

Accuracy of comparing bone quality to chocolate bars for patient information purposes: observational study

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ABSTRACT

Objective To test whether standard information for patients using Crunchie and Aero chocolate bars to explain bone health and risk of fracture is robust.

Design Observational study.

Setting Domestic kitchen in rural west Wales.

Participants 10 Crunchie bars and 10 Aero bars.

Main outcome measure Fracture after falls from varying heights.

Results Both Crunchie and Aero bars exhibited the same T and Z scores for bone density. Crunchie bars had a lower chocolate mass index than the Aero bars. Crunchie bars are more liable to fracture.

Conclusions Using Crunchie and Aero chocolate bars to explain bone structure to patients may be visually attractive but oversimplifies the situation.

INTRODUCTION

It is important that information provided to patients as part of their treatment should be comprehensive and accurate. Within our area of practice relating to osteoporosis and fragility fracture we have noticed a tendency to compare normal, healthy bone to the finely honeycombed structure of a Crunchie (Cadbury Trebor Bassett; Bournville, Birmingham) chocolate bar and to compare abnormal, osteoporotic bone to the coarser structure of an Aero (Nestle UK; York) bar (fig 1).^{1 2} Although this explanation is readily appreciated by patients and clinicians it struck us that the comparison may not be completely valid as no work has been published on the fracture potential of each bar. This might mean that with best intentions we are advising patients to aspire to a bone structure that is actually more liable to fracture. To enable us to provide accurate data to our patients we studied the fracture risk for each chocolate bar.

METHODS

We randomly purchased 20 chocolate bars (10 Crunchie and 10 Aero) from a reputable high street confectioner; the number of bars was limited by research funds and our rural environment. Each bar was measured to provide information on height

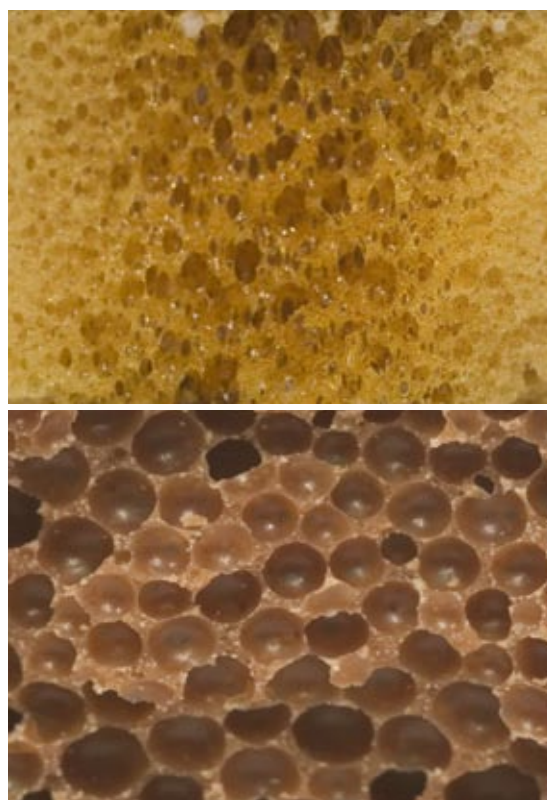


Fig 1 | Cross section of Crunchie (top) and Aero (bottom) chocolate bars

(defined as the longest dimension of the bar, in metres) and mass (determined in kilograms). The composition of the bar was determined through reference to the packaging. We could ascertain no data on other fracture risks. The tests were completed in a controlled environment and the flooring was standard 33×33 cm ceramic kitchen floor tiles with average grouting. This environment was chosen as being representative of the home environment, where many fractures occur.

The end point of the study was fracture. Firstly, we allowed each bar to topple from its standing height in the centre of a tile. We then dropped each bar horizontally on to the centre of the tile from increasing heights until fracture, defined as a break in the cortex;

we did not regard mild deformity as a fracture. The tests were carried out at a temperature of 22°C after the bars had had eight hours to reach a steady state temperature. We used a bone densitometer (Discovery-C; Hologic, Bedford, MA) to carry out dual energy x ray absorptiometry (whole body) on one Aero and one Crunchie, with bone mineral density being used as a surrogate for measuring chocolate density. Height was measured with a tape measure (Olympia (5 m/16 ft) Power Return Tape; Olympia (UK); Reading, Berks). We chose a Kaplan-Meier “fracture free” survival curve as the best means of analysing the data obtained.

RESULTS

The table provides comparative data for Crunchie and Aero chocolate bars. All bars had the same dimensions (to within the accuracy of our measure). No bars fractured in falls from a standing height. A Kaplan-Meier survival curve shows the occurrence of fractures according to heights (fig 2). Figures 3-5 show the range of fractures.

DISCUSSION

Using Crunchie and Aero chocolate bars to explain bone structure and fracture risk to patients may be visually attractive but oversimplifies the situation. Our findings must be interpreted with some caution as we used a small number of participants and the falls were not low trauma—that is, standing height or less. To date a reliable population database for chocolate densities has not been established and we acknowledge that our reference population is somewhat subjective; there may be scope for further research in this area, including risk of fracture over 10 years. Our findings, however, clearly show that despite the apparently more robust structure of a Crunchie it is more likely to fracture than an Aero.

It is generally recognised that bone strength is a reflection of bone density and bone quality and therefore the explanation for our incidence of fracture is likely to be multifactorial. It may include differences in chocolate mass index (2.16 for Crunchie *v* 2.76 for Aero), and the higher protein content of the Aero is likely to provide more elastic stress properties than that of the Crunchie.

