started with selecting the priority touch surfaces to upgrade in a given healthcare environment?

A number of studies have identified frequently-touched surfaces as being contamination hotspots that present an infection risk and are therefore targets for upgrade. Based on a review of international research, the United States Centers for Disease Control and Prevention (CDC) published a checklist of key surfaces based upon the likelihood of touch and contamination (Guh et al. 2015).

In the many copper clinical trials, conducted around the world, multi-disciplinary teams have prioritised high frequency touch surfaces to upgrade to copper. The factors considered include known hotspots from microbiological testing and likely hotspots based on experience and understanding of staff/patient/visitor dynamics.

Table 1 represents a summary of these surfaces with CDC surfaces indicated by an asterisk, to differentiate from those identified in clinical trials, and is the starting point for selecting items to upgrade for any new build or refurbishment project.

Input should also be sought from the infection control team and ward staff to ensure that all high-risk touch surfaces specific to a particular area are included. The regular environmental swabbing carried out by infection control teams to assess the state of cleanliness will also indicate contamination.

Support with identifying efficacious products is available in the form of an industry stewardship scheme. The Antimicrobial Copper brand and Cu⁺ mark are used by leading manufacturers of

hospital equipment, furniture and fittings to indicate their products are made from solid antimicrobial copper, and that the organisation adheres to strict usage rules guiding their understanding of the underlying technology and its deployment.

An online directory of approved products is available to browse on antimicrobialcopper.org.

Copper alloys offer a wide palette of colours from the gold of brasses to the rich brown of bronzes right through to the silver/white shades of copper-nickels. Copper alloys will naturally darken over time, but this does not impact their antimicrobial efficacy. More colour-stable alloys traditionally used in naval applications are available.

Wide Installation

Antimicrobial copper surfaces are an adjunct to and not a replacement for existing infection control measures. Alongside good hand hygiene and regular surface cleaning and disinfection, they will continuously reduce surface contamination and consequently the risk of infections being passed between people via these surfaces.

Installations have already taken place around the world in more than 25 countries. In these hospitals, the importance of taking a multidisciplinary approach to infection control has been clear.

Further Reading

You can download a simple, four-page guide *Antimicrobial Copper: A Hospital Manager's Guide* (CDA Publication 219) (2014) from News and Downloads/ Brochures on antimicrobialcopper.org.

Key points

- ✓ Copper is a powerful antimicrobial with rapid, broad-spectrum efficacy against bacteria and viruses, including MRSA, E. coli and norovirus.
- ✓ 'Antimicrobial Copper' is an umbrella term for pure copper and a family of copper alloys that benefit from the metal's inherent antimicrobial efficacy.
- ✓ Touch surfaces – such as bed rails, overbed tables, taps and light switches – made from antimicrobial copper harbour >80 percent less microbial contamination than non-copper equivalents.
- ✓ This reduction in contamination has been shown to reduce infections by 58 percent.



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COGNITIVE IMPAIRMENT AFTER CRITICAL ILLNESS

PREVENTION AND TREATMENT



Prof. Ignacio J. Previgliano

is Head of Intensive Care, Hospital General de Agudos J. A. Fernández, Buenos Aires, Argentina. He talked to *ICU Management* about his investigations into the use of neurotrophic factor preparation (NTF-prep) for cognitive impairment after critical illness.

Why did you decide to investigate NTF-prep?

Long-term cognitive impairment after critical illness (CIACI) was first described in 1999 (Hopkins 1999). In 1992 we noticed that in cardiac surgery with extracorporeal circulation patients there was a correlation between jugular bulb lactic acid and cognitive decline. We concluded that CIACI was a real dementia, not a post-traumatic stress disorder (Previgliano 2015). Pandharipande et al. revealed that impairment was independently associated with duration of delirium (Pandharipande et al. 2013). Analysing delirium pathophysiology under the physiologic mechanisms of brain cell death and survival, including the neurovascular unit (NVU) concept, led us to conclude that vascular ischaemia, necrosis and apoptotic mechanisms were involved or triggered in CIACI. Endogenous neurotrophic factors (ENTF), as brain-derived neurotrophic factor (BDNF), were found to be involved in almost all stages of development of neural circuits, with a key role in synaptic N-methyl-D-aspartate transmission activity, inflammation and apoptosis regulation. Natural neurotrophic factor preparation (NTF-prep; commercially available as Cerebrolysin®) acts like endogenous neurotrophic factors and showed clinical efficacy in Alzheimer's disease (AD), vascular dementia, ischaemic stroke and traumatic brain injury (TBI). We hypothesised that NTF-prep could play a neuroprotective role at delirium onset, or a neurotrophic or neurogenic one when CIACI was present.

How might NTF-prep be useful for prevention and treatment of CIACI?

NTF-prep was shown to stimulate angiogenesis, neurogenesis, remyelination, cell migration, suppression of apoptotic-like processes and recovery of functional NVU. These findings were translated into improved functional outcomes in various animal models. They were shown to act through sonic hedgehog and neurotrophic signal transduction pathways, which are part of the endogenous mechanisms of neuroprotection and neurorestoration. Our hypothesis is that due to this neuroprotective action NTF-prep could be effective in CIACI prevention. For this setting a 30 ml/day infusion for 10 days, as used for stroke, might prevent CIACI development.

Once CIACI is present the clinical picture resembles mild cognitive impairment or mild dementia. In dementia, NTF-prep has showed improvement over placebo in 12 randomised controlled studies. In a trial in Argentina on NTF-prep in 202 AD and mixed dementia patients, we found a 70%

improvement. For CIACI treatment we think the regimen of 10 ml/day for 20 days repeated each three months, as used in dementia, could be suitable.

What might be the advantages of NTF-prep compared to the delirium care bundle?

The delirium care bundle includes sedation suspension, spontaneous ventilation assays, early mobility and sleep hygiene programmes (Barr et al. 2013). While it is associated with significant improvements, it is an example of how endogenous defence mechanisms can be triggered. Awakening patients augments cerebral blood flow and generates local NTF release, as does physical activity. The muscle must be seen as an endocrine system with endocrine, autocrine or paracrine effects. There is a clear relationship between levels of IL6 and BDNF, exercise and improved cognitive function. As BDNF is a large molecule it cannot pass through the NVU and blood brain barrier (BBB), so an endocrine and paracrine activation gear promotes BDNF release within the brain. NTF-prep is produced by an enzymatic breakdown of purified porcine brain proteins, and contains a complex mixture of <10 kDa peptides that was shown to stimulate neurotrophic signalling pathway as well as endogenous production of NTFs. Therefore, NTF-prep acts in a similar way to ENTF, but is able to cross the BBB. In this way it could be used in conjunction with the delirium care bundle to protect the brain.

What might be the potential risks of NTF-prep?

A review of NTF-prep safety in randomised clinical trials of dementia and stroke found no differences with the placebo (Thome and Doppler 2012). Adverse effects were generally mild and transient. Prescribing information warns about anaphylactic reactions in less than 10⁻¹⁰⁰ of patients. NTF-prep appears to be safe when used in combination with recombinant tissue plasminogen activator or cholinesterase inhibitors such as donepezil or rivastigmine.

NTF-prep is already in use for TBI and stroke patients. What are the results? What is your own experience?

A randomised clinical trial in 1,070 patients with acute ischaemic stroke found no significant difference 90 days after stroke onset between patients receiving the NTF-prep or placebo (Heiss et al. 2012). A post-hoc analysis, however, showed a trend in favour of the NTF-prep in patients with a National Institutes of Health Stroke Score >12. The cumulative mortality at day 90 was significantly lower; 20.2% in the placebo group and 10.5% in the treatment group. The morbidity was lower in the treatment group with an improvement of 4.8 points versus 1.8 points for placebo. A consistent, across all clinical studies in acute brain injuries, is accelerated recovery pattern reflecting activation of consciousness, motor and cognitive functions. These clinical effects might be of relevance for supporting delirium care bundle. A recent trial investigated the cognitive effects of the NTF-prep in mild TBI patients. It found that the acute administration of the NTF-prep resulted in the recovery of cognitive deterioration as assessed at 1 and 3 months post-injury (Chen et al. 2013).

Our experience, in 18 patients surviving severe TBI that developed post-traumatic dementia, treated with NTF-prep at the dementia dosage and quarterly cycles, showed significant improvement in memory, executive and motor function. Transcranial Doppler studies revealed significant improvements in cerebral blood flow velocities in both middle cerebral and basilar arteries, and in estimated cerebral perfusion pressure, with a decrease in pulsatility index reflecting a drop in cerebrovascular resistance.

What further research is needed?

Although NTF-prep is approved in many countries to treat dementia, stroke and TBI, and all these diseases have common pathways with CIACI, we still need to prove that our hypothesis on prevention is correct. A dedicated clinical development programme could provide the answer. ■

Abbreviations

- BBB Blood brain barrier
- BDNF Brain-derived neurotrophic factors
- CIACI Cognitive impairment after critical illness
- IL6 Interleukin-6
- ENTF Endogenous neurotrophic factors
- NTF-prep Neurotrophic factor preparation
- NVU Neurovascular unit
- TBI Traumatic brain injury

DISCLOSURE:

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BUSINESS INTELLIGENCE IN HOSPITAL MANAGEMENT

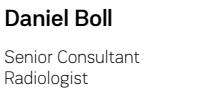
CHALLENGES AND OPPORTUNITIES USING THE EXAMPLE OF A RADIOLOGY DEPARTMENT



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Management cannot work without defining and utilising key performance indicators (KPI) to control entire business procedures. This is also a must for the health management sector. Cuts in reimbursement, higher demand from patients and referring physicians combined with a permanently varying political and legal framework require high transparency and the ability to react quickly, change strategies and optimise processes. This leads to increased requirements in the availability of information and data analysis. The implementation of modern methods in Business Intelligence (BI) opens up the opportunity to face these challenging tasks.

Why should managers in the healthcare sector care about BI? What are the costs of implementation and operation and what is the benefit? Calculating the cost of BI is definitely less complex than calculating its benefits, especially on a monetary basis (Buff 2015). The underlying problem is that BI cannot create revenues by itself, and the benefit arises from the consequences driven by its results. The use of BI is the key to identifying and implementing precise actions and observing their outcome. BI has to become a major part of the strategy of each department and the overall hospital management. Maurer et al. (2012) show that the use of the Balanced Scorecard (BSC) is suitable for the management of a radiology department. For each perspective of the BSC objectives, measures, targets and initiatives have to be defined. The measures or KPI should be permanently observed to ensure that the predefined targets are achieved.

What is BI and What is Needed for its Implementation?

There are many definitions of the term BI published in the literature. Technically, BI summarises all applications used for the analysis of data and decision support.

Thus a simple Microsoft Excel spreadsheet displaying the number of examinations and interventions at a hospital is one form of BI. This is, however, a very narrow perspective, as BI is more than that.

Business Intelligence (BI) is an umbrella term that includes the applications, infrastructure and tools, and best practices that enable access to and analysis of information to improve and optimise decisions and performance. (Gartner 2013)

This definition shows that besides the tools and applications appropriate organisational structures are necessary. For a successful implementation of a BI environment, investment in technical and personnel resources is required.

Data and its availability: First it must be clear what data is needed for the analysis. IT architecture is very heterogeneous, especially in a hospital environment. It is dominated by specific and mostly self-sufficient departmental IT systems (eg, radiology, laboratory, operating rooms). Access to the data in these departmental systems can be challenging, especially if it is necessary to combine data from different systems. Depending on complexity and requirements of the analysis it is usually necessary to build a data warehouse and implement a solid ETL (Extraction, Transformation and Loading data from different systems) process. This helps consolidate and prepare the data and enables easy and reliable data analysis. The implementation of such a professional BI environment is complex and time-consuming, and often collides with the need for immediate and valid results at the management level. It also requires specific know-how that isn't usually available in a hospital setting, especially when it comes to the analysis of data of departmental systems. Consolidation of these data requires a deep understanding of the specific application and database, ideally in combination with a deep insight into the

procedures of the corresponding department. For optimal results close cooperation between IT experts and the service owner of the departmental application is mandatory.

