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When acronyms cause confusion
Or: Alphabet soup (with comments from Hamlet)

Peter A. Rinck

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Medical terminology cannot exist without abbreviations. For many terms there are short names, ranging from the common ones understood by everybody, like TB for tuberculosis, ECG for electrocardiogram, to SIH for somatotropin-inhibitory hormone, understood only by those who deal with it every day.

Generally speaking, abbreviations are necessary because they facilitate daily medical routine. Who wants to say 'computed tomography', 'magnetic resonance imaging' or 'endoscopic-retrograde cholangiopancreaticography' when it takes less than one second to pronounce CT, MRI, or ERCP?

Or, as William Shakespeare described it:

Brevity is the soul of wit.
(Shakespeare, Hamlet; II.ii.)

There are clear advantages in using abbreviations that are well known from everyday usage: If you sit in a bar and utter "G & T" twelve times in half an hour you will be drunk a lot faster than the guy at the next table who says: "Waiter, another gin and tonic, please".

He can say this only six times per half hour.

More matter, with less art.
(Shakespeare, Hamlet; II.ii.)

There has been an explosion of abbreviations and acronyms in radiology during recent years, particularly in MR imaging. Abbreviations shorten or substitute an understood or stipulated word or phrase, whereas acronyms are made up of the initial letters of a term and often sound familiar to existing words.

Unfortunately, when reading medical articles in journals or books, the abbreviations you find in the text are in many instances not explained because many authors believe that your brain works like their's. Very often, however, you have no idea what specific abbreviations or acronyms mean.

There are simple rules – not always obeyed – for the use of abbreviations in articles. No abbreviations should be used in titles and abstracts; abbreviations should be spelled out the first time they occur in the text; and if the publication is very long, a list of abbreviations should be included in an appendix to the article or book chapter.

It gets even worse if there might be a double meaning. For instance, is IQ image quality or intelligence quotient, PC phase contrast or personal computer, ADC analog-to-digital converter or apparent diffusion coefficient, ROI region-of-interest or return-on-investment, GE gradient echo or General Electric?

The Books of Abstracts of the 1996 meeting of the International Society of Magnetic Resonance in Medicine in New York provide sufficient examples: What on earth is ERPF? Is it an exclamation by ducks? We, the poor readers, have to find out ourselves.

Alas, poor Yorick!
(Shakespeare, Hamlet; V.i.)

Most abbreviations and acronyms used in radiology are rooted in the English language because, like it or not, it is today's international medical language. Different languages have different medical abbreviations and acronyms, however, and sometimes they spill over from one language to the other.

In German, the Scandinavian languages and Russian, MRT is used for magnetic resonance tomography, instead of the English MRI. When reading *MRT* in an English text, you still can conclude that the authors mean MRI. SIDA, of course, means AIDS.

Sometimes, however, you find abbreviations you do not necessarily recognize: SEP (French: *sclérose en plaque*) should rather read MS in English (multiple sclerosis).

The avalanche of recent radiological acronyms was broken loose by a streak of lightning, the FLASH,

which stands for "fast low angle shot". It was described by Axel Haase and his collaborators as the basic gradient-echo sequence, and then it was taken over by Siemens. Today the company sells a different pulse sequence under the same name without having changed the acronym. Similarly, FISP has also two meanings and describes two different pulse sequences in MR imaging.

If you think that FISP describes a wasp with pronunciation problems, you are wrong. In this case, you should read one of the numerous overviews of such acronyms and abbreviations or, simply, the List of Acronyms of the TRTF/EMRF Basic Textbook [1]. Unfortunately, because of the explosive propagation of acronyms, even this thorough compilation might be incomplete.

Many different acronyms describe similar procedures, which adds to the problem. Several suggestions have been made about cleaning up this disorder by creating generic names for functional groups of pulse sequences.

Spin-echo (SE) and inversion-recovery (IR) sequences would stay as they are. The gradient-echo (GRE, not GE) sequences would be grouped into S-GRE (spoiled gradient-echo), CE-GRE (contrast-enhanced gradient-echo), and R-GRE (refocused gradient-echo). All Turbo-SE, fast SE, and RARE sequences would be combined under the umbrella term RSE (rapid spin echo). However, there is no common agreement yet on this terminology.