Characteristics of Crunchie and Aero chocolate bars

Characteristic	Crunchie	Aero
Height (m)	0.136	0.129
Weight (kg)	0.04	0.046
Chocolate mass index (kg/m ²)	2.16	2.76
Content:		
Protein (g)	1.6	3.0
Carbohydrate (g)	27.8	27.0
Fat (g)	7.6	14.6
Fibre (g)	No data	0.4
Sodium (g)	No data	Trace
Salt equivalent (g)	No data	0.1
Calcium (g)	No data	No data
Collagen (g)	No data	No data
T score†	-9.5	-8.8
Z score‡	-9.5	-8.8

T and Z scores are referenced to 50 year old woman.

†Number of standard deviations above (or below) mean for peak bone mineral density score.

‡Age and sex matched number of standard deviations above (or below) the mean bone mineral density score.

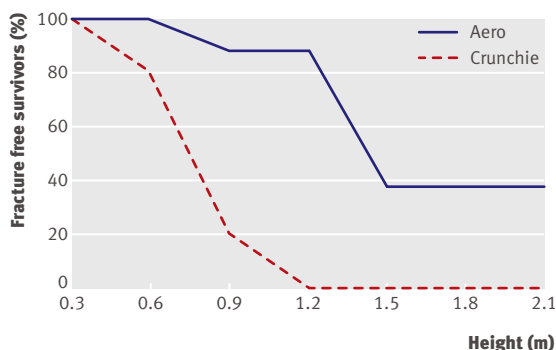


Fig 2 | Fracture free survival curves for Crunchie and Aero chocolate bars



Fig 3 | Simple, complete fracture at interchunk area of Aero chocolate bar, the only fracture seen in the Aero group



Fig 4 | Splinter fracture in Crunchie chocolate bar



Fig 5 | “Blow-out” fracture at higher fall heights in Crunchie chocolate bar

WHAT IS ALREADY KNOWN ON THIS TOPIC

Increase in bone porosity is implicated in increased fracture risk in vivo but is not the only determinant

The use of confectionary visual aids in patient education is widespread among health professionals to convey fracture risk to patients

WHAT THIS STUDY ADDS

Fracture risk is not wholly determined by dual x ray absorptiometry, and a full and rigorous fracture risk assessment is required for both chocolate bars and, more importantly, patients

Our data provide evidence of the disparity between chocolate density and fracture rates. The use of Crunchie and Aero bars to explain bone health and fracture risk to patients, although palatable, is not justified. In practical terms we believe that the findings should contribute to the provision of improved patient

information and education by enlightened healthcare professionals. The study serves to remind clinicians that both chocolate density and bone mineral density form but one component of fracture risk. The accurate assessment of fracture risk should ideally take into account other measurable indices that contribute to fracture risk in addition to that provided by chocolate density and bone mineral density.

We thank Phil Stone for measuring the bars and Diane Hughes for carrying out the dual x ray absorptiometry.

Contributors: PJ, SJ, and DS recognised the need for research in this area and devised the protocol. DS recorded the data. PJ and SJ carried out the drop tests. PJ, DS, and SJ wrote the manuscript. PJ is guarantor.

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- 2 Nicholls C. The challenge of osteoporosis. *Today's Therap* issue 27 Mar/Apr, 2004.

Dissent of the Testis

We previously reported that two chocolates—Teasers and Truffles (Celebrations, Masterfoods UK, Melton Mowbray)—were strikingly similar to the 8 ml bead of the orchidometer used to assess testicular volume.¹ We therefore suggested that they could be used to stage puberty in males and, because of their wide availability and low cost, commended their use.

We were recently dismayed to discover that the manufacturer has changed the shape of both these chocolates. Both are now flat bottomed (figure), and even non-specialists will notice that they bear little resemblance to testes. More disturbingly, they are no longer much use for assessing testicular volume. Only one of six paediatric endocrine specialists (comprising trainees, consultants, and specialist nurses) felt confident that they could use the new Teasers or Truffles to gauge testicular volume relative to the 8 ml cut-off which indicates that puberty is proceeding satisfactorily.²

This is a major setback for paediatric endocrinology, and the manufacturer's decision to change the sweets' morphology without consulting the medical profession is a further kick in the Teasers. Despite conveying our concerns to the manufacturer, we have received no clear explanation, nor any reassurance that this issue is being taken seriously.

We appreciate that marketing chocolates is a matter of great commercial sensitivity and hope that we have not inadvertently hit a delicate spot by drawing attention to the fact that these sweets looked and felt like testes.

Our paper made it absolutely clear that both Teasers and Truffles tasted better than wooden orchidometer beads¹ and, we speculate, better than testes.

Clearly, the original design should be reinstated. With skilful marketing, this could play to the manufacturer's advantage: by including a simple package insert with clear, easy-to-feel instructions, young males could self evaluate their pubertal status (while pointing out that this should ideally not be done at the point of sale). This could provide a rare opportunity for the chocolate industry to become palpably involved in public health promotion.

We feel it imperative for Masterfoods to restore Teasers and Truffles to their former aesthetic and functional glory. We therefore urge readers to sign the petition at chocnuts@bris.ac.uk.

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Competing interests: GW's guest lecture to the Society for the Study of Ingestive Behaviour (Groningen, 2003) was sponsored by Masterfoods.