Professional BI applications: Microsoft Excel is probably still the most common tool for data analysis and control tasks. Even in the near future it will play a significant role in detailed and ad-hoc analysis. However, for more complex and standardised data analysis the use of a professional BI application is encouraged. BI applications are suitable for the needs and requirements of quick, reliable and intuitive KPI. They outperform the common means of reporting and analysis with high performance and flexibility, especially in handling big data, complex algorithms and visualisation of KPI. Additionally, as the extraction and preparation of data can be run automatically, independent data access can be granted to all staff.

Currently, many different and powerful applications exist, and finding the right application is not easy. As always, individual solutions and vendors have their own strengths and restrictions, making it helpful to start with an overview of the BI solutions market. The following professional market overviews may help to sift the eligible applications.

- Magic Quadrant for Business Intelligence and Analytics Platform - Gartner (gartner.com)
- Healthcare Analytics Performance - KLAS (KLASresearch.com)
- BI Survey -BARC (barc-research.com)

The second step in choosing the right solution is based on individual requirements. It is strongly recommended to create a detailed requirements specification, which should be drawn up in collaboration with users (such as controllers and managers), the departmental applications administrators and IT experts. The resulting document will assure that



Figure 1. Dashboard for Monthly Utilisation Reporting, University Hospital Radiology Department

Key: Charts for utilisation per month (1), modality (2), subspecialties (3), workplaces (4), daytime (5), weekday (6), outpatient ratio (7), years (8) and single days (9).

defined specifications are fulfilled. The document should contain the following topics.

- **Goal** (Why should a BI application be implemented?)
- **Visualisation and analysis** (eg dashboards, charts, interactive visualisation, drill-down)
- **Additional functionalities** (eg use of mobile devices, export of data)
- **Data integration** (eg compatibility, transformation)
- **Installation** (eg servers, compatibility)
- **Administration** (eg performance, support, community)

Personnel resources, know-how and skills: For successful BI solution implementation personnel resources with specific know-how and skills must be considered. Permanent training is a must to suit continuous development in this dynamic field. For instance, in a radiology department the administrator of the Radiology Information System (RIS) will be the one with knowledge and access to the database and a good insight into departmental procedures. He/she might not, however, have the skills for implementing and operating a professional BI solution, and might lack data access to other applications if needed for further analysis. This is when other experts come into play. For personnel with usual IT skills

the use of modern BI applications is easy to learn. Initial results are available within the first two weeks, but for routine use of the extensive features a training period of at least one year must be taken into consideration. Modern teaching methods,

“FOR MORE COMPLEX AND STANDARDISED DATA ANALYSIS THE USE OF A PROFESSIONAL BI APPLICATION IS ENCOURAGED”

such as video tutorials, online courses and user communities, are helpful and, compared to conventional teaching methods, less expensive.

The ongoing effort to prepare and publish reports and analysis will decrease with successful implementation of a BI approach. However, a substantial investment in the initial implementation of the new system is required. But this investment will result in a greater benefit. At the start management is responsible for evaluating if the required personnel resources and skills are available. In bigger hospitals a central unit for control and BI might be in charge of delivering reports and KPI to the CEO on the level of a management information system. Nevertheless a decentralised control structure is necessary, as staff from a central control unit are too far removed from the business

of specific departments. Definition and deployment of KPI in these departments always demands knowledge of its processes and rules. For radiology Busch (2013) describes the need to establish a position alongside the chairman to offer

support in areas like organisational development, process optimisation and control in a modern radiology department.

What Happens if Technical Implementation is Done?

How many CT scans did we have in neuroradiology in the first five months of the current year compared to the same time period last year? And how do they divide among the different referring physicians?

Questions like these will be asked frequently by responsible managers. With a professional BI solution these types of questions can be answered in seconds. Above all, these questions can also be independently answered by the user. The user interfaces of these applications are very intuitive, and the database beneath the charts is well prepared to guarantee

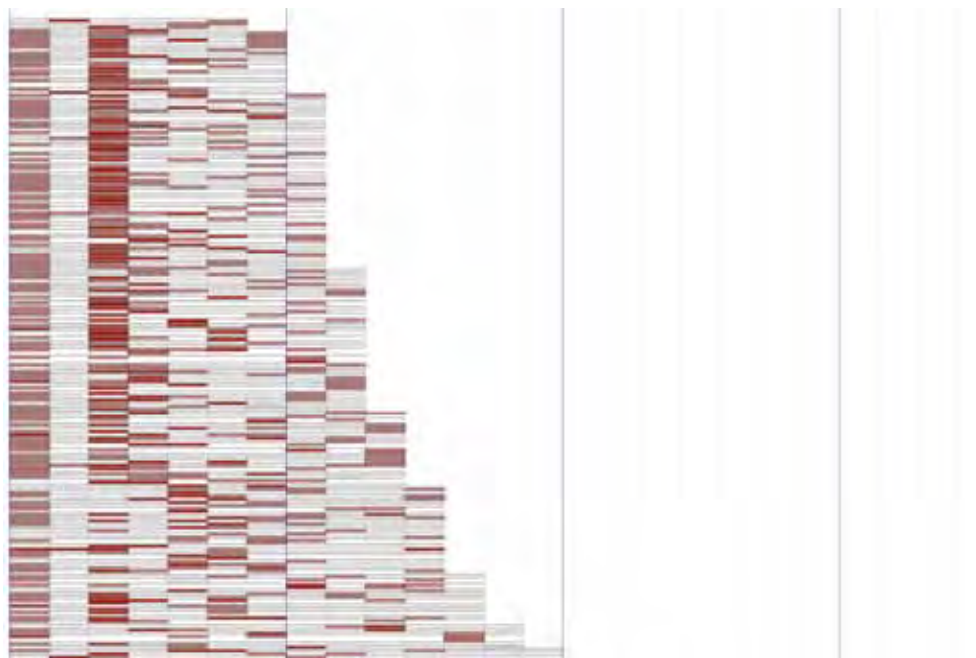


Figure 2. Visualisation of Patterns of Diagnostic Imaging Correlated to Length of Stay (LOS) of Inpatient Treatment in the (Diagnosis Related Groups (DRG) System

Each line indicates an inpatient stay in the hospital; its length represents the LOS. Cases are ranked by LOS. Red rectangles indicate a radiology examination. A stable pattern can be seen for cases with shorter LOS (examination mostly on first and third day of the stay). This pattern dissolves for cases with longer LOS, especially for examinations on the third day.

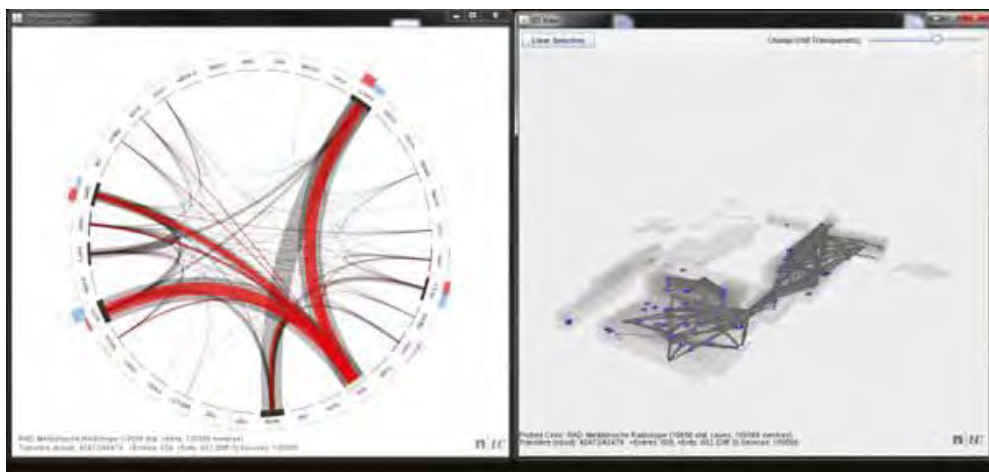


Figure 3. Visualisation of Patient Pathways

L: Graph to visualise the volume of traffic from and to the different units in a hospital
 R: Same pathways visualised in a 3D-model of the campus

valid KPI. This relieves the analyst of the time-consuming, endless preparation of new insights on data and the building of new reports and charts. Finally, the analyst can spend more time on the interpretation of data than on preparing it.

Now, two important prerequisites for a successful implementation (Busch 2011) — quick availability and low running effort — are fulfilled. The next step defines the required KPI. These should be oriented to the strategic objectives of the hospital or department, and should include strategies and consequences in case targets

are missed. A description of each KPI's interpretation and metric is necessary to avoid misinterpretation by different recipients. Ideally, these descriptions are included directly in the BI application, to synchronise access to KPI, their definition and explanation at the same time.

Initially, the definition of KPI seems straightforward, but the daily use of KPI shows that it is quite difficult, and misinterpretations occur frequently. This can be illustrated using the most common KPI in radiology — the number of examinations. How to count a combined CT scan

of the thorax and abdomen? It can be counted as a single examination, corresponding to the number of time slots that one has to plan in the scheduler. But it also can be counted as two examinations, corresponding to the different body regions read by the radiologist which can be reimbursed. Neither interpretation is right or wrong. The key is to determine which of these interpretations is valid, to guarantee that all recipients are working with the same format. For this reason, it is recommended to verify the algorithm on which the KPI is based and its interpretation in the sense of quality assurance. Verification and quality assurance is not the responsibility of the analyst. Rather it is that of the 'customer' (management) to the 'supplier' (analyst), and should be confirmed with an acceptance document.

Implementation Phases

Initially BI will take over the tasks of common retrospective reporting such as the monthly utilisation report. But even for this simple task a modern BI solution offers significantly more possibilities. Performance, availability, flexibility and the depth of possible views on the reports exceed the capacity of conventional manual provision of reports. Figure 1 shows an example of a BI dashboard used in a radiology department to show utilisation figures. Success and acceptance of BI depends massively on the early availability of initial results (Bachmann and Kemper 2011). These 'quick wins' are the basis for further development and support by the board and the recipients. The easiest way to achieve this is by transforming retrospective reporting into a BI system, because well-known content and visualisation can be enriched with new functionalities and more flexibility.

Soon after this kind of reporting is available users will start to dig deeper into data analysis. This is when requirements of data complexity start to increase, as data from other applications come into play. Figure 2 shows an example in which data from the RIS is matched with data from the Diagnosis Related Groups (DRG) system. The visualisation in this case helps to identify correlations between patterns in radiology procedures and the length of stay of inpatient treatment (Truong 2015). Figure 3 shows another example of the analysis of patient's pathways within a hospital and its visualisation, using a 3D model of the campus

Angeforderte Untersuchungen

Name	Vorname	Geb.dat.	amb/stat	Gerät	Untersuchung	Anforderungszeitpunkt
Baumgartner	Thomas	19.03.1978	A		MRI Halswirbelsäule	19.03.2014 16:31

Terminierte Untersuchungen

Name	Vorname	Geb.dat.	amb/stat	Gerät	Untersuchung	Ungefährer Untersuchungsbeginn
Baumgartner	Thomas	19.03.1978	A	UMRIABRUF	Aufklärungsgespräch	26.03.2014 11:40
Baumgartner	Thomas	19.03.1978	A	UMRI/2	MRI Arthrografie Schulter re	27.03.2014 15:30
Baumgartner	Thomas	19.03.1978	A	UMRI/2	MRI Kniegelenk rechts	21.03.2014 18:00

Achtung: Der angegebene Termin ist provisorisch. Eine Verzögerung bis zu zwei Stunden, aber auch ein kurzfristig früherer Aufruf ist möglich.