Since the late 1980s, companies have tried to outmaneuver one another by coining new acronyms that should be easy to pronounce and have a certain marketing and sales (or sex?) appeal – exactly how much appeal remains to be determined by the reader.

Though this be madness,
yet there is method in it.
(Shakespeare, Hamlet; II.ii.)

Unfortunately, often this moderately offensive company slang is not understandable to outsiders who are not exposed to the company's products. Nevertheless, it is used for scientific publications and creeps into the scientific literature, such as into abstracts of scientific meetings.

By and large, there is no substantial difference between companies and research groups at universities or other institutions creating clever new acronyms; their purpose is the same, namely to profile and promote themselves. The result is utter confusion, followed by disregard for such presentations.

Absolute confusion can be created by not writing the acronyms in capital letters but in small letters. What do you do with a ‘rare’ pulse sequence? Personally, I prefer a well-done pulse sequence. (To kill this joke completely, I believe that RARE is a well-done pulse sequence).

In one article, I found the acronym SELESTRA for spin echo, long echo, short TR acquisition (TR = 600 ms, TE = 50 ms). Firstly, this acronym is inconsistent, as are many other acronyms (long echo, instead of long echo time or TE). Secondly, it is completely unnecessary and irrelevant. Just mentioning ‘TE was chosen at 50 ms, TR 600 ms’ gives readers all the information they need without confusing them with SELESTRA.

Some people believe that they have contributed to science just because they made up what they consider to be a "funny" acronym. Sometimes acronyms can diminish or even completely destroy the value of a pulse sequence.

This is the very coinage of your brain.
(Shakespeare, Hamlet; III.iv.)

Guess where RODEO (rotating delivery excitation off-resonance) originates. Texas, of course.

I always thought PIPS was a chicken's disease, but it also can be applied to MR imaging. FLAT TIRE is an acronym for fluid-attenuated turbo inversion recovery, while FLAT BRAIN does not exist yet. EPISTAR describes echo-planar imaging in the stars – most likely somewhere in the Milky Way. CEPI, IEPI, and SEPI are European relatives of the yeti, the Himalayan snow man.

Let’s continue: “PRESTO, bring me my FASTCARD and be FAST, BRISK and HASTE. STIR the SPARE PASTA for DANTE with the STEAMed and SMASHed RARE SPIDER and the ROAST PEAR. I SENSE a PILS and a GRAPPA.

"Oh god, I swallowed my fake SAPPHIRE.

“Don’t be CRITICAL with this FAIR and COSY SUPER DIET because we want to BURP and BURST.

FREEZE and SHORTen your CRAZED RAGE, otherwise you might be visited by the ONG [oblique Nyquist ghost]. RISE early and be SMART and not SISSI! Even you MOLLI, ShMOLLI, and SANDRA.

"What a MESS! Let's FLASH this acronymania down the …"

There needs no ghost, my lord,
come from the grave, to tell us this.
(Shakespeare, Hamlet; I.v.)

I hope that we will never see a new pulse sequence from France: magnetization-enhanced rapid double-echo, or MERDE.

To be frank and fair: some acronyms describing pulse sequences or procedures are necessary and to the point, and they give a name to a specific diagnostic tool.

However, Shakespeare commented on all of them:

Thou comest in such questionable shape.
(Shakespeare, Hamlet; I.iv.)

Most acronyms do not contribute anything new in terms of substance; they are only packaging. In the era of environmental protection, we do not need them. Rather, we need some orientation in the bewildering jungle of acronyms. The fundamental idea of facilitating communication between inventors and users by shortening terminology is positive, but playing around with it has no advantage for the already confused customer. Such customers or other scientists will strike back sooner or later by leaving the marketplace or scientific area.

Finally, I would like to apologize to those individuals, companies, and research groups whose acronyms were not included here, but there is not enough space for all of them. I also apologize to those whose creations have been selected.

As already mentioned, not all of them are bad or useless. My choices were made purely on the basis of emphasizing the point or just because the terms fitted nicely into the text.