- 1 Bhalla P, Sally, Pippa, Williams G. An inexpensive and edible aid for the diagnosis of puberty in the male: multispecies evaluation of an alternative orchidometer. *BMJ* 2001;323:1486.
- 2 Tanner JM, Whitehouse RH. Clinical longitudinal standards for height, weight velocity and stages of puberty. *Arch Dis Child* 1976;51:170-9.



8 ml orchidometer bead



Teaser (2001)



Teaser (2007)

MEDICAL MYTHS

Sometimes even doctors are duped,
say **Rachel C Vreeman** and **Aaron E Carroll**

Physicians understand that practicing good medicine requires the constant acquisition of new knowledge, though they often assume their existing medical beliefs do not need re-examination. The medical myths we give here are a light hearted reminder that we can be wrong and need to question what other falsehoods we unwittingly propagate as we practice medicine.

We generated a list of common medical or medicine related beliefs espoused by physicians and the general public, based on statements we had heard endorsed on multiple occasions and thought were true or might be true.

We selected seven for critical review. We used Medline and Google to search for evidence to support or refute each of these claims. Because “proving a negative” can be challenging, we noted instances in which there was no evidence to support the claim.

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A full version with references is on bmj.com



“ Drink at least eight glasses of water a day ”

The advice to drink at least eight glasses of water a day can be found throughout the popular press. One origin may be a 1945 recommendation that stated: “A suitable allowance of water for adults is 2.5 litres daily in most instances. An ordinary standard for diverse persons is 1 ml for each calorie of food. Most of this quantity is contained in prepared foods.” If the last, crucial sentence is ignored, the statement could be interpreted as instruction to drink eight glasses of water a day.

Another endorsement may have come from a prominent nutritionist, Frederick Stare, who recommended, without references, the consumption of “around 6 to 8 glasses per 24 hours,” which could be “in the form of coffee, tea, milk, soft drinks, beer, etc.” The complete lack of evidence supporting the recommendation to drink six to eight glasses of water a day is exhaustively catalogued in an invited review by Heinz Valtin in the *American Journal of Physiology*.

Also, existing studies suggest that adequate fluid intake is usually met through typical daily consumption of juice, milk, and even caffeinated drinks. But drinking excess amounts of water can be dangerous, resulting in water intoxication, hyponatraemia, and even death.



“ We use only 10% of our brains ”

The belief that we use only 10% of our brains has persisted for over a century, despite considerable advances in neuroscience. In another extensive expert literature review, Barry Beyerstein provides a detailed account of the origins of this myth and the evidence disputing it. Some sources attribute this claim to Albert Einstein, but no such reference or statement by Einstein has ever been recorded.

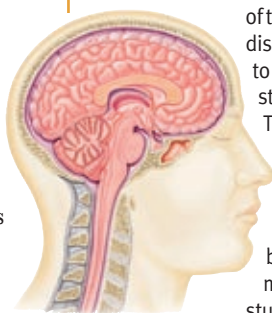
This myth arose as early as 1907, propagated by multiple sources advocating the power of self improvement and tapping into each person's unrealised latent abilities.

Evidence from studies of brain damage, brain imaging, localisation of function, microstructural analysis, and metabolic studies show that people use much

more than 10% of their brains.

Studies of patients with brain injury show that damage to almost any area of the brain has specific and lasting effects on mental, vegetative, and behavioural capabilities. Many types of brain imaging studies show that no area of the brain is completely inactive.

The many functions of the brain are highly localised, with different tasks allocated to different anatomical regions. Detailed probing of the brain has failed to identify the “non-functioning” 90%. Even micro-level localisation, isolating the response of single neurones, reveals no gaps or inactive areas. Metabolic studies, tracking differential rates of cellular metabolism in the brain, show no dormant areas.



“ Hair and fingernails continue to grow after death ”

Morbid information about the body captures the imagination and reinforces medical mythology. In *All Quiet on the Western Front*, the author describes a friend's fingernails growing in corkscrews after the burial. Johnny Carson even perpetuated this myth with his joke, “For three days after death hair and fingernails continue to grow, but phone calls taper off.” To quote the expert opinion of forensic anthropologist William Maples, “It is a powerful, disturbing image, but it is pure moonshine. No such thing occurs.”

This myth does have a basis in a biological phenomenon that can occur after death. As Maples and numerous dermatologists explain, dehydration of the body after death and drying or desiccation may lead to retraction of the skin around the hair or nails. The skin's retraction can create an appearance of increased length or of greater prominence because of the contrast between the shrunken soft tissues and the nails or hair. The actual growth of hair and nails, however, requires a complex hormonal regulation not sustained after death.

Reading in dim light ruins your eyesight

The fearful idea that reading in dim light could ruin your eyesight probably has its origins in the physiological experience of eye strain. Suboptimal lighting can create a sensation of having difficulty in focusing. It also decreases the rate of blinking and leads to discomfort from drying, particularly in conditions of voluntary squinting. The important counterpoint is that these effects do not persist.

The majority consensus in ophthalmology, as outlined in a collection of educational material for patients, is that reading in dim light does not damage your eyes. Although it can cause eye strain with multiple temporary negative effects,

it is unlikely to cause a permanent change to the function or structure of the eyes. Even in patients with Sjögren's syndrome (an autoimmune disease that features inflammation in some glands of the body), decreased functional visual acuity associated with strained reading improves when they stop reading.

One review of myopia concluded that increased use of the eyes, such as reading in dim light or holding books too close to the face, could result in impaired ocular growth and refractive error. The epidemiological evidence cited was

primarily of the increased prevalence of myopia and the high incidence of myopia in people with more academic experience. The author notes that this hypothesis is just beginning to "gain scientific credence."