Abgeschlossene Untersuchungen

Name	Vorname	Geb.dat.	amb/stat	Status Untersuchung	Untersuchung	Untersuchungsbeginn
Baumgartner	Thomas	19.03.1978	S	Befund finalisiert	MRI Schädel	19.03.2014 17:30
Baumgartner	Thomas	19.03.1978	A	Befund finalisiert	MRI Schädel	19.03.2014 18:30
Baumgartner	Thomas	19.03.1978	S	Befund finalisiert	MRI Schädel	19.03.2014 11:30
Baumgartner	Thomas	19.03.1978	S	Befund finalisiert	MRI Schädel	19.03.2014 10:20
Baumgartner	Thomas	19.03.1978	S	Befund finalisiert	MRI Schädel	19.03.2014 13:37

Figure 4. Real-Time Status Monitor for Emergency Room Patients

Top table shows all patients with pending orders. Middle table shows all scheduled patients. Bottom table shows all completed examinations and the status of the images and the report.

(Brodbeck et al. 2013). Possibilities seem to be infinite, but on the other hand this demands high discipline from the recipients of data analysis and visualisation. Every complex analysis is accompanied by additional effort, and not every fancy visualisation is rational. There should be no analysis without a specific goal and a corresponding consequence.

Another important use for BI is real-time monitoring (RTM). In this context RTM is defined as a continuous extraction of data in real time (or near real time) for the purpose of controlling processes. In health management this approach is underrepresented, as it has been established in productive industries (eg, automotive or chemistry) for decades. No chemical reaction would run properly without control of temperature, pressure, etc. Naturally, procedures in healthcare are not as deterministic as in the production of automotive parts, yet the control process can be a very helpful approach

for all stakeholders (Escher et al. 2015). A remarkable example is the provision of the status of patients sent from the emergency room to the radiology department for further diagnosis. This is deployed by monitoring status based on RIS data, which shows the status of all patient orders from the emergency room (see Figure 4). Knowledge of the whereabouts of the patient, the availability of images and reports will help the emergency physician monitor progress of the requested examination. Time-consuming frequent inquiries by telephone decrease to a minimum. This is a benefit for the emergency room, the radiology department and even the patient.

BI: A worthwhile investment!

There are many possible uses for BI. For example, it can answer many questions about business administration. The effort to implement and operate BI should not be underestimated, but it can

ultimately reduce the running effort for the conventional labour-intensive provision of data. Managers will see the value combined with rapid availability and flexible analysis and visualisation possibilities. This is why BI will be an indispensable tool in central and decentralised hospital management. ■

Key Points

- ✓ Business Intelligence (BI) is a worthwhile investment, and will play a significant role in hospital management in the near future.
- ✓ Implementation of BI is challenging, requires resources, skills and a strategy, but enables management to have easy access to relevant analysis of data and visualisation of important key performance indicators (KPI).
- ✓ Modern BI applications will help to overcome shortages of common 'hand-made' analysis, save time and money, and will enable even managers to do 'self-service' analysis and reporting.

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HEALTH ECONOMIC SYSTEMS

HOW DO THEY INFLUENCE RADIOLOGY?



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Why do Healthcare Markets Fail? The Origin of Health Economics

In an ordinary market, the client uses their knowledge and the resources available in order to make purchases, which will cover their needs. Depending on their knowledge, their needs and the money that they possess, they compare prices and products in order to make informed decisions on what to buy.

When it comes to their healthcare, the client does not have specific knowledge, so they seek a physician. The physician has asymmetrically more knowledge than the patient, and in that way they act as the patient's agent when it comes to the purchase of health services. In cases where the patient is covered by a social security plan (that means broadly that somebody else will cover the bill), neither the patient nor the doctor are interested in the cost of the healthcare services. This may lead to over-utilisation of services or, in other words, to a moral hazard to the social security system (Allart et al. 2000). This creates healthcare market failure.

Health economists are interested in how healthcare market failure can be confronted (Kenneth 1962). The issue becomes even more complicated, because the resources of the society are scarce at the same time as the needs are unlimited. Therefore societies have to allocate their scarce resources amongst health and the other goods that they provide (such as education, transportation etc.).

The question is not only how to allocate the resources amongst health and other goods, but most importantly how to allocate the scarce resources within the healthcare sector itself. Within this sector, the demand for health services is unlimited. Opportunity cost is a key concept in order to approach this issue. It has been described as expressing the basic relationship between scarcity and choice. For instance, the opportunity cost of buying a new scanner might be not to have a refurbishment of the reception area of your department. This cost of

the lost opportunity of the refurbishment as a second alternative choice of the budget's usage, represents the opportunity cost, and reassures the good or the bad use of the budget.

The notion of opportunity cost plays a crucial part in ensuring that scarce resources are used efficiently. This is because societies express major concerns about the following issues:

- How much are we willing to spend to save a life?
- How much do we value quality of life, or patient satisfaction, against cost?

Thus, health economics is used to orient policies on:

- Which services must be produced?
- How many resources will be allocated for those services?
- How, and in which combination, will those services be produced?
- Who will provide them and in which way will they be used?'

Moreover, health economics evaluates multiple types of financial information,

the best available services to patients without thought to cost. Unfortunately, cost is tightly linked to offered services and somebody has to cover it.

Health Economic Systems and Radiology Departments

The cost of health services is becoming more and more unbearable for working-class people. Unfortunately, in the highest percentage of the world's under-developed countries patients have to buy their health services out of their own pocket. It is expected that when there is no insurance coverage umbrella, only rich people or the political elite can have access to the health services. This is called an out-of-pocket payment health coverage "system"; it is practically a "non-system".

In the European region, but also in other areas of the world, systems have been established based on re-distributional policies to equalise the financial burden of healthcare and to ensure access on the basis of need and not on the ability

“ENSURING THAT THE PRESCRIBED EXAMINATION WILL CONTRIBUTE TO ADDRESSING THEIR HEALTH PROBLEM”

such as costs, charges and expenditures (Wonderling et al. 2005).

In this evaluation radiologists, radiographers, physicists and radiology managers must take an active part by using evidence-based knowledge about the appropriateness and the utility of the imaging services related to each particular clinical question of their clinicians or managerial fellows.

We know, for instance, that an MRI for patients with back pain typically leaves them no healthier, but it does leave them more satisfied. Is it a cost that the citizen taxpayer should bear? Everyone in a department wishes to offer

to pay. Broadly, these models, in the chronological order they were developed are (Reid 2009):

The Bismarck model: This model was introduced by Chancellor Bismarck in Germany around 1883. In the Bismarck model countries' healthcare providers and payers are both private entities. The model uses private health insurance plans, usually financed jointly by employers and employees through payroll deduction, to cover everybody, and they do not make a profit. Although the Bismarck model is a multiplayer one, tight regulation of medical services and fees gives the system a strong cost-control clout.



The Beveridge model: The system was introduced in Britain around 1945. In this system healthcare is provided and financed by the government through tax payments. There are no medical bills. Many or sometimes all hospitals and clinics are owned by the government. These systems tend to have low cost per capita, because the government as the sole payer controls what doctors can do and what they can charge. The core theory of the Beveridge model nowadays can be summarised as “services can be provided to everyone, but not everything”.

The national health insurance model: This system has elements of both Bismarck and Beveridge. The provider of healthcare is private, but the payer is a government-run insurance programme that every citizen pays into. The insurance plan collects monthly premiums and pays medical bills. As a single payer covers everybody, the system tends to have considerable market power to negotiate for lower prices. The national insurance model runs as a nonprofit one.

Summarising the above in relation to radiology departments’ reimbursement we observe:

1. Departments working under a health coverage system offer services free or near free at the point of delivery to every patient properly referred to them.

2. Those departments are expected to develop a gatekeeper’s role by justifying the imaging referral of a patient by ensuring that the prescribed examination will contribute to addressing their health problem.
3. By practising a gatekeeper’s role imaging departments preserve the rare resources of society, contributing in this way to keeping the overutilisation and the consequent moral hazard low.
4. The European radiation protection directive (Council Directive 2013), the EU’s “Referral Guidelines For Imaging”, have a chance to be precisely followed by the departments that work under a social security reimbursement system.
5. To the cons can be attributed the zero financial transaction between the customer and the provider at the point of the service delivery. This may cause an overutilisation of the services by the customer and by the provider, the latter because of the incentive of the fee for volume reimbursement.

Government bodies attempting to eliminate moral hazards from free at the point of delivery imaging services have developed mechanisms, as follows:

- Referral criteria that must be fulfilled

in order for a patient to be booked for an imaging examination.

- A pre-determined order of examinations, from lower cost to those of a higher cost, associated with the available technology, such as an ultrasound imaging examination as a pre-requirement for a CT referral for an abdominal examination.
- Booking time delays.
- A direct out-of-pocket percentage of an amount that the patient must pay, even though they will claim it later.

Publicity of the protocols and the referrals criteria gives transparency to those mechanisms and reduces public criticism, and also reassures them that no-one can trespass them.

Despite all the aforementioned methods for patients’ coverage, the reality is that health services are getting more expensive, and cost control alone is not effective. Policies have to be developed aimed at improving efficiency of service delivery and use.

Developing Effective and Efficient Radiology Departments

Radiology departments are units that transform inputs to outputs through the imaging process. Inputs are the medical

referrals of the patients. The main aim of an imaging department is to produce the maximum possible output from a fixed resource, in other words to function efficiently. The question is what the department considers as an output and how they measure it. The key phrase here is the “maximum possible output” in relation to the “fixed cost”. It is the responsibility of everyone who is involved in the imaging services to protect the scarce resources of the system by making efficient use of them and by keeping cost to the minimum. In the health sector cost has a broad meaning beyond financial expenditures, that also includes time, education and training of personnel, availability of the imaging units around the clock, etc. (IAEA 2011).

The health service’s funding mechanisms are believed to influence the delivery and quality of patient care. Private imaging providers are looking for a considerable volume of examinations in a certain time frame, as their reward comes from the volume of examinations they provide. It is expected that fee-for-volume funding is associated with overutilisation of imaging services. The contribution of the referring physician under the possible existence of any financial incentives is unquestionable due to the asymmetric information that the physician has and the patient lacks. The existence of a health coverage system, which will later pay the bill, probably increases the volume of the prescribed examinations, as Roemer’s law states: “Under a Social Insurance payment plan, every offered imaging unit is a usable unit” (Shain and Roemer 1959).

When hospital-based imaging departments are reimbursed through global budgets they are expected to have a gatekeeper’s role, by exercising the principles of justification and optimisation (Porter and Lee 2013). Those two pillars of radiation protection are also expected to

increase the effectiveness of the department by allocating imaging resources and controlling the radiation risk to patients.

A critical parameter for the effectiveness of radiological departments should be the number of accurate diagnoses in relation to the number of exams produced, booking waiting time, and the radiation dose burden delivered to patients (IAEA 2011). The number of exams performed by itself may not be an indicator of the department’s efficiency. If the reimbursement is on a fee-for-volume basis, it is expected that the interest of the department is in the volume of the exams produced in a certain time frame rather than the accurate diagnosis given to the patient’s problem. It is established empirically that money follows the patients, with the more patients treated the higher the reimbursement to the efficient, flexible providers. This should encourage departments to meet the needs of their customers, who are both patients and their referring physicians. Patients need quality services and referring physicians need an accurate report. Departments also have the task of minimising costs not only by switching to new efficient technologies, but by extending the working

hours of the existing facilities, developing in this way economies of scale. Modern competitive departments must always ask themselves: Do we solve the clinical problem of the patient? How many accurate vs. inaccurate diagnoses do we produce weekly?