I must be cruel, only to be kind.
(Shakespeare, Hamlet; III.iv.)

Reference

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Time to think again about computers

Peter A. Rinck

Do you know the following brand names: Panhard-Levassor, De Dion-Bouton, Isotta-Fraschini, Hispano-Suiza, Minerva, Excelsior, Hammel, Horch, Maybach, or Lloyd? For those of you who do not recognize them, they are all automobile manufacturers or, in fact, they were. In 1898, there were 50 automobile manufacturing companies in the United States of America, a number that rose to 241 by 1908. The names above are European and tell a similar story for Europe. Dozens of companies started building motorcars around the turn of the century.

Cars built before 1914 looked very different from those built today, whereas those built before the Second World War more closely resemble those of today. In the last thirty years, cars have also become simpler and more comfortable. They are now very easy to operate and because their handling does not differ greatly it is not a major problem to change from one to another.

The point is that it took more than half a century for motorcars to evolve into a stable product that can be used by anyone with a minimum amount of training. The automobile industry responds to new developments in safety, comfort, environmental protection, or pure fashion, but in essence, the product remains the same. Along the way, however, many manufacturers faltered and disappeared.

This example should be kept in mind when updating your views on computers.

My first contact with computers in medicine was in nuclear medicine some twenty years ago. We had a DEC station connected to a gamma camera for cardiac examinations with thallium-201.

It created beautiful color pictures of the myocardium, and I could easily manipulate the size of an ischemia or infarction by playing with this computer. This made a lasting impression on me which has stayed with me ever since: it made me realize that computers are only as intelligent as those who use them. As with cars, they are tools (or toys). As tools, they can make life a lot easier.

Fifteen years ago, in 1982, I bought my first personal computer for writing articles, making calculations, creating patient databases, and evaluating data collected in studies. It was a Kaypro II and I bought it in a gun shop on Long Island; at that time, there were no specialized computer shops.

The manufacturer of this computer has long disappeared from the market – as has this computer from my life. If you were to see this computer today, you would think you were watching a bad science fiction movie.

It was a “portable” computer: a heavy, clumsy, noisy box, the cover of which would become the keyboard; the small, black-and-green screen was next to the two floppy disk drives; and, of course, there was no hard disk. Today you would laugh at its performance, yet it was only fifteen years ago.

Since then I have changed computers nearly every other year. At present I have four personal computers – more than enough you may think, but two of them are too slow for today's software applications, and I use one of them solely to read floppy disks.

In hospitals, and radiological departments in particular, the situation has changed accordingly. You find computers everywhere, not only connected to run equipment, but also freestanding or network--connected personal computers, but I wonder if someone has ever made a cost/benefit calculation for personal computers in radiology.

Of course, reports processed on computers usually contain fewer mistakes and look nicer than those done on an old-fashioned typewriter. With PCs is easier to create forms and calculate the hourly, daily, weekly, and monthly patient throughput. We can also use our PCs for image processing, archiving, communication, and even teleradiology.

But do we really need all this computer-based administrative bureaucracy, or are we just creating more work and data output in a manner worse than predicted by Parkinson’s law? Are we not only creating new employees in healthcare administration but also be-

coming serfs to our computers because we are unable to restrain ourselves from trying out new software tools and doing work other people could do?

Increasingly, radiologists are doing the work of secretaries; after all, the PC is sitting there on their desks and they do not have to bother dictating, explaining, or begging that the reports should be typed up immediately. Yet, the hours accumulate and you end up filling your workday with such jobs, not to mention the fact that you leave secretaries out of work.

When you try to find out which computer, which paraphernalia, and which software are most suitable and best for your purposes, you have three possibilities: Ask somebody you know, try to get advice at a shop, or read computer magazines.

But even if you ask a well-trained software engineer which computer you should buy and what software you should install, you will not get straightforward answers. At best, the answers will be ambiguous: It depends on what you want the computer for, how much you are willing to spend on it, whether you will use it only at your workplace, and certainly how good you are at programming.