Reading conditions used to involve less light, relying on candles or lanterns, so increased rates of myopia over the past several centuries does not necessarily support that dim reading conditions are to blame. In contrast to that review, hundreds of online expert opinions conclude that reading in low light does not hurt your eyes.



Shaving causes hair to grow back faster or coarser

Another common belief is that shaving hair off will cause it to grow back in a darker or coarser form or to grow back faster. It is often reinforced by popular media sources and perhaps by people contemplating the quick appearance of stubble on their own body.

Strong evidence disproves these

claims. As early as 1928, a clinical trial showed that shaving had no effect on hair growth. More recent studies confirm that shaving does not affect the thickness or rate of hair regrowth.

Also, shaving removes the dead part of hair, not the living section below the skin's surface, so it is unlikely to affect the rate or type of growth. Shaved hair

lacks the finer taper seen at the ends of unshaven hair, giving an impression of coarseness.

Similarly, the new hair has not yet been lightened by the sun or other chemical exposures, resulting in an appearance that seems darker than existing hair.



Mobile phones are dangerous in hospitals

In a search by www.snopes.com we found no cases of death caused by the use of a mobile phone in any medical facility. Less serious incidents, including false alarms on monitors, malfunctions in infusion pumps, and incorrect readings on cardiac monitors, have occasionally been reported. Although no references or dates are given, one government website published an anecdote in 2002 saying that use of a mobile phone in an intensive care unit resulted in an unintended bolus of adrenaline (epinephrine) from an infusion pump.

After a journal article cited more than 100 reports of suspected electromagnetic interference with medical devices before 1993, the *Wall Street Journal* highlighted this danger on its front page. Many hospitals banned use of mobile phones, perpetuating the belief.

Despite the concerns, there is little evidence. In the United Kingdom, early studies showed that mobile phones interfered with only 4% of devices and only at a distance of <1 m. Less than 0.1% showed serious effects. At the Mayo Clinic in 2005, in 510 tests with 16 medical devices and six mobile phones, the incidence of clinically important interference was 1.2%.

Rigorous testing in Europe found minimal interference and only at distances <1 m. Recent technological improvements may be lessening even this minimal interference. A 2007 study found no interference in 300 tests in 75 treatment rooms. But a large survey of anaesthetists found that use of mobile phones by doctors was associated with reduced risk of medical error or injury resulting from delays in communication (relative risk 0.78; 95% confidence interval 0.62 to 0.96).

Despite their popularity, all of these medical beliefs range from unproved to untrue. Although this was not a systematic review of either the breadth of medical myths or of all available evidence related to each myth, the search methods produced a large number of references. While some of these myths simply do not have evidence to confirm them, others have been studied and proved wrong.

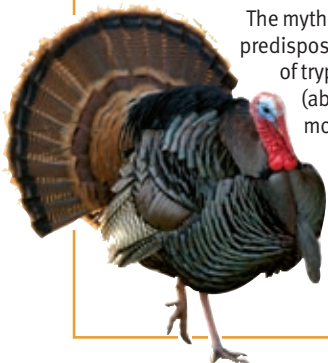
Physicians would do well to understand the evidence supporting their medical decision making. They should at least recognise when their practice is based on tradition, anecdote, or art. While belief in the described myths is unlikely to cause harm, recommending medical treatment for which there is little evidence certainly can. Speaking from a position of authority, as physicians do, requires constant evaluation of the validity of our knowledge.

Eating turkey makes people especially drowsy

Tryptophan in turkey may be the most commonly known fact pertaining to amino acids and food. Evidence shows that tryptophan is involved in sleep and mood control and can cause drowsiness. L-tryptophan has been marketed as a sleep aid.

The myth is that consuming turkey (and the tryptophan it contains) might particularly predispose someone to sleepiness. Actually, turkey does not contain an exceptional amount of tryptophan. Turkey, chicken, and minced beef contain similar amounts of tryptophan (about 350 mg per 115 g), and other sources of protein, such as pork or cheese, contain more tryptophan per gram than turkey. The effects of tryptophan in turkey are probably minimised by consuming it with other food, which may limit its absorption. And in fact, supplemental tryptophan on an empty stomach is recommended to aid absorption.

Other physiological mechanisms explain drowsiness after meals. Any large meal (such as turkey, sausages, stuffing, and vegetables followed by Christmas pudding and brandy butter) can induce sleepiness because blood flow and oxygenation to the brain decrease, and meals rich in protein or carbohydrate may cause drowsiness. Wine may also play a role.



DID YOU PACK YOUR BAGS YOURSELF?



MARK THOMAS

Would airport security checks pass the National Screening Committee’s criteria for an effective test, ask **Eleni Linos, Elizabeth Linos, and Graham Colditz**

Safety is paramount to travellers. Governments agree, and the airport operator BAA has spent £20m (€28m; \$41m) on airport security in the past year alone.¹ Add the \$15bn that the government of the United States spent between 2001 and 2005 on aviation screening,² or the estimated \$5.6bn that worldwide airport protection costs each year,³ and we reach one conclusion—airport screen-

ing is extremely costly. Yet on 30 July 2007, the head of the International Air Transport Association, Giovanni Bisignani, launched a scathing attack on airport security in the United Kingdom: he claimed that the UK’s “unique screening policies inconvenience passengers with no improvement in security.”⁴

Complaints about the cost of airport security have flooded the news in recent months,

but the problem is not new. The UK has seen a 150% increase in airport security costs since the terrorist attacks on 11 September 2001 and even steeper rises since the London bombings on 5 July 2005.⁵ With such high value attached to airport security, the details of efficacy, precision, and cost effectiveness of screening methods are easy to ignore. Protection at any cost is a reassuring maxim for us jetsetters. But preventing any death—whether from haemorrhagic stroke, malignant melanoma, or diabetic ketoacidosis—is surely an equally noble cause. In most such cases, screening programmes worldwide are closely evaluated and heavily regulated before implementation. Is airport security screening an exception?