Everyone must start to measure value, quality and performance as we transition from a fee-for-volume to a fee-for-value performance scenario. In that case the department creates realistic expectations of the revenue it can have, as more referrers trust it, and more patients (followed by money) are using its services.

A plan for measuring and identifying weak performance areas must be established in the departments. Although “To Err is Human”, mistakes must be analysed and provisions must be taken for them not to be repeated. That procedure, when incorporated as a standard one, can be a valuable source of information, which potentially transforms the department to a learning organisation. This is the way evolving imaging departments always meet the needs of their clients. And that way the department is working effectively and efficiently. ■

Key points

- ✓ A short description of the fundamental economic concepts.
- ✓ Outline of the health economic systems and their influence on radiology departments.
- ✓ Efficiency and efficacy function of radiology departments: reimbursement on a fee for volume or on a fee for value approach?



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BIG DATA

OPPORTUNITIES FOR HEALTHCARE ORGANISATIONS



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Healthcare organisations need to make much better use of the health data that they hold and to share that use with other organisations in order to scale up their learning opportunities and improve the quality and efficiency of the healthcare they provide.

At the level of the individual patient, guideline and decision support systems, notification and alerting components and analytic tools need to process integrated health data drawn from multiple electronic health record (EHR) systems in a consistent manner. Health services, insurers and public health bodies also need fine-grained activity and outcome data to inform service planning, commissioning and prevention/wellness programmes. However, health data is captured today at a variable quality, is not collected or stored consistently and the adoption of interoperability standards is far from ideal.

Healthcare organisations therefore need to invest more in their capability to capture high-quality structured and coded health data from every clinical encounter, and from patients themselves using an increasing repertoire of wearable and portable devices and sensors.

Integrated Data Key

Typical patient journeys span multiple healthcare organisations, who all have their own IT systems. It is therefore critical that patient information is able to flow seamlessly between these IT systems to support and enhance the patient journey, ensuring that clinicians always have the right information in the right place at the right time to make clinical decisions, and to support new integrated care models.

Integrated data are needed for cross-organisational care coordination and to increase adherence to evidence of best practice such as clinical guidelines. The ability to integrate data themselves, or to accurately combine and compare analyses of data, is vital in order to calculate more accurate clinically-relevant benchmarks of performance, to detect areas of poorly effective or unsafe practice and thereby to optimise care pathways, reduce clinical risk, improve clinical outcomes and maximise cost-effectiveness.

This is not just promised, but reality: Kaiser Permanente is able to track outcomes and develop data-driven algorithms using the connected and interoperable EHRs of its 9 million patients. As a consequence it has demonstrated:

- an HIV death rate half of U.S. national average;
- a decrease in coronary heart disease death rate by a third;
- a decrease in pressure ulcers by two-thirds;
- death due to sepsis reduced by > 50 percent;

European hospitals cannot individually reach that patient number, but if their health data are structurally and semantically consistent, and capable of being connected, they can still gain important decision-influencing insights internally and collaborate at regional, national and EU levels in research. Large healthcare organisations, especially hospitals, increasingly implement a clinical data warehouse as a repository, sometimes fully de-identified but often

pseudonymised, to enable in-house analytics and research.

Digital Research Potential

Healthcare organisations greatly benefit from participating in research, for example through clinical trials. These are increasingly being undertaken in small as well as large healthcare organisations, hospitals and general practices and there are some critical bottlenecks to reusing health data for research that are now being unblocked, such as semantic interoperability and privacy protection.

A European public-private research partnership has recently established a trustworthy platform that can connect EHR data warehouses in individual hospitals to enable them to collaborate in pharma-sponsored research, by helping them to discover the patients most suitable for enrolment in a new clinical trial. The Electronic Health Records for Clinical Research (EHR4CR) platform (2015) is now being scaled up across Europe, and is growing a network of connected hospitals (and later general practitioner (GP) practices).

Given that over half of clinical trials experience recruitment delays, reusing EHRs to help accelerate recruitment will improve trial efficiency and enable more healthcare organisations to become trial centres. Healthcare providers will have the opportunity to increase research revenues, grow scientific reputation, be more attractive to high calibre clinicians and enhance their standing with patients. Using health data and research platforms can enrich the business intelligence available to a healthcare organisation itself, to improve its efficiency and outcomes. A culture of research can improve staff attitudes to data quality, which in turn enriches the ability to use that data to improve care and conduct research.

Concerns about protection of privacy when health data are integrated or shared, for direct patient care as well as for aggregated data purposes, limit the extent to which even the data we

Key Points

- ✓ Healthcare organisations need to make much better use of the health data that they hold in order to improve quality and efficiency of care.
- ✓ If an organisation's health data are structurally and semantically consistent, and capable of being connected, they can gain important decision-influencing insights internally and collaborate at regional, national and EU levels in research.
- ✓ Healthcare providers should participate more in research, to increase revenues, grow scientific reputation, be more attractive to high calibre clinicians and enhance their standing with patients.
- ✓ State of the art governance policies, information security and audit measures can now provide society with a greater assurance of privacy protection when health data repositories are combined and analysed to optimise health services and for research.



have today are combined, aggregated and analysed appropriately. Several recent European initiatives have specifically addressed this, developing codes of practice for the use of 'big' health data, establishing governance policies and state-of-the-art information security and audit measures such as EHR4CR, Electronic Medical Information Framework (EMIF) (2015) and Translational Research and Patient Safety in Europe (TRANSFoRm) (2015). Such approaches can now provide society with a greater assurance of privacy protection. We are therefore very well placed to scale up the trustworthy re-use of health data for research.

Big Data in Health

So what do we mean by 'Big Data'? The term was historically used to refer to data volumes and a complexity of processing that exceeded conventional computing capability, but it is increasingly used more broadly to refer to very large networks of data that comprise high data volumes, diversity of data types and constantly evolving content. Health data certainly qualifies! As an example of where large scale data are needed, many of our current clinical guidelines are for single diseases, but patients rarely have only one. The most realistic way of building up an understanding of how diseases and treatments interact and the optimal ways to manage multiple conditions, is to analyse large-scale EHR repositories.

Apart from data traditionally captured by healthcare professionals, health data potentially includes genomic data, data about social needs and care, environmental factors such as atmospheric pollution, and an increasing volume of data generated by patients and healthy citizens. Forty-four million health-related smartphone apps were downloaded worldwide in 2011 and monitoring services will account for 65% of the global mHealth market by 2017. (Ernst and Young 2012). Disease self-management and prevention/wellness



"A CULTURE OF RESEARCH CAN IMPROVE STAFF ATTITUDES TO DATA QUALITY, WHICH IN TURN ENRICHES THE ABILITY TO USE THAT DATA TO IMPROVE CARE AND CONDUCT RESEARCH"

information are therefore predicted to be our next big contribution to the big health data ocean, offering us greater opportunities to personalise care, target therapies more precisely and to partner patients in managing their health.

Increasing sophistication of care, with an ageing population and more and more illnesses becoming long-term conditions (such as HIV), requires greater cooperation between professionals of different disciplines working in different locations, knowing each others' care goals, progress made and any difficulties encountered. This needs

more than sharing the record of what has been done (EHRs), but sharing each other's clinical care strategy, options and logistic constraints, to determine optimal ways of aligning efforts.

The rapid pace of bio-science discovery, the advent of personalised therapies, and the overwhelming volume of new clinical evidence, combined with demands for evidence-based, safe, high-quality and equitable standards of care, now makes big data a vital resource to healthcare organisations - for local intelligence, service optimisation and for collaboration in research. ■



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CLINICALCONNECT PORTAL

IMPROVING PATIENT CARE AND EFFICIENCY



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Beginning in 1996, hospitals in the Hamilton, Ontario, Canada area started coming together to form Hamilton Health Sciences (HHS), a family of seven hospitals, a cancer centre and an urgent care centre, serving more than 2.3 million residents of Hamilton and South Central Ontario, Canada. HHS is the second largest hospital group in Ontario, and serves as a regional referral centre for cardiac, stroke, burns, trauma, neurosurgery, paediatrics, digestive diseases, high-risk obstetrics, cancer, orthopaedics and rehabilitation services.

With this merger activity came different Health Information Systems, so centralising patient health information within HHS quickly became necessary. A common Hospital Information System for HHS was developed in order to best serve patients and recognise operational efficiencies. The need to make this information available to physicians outside of HHS but within the patient's circle of care, particularly community providers, was identified.

ClinicalConnect: A Secure Web-based Portal

Enter ClinicalConnect, a secure web-based portal that provides physicians and clinicians with real-time access to their patients' electronic medical information from a variety of data sources, not just their own Health Information System. Since its inception in 2005, ClinicalConnect has changed the way healthcare is being delivered. ClinicalConnect has grown from integrating HHS-generated health records to including real-time patient data from regional hospitals, oncology centres, provincial data repositories and Community Care Access Centres (CCACs; also known as Homecare), which gives health service providers a more complete picture when treating their patients. The primary goal of ClinicalConnect is to increase efficiency for healthcare

providers, enhance workflow, and improve patient safety by having access to the right patient information, at the right time.

Today, 10 years since it was first created, ClinicalConnect is connecting physicians and clinicians practising well beyond the Hamilton area. It's being used by a wide variety of health service provider types, who are benefiting by having access to their patient's records for treatments performed across South West Ontario. In 2013, ClinicalConnect was selected as the Regional Clinical Viewer for the connecting South West Ontario (cSWO) Program, a regional integration initiative funded by eHealth Ontario. Regional integration initiatives (connectingGTA [cGTA], connecting South West Ontario [cSWO] and connecting Northern and Eastern Ontario [cNEO]), are enabling the province to achieve an electronic health record (EHR) solution for all Ontarians. ClinicalConnect is being leveraged and used as the viewer to aggregate patient health information from all 67 acute care hospitals, four CCACs and Oncology Centres across South West Ontario (at the time of writing). ClinicalConnect also aggregates data from the Ontario laboratories information system (OLIS), an eHealth Ontario repository that connects hospitals, community laboratories, public health laboratories and practitioners to facilitate the secure electronic exchange of laboratory test orders and results; the Southwestern Ontario Diagnostic Imaging Network (SWODIN), another provincial repository for diagnostic images for tests performed at hospitals in South West Ontario, and Canadian Health Outcomes for Better Information and Care (C-HOBIC) nursing assessments.

HHS continues to own and operate the ClinicalConnect portal, and is responsible for tasks including, but not limited to, user authentication, bringing new integrations to fruition and managing ongoing maintenance of the portal in collaboration with the vendor.

Identifying Patients with the Greatest Needs

Another recently added feature is the integration of a flag to identify patients with the greatest healthcare needs, known locally as Health Links patients. Health Links is a new model of care where all providers in a community, including family care providers, specialists, hospitals, long-term care, home care and other community supports, are charged with coordinating plans at the patient level. Eventually the flag in ClinicalConnect will link directly to these care plans so that physicians and clinicians not normally treating the patient, for instance if they have an emergency room visit, can review the complete details of their care from within ClinicalConnect.