Salespeople in computer shops are worse. Of course they want you to buy the latest, greatest, fastest, lightest, and most wonderful piece of equipment on the market. It does not matter than in three months there will be a new machine that meets these criteria. They want to sell, so you cannot blame them, but it is doubtful that you trust them.

As for reading computer magazines, there is no need to waste your time. Most of these publications are full of advertisements anyway – you are better off going to the shop, where at least you get to touch and see the equipment. The few articles you do find in these journals are written for experts, so you are left confused and with no easy answer to a simple question.

When you finally buy our computer, our troubles are just beginning. You must partly assemble it, install the software, learn how to use it, etc. Often you also have to change the electric plug because it does not fit into the socket.

Endless hours are spent reading manuals, consulting friends and colleagues who have similar PCs, and finally trying to reach the telephone “hotline” of the manufacturer. The lucky few will reach a person and not an answering machine, but the advice is seldom useful. To continue the installation, you are told you have to straighten out a paper clip and push it into the hole in the bottom of your computer, being careful not to drop the computer during this procedure. You must them continue with step 126 on page 74 of the manual.

Sometimes, reading the small print in the documents that came with the computer you can find sentences starting like the following: “If you experience erratic function with your computer, …“

In other words, the manufacturers knew from the beginning that the device they sell functions only randomly.

If you are persistent, you may end up with an operational computer and can begin catching up all the work that has accumulated since you thought about buying a new computer.

What is it about computers that makes us deviate from the normal procedures when buying equipment?

Usually, when your department buys a new refrigerator or angiography suite, somebody will deliver and install it. The same should hold true when buying computers: Have them delivered and installed by the people from the computer shop. If they tell you that they do not have such a service, then move on to the next shop. There are five per block.

Interestingly enough, a German poll has revealed that 50% of all new PCs break down within the first six months. Could it be that all kinds of products are being dumped in the market for us, the users, to test? After all, there will be plenty of good excuses if things do not work out as they should. Technology is advancing and growing rapidly, and users are so hooked on it that they are more than willing to try the latest fads and frills.

Much of the fantastic savings this technology is supposed to bring about are questionable. You can save time when it works properly, but has anybody kept an account of the time spent purchasing, setting up, learning, repairing, reinstalling, and cursing?

We save space when information can be stored on a PC or on disks and accessed with the push of a button, but just in case, we keep mountains of diskettes

with backups and all our hard copies on paper, x-ray films and slides.

There is only one thing that becomes obsolete faster than a personal computer: the popular color in women's fashion, which changes every six months.

Information technology (IT) booms and networking is the name of the game. Massive public relations and marketing efforts by the manufacturers have led to the conviction that radiology departments and private offices cannot survive without it. Often, decisions to install computers and computer networks are made prematurely, and they are made by technology freaks who call themselves "system consultants", rather than by persons involved in daily routine, or healthcare administrators who could make cost/benefit calculations.

Many commercial enterprises have invested heavily in IT, but there is no proof of a proportional link between the amount invested in computers, accessories, and personnel and the success of the enterprise. Some companies spend 0.5% of their annual turnover on IT, others 3%. Market research shows no difference in profitability between them. It can be concluded that there is a certain level of necessary investment in data technology, and anything beyond this investment creates no added value. The same holds for medical enterprises.

We are becoming increasingly dependent on this technology, and there is no going back. I am the first one to acknowledge I do not want to go back to my typewriter and dictaphone. We are on a roller coaster, supporting a market in which we are both users and used but we must not forget we are still in a developmental period. Hopefully, in no more than 30 years we will reach the same point of stability that the automobile industry has reached today.

It must be possible to create hardware and software which is made and written for users who are not amateur computer-repairmen and which perform the tasks they are promised to have been developed for without erasing irretrievably all data created during the last week.

Footnote: *Many years later:* We are using Linux now, in its Ubuntu versions. It's not perfect for playing games, but it's the perfect workhorse, exactly what we need. And if something goes wrong, it's easily solvable. If the computer crashes, we just reinstall Linux. It's pleasant and lets you forget the terror of Microsoft.