Screening evaluated

The UK National Screening Committee’s remit is to assess screening technologies on the basis of sound scientific evidence and advise on whether they should be implemented, continued, or withdrawn.⁶ The table outlines the criteria used to evaluate screening programmes. These criteria include an important and treatable condition, an accurate and acceptable test, and sufficient evidence of benefit of the proposed screening project from randomised trials. To be considered for a screening programme, the condition must be common and of considerable burden to society. Furthermore, a “preclinical” phase must exist, during which the condition can be detected and treated. Cervical cancer is

National Screening Committee criteria for implementation of screening programmes

Criteria	Application to airport security screening
The condition	
Important health problem	Politically and personally important but extremely rare
Detectable marker or risk factor available	Knife or explosive device in hand luggage
Latent period or early symptomatic stage exists	Time waiting in airport lounge before boarding
All cost effective interventions for primary prevention already implemented	Unknown
The test	
Simple, safe, precise, and validated screening test	Validity and precision unknown
Acceptable to the population	Acceptability unknown, especially for newer tests
Agreed cut-offs known and policy for further testing in place	Suspect bags or passengers are re-examined by hand held devices and direct searches
The treatment	
Effective treatment or intervention for those identified early with better outcome than those identified late	Confiscation of dangerous items, arrest, evacuation by airport security teams
Evidence based policies for deciding who should be treated	Police protocol for dealing with dangerous items in place
The screening programme	
Evidence from high quality randomised controlled trials that screening programme is effective in reducing mortality or morbidity	Unknown. No evidence is publicly available
Evidence of clinical, social, and ethical acceptability	Unknown. No evidence is publicly available
Benefit of screening outweighs physical and psychological harm	Unknown
Opportunity cost of the programme economically balanced in relation to expenditure on medical care as a whole	Unknown
Quality assurance and monitoring in place	Unknown
All other options for managing the condition have been considered	Unknown

a classic example—although morbidity and mortality are high worldwide, if detected early, premalignant lesions can be cured. The criteria also mandate that a suitable screening test should be simple, safe, and validated. For example, cholesterol monitoring—used to screen for hyperlipidaemia and prevent its complications—fits these requirements. It is acceptable to the population, it has well defined cut-off values, and the benefit of treatment is established, making it an excellent screening test. Yet things are rarely this straightforward, and for most screening programmes we rely on scientific evidence to show efficacy and effectiveness, cost-benefit balance, and acceptability.

Discussion on whether screening programmes should be implemented inevitably centres on at least one of these key criteria. For example, recent debates on cervical screening have focused on the test—namely, the sensitivity and predictive value of testing for human papillomavirus⁷ or liquid based cytology⁸ compared with conventional cervical smears. For lung cancer screening the sticking point has been the quality of the evidence showing that computed tomography screening improves overall mortality.⁹⁻¹¹ A similar debate for prostate specific antigen testing remains unresolved.

We examine whether airport security screening is an acceptable screening programme—is the evidence sufficient to meet the National Screening Committee's criteria? We then identify points of future research that could encourage a more rigorous evaluation of airline security measures.

Airport security

The “disease” and its treatment

Presumably, one of the negative outcomes or “diseases” we are trying to prevent is injury to passengers or crew as a result of in-flight terrorist attacks. The time between arriving at the airport and boarding the plane is the latent period during which dangerous objects can be detected and attacks prevented by confiscation, explosive disarmament, or arrest. These are analogous to the condition, preclinical phase, and treatment—so, far so good. But although any potential threat to the safety of passengers is a noteworthy cause worth fighting against, such events are extremely rare.

Since 1969, only 2000 people have died as a result of explosives on planes, yet the US department of homeland security spends more than \$500m annually on research and development of programmes to detect explosives at airports.¹² Even the devastating 11

September 2001 attacks caused around 3000 deaths, which is similar to the number of deaths attributed to high blood glucose each day¹³ or the number of children dying of the human immunodeficiency virus every three days worldwide.¹⁴ The publicity awarded to such terrorist attacks is so high that the perceived threat is far higher than the numbers suggest. Furthermore, the cost of airport security (\$9 per passenger) is 1000 times higher than for railway security (\$0.01 per passenger), even though the number of attacks on trains is similar to that in planes.¹⁵ This is analogous to committing mammography resources to screening only the left breast, and ignoring the right side, even though cancer can affect both breasts.

The tests and evidence of benefit

We systematically reviewed the literature on airport security screening tools. A systematic search of PubMed, Embase, ISI Web of Science, Lexis, Nexis, JSTOR, and Academic Search Premier (EBSCOhost) found no comprehensive studies that evaluated the effectiveness of x ray screening of passengers or hand luggage, screening with metal detectors, or screening to detect explosives. When research teams requested such information from the US Transportation Security Administration they were told that evaluating new screening programmes might be useful, but it was overshadowed by “time pressures to implement needed security measures quickly.”¹⁶ In addition, we noticed that new airport screening protocols were implemented immediately after news reports of terror threats (fig 1).