Users

As of September 2015, there were more than 31,000 ClinicalConnect authorised users, representing physicians, nurses, clinical support staff, who have been sponsored by physicians with accounts, CCAC care coordinators, pharmacists, social workers and midwives, just to list a few of the types of ClinicalConnect users spanning the continuum of care. These users work at facilities in almost all healthcare sectors – acute care facilities, CCACs, family health teams, long-term care homes, community support services, mental health and addiction centres, community health centres and public health units. There is no subscription fee associated with using ClinicalConnect by health service providers as it is funded by eHealth Ontario, through the cSWO Program.

Future Development

The ClinicalConnect team is working to expand the functionality and features of the portal to include eNotifications, eReferrals and eConsults, making it a true 'one-stop shop' for electronic health records. Discussions are also



under way detailing integrations with eHealth Ontario's ONE® ID Identity and Access Management Service, a set of systems and processes that enables healthcare providers to access secure ehealth services, as well as the provincial diagnostic imaging (DI) common service, which will enable the sharing and viewing of patients' diagnostic images and reports from across Ontario to hospital and community-based healthcare providers anytime, anywhere. ClinicalConnect has become a fundamental tool in bridging the gap

privacy officers and controls in place that serve to protect patient information accessed via ClinicalConnect.

User Feedback

Reaction from ClinicalConnect users is very positive:

Dr. Rob Lloyd, a Paediatric Intensivist at HHS, is an early adopter and a firm believer in ClinicalConnect. He says, "ClinicalConnect is a godsend. In the past we had essentially no access to patient info from other hospitals so it often took many days after admis-

Patient View

How is ClinicalConnect from the patient's perspective? Chaplain Erna Hibbs and her husband, Don, can attest to the benefits of Don's care team using the portal to provide him with better, more efficient care given they have his necessary medical history at their fingertips. Don is a patient from Simcoe, Ontario, but has been a patient at multiple healthcare facilities in the region, including the Juravinski Hospital, about an hour's drive from where Don lives, and he has been seen and treated by a variety of providers. We all know it can be frustrating to repeat your story to those providing your care, but as Chaplain Hibbs explains, ClinicalConnect helps with that. "We no longer have to pull out his letter from his mother, as he says, that lists his medications and treatments. We don't have to do that anymore – it's in ClinicalConnect". Not only does accessing ClinicalConnect save time and reduce stress for the patient, but it also means the provider doesn't have to rely as much on their patients' recall, nor do they have to ask the patient to provide information about treatment and medications from other facilities again and again; that's better for everyone. The Hibbs also explain they take comfort in the fact that Don's healthcare information is available in the secure portal to the various providers – with ClinicalConnect, providers know the full story, with real-time information, anytime, anywhere.

Patient Portal

At this point, health information in ClinicalConnect is accessed by physicians and clinicians within a patient's circle of care. But a version of the portal designed for patients' use may not be far

"ACCESS TO THE RIGHT PATIENT INFORMATION, AT THE RIGHT TIME"

between disparate information systems spanning a wide geographical area and multiple regional healthcare facilities.

Privacy and Security

From a privacy and security perspective, ClinicalConnect utilises a combination of industry standards for authentication, authorisation and auditing to safeguard data. ClinicalConnect data is encrypted with the appropriate security controls in place to safeguard the privacy of patient information according to the Province of Ontario's *Personal Health Information Protection Act, 2004* (PHIPA). PHIPA establishes the legal privacy roles and responsibilities for each organisation participating in the use of systems like ClinicalConnect. Each participating organisation signs a Data Sharing Agreement, and must meet PHIPA requirements by having the requisite privacy and security policies, procedures, training programmes,

sion to get a complete picture of the patient's past history. This often resulted in repeat tests, miscommunication, and delayed care. Now, with the click of a mouse I can instantly be looking at consult notes, discharge summaries, radiology reports and lab data from previous hospital visits across all four South West Ontario LHINs – geographically that's remarkable as South West Ontario is a vast area – more than 35,000 square kilometres."

Dr. Jason Bandey, a family physician with a Family Health Team in Stratford, Ontario, explains that ClinicalConnect is a valuable tool to him and his clinical staff because they can quickly and reliably pull reports that aren't already being pushed to their office's electronic medical record (EMR).

Sandy Moss, a Registered Nurse at Niagara Health System, says "ClinicalConnect speaks for the patient when they cannot speak for themselves."



intelligence (Cohen et al. 2010). Research shows that 73 per cent of consumers would use a tool to help them pay their medical bills, communicate with doctors, make appointments and obtain lab results online (Intuit 2011).

Benefits for Patients

There is undoubtedly a movement afoot to move away from paper-based health records – be it for greater efficiency, appropriate and effective sharing of relevant patient care information across the continuum, and for enhanced privacy and security reasons – all benefiting patients and providers alike. A survey in the U.S. found that people pay more attention and become more engaged in their health and medical care when they have easy access to their health information online – and that is especially true for those with lower incomes (Udem 2010).

Expanding ClinicalConnect as a patient portal could assist healthcare providers to better understand the patient’s view relative to health management, healthy living goals, compliance, outcomes and overall patient satisfaction. Other benefits to patients include improved access to healthcare providers themselves and relevant healthcare resources, easier access to their own health records, and the ability to get test results to the patients faster, because they are integrated into ClinicalConnect in real time from the source systems.

From a provider perspective, using a future version of ClinicalConnect that is patient-facing could increase efficiencies in the form of shorter time and effort needed to gather information and disseminate it to patients, which in turn reduces the wait times for patients and anxiety associated with waiting for test results; reduce administrative costs through increased automation; and reduce and possibly eliminate the need for duplicate medical tests. Moving to a more electronic-based system could result in greater time efficiencies for both the

provider and patient with less travel time for appointments that in some cases could be carried out electronically or by phone.

Discussions around ClinicalConnect evolving to a patient portal have included the possible integration of evidence-based information sources that would provide patients with clinically relevant information about their condition – information from cases similar to theirs in terms of age and gender, amongst other characteristics. Furthermore, leveraging existing software that regularly ‘pushes’ relevant information directly to patients by email or text message to treat their specific conditions would be an added benefit and help keep managing conditions top of mind for patients. Finally, the option exists to integrate the patient version of the portal with existing software that is being used to develop Personal Health Records, whereby patients can input their own health information and eventually tie that to the information being contributed by healthcare facilities, creating the all-encompassing patient portal.

Although adapting ClinicalConnect to have a patient-facing component is not yet under way, the provider platform is already significantly deployed in the region and could be leveraged for patient use. Work continues to expand the depth and breadth of data that is available to physicians and clinicians to better serve the approximately 3.6 million patients residing in South West Ontario, as well as continuously leveraging other trusted online resources to make ClinicalConnect the key regional access point for patients’ electronic health information.

Further Information

To learn more about ClinicalConnect, please visit info.clinicalconnect.ca or email info@clinicalconnect.ca. Our website features a variety of video and written testimonials about the benefits of ClinicalConnect and how this established eHealth solution is improving patient care and safety across a vast geographic region. ■

behind. We know that the patient experience no longer begins at the front door of the hospital. When patients interact with hospitals or healthcare organisations, they expect the same kind of ‘electronic experience’ that they enjoy in other industries like banking, travel and retail.

Consider the level of personalisation available in those industries – online book stores recommend books based on your previous purchases and personal preferences, your bank reminds you to pay recurring bills (or even does it for you), online travel services know you prefer an aisle seat, but yet when you visit the hospital or physician, you often have to fill out your information on a clipboard each time and, even more often, you have to recount your previous medical history. In addition to how other industries use technology to provide their customers with greater convenience and efficiency, in the healthcare sector specifically, there has been a proliferation of new products and technologies that foster healthcare consumerism, including telemedicine, clinical decision support, electronic health records and health



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THE OLDER PATIENT

EHEALTH AND MHEALTH APPROACH IN TODAY'S CONTEXT OF DEMOGRAPHIC AGEING



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Background

The demographic trends projected over the long term reveal that Europe is 'turning increasingly grey' in the coming decades. By 2025 more than 20 percent of Europeans will be 65 or over, with a particularly rapid increase in the number of over 80s. This ageing trend will continue, and it is expected that by 2060 more than 30 percent will be 65 or over and the number of over 80s will reach 12 percent of the population. While in most parts of Europe life expectancy at birth continues to increase, the healthy life year expectancy is however not increasing in parallel and is even decreasing in some countries. This means that we can expect a sharp rise in the number of older people who will need support if nothing is done in the near future to empower them to cope with chronic diseases, old age frailty and the limitations on their daily activities that result from their health conditions. The rapid ageing of the population must be reflected in a greater empowerment of older citizens and consumers in all relevant areas and in particular in the whole innovation process of eHealth and mHealth solutions.

Empowering Patients: From Theory to Practice

Many innovative eHealth and mHealth solutions are being developed in Europe today. Not all make it to their national market and even fewer are scaled up cross-border. The industry and policy-makers are struggling to find ways to overcome the technical and structural barriers that hamper the development of a digital single market for eHealth and mHealth solutions.

But there are also other barriers, such as the huge differences in terms of health and digital literacy among older persons, between countries and the passive reluctance from a significant part of the demand side. This comes

mainly from older patients but also carers, who are not so easily convinced of the added value such products would bring them.

Make it Relevant for the Target Group

Let's take for example the electronic pill dispenser, which is promoted as an innovative way to support adherence to treatment, a major challenge among older people living at home. Just like a classical pill dispenser, the electronic dispenser has to be filled in once a week with medication divided per day and time of the day.

The advantage of the classical dispenser is that it is much smaller and you can carry it easily in your bag when you go out for a meal or on holiday. The advantage of the electronic dispenser is that it beeps when the patient needs to take a pill and it alerts the informal carer or physician if the patient forgets to take the pill out of the box at the pre-set time. Such a system can be helpful for people who live alone at home and have very severe health conditions for which it is really important to take certain medication at a given time. But what if the patient is unable to hear the beep, if he or she is having a nap (frail older people tend to take several naps during the day), has left the room to go to the bathroom or is sitting in the garden?

Most older people are prescribed a range of medications that should be taken around meals. They usually start their meal by emptying their pill box compartment on the table near their glass. Older patients are quite good at taking the pill(s) that have to be swallowed before they start eating, but some tend to forget the medication that has to be taken during or after the meal. The electronic pillbox does not help if they forget their pill(s) on the table and it gets thrown away with the breadcrumbs at the end of the meal, a scenario which is rather common among older people.

So, with the exception of those with very severe health conditions who are living alone, many older people just wonder what added value there is for them to have an electronic pill dispenser, which only reacts if they have not taken their pill out of the box at a certain time, but does not help them remember whether they really took their medication or not.

Many older people are also reluctant to use electronic devices that would alert a relative or carer whenever something is detected, for fear of false alarms, because they do not want to overburden their carer, or have no close relative or friend who could take up that role. Regardless of the type of dispenser used, a very simple way that can help many older patients check whether they have taken all their medication is by putting the pill(s) on a small cup near the glass. It is very easy then to see if the patient is adhering to their treatment.

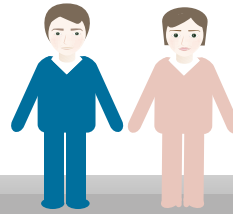
Another barrier that is common with eHealth and mHealth solutions is the reluctance of many older people to be monitored all day long. No one will contest the benefit of monitoring vital functions, in acute care patients. Yet, because the technology is available, the industry's interest is to equip older patients — and even healthy people — with 24/7/365 monitoring of their vital functions, and some present this as a pre-requirement to ageing at home.

The push should not come from the industry, because older people do not necessarily see the need for such solutions and do not know what solutions to trust. The voluntary certification scheme set up by the Andalusian Agency for Healthcare Quality is an interesting example of what can be done to better match needs, to overcome older people's reluctance and help them access the benefits of eHealth and mHealth solutions that have proved useful, safe and effective.