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The European Congress of Radiology – a European success story

Peter A. Rinck

The annual meeting of the Radiological Society of North America is better known by the abbreviation of the organizing society: the RSNA. Every year, during the week after the Thanksgiving holiday in the U.S.A., it attracts tens of thousands of radiologists, support personnel, hospital administrators, physicists, and exhibitors to Chicago; to be exact, in 1996 more than 61,500 people attended this meeting, among them 27,250 medical professionals.

The first time I attended the RSNA, it left a deep impression on me. At that time I lived in New York and I had taken an early morning flight to Chicago. I checked in to my hotel and walked (sic!) to McCormick Place, where both the congress and the exhibition took place. I registered and entered the exhibition hall, but then left ten minutes later intimidated and speechless. The registration lines were gigantic, the scientific program was stunning – but it was the exhibition which finally scared me off completely. I just turned around and walked back to my hotel.

Today I do not have such problems any more. My expectations have changed. When I attend the RSNA, I know that I go to this radiological Disneyland to be entertained, to see some of the new commercial developments, and to attend very few lectures. It has become both too big a scientific conference and too big a trade show, being topped only by Medica, the medical trade show in Düsseldorf, Germany, which attracts some 110,000 participants and visitors every year.

Of all the major radiological congresses, I consider the European Congress of Radiology (ECR) to be the best. With 12,500 participants it is a large size meeting, but both the participants and the organizers can handle this size.

Usually nobody pays much attention to the self-praise at opening or closing ceremonies of conferences, but that included in the speech by Hans Ringertz, the president of ECR '97, was well deserved. The meeting in the spring of 1997 in Vienna had everything you hope to get from such a meeting. The conference comprised balanced presentations from all modalities, teaching courses and state-of-the-art lectures on the latest results in research and development, poster and commercial exhibits which were not completely overpowering, an extremely smooth organization, and, last but not least, a pleasant social program in one of the most beautiful cities of Europe.

The inner city of Vienna can easily be conquered by foot and the congress center, although outside the inner city, is within easy reach and close to the well-functioning public transportation system. Vienna has the additional advantage of being centrally located in Europe, and being a neutral territory in radiological politics, it is an acceptable meeting place for participants from most of Europe.

ECR and EAR - who is who?

The official arranger of the ECR is EAR, the European Association of Radiology. This organization used to have the reputation of being an association dominated by arteriosclerotic radiological functionaries. A few of them are still around, such as the Russian who felt that all ECR-sponsored travel grants for Russian attendees should be distributed by him, rather than by an ECR committee, because he knows best.

Generally, however, there has been a change of attitude from national society bureaucrats to open-minded and flexible, though not directly elected, representatives. For the future it would be desirable to have a transparent and democratic institution, accessible to all European radiologists.

To build up the infrastructure of a congress such as the ECR and to make it run, you need a dedicated core of people who invest all their time and energy over many years in such an endeavor. More than a dozen well-known radiologists have done that. Among them Josef Lissner, Albert L. Baert, Hans G. Ringertz, and, in recent years, Roberto Passariello stand out. Also important have been the people in the

background: Peter Baierl and his team, who lead the permanent staff of the congress and have built up a perfect organization with well-functioning logistics.

In addition, there are cohorts of radiologists and other medical professionals working all year round to assure the quality of the scientific and educational presentations. ECR depends on their individual and combined endurance, drive, and efficiency to keep up and control the high level of the program.

Of course, there were also some faults at this year's meeting. The exhibition space was limited and scattered, so that it was difficult to get an overview. Compared to the RSNA, the message system was difficult to use and the press facilities were insufficient. The latter points are easy to overcome.

It seems that the worst problem will be solved by the next ECR. The exhibition facilities are to be expanded in the future. By 1999 there should be a new exhibition hall, which hopefully will solve the hide-and-seek game in Austria Center.

Radiology in Europe

European radiology is multilayered. In many instances there are no general trends as in the U.S.A., but the different European health systems, cultures, and politics result in many discrepant opinions and schools. The differences are enormous – not only those between Germany and Albania, for instance, but also between countries in which the prevalent diseases and thus radiological indications are not substantially different, such as Great Britain and France. A major meeting such as the ECR is of advantage for the European idea and for patients at large. Over the years, discussions should lead to a consensus in radiological diagnostics and therapy. Unifying radiology in Europe in this way would be a great step forward.