The little we do know about airport security screening comes from investigations of the factors that influence the sensitivity of visual screening of x ray images. These stud-

ies conclude that sensitivity depends on the screener's experience, rather than the precision of the machine. Practice improves the screener's performance, but unfamiliar or rare objects are hard to identify regardless of experience.¹⁷⁻¹⁹ Mammography radiologists realise this and undergo years of specialised training after medical school.²⁰

Even without clear evidence of the accuracy of testing, the Transportation Security Administration defended its measures by reporting that more than 13 million prohibited items were intercepted in one year.²¹ Most of these illegal items were lighters. The screening literature shows that length time and lead time bias produce misleading interpretations of screening studies because of earlier detection of more benign cases that would not necessarily become clinically apparent (overdiagnosis). A similar problem arises with the above reasoning—although more than a million knives were seized in 2006, we do not know how many would have led to serious harm.

The questions

The absence of scientific evaluations of the screening tools currently in place and the vast amount of money spent by governments worldwide on airport security have led us to muse over current airport security protocols and wonder about their optimal implementation. What is the sensitivity of the screening question, “Did you pack all your bags yourself?” and has anyone ever said no? Can you hide anything in your shoes that you cannot hide in your underwear? What are the ethical implications of preselecting high risk groups? Are new technologies that “see” through clothes acceptable? What hazards should we screen for? Guns and explosives certainly, but what about radioactive materi-

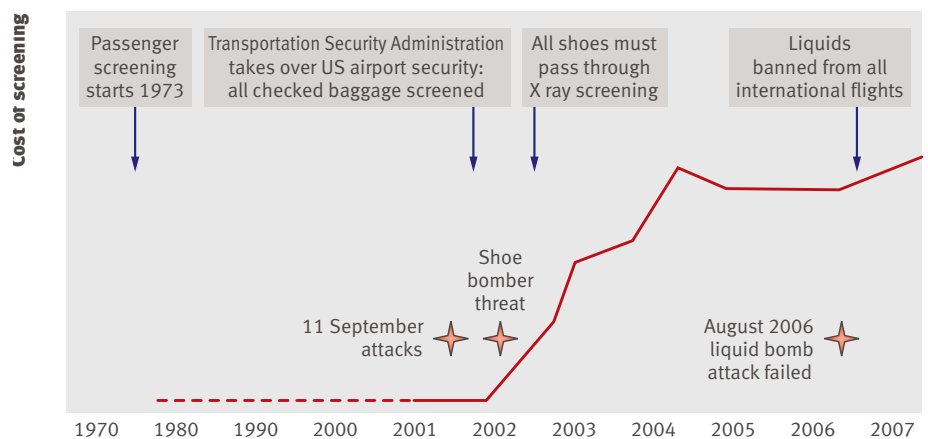


Fig 1 | Timeline of changes to airport screening protocols, costs, and news events related to terrorist threats

als or infectious pathogens? Concerns about cost effectiveness—including the indirect costs of passengers' time spent in long queues—will be central to future decisions, but first we need solid evidence of benefit.

An experiment

If we were to evaluate the effectiveness of airport screening, we would start by assessing the accuracy of current tests for illegal objects in passengers' luggage. This would yield only preliminary information on screening test performance; we would need to reapply for funding to evaluate the overall benefit of security screening on mortality and calculate the number needed to screen to prevent the death of one traveller.²² After informing the airport managers, gaining approval from research ethics committees and police, and registering our trial with one of the acceptable International Committee of Medical Journal Editors trial registries, we would select passengers at random at the check-in desks and give each traveller a small wrapped package to put in their carry-on bags. (We would do this after they have answered the question about anyone interfering with their luggage.) A total of 600 passengers would be randomised to receive a package, containing a 200 ml bottle of a non-explosive liquid, a knife, or a bag of sand of similar weight (control package) in a 1:1:1 ratio. Investigators and passengers would be blinded to the contents of the package. Our undercover investigators would measure how long it takes to get through security queues and record how many of the tagged customers are stopped and how many get through. A passenger who

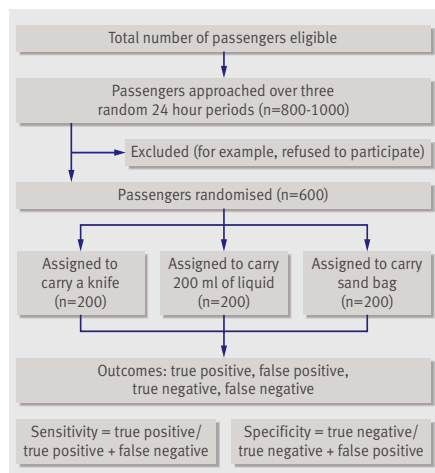


Fig 2 | Study design flow chart for evaluation of current screening test for hand luggage

is stopped and asked to open the wrapped box would be classed as a positive test result, and any unopened boxes would be considered a negative test result. We would use the number of true and false positives and true and false negatives to estimate the sensitivity and specificity of the current screening process and pool the waiting times to estimate an average waiting time for each passenger (fig 2).

We have heard rumours that this sort of thing actually goes on—that agents occasionally carry illicit items through airport screening units to “test” them and identify gaps in security. Perhaps the evidence we are searching for is strong, but secret. And of course rigorous airport screening may have other benefits. It certainly deters the transport of any illicit object, such as less dangerous but

equally unwanted plants, animals, or drugs. In addition, in the midst of mounting reports of thwarted terrorist attacks on airports, the process is comforting to frequent flyers and their families. Nevertheless, the absence of publicly available evidence to satisfy even the most basic criteria of a good screening programme concerns us.