BY 2025 MORE THAN

20%

of Europeans will be 65 or over with a particularly rapid increase in the number of over 80s



This ageing trend will continue and it is expected that by 2060 more than

30%

will be 65 or over

and the number of over 80s will reach 12 percent of the population

Co-Production Approach

To reach out to these growing numbers of potential patients, it is therefore of utmost importance that the eHealth and mHealth industry pays better attention to the specific and very diverse needs of older patients, and involves them in the co-production of innovative solutions that reflect their real needs and expectations. In other words, involving end-users in the co-production of eHealth and mHealth solutions is the best way to ensure that they are efficient, reliable, relevant and adaptable to the patient's own needs and situation, affordable and respectful of their privacy.

Older people are more concerned than younger population groups about potential risk to their privacy and misuse of personal data. It is not always obvious for the older consumer to assess whether ethical issues around privacy have been properly addressed in the development of existing eHealth and mHealth solutions. Involving older people from the inception is a good way to ensure their concerns are addressed.

To support the co-production approach, AGE Platform Europe has developed guidelines on involving older people in social innovation development in the framework of the INNOVAGE project. In this publication AGE stresses that:

Involving older users in the planning and development of innovative approaches is essential when developing new goods and/or services. Transforming users into partners ensures relevance and adequacy of new approaches and will help them

to be implemented and adapted to different contexts (Age Platform Europe 2014).

The co-production approach is also the core principle of the World Health Organization's initiative and methodology on age-friendly environments.

Benefits of the Co-Production Approach

Based on our experience, the co-production approach helps:

- bridge gaps between research and practice;
- highlight ethical concerns;
- pinpoint issues of acceptability (eg privacy, safety);
- raise questions of affordability and costs;
- address issues of interoperability, technical reliability and support;
- cross-evaluate from a user's point of view the added value of the innovation and bring the experience of users in the innovation process;
- qualify the outcomes of the innovation process;
- identify issues that need to be further studied;
- draw attention from media and political stakeholders;
- strengthen the dissemination strategy;
- better adapt the innovation to the needs of different communities by listening to users from different contexts.

This list, which was initially developed by AGE for social innovation, applies equally to e and mHealth innovation.

EU Movement on Age-friendly Environments

Another solution to improve the age-friendliness and acceptance of e- and mHealth solutions among older people is to join forces with the growing EU movement on age-friendly environments. This campaign started in the framework of the European Innovation partnership on active and Healthy Ageing in 2011, and is inspired by the WHO age-friendly environment approach.

Thanks to the AFE-INNOVNET thematic network a growing community of more than 300 partners is now working together to promote age-friendly environments, goods and services across Europe. This community will formalise through the Covenant of Demographic Change that will be launched in December 2015 with the support of the Committee of the Regions and the European Commission. The Covenant will gather bodies (ie local, regional and national authorities, as well as civil society organisations, industries, research centres and universities) that voluntarily commit to making age-friendly environments a reality in their communities and to share their experience with other Covenant members. EHealth and mHealth actors are welcome to join the AFE-INNOVNET thematic network and upcoming Covenant and share their expertise with those who are looking for innovative solutions to support active and healthy ageing. ■



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HEALTH AND WELLBEING OF THE WORKFORCE

WORKFORCE HEALTH MUST BE A PRIORITY



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The National Health Service (NHS) must work hard to protect the health and wellbeing of its workforce. Failure to do so costs organisations across the system dearly but, more importantly, patient care may suffer. What does it feel like to be unable to do your job properly through lack of time, staff shortages or financial constraints? Today, many NHS clinicians and managers (and probably support staff too) could tell you. But they may not always make the correlation between working under relentless pressure and the cost to their mental and physical health.

In March, the BBC revealed that it had obtained figures showing that staff absences for mental health problems, such as anxiety, stress and

depression, had doubled at hospital trusts across England — from 20,207 in 2010 to 41,112 in 2014 (BBC 2014). Unprecedented demand for health services means staff cannot always deliver the care they want to and the price paid may be their own health.

The NHS needs staff that are both healthy and at work in order to deliver the best possible patient care. This means staff who are neither absent through sickness nor unhealthy or present through a misguided sense of loyalty to their patients and colleagues. Looking after the health and wellbeing of staff directly contributes to the delivery of quality patient care, but it is also the moral duty of employers.

Of course, poor workforce health ultimately carries high and far-reaching

costs to NHS organisations. It is estimated that the median cost of sickness absence to each NHS organisation is 3.3 million pounds annually (Audit Commission 2011). Good managers recognise that wellbeing and productivity are inextricably connected.

In August 2009, Dr. Steve Boorman's interim report on the health of NHS staff was published (Boorman 2009). It called for "a sea change in the way in which staff health and wellbeing is perceived", and asked NHS leaders to put the health of staff "at the heart of the NHS mission and operational approach".

A year later, the final *NHS Health and Well-being Review* (Boorman 2010) was welcomed by the then Health Secretary, Andy Burnham, who said that the NHS organisations needed to be exemplars

in promoting the health and wellbeing of their staff. By doing this, they would “support the NHS to play its key role in promoting public health” (House of Commons 2009).

More Work to be Done

Whether the NHS has succeeded is a moot point. In 2013-14, according to the Health & Social Care Information Centre, health service workers in England took an average of 14.82 sick days, a small improvement on 2012-13, when the figure was 15.52 days (Health & Social Care Information Centre 2014). Significantly, however, data from the Office for National Statistics (ONS) shows that in 2013, across the whole UK labour force, just 4.4 days per worker were lost to sickness (ONS 2014).

The publication of further workplace policy and management practices guidance from the National Institute for Health and Care Excellence (NICE) earlier this year (NICE 2015), making recommendations on how organisations can improve the health and wellbeing of employees, suggests that there is a recognition that there is still work to be done.

The IHM believes that making the health and wellbeing of employees a core priority should be an absolute given for all managers, at every level across all healthcare services. The *raison d'être* of healthcare provision is to improve the health of patients and the wider public, so it would be ironic if management failed to do the same for its own workforce.

In particular, IHM supports the NICE recommendations on leadership style of line managers (nice.org.uk/guidance/ng13/chapter/1-recommendations#8-leadership-style-of-line-managers), reflected in its own Professional Practice Framework (ihm.org.uk/en/about-us/professional-practice-framework), which has optimising health and wellbeing

and will impact negatively on the mental health of those who experience it.

In particular, all organisations need to ensure that they have a robust and meaningful whistleblowing policy. Without a commitment to fairness and justice, fear of bringing failings in care to the notice of management will cause employees anxiety, as well as proving a stumbling block to service improvement.

“THE NHS NEEDS STAFF THAT ARE BOTH HEALTHY AND AT WORK IN ORDER TO DELIVER THE BEST POSSIBLE PATIENT CARE”

at its centre. Encouraging creativity, having a clear vision to communicate to employees, providing a sense of meaning and challenge in the workplace and consulting regularly on daily procedures and problems are all key components of good management and vital to the health and wellbeing of any workforce.

The guidance includes a section on fairness and justice, highlighting that “senior leadership and managers, human resource teams, and all those with a remit for workplace health should ensure any unfair treatment of employees is addressed as a matter of priority” (nice.org.uk/guidance/ng13/chapter/1-recommendations#4-fairness-and-justice) This is important, since experience of unfair treatment is stressful

Last month saw NHS England announce a five million pound drive to support NHS organisations help their staff to stay well through initiatives such as serving healthier food, promoting physical activity, reducing stress, and providing health checks covering mental health and musculoskeletal problems (NHS England 2015).

Announcing the move, NHS England Chief Executive Simon Stevens said: “When it comes to supporting the health of our own workforce, frankly the NHS needs to put its own house in order” (NHS England 2015). He is right and these are important first steps. Success, as ever, will be dependent on clear leadership from managers who, in implementing change, must be cognisant of their own health and wellbeing. ■



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INSIGHTS INTO PERSONALITY

IMPLICATIONS IN PHYSICIAN PROFILES



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According to a scientific study published in 2013 by acclaimed NASA toxicologist Dr. John T. James, an estimated 210,000 to 440,000 people die each year due to preventable medical errors (James 2013). Further examination reveals that medical errors would then be the third largest cause of death in the United States (Allen 2013). A driving component of healthcare reform in the United States is the mandate to improve quality through reduction of variability in patient outcomes. While processes play a factor in preventable medical errors, we submit that personality insights may play a role in the future in more clearly matching physicians and their personality types with specific physician specialties, and thus an indirect association with preventable medical errors (Bradley et al. 2007). We advance this concept through examination of psychological profiling in other important industries outside of healthcare.

A handful of broadly-publicised and tragic airline incidents, where pilot error

and implication of pilot personality-related problems were questioned, led us to examine if personality issues play a role in the frequency of preventable medical errors. Specifically, would the quality of healthcare services provided in the United States improve through the incorporation of some form of advanced personality assessment testing for physicians?

Industry Personality Tests

Of the top Fortune 100 companies, including Apple, Exxon, and General Motors in the United States, 89% require their potential new hires to complete a comprehensive personality assessment and profile prior to any formal offer of employment (Shuit 2003). Testing is designed to determine whether or not a candidate's personality set will be an appropriate 'cultural fit' for job tasks and that of the organisational culture.

If the testing reveals that their personality disposition does not marry with the job requirements and organisational culture, disqualification occurs and they

are not employed. Some might argue that this process of human resources risk management may play some role in preventing productivity issues, lawsuits or more serious human resources implications for the respective organisation.

In healthcare, whilst some personality testing may take place by suppliers and vendor organisations, our research indicates that there does not appear to be a consistent or uniform methodology for personality assessments of current or future physicians. Limited publications exist in examining the personality type of specific types of specialists or any corollary in physician personality and medical errors. Upon completion of medical education and training, a licensed physician, in order to practise medicine at a hospital, completes a cursory background check. Credentialing, and the privileging process as it is referenced in the United States, is completed in order to determine what a particular physician may be allowed to perform within the confines of the hospital facilities. This in turn begs the question that in addition

to a validation of educational credentials might an organisation ask about the utility of potential personality testing as part of the credentialing process for physician privileges or employment?

In contrast to the healthcare industry, the aviation industry consistently completes psychological testing required by the Federal Aviation Administration (FAA) to have a medical certificate prior to becoming a licensed airline pilot (FAA 2014). This certificate certifies that a pilot is both physically and psychologically fit to be a pilot. Pilots are required to take a battery

alternative explanation for why physicians are not scrutinised to the same degree as airline pilots? According to a census conducted by the Federation of State Medical Boards in 2012, there were approximately 878,194 practising physicians in The United States (Young et al. 2014). Given that the Affordable Healthcare Act aims to provide coverage to approximately 32 million additional people by the year 2019, compounded by the fact that the average age of practising physicians is 51 years old, and the finite pipeline for future physicians shows an alarming shortage for physi-

help women get careers in the 1950s. In 1962 they published the first ever personality questionnaire indicator that eventually became known today as the Myers-Briggs (Myers 1962). They saw this indicator as a way for women to better understand what jobs they would be the most proficient at during World War II. The test has evolved since its initial inception and is used by many different organisations in order to determine potential employee personalities as a determinate for cultural fit.

The questions given on the Myers-Briggs test are designed to determine how people view the world around them, and how they make decisions within that scope. Once the test has been taken, the individual will score within four dichotomies.

- Introverted or Extroverted;
- Sensing or Intuition;
- Thinking or Feeling;
- Judging or Perception.

The Myers-Briggs does not show that a person is either Introverted or Extroverted, but it shows what preference a person may have over the other, and it is not a measurement of a person's aptitude. The majority of people that take the Myers-Briggs tend to maintain identical personality traits as they progress in age (OPP nd).