One sad aspect of the ECR is the lack of participation from France and Great Britain. For France, the reasons are easy to explain, for Britain more difficult.

The only radiological event in Europe comparable in size to the ECR is the annual Journées Françaises de Radiologie which appeals to French-speaking radiologists from Europe, Africa and the Americas. The Paris meeting is a good alternative for French-speaking radiologists for whom English could present an obstacle. There are also French objections to the all-embracing and overpowering Anglo-American culture and politics. This is an attitude many other European share – but the course of history has resulted in American English becoming the scientific language of the second half of the 20th century.

The Radiological Society of North America comprises the three North American countries Canada, the U.S.A., and Mexico, with the U.S.A. being the dominating country. From the outset, the annual meeting was basically a one-country, one-language meeting. In contrast it took a long time in Europe to compromise and have meetings in one language only – although some native speakers of American-English and British-English still have difficulties understanding Euro-Fizz English. In the long run, even they will learn to understand this language.

British participation in the ECR seems to be hampered by the relatively small number of qualified radiologists on the island. Moreover, money is scarce for radiologists in the British health system and traveling in Europe is expensive. On the other hand, there are some excellent radiological academic institutions which could contribute more to a congress like the ECR.

More still to come

From 1999, the ECR will change from its two-year rhythm to being an annual congress. For some this is a controversial issue, although (or because) this move will establish the conference solidly as the main congress in Europe and, partly, Africa and the Middle East. However, the annual frequency might hit some of the ailing national congresses in a similar way that supermarkets have killed or altered the small corner shop.

Still, national conferences and, in particular, specialized seminars and small-scale teaching courses will continue to exist and flourish because they are the backbone of continuing education.

Some commercial companies are opposed to an annual European conference. They would prefer one single big commercial show per year – in the U.S.A.

They have a good argument in their favor. For them the United States of America is the biggest market in the world for imaging equipment and accessories with approximately 52%, followed by Japan (26%) and Germany (11%). Compared to these countries,

all other markets are marginal (France 4%, Italy 3%, Great Britain 2.5%). However, the advocates for a U.S.-based world fair of radiological equipment do not seem to understand the needs of their potential customers. They also forget that Europe still buys nearly one quarter of their production and that much research towards developing their products stems from European academic and industrial research sites.

Moreover, one should hope that the exhibition planners of some companies will learn from past experiences of congress attendees in Vienna and Chicago, where many participants either did not find the booth they were looking for or could not get into the booth because it was overcrowded. Some companies should also acquire the knowledge on how to design a booth in a way that potential visitors are not deterred from entering.

Value for money

Individual membership of ECR is another major step forward. At last there is a member organization of European radiologists, not only a representation of national organizations through the EAR.

As a member of the German Roentgen Society, DRG, I pay an annual membership fee of DM 300. In return, members have free access to the annual German Roentgen congress and they receive free newsletters, which are usually reprints of the opening speeches at this congress. The scientific program is not made available to all members, and a subscription to DRG's journal amounts to another DM 500 per year – in other words: little value for money.

The annual membership fee of the RSNA for European members is US$ 280. This includes the subscription to a newsletter and the journals *Radiology* and *RadioGraphics* as well as free access to the annual scientific meeting for the member and one guest and the complete book of abstracts, whether you attend the meeting or not. This represents good value for money.

For a mere 500 Austrian shillings (approximately DM 70 / € 35) per year, the conference fee of ECR members is substantially lowered. Ultimately it is expected that they will pay no fee at all. Members also receive a newsletter, the abstracts of the ECR (if they attend or not), and the journal European Radiology. During the last years this journal has developed into a serious radiological journal with high scientific standing.

Because the ECR also seems to offer value for money, I hope that the number of 3,000 members necessary to reach the break-even point will be met soon. In this case, there will not only be a powerful scientific European radiological society but also a stable European Congress of Radiology where it will be worthwhile to present the latest scientific results and commercial breakthroughs (not only) originating in Europe.