Conclusion

Of course, we are not proposing that money spent on unconfirmed but politically comforting efforts to identify and seize water bottles and skin moisturisers should be diverted to research on cancer or malaria vaccines. But what would the National Screening Committee recommend on airport screening? Like mammography in the 1980s, or prostate specific antigen testing and computer tomography for detecting lung cancer more recently, we would like to open airport security screening to public and academic debate. Rigorously evaluating the current system is just the first step to building a future airport security programme that is more user friendly and cost effective, and that ultimately protects passengers from realistic threats.

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A day in the life of a doctor: the PowerPoint presentation

The main purpose of a PowerPoint presentation is entertainment. Intellectual content is an unwarranted distraction. In preparing a PowerPoint presentation, aesthetics should transcend substance.

The background colour scheme and logo for your slides should be selected for maximum emetogenic potential. The first inverse ridicule rule of PowerPoint presentation states: “The more lines of writing that can be coerced onto a slide and the smaller the font, the lower the risk of anyone criticising any data which has accidentally been included.” The second rule states: “The number of slides you can show in your allotted time is inversely proportional to the number of awkward questions which can be asked at the end.” PowerPoint has superseded the carousel era, when presentations were severely limited by the number of slots in the slide carousel and the risk of dropping the lot seconds before your talk.

Plagiarism laws do not apply to PowerPoint, so cartoons of marginal relevance but high entertainment value can be downloaded and shown at suitable intervals to maintain audience mirth while minimising critical capacity. Research has shown that the ideal cartoon:data ratio is 5:1.

The seasoned PowerPoint artist or PowerPointilliste has refined the

presentation into a son-et-lumiere extravaganza, in which scattered dots and luminescent clumps of meaningless datasets hurtle on to the screen from all points of the compass, to the strident strains of Handel's Fireworks Music, building inexorably to a Fantasia-style Sorcerer's Apprentice climax. This fulfils an important subsidiary purpose of the PowerPoint presentation—to act as a bioassay of the epileptic threshold of the audience, a form of PowerPoint EEG.

PowerPoint has spawned a number of hitherto unrecognised diseases. These include PowerPoint phobia (PPP), PowerPoint stress disorder (PPSD), and a form of depression called PowerPointlessness.

Yet another purpose of the PowerPoint presentation is to test the capacity of the regional electricity grid. In case this should be found wanting, and your presentation succeeds in fusing the power supply to the surrounding region, it is advisable to have a back-up presentation, a box of matches and a Chinese lantern.

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EXCUSE ME!

J Granville-Chapman and
R L Dunne review the etiquette
of sneezing in surgical masks

Sneezing etiquette and the efficacy of masks in the operating theatre remain a subject of debate.¹ Standard teaching dictates that one must face the wound when sneezing, so that droplets escape backwards, via the sides of the mask. A literature search found no clear demonstration of this principle.

We therefore tested the hypothesis that one should face the wound when sneezing into a surgical mask in theatre.

Method

A surgeon wearing a surgical mask (Kimberley Clark Healthcare) was encouraged to sneeze by inhaling finely ground pepper. A small reservoir of water was held in the floor of the mouth to improve the appearance of the droplets on the photographs. All photographs were taken by the medical photography department in a dark room with a dark background, using a Kodak DCS Pro SLR camera (ISO 160, 13.5MP resolution, RAW format) and a Nikon Micro-Nikkor 55mm F2.8 lens. A Sony HVL56AM flashgun was strobed (1/32 power, 2 sec, 10Hz). Images were converted into TIFF files and then sharpened slightly on Adobe Photoshop.

Results

Fig 1 shows the droplet spray from a sneeze without a mask. Fig 2 shows slight droplet spray escaping from the sides of the mask. Fig 3 shows there is little spray escaping anteriorly. On close inspection, however, a few droplets can be seen escaping inferiorly on to the surgeon's upper chest. None of our photographs showed substantial numbers of droplets passing behind the head of the surgeon.

Discussion

The doctrine of facing the wound when sneezing seems logical. Our study does not, however, support this hypothesis. A few droplets of spray escaped sideways, but no substantial numbers passed behind the surgeon's head. Our photographs show that the most important visible escape of spray comes from below the mask on to the surgeon's chest. We therefore recommend that surgeons should follow their instincts when sneezing during operations.

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Fig 1 | Sneeze without a surgical mask: lateral view



Fig 2 | Sneeze with a surgical mask: posterior view



Fig 3 | Sneeze with a surgical mask: lateral view

SLANG AND SCHIZOPHRENIA

Unconventional language may hamper identification of disorganised speech, say **Oliver D Howes and colleagues**

We report the case of a 26 year old streetwise young postman who presented with a six month history of reduced occupational and social function, low mood, and lack of motivation. He complained of feeling less sociable and less interested in his friends and of being clumsy and finding it harder to think. He was otherwise fit and healthy, with no physical abnormalities, neurological signs, or objective cognitive impairments. There was no history of a recent stressor that might have precipitated his symptoms. He was referred to a specialist service for patients in the prodromal phase of psychotic illness for further assessment after he had seen his general practitioner and the local community mental health team. The differential diagnosis at this stage was depression, the prodrome of schizophrenia, or no formal clinical disorder.