Another widely used assessment was created by the same man who created the fictional character Wonder Woman, William Marston. He was a Harvard-educated psychologist, who was well known for publishing several essays in popular psychology. His most popular essay *The Emotions of Normal People* (Marston 1928) would eventually evolve into what we know today as the DiSC assessment. This assessment allows for an organisation to learn more about particular attributes of a person, rather than a broad personality assessment.

The DiSC assessment tool was designed to measure a person's communication behaviours. It is based around four personality traits: Dominance, Inducement, Submission, and Compliance. Similar to the Myers-Briggs, a person is given a series of questions to answer and, based upon completion of the test, they will be given a score. A person will be ranked as having one of previous listed personality traits or they may have a dominant and a subdominant trait that they fall within.

“IN CONTRAST TO THE HEALTHCARE INDUSTRY, THE AVIATION INDUSTRY CONSISTENTLY COMPLETES PSYCHOLOGICAL TESTING”

of tests including, but not limited to, The Weschler Adult Intelligence Scale, Trail Making Test Parts A & B, and the Minnesota Multiphasic Personality Inventory. If deemed necessary a psychiatrist may conduct a Rorschach test, or any other personality assessment that they deem fit (FAA 2014).

In 1997 a study that spanned across five Flemish universities was conducted as an attempt to determine how a student's personality would affect their rate of success in medical school. Success was measured in the classroom and in practice as well. Researchers were able to show that success rates did indeed differ based on a student's personality (Lievens et al. 2009). More recently in 2010 a retrospective study at the Saint Louis School of Medicine was conducted to assess student medical school performance during the first three years of medical school. What the researchers found was identical to what was found over a decade prior: medical student performance varied based on their personality type. The study concluded that medical school admission should be adjusted with the addition of personality examinations, due to its importance as an accurate gauge and predictor of future performance (Haight al. 2012).

While research has shown that personality testing does indeed determine performance, could there be an

alternative explanation for why physicians are not scrutinised to the same degree as airline pilots? Could the need created by so many new patients, the unknown cost, or the lack of measurable benefit be determinates of why organisations do not require personality profile testing as an additional assessment during the physician hiring process?

Defining Personality Tests and Test Types

There are numerous personality profile tests that exist in the market. Many are considered to be broad, and simply measure personality from a very wide perspective. One of the more commonly known broad personality tests is the Myers-Briggs personality test. Other more specific personality tests can be taken to look at a particular trait of a person. A common personality test that exists is the Dominance, Inducement, Submission, and Compliance (DiSC) assessment profile that measures a person's communication behaviours.

Studies on personality traits and the methods used to determine these personalities in people have been researched for many years. It was not until a mother and daughter team by the name of Katharine Cook Briggs and Isabel Briggs Myers took existing research on personality and applied it to their own work on creating a formal assessment test that was to be used to

For example it is possible to be strong Dominance, but close to Inducement. This simply means you may exhibit some of both traits in your communication behaviours. Unlike Myers-Briggs, a person's DiSC can change over time as they grow in their lives and their careers (Personality Profile Solutions, LLC 2010). These personality tests have been used in education and in the corporate world when determining placement of a student within a group, or placement of an employee within an organisation. Different personalities exhibit comfort and discomfort when it comes to certain jobs or areas within education or place of work.

Is There Such a Thing as an Ideal Personality for Being a Doctor, or a Specific Type of Doctor?

While there are several different types of potential personalities that a physician could have, no single personality

type is considered a poor personality type. Physicians of all personalities have been effectively practising medicine for years and have proven themselves in the field of medicine. However each personality type has associated traits that can strengthen or weaken a physician's effectiveness given a specific specialty. It is also critically important to note that for procedurally-oriented physicians psychomotor skills testing and assessment might serve as a valuable adjunct to personality testing during the medical school residency selection process. However, for the purposes of this article, we raise this additional testing consideration, but do not address it further in this publication.

In recent studies such as the Jackson and Coker study (2009), it has been determined that a physician's personality was a direct indicator as to which specialty they would excel in. This research is further supported by studies done through an organisation called PeopleKeys®. They include physician personality as an important characteristic in their Perfect Match for Hiring within Medical Practices Package (DISC Insights 2013). Essentially if a physician expressed interest in highly structured environments and was uncomfortable with ambiguity, a hospital-based specialty such as anaesthesiology would be beneficial for them to explore. Within the confines of a hospital, a physician is given structure and guidelines within which they are to stay. Personality tests allow for physicians to not only understand what specialty type they would excel in, but also allow for a healthcare organisation to determine if a physician would make an appropriate fit, given the role which the physician was applying for.

The misunderstanding or misinterpretation of one's personality type could lead to a physician not understanding their own strengths and weaknesses within a given specialty.

Understanding the current state of our healthcare system and the problems it faces with a large number of medical errors per year is the first step in trying to find a solution to this problem. The next step is for healthcare administrators and human resources to take action and question the current system based on the comparative information in other industries regarding personality type. As humans we are not perfect and cannot always be perfect. If healthcare systems knew and understood the personalities of the physicians they were looking to hire, could they potentially create a cohesive environment receptive to improved outcomes?

Given that the airline industry takes into account a psychological evaluation prior to employment, it raises the question as to why this has not become commonplace within the healthcare industry. Physicians are given an enormous amount of power when it comes to treating patients and being responsible for patient lives. Typically physicians are autonomous and care for their patients in the way they see fit. In the healthcare industry, similar to the airline industry, every time the pilot gets into the cockpit or a physician preps for surgery, they are ultimately responsible for the lives of those people. If the aviation industry in addition to other industries such as engineering are utilising personality testing as a measure of safety, is there utility in the healthcare industry implementing personality testing for physicians and other direct care providers? ■

Key Points

- ✓ Of the top fortune 100 companies, including Apple, Exxon, and General Motors in the United States, 89% require their potential new hires to complete a comprehensive personality assessment and profile prior to any formal offer of employment.
- ✓ Could the need created by so many new patients, the unknown cost, or the lack of measurable benefit be determinates of why organisations do not require personality profile testing as an additional assessment during the physician hiring process?
- ✓ In the healthcare industry, similar to the airline industry, every time the pilot gets into the cockpit or a physician preps for surgery, they are ultimately responsible for the lives of those people.



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HOSPITAL MAGAZINES

TOP TIPS FROM AN EXPERT



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Following *HealthManagement.org's* articles on blogging (La Calle et al. 2015) and tweeting (Wong and Mathieu 2015), in this issue, *HealthManagement.org* puts the hospital magazine in focus. Kathy Smith, Vice President of Marketing & Communications at The Johns Hopkins Hospital and director of the quarterly publication, *Johns Hopkins Health*, shares her tips on how to create a magazine that works for both readers and the hospital.

How long have you been involved with the publications for Johns Hopkins Hospital?

We created the concept for *Johns Hopkins Health*, our primary consumer health and wellness newsletter, in 2007. We first started producing the publication in 2008, following comprehensive research via focus groups to ensure we would produce a publication that was useful and well received by our target audience.

Tell us about your publications. As well as your online presence, do you have print versions? Do you have to approach them differently and, if so, how?

For Johns Hopkins Health, print and online strategy go hand-in-hand. One of the main goals of the publication is to drive readers online to our consumer health resources for more information about topics featured in the publication. These resources include our consumer health hub, video galleries, health library, social channels and patient stories.

We also make *Johns Hopkins Health* available online (hopkinsmedicine.org/news/publications/johns_hopkins_health) and post individual articles in our social media channels so we can share its content with a larger audience. Prior to posting content online, we optimise articles for keywords so it's easier for our online readers to find relevant information. We also re-package stories for our

primary consumer health e-newsletter, *Your Health*.

What in your view makes an effective and successful hospital publication?

Engaging, digestible content that showcases the innovative work of our researchers, clinicians and staff, while keeping the readers' interests and needs front and centre makes for an effective and successful hospital publication. We use *Johns Hopkins Health* to share useful health information with our readers from Johns Hopkins' unique point of view, and keep our focus on

any print publication at Johns Hopkins Health is deciding what to include. We have so many amazing stories to tell and knowledge to share. We know we can only capture a reader briefly, so we need to make tough choices about what to include that will entice our audience to engage with our content.

What is the most satisfying part?

The most satisfying part of producing Johns Hopkins Health is sharing the amazing and often life-changing work of Johns Hopkins experts. From providing simple health tips to translating complex

“ONE OF THE MOST SURPRISING PARTS OF PRODUCING JOHNS HOPKINS HEALTH IS THAT WE STILL RECEIVE HAND-WRITTEN LETTERS FROM OUR READERS THANKING US”

keeping our readers well and out of the hospital. We inform them about topics that can help prevent disease, but also provide information about diagnosis and treatment of disease should they encounter health issues and need to make decisions that can impact the rest of their life.

How important is it to keep in touch with your readers' wants and how do you do this?

It's very important to stay in touch with our readers' wants and needs. To accomplish this, we periodically survey our readers to check in. Additionally, we look at website traffic and event registrations to see what topics are resonating with consumers. This information influences the content we feature in the publication.

What is the most challenging part of producing publications for Johns Hopkins Hospital?

The most challenging part of producing

advances in research and new treatment options, our publication serves as a resource to improve the health of the populations and communities we serve.

What has been the most surprising part?

One of the most surprising parts of producing *Johns Hopkins Health* is that we still receive hand-written letters from our readers thanking us for the publication — in this fast-paced, digital age. It's a joy to hear stories from readers who found support from a patient story, wanted to share the publication with friends, or brought an article to an appointment to show their physician.

How do you decide on content for the publications?

The publication's content is determined by an internal team that represents a wide variety of Johns Hopkins research and clinical areas. Our goal is to include content from across the institution, including cutting-edge research, new

treatment options and tips for everyday health and wellness. It's very much a team effort.

What is your top tip for hospital administrations considering producing a publication on their activities?

Publications are a great branding tool for healthcare institutions and generally serve long-term goals. As a result, it may be difficult to measure immediate engagement and response. And, remember that you need to engage readers with content that they want to receive when they are healthy, or to stay healthy. Many want to read more about tips for preventing cancer, not about the newest piece of surgical equipment to treat cancer. We're competing

with many other mailbox items and periodicals — major consumer health and news magazines, the school newsletter, coupons and bills. We need to stand out and draw the reader in with something they want to spend a few minutes of their precious time with that might be very different than what we want to grow patient volumes for.

Finally, what is the most important characteristic of a good team?

Good teams listen to each other. When you bring a diverse group of colleagues together to produce a deliverable such as a publication you get many ideas and rich perspectives. Good teams respect each other's thoughts and ideas even if not everyone is in agreement. And the outcome is usually something great! ■



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MEXICO

FOCUS ON SEGURO POPULAR



David García Junco Machado

Chief Financial Officer
National Council
for Science and
Technology (CONACYT)
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Welfare in Healthcare

Seguro Popular: Mexico's Progress in Protecting the Right to Health

Mexicans are embracing human rights more than ever before, and Mexico's constitution has recognised that healthcare is a universal right for more than thirty years. And yet, as made obvious by conflicts over 'Obamacare' in the United States (Council of Economic Advisers 2015), this most obvious of rights is rarely accepted without debate. Although Mexico has recognised that the government is indeed responsible for providing a dignified and high-quality healthcare system, is this just more human rights talk with no substance?

And if not, what has the government actually done?

Mexico's National Commission for Social Welfare in Healthcare (the 'Seguro Popular', or 'popular insurance'), created in 2004, has been a key public policy. We can evaluate its progress along three factors: financing, equity and actual healthcare impacts (Comisión Nacional de Protección Social en Salud 2004).