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Statistics lead to frustration and falsehoods: "Facts and figures"

Peter A. Rinck

It's 2 AM. The telephone rings. Roused out of his sleep, the man in the bed lifts the telephone receiver, listens, and then shouts into the receiver: "You got the wrong idiot, you number!"

When dealing with numbers and statistics in medicine, and in our case, in medical imaging, this slip of the tongue very often comes into my mind. I was reminded of it in particular when preparing a lecture on "Figures & Facts" for a recent congress. When I received the invitation to give this talk I thought I had finally been given an easy topic. It is not so difficult to find data on the number of MR imaging, CT, ultrasound (US), and nuclear medicine machines worldwide, how many examinations are performed per year, and how much money this costs; and you can easily compare these numbers with those of other imaging modalities.

This was the first mistake. You hardly find any figures on medical equipment or procedures in the scientific literature, although there are some in health/general economic publications. However, even their data are scarce and mostly outdated. When you approach people selling equipment or accessories, many of them either do not have a good overview of the marketplace or they keep the numbers secret. The last resort is so-called “intelligence” companies, which gather data for the industry or other interested parties. To get some of their figures and predictions, you have to pay them between US$ 1,000 and US$ 4,500.

All numbers cited in this column are from sources commonly considered reliable. However, when I compared data compiled from different sources, I discovered that it is not so easy to find exact numbers, and those you find are wrong.

Now you ask: “How do you know that they are wrong?”

For example, one source says there are 7,000 MR imaging systems worldwide, the next says there are 9,000 in the three largest markets combined. A third source states there were exactly 6,678 MR units installed worldwide in 1995. Trusting the latter one is like believing the numbers in statements by politicians or published in clinical studies: exact numbers must be wrong, and percentages are even worse.

It seems that health politicians, trade unionists, journalists, lawyers, health system planners, people talking about cost containment, medical functionaries, company people, and medical researchers (in this order) often get their numbers wrong.

Taken together, physicians in the United States, Japan, and Europe operate approximately 150,000 ultrasound, 20,000 computed tomography, 7,350 nuclear medicine (mostly SPECT, single photon emission computed tomography), and 9,000 MR imaging systems. Anually, these machines perform some 115 million ultrasound, 63 million CT, 35 million nuclear medicine, and 17.5 million MR examinations.

For the sake of finding a common denominator, let's assume the numbers given in the last paragraph are correct within the medical range (± 25%). Then you can start looking at them in detail and assessing them.

In 1995, Germany had 24,000 US machines, France 12,750, Italy 12,400, Great Britain 9,350, and Spain 6,380. There were 1,350 CT units in Germany, 514 in France, 350 in Great Britain, 266 in Italy, and 190 in Spain. Germany had 365 MR machines, Italy 210, France 125, Great Britain 147, Spain 131.

In another source, the figures for MR equipment read: Germany 560, Italy 302, Spain 179, and Great Britain and France same as above. A third source states that there are more than 800 MR machines in Germany. This means that the figures for Germany alone differ by more than 100%.

If you turn these numbers into imaging units per head of population, Germany stays the leader with 293 US units, 16.5 CTs, and 4.5 (or 9.6) MR machines per one million inhabitants. This is followed by Italy and

France in close competition with each other; and, after a while, by Spain and Great Britain.

Thus, the statistical notion (or prejudice) that the per capita density of sophisticated medical imaging equipment changes negatively in proportion to the per capita consumption of red wine is wrong; it decreases proportionally to the consumption of stale ale to the northwest of Europe and red wine to the southeast.

Even worse for some of my friends with deeply rooted preconceptions: Because more high-technology equipment is sold in Northern Italy than in the south, this region has a higher density of medical imaging equipment than most countries of the European Union.

Healthcare statistics can also be used to find out the reasons for differences between countries, or to reach unsuspected conclusions: the Germans have one ultrasound machine per ten physicians; in Spain, 21 physicians share one US unit; you see more bullfights in Spain than in Germany. This must be because Spanish physicians train with bulls first to fight for the use of the few US machines.

Gathering the figures and getting the facts – or, even worse, making predictions for the development of different imaging modalities or individual markets or companies' market shares is difficult because collecting and processing the numbers is a doubtful business. The penetration and acceptance of a technique or modality do not seem to depend much on scientific results or cost considerations, but rather on local culture, politics, and lobbying within the healthcare system.

In the first half of the 1990s, and increasingly in the second half of the decade, health politics have stressed cost reduction. Although this approach showed limited success from the beginning, medical imaging has been relatively hard hit. The impact was mainly on large capital purchases (= heavy equipment such as MR imaging, CT, and angiography equipment) as well as bulk sales through healthcare purchasing groups.

X-ray accounts for more than half the worldwide sales of imaging equipment. In Europe, sales of x-ray equipment were only affected during the first half of the 1990s and have since recovered. Both the x-ray markets in the U.S.A. and Japan have increased considerably during this period. The values of the CT and MR markets have risen again after an earlier fall, and the ultrasound and nuclear medicine markets have been effected but show signs of recovery. Unit sales of ultrasound equipment have steadily grown.

Let's return to our numbers. When numbers are processed, incredible results are often obtained, but they might be true. The differences in the utilization of imaging equipment are not as pronounced as those in the regional distribution.

Whether you are in the U.S.A., Japan, or in one of the European countries mentioned, the annual number of ultrasound procedures per machine ranges between 710 and 790, with Germany being at the lower end and Japan at the higher end. Annual MR examinations in the U.S.A. range between 2,300 and 2,600, in Europe between 3,100 and 3,300. The numbers for CT examinations are higher in the U.S.A., amounting to 3,500 per year and unit; but in Europe, CT examinations balance with MR examinations, with 3,000 to 3,200 examinations per machine and year (oops, there goes the argument of higher patient throughput in CT; everything depends on how many machines there are in a region and how the machines are used).

If you calculate on the basis of 250 working days per year, you get the most interesting result of this excursion into statistics: the average number of patients examined in a CT or MR unit is about 12 per day in the U.S.A. or Europe. The average number examined with a US machine is two to three. Even considering that there might be an error rate of 50%, the number of patients examined by each ultrasound unit per year is extremely low. Ultrasound is supposedly versatile, fast, and mobile, but apparently the equipment is only marginally used.

Why do we see this discrepancy?

The answer seems to be hidden in the different user populations. CT and MR machines are only used by specialists educated and trained to perform and assess such examinations. Thus, it is possible to get accurate figures and facts on the utilization of this kind of equipment. Utilization of and indications for ultrasound are diffuse. In the best case you get some soft data of the utilization.

Ultrasound can be performed by any physician, and in some countries no training or only introductory courses are required. The price of a state-of-the-art

ultrasound machine is affordable at one sixth of a CT or one tenth of an MR equipment (of course, you also can acquire ultrasound equipment for the price of a CT).

Furthermore, there are severe restrictions on buying heavy equipment. To acquire MR, CT, or angiography equipment, you need permission in many countries; and permission will not be easily granted, at least not by the politicians and the cleaning lady on the supervising board in charge of new acquisitions.

On the other hand, ultrasound machines can be freely sold and bought. In many countries the market values of ultrasound sales are at least the same or even substantially higher than CT and MR combined. In other words, the overall costs for ultrasound are as high as for all "heavy" imaging equipment. Actual ultrasound costs per examination are one fifth of an MR examination.

Is this an artificially created market which was chosen to bypass the hard-hit MR and CT markets? If so, was it chosen by the physicians themselves or by administrators and/or vendors?

At the heart of this discussion on facts and figures are the questions: who needs them, who uses them and for what purpose are they used?

Reliable figures should be compiled and used to improve health services and not to engage in games where we end up not knowing which numbers are correct. Those selling equipment and accessories should know the state of the market for their own and their clients' interests. The same holds for medical associations, which should argue their cases with dependable and trustworthy data that have not been manipulated in favor of one or another medical discipline.

Last but not least, by definition health politicians cannot be trusted because, according to Mark Twain, they base their arguments on three pillars: lies, damned lies, and statistics.

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