Financing

Financing is critical if the healthcare system is to offer timely, high-quality services. One substantial change introduced by Seguro Popular was the creation of binding legal financial obligations. As a result, Mexico's health budget no longer depends on political or

economic circumstances; instead, the government must, by law, allocate, a minimum budget to each card-carrying member of the new Seguro Popular, or the older social security systems.

Because of this fixed per-person sum, increases in the number of insured people were accompanied by similar

Mexico's public healthcare expenses were directed towards people with stable jobs and access to the country's traditional employment-related social security systems. In 2002, two of every three government healthcare pesos were directed to this already-insured population.

"OVERALL, THE MERE ACT OF SEGURO POPULAR REGISTRATION WAS ASSOCIATED WITH AN INCREASE OF UP TO 30 PERCENT IN THE NUMBER OF DOCTOR VISITS"

increases in resources. The resulting funding boost was enormous, making it possible to deal with rising Seguro Popular enrolment, increase demand for health services, and ensure a stable and predictable flow of funds to improve infrastructure and capacities (Office of the President 2011).

Social Equity

Seguro Popular helped reduce inequality by guaranteeing broad health coverage to the roughly 50 percent of Mexicans who were not enrolled in the traditional insurance programmes. Prior to the arrival of Seguro Popular, most of

Seguro Popular helped reduce this inequality by guaranteeing broad health coverage to the roughly 50% of Mexicans who were not enrolled in the traditional insurance programmes. As a result, the government now spends about the same for everyone's healthcare, regardless of whether they are part of Seguro Popular. Previously, the ratio was a lopsided 2 to 1 in favour of the more privileged members of the traditional healthcare systems.

In addition, a study by researchers at the University of Chicago (Grogger et al. 2010) concluded that Seguro Popular had reduced healthcare-related bankruptcy in Mexico by 16 to 22 percent, and reduced healthcare-related impoverishment by 22 to 36 percent. Furthermore, the probability of falling into bankruptcy had been reduced in almost every Mexican state, in both urban and rural areas.

Impact on Public Health

To determine how Seguro Popular has affected the health of the registered population, Seguro Popular carried out an in-depth evaluation with 65 teams of investigators and a wide array of national and international universities.

Some results were encouraging. Registration for Seguro Popular

The project supported the expansion in coverage of Seguro Popular for people without health insurance from the contributory social security system, and helped set the basis for reform of the system.

- Between 2009 and 2013, the number of individual beneficiaries of Seguro Popular grew from 31.1 million to 55.6 million;
- The states started a new programme of preventive visits to screen new beneficiaries for a variety of conditions including high blood pressure and diabetes. By 2013, 22.8 million people had received a screening;
- The percentage of poor individuals that benefited from Seguro Popular, as a percentage of those not affiliated to a contributory social security system, grew from 42.3 percent in 2008 to 72.32 percent in 2012;
- Between 2006 and 2012, the gap in insurance coverage rates between indigenous and non-indigenous populations was virtually eliminated, and significant advances were made in narrowing service utilisation gaps and even health outcomes, even though there remain significant service utilisation differences.

Source: World Bank (2015) Seguro Popular: health coverage for all in Mexico, 26 February 2015. [Accessed: 9 November 2015] Available from: worldbank.org/en/results/2015/02/26/health-coverage-for-all-in-mexico

increased the probability that families would visit a primary health clinic, which is fundamental to the control, prevention and care of disease.

The effect varied by social class, but overall, the mere act of Seguro Popular registration was associated with an increase of up to 30 percent in the number of doctor visits. This effect was higher in adult women living in urban communities.

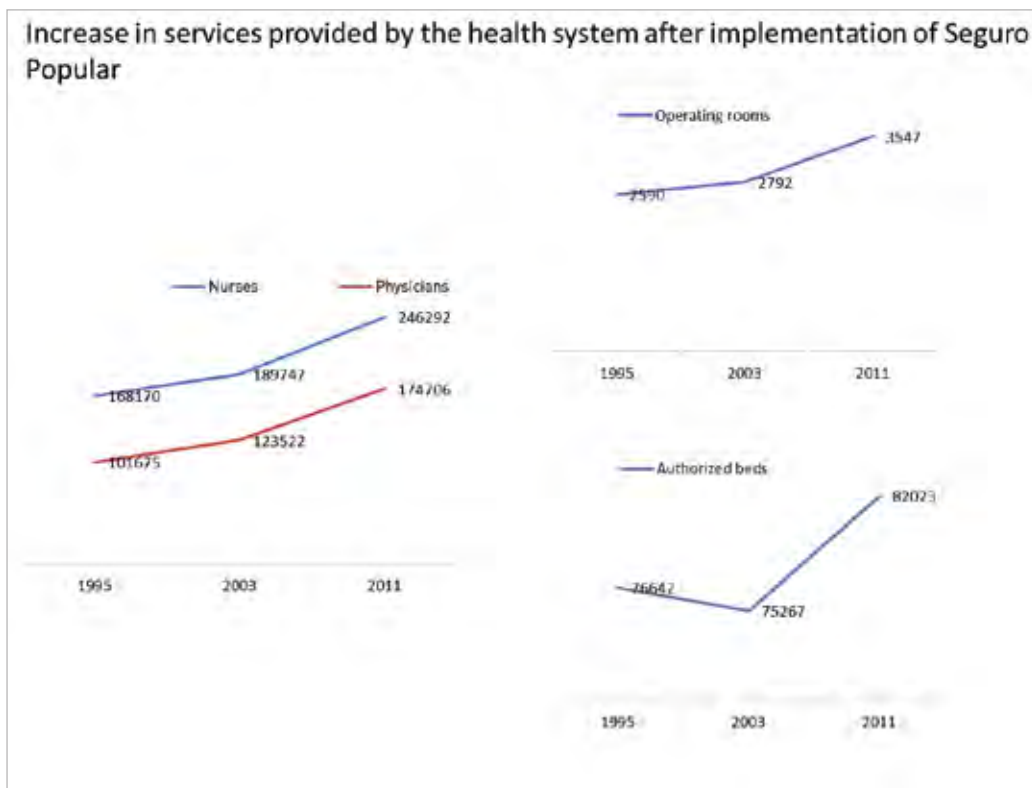
Registration also increased Seguro Popular members' sense of having better health than peers of the same age and gender; for urban residents, moreover, it reduced their probability of suffering from colds, coughs, stomach aches and heart disease. Meanwhile, in rural areas, Seguro Popular membership reduced the probability of missing work due to health problems.

More complex illnesses also registered positive impacts. For example, the rate of cessation of treatment (due to inability to pay) for children with cancer decreased from 30 percent to 5 percent, and the survival rate was 30 percent to 5 percent over three months. Also, as reported in medical literature, after the introduction of Seguro Popular, the survival rate of acute lymphoblastic leukaemia reached 80 percent over a period of 115 months, when children received proper treatment.

Final Thoughts

More than 10 years after its establishment, Seguro Popular's principal challenge remains achieving higher quality medical service and strengthening its links to the traditional Mexican healthcare systems, which rely on employment-related insurance for those lucky enough to have stable jobs.

Overall, however, Seguro Popular has been a great step forward in creating a free, dignified, high quality universal



Source: Fifth government report, Office of the President, 2011

healthcare system. It has not been an easy task, and there are still great challenges and areas for improvement.

But while there is still a long way to go in human rights, Mexico has made significant progress in fulfilling its' citizens' right to the maximum available level of healthcare. At home and abroad, these achievements should be recognised, supported and celebrated (openGlobal Rights 2015).

This article was first published on June 18, 2015 by openGlobalRights (opendemocracy.net/openglobalrights) a section of openDemocracy (opendemocracy.net). ■

Mexico Statistics (2013)

Country	Mexico
Total population	122,332,000
Gross national income per capita (PPP international \$)	16
Life expectancy at birth m/f	73/78
Probability of dying between 15 and 60 years m/f (per 1,000 population)	174/93
Total expenditure on health per capita (Intl \$)	1,061
Total expenditure on health as % of GDP	6.2

Source
World Health Organization (2013) Mexico Country Statistics who.int/countries/mex/en/



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“Luck is when preparation meets opportunity”



DIPAK KALRA

PRESIDENT, THE EUROREC INSTITUTE

1. What are your key areas of interest and research?

Helping to drive the future evolution of electronic health records (EHRs) to be a rich, holistic and smart information resource to all players involved in healthcare and research. My present areas of focus include semantic interoperability, enabling meaning to be understood by people and computers when data are shared between different information systems and different health settings and information governance, especially developing best practices in the trustworthy re-use of health information for research.

2. What are the major challenges in your field?

Serving many different purposes and stakeholders, which often pulls investments in health systems and development of standards in different directions. Unfortunately those needs which are closest to the care of individual patients can easily be overshadowed by the needs of those who need to make high-level management decisions. ICT systems are often better at management reporting than they are at supporting the documentation of care about individuals and the delivery of useful information to guide care decisions about individuals. We must work together to advance EHRs and their semantic interoperability at a global level.

3. What is your top management tip?

Unless healthcare IT systems deliver for patients and healthcare professionals, everybody else will have poor quality data, poor evidence and make unwise management decisions from it.

4. What would you single out as a career highlight?

The long-term championing of the vision for great electronic health records and great value from good quality, interoperable health information.

5. If you had not chosen this career path what do you think you would have become?

My original career path was as a general practitioner. I like to think that, if I had not fallen in love with health informatics, I would have played leading roles nationally and internationally to ensure that this profession always strongly promotes the best interests of patients, healthy citizens and populations, as well as being a good person-centred GP to my patients.

6. What are your personal interests outside of work?

Before I left London and moved to Brussels I had just discovered how wonderful it is to play golf! Now I need to take this up again.

7. What is your favourite quote?

"Luck is when preparation meets opportunity." Seneca the Younger, Roman philosopher.



“One of my passions is getting radiologists working as doctors”



DAVID WILSON

PRESIDENT, BRITISH INSTITUTE OF RADIOLOGY 2014-2016

1. What are your key areas of interest and research?

Occult fractures and outcome in acute ankle injuries and using MR-Ultrasound to treat nerve root pain. Education is a key area of interest for me in my role as President of the British Institute of Radiology and in my own practice.

2. What are the major challenges in your field?

One of my passions is getting radiologists working as doctors. The biggest challenge is working out whether the things we are doing are changing healthcare, impacting on patients' wellbeing and altering the eventual outcome.

With my ankle research, for example, it's all very well saying you've discovered occult fractures, but does outcome differ as a result? In radiology we tend to see the "I have found this lesion, I have made this diagnosis" as the endpoint. If you treat the patient the same way anyway is the test altering the management of the patient? It is an area where many radiologists are weak, because their input is literally issuing a report, and they are not following up patients after seeing them. Radiologists should be looking at what the eventual outcome of that patient's treatment is and their outcomes in terms of health – either preventative or curative and how that links into doing a test. We should be measuring value not counting the numbers.

3. What is your top management tip?

Get a good management team! It is really easy for me to do this job as President of the British Institute of Radiology. We have a superb management team, who are very motivated. So my tip is: "Choose the right people".

4. What would you single out as a career highlight?

Hard to single out one - I was a travelling professor for the Royal College of Radiologists. I also received an award for teaching medical students at the University of Oxford, which was a nice surprise. Lastly is writing the first paper on musculoskeletal ultrasound in the world (Wilson et al. 1984).

5. If you had not chosen this career path you would have become a...?

Geologist.

6. What are your personal interests outside of work?

Playing the viola, rowing and cycling.

7. Your favourite quote?

"I refuse to join any club that would have me as a member" – Groucho Marx.



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