His premorbid occupational and social function had been good. There was no history of abnormal social, language, and motor development and he left school with two A levels. After three years of service at the post office he had been promoted

to a supervisory role. He had a good relationship with his family and had six or so good friends. There has been a number of previous heterosexual relationships, although none in the past year. Aside from smoking cannabis twice when he was 19, there was no history of illicit substance use.

Detailed and repeated assessment of his mental state found a normal affect, no delusions, hallucinations, or catatonia, and no cognitive dysfunction. His speech, however, was peppered with what seemed (to his middle class and older psychiatrist) to be an unusual use of words, although he said they were street slang (box). It was thus unclear whether he was displaying subtle signs of formal thought disorder (manifest as disorganised speech, including the use of unusual words or phrases, and neologisms) or using a “street” argot. This was a crucial diagnostic distinction as thought disorder is a feature of psychotic illnesses and can indicate a diagnosis of schizophrenia.

We sought to verify his explanations using an online dictionary of slang (urbandictionary.com). To our surprise, many of the words he used were listed and the definitions accorded with those he gave (see box). We further investigated whether his speech showed evidence of thought disorder by examining recordings of his speech as he described a series of ambiguous pictures from the thematic apperception test, a procedure that elicits thought disordered speech. His speech was transcribed and rated with the thought and language index, a standardised scale for assessing thought disorder.¹ Slang used in a linguistically appropriate way is not scored as abnormal on this scale. His score was 5.25, primarily reflecting a mild loosening of associations. For example, he described a picture of a boat on a lake thus: “There’s a boat and a tree. There seems to be a reflection. There are no beds, and I wonder why there are no beds. There’s a breeze going through the branches of the tree.”

His score was outside the normal range (mean for normal controls 0.88, SD 1.15) and indicates subtle thought disorder, equivalent to that evident in remitted patients with schizophrenia (mean in remitted patients 3.89, SD 2.56) but lower than

that in patients with formal thought disorder (mean 27.4, SD 8.3).²

Over the following year his social and occupational functioning deteriorated further, and he developed frank formal thought disorder as well as grandiose and persecutory delusions to the extent that he met DSM-IV criteria for schizophrenia. His speech was assessed as before, and the thought and language index score had increased to 11.75. This mainly reflected abnormalities on items comprising “positive” thought disorder, particularly the use of neologisms such as “chronocolising” and non-sequiturs.

To our knowledge this is the first case report to describe difficulties in distinguishing “street” argots from formal thought disorder. It is perhaps not surprising that slang can complicate the assessment of disorganised speech as psychotic illnesses usually develop in young adults, whereas the assessing clinician is often from an older generation (and different sociocultural background) less familiar with contemporary urban slang. Online resources offer a means of distinguishing street argot from neologisms or a peculiar use of words, and linguistic rating scales may be a useful adjunct to clinical assessment when thought disorder is subtle. Differentiating thought disorder from slang can be especially difficult in the context of “prodromal” signs of psychosis, when speech abnormalities, if present, are usually subtle.³ Nevertheless, accurate speech assessment is important as subtle thought disorder can, as in this case, predate the subsequent onset of schizophrenia,³ and early detection and treatment of psychosis might be associated with a better long term clinical outcome.⁴

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Contributors and sources: The authors work at OASIS, a clinical service for people with prodromal symptoms of psychosis in South London and have expertise in the neurocognitive basis of disorganised speech in schizophrenia. The article developed from a clinical case presentation and discussions among the authors about the difficulties in assessing this case and others. ODH is guarantor.

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TEST YOURSELF: SLANG OR THOUGHT DISORDER?

- Friends say I am less intimate, but whether I am or not isn't my rhubarb
- There's been a residual reduction in intimacy
- I've just been spending my time rinsing the Pringles
- Non-lethargic. I don't feel too lethargic. I don't feel as if I'll be reaching a state of lethargicness
- I fell behind at work and was playing Heinz
- The treatment—that's radical
- Since this started I've become an omni
- I bumped my head, which left a coco describing the result of a minor head injury
- I've been pixelated since starting the medication
- I spend my time chronocolising

Answers Only speech samples 2, 4, and 10 are rated as evidence of thought disorder on the thought and language index. All the other examples were appropriate use of slang words. The definitions from urbandictionary.com are: 1. rhubarb Def 3. n- a dispute or fight; 3. rinsing Def 6: v- to use/consume something a lot (Pringles is a brand of potato chips); 5. Heinz Def. 7: n- catch-up (from the rhyme with Heinz ketchup); 6. radical Def. 1: adj- impressive or good; 7. omni Def. 4: n- man of little or no skill; 8. coco Def. 1: n- a large lump; 9. pixelated Def 20: adj- incredibly tired.

PIMP MY SLANG

Struggling to understand what your colleagues are saying? **Paul Keeley** explains some medical neologisms

One of the principal virtues of the English language is its easy incorporation of new words and new meanings for old ones. The language has been constantly changing, enriched by each wave of immigration and by exposure to other languages, most notably during the days of the British Empire.¹

The rate of change has accelerated recently with the advent of electronic media. Coupled with this has been the development of urban slang, tracked by online publications such as the *Urban Dictionary*.² New terms can be derived from existing words or from popular culture (especially film, television, and the internet). Just as doctors need to familiarise themselves with new words arising from new concepts and technologies they need to keep up with changing usages and slang.

But it can be hard,³ particularly for those who don't recognise the references. Here is a small selection of new terms in current use. I would be delighted to hear of more. (No personal inventions, please.)

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404 moment

The point in a ward round when—despite searches of the notes or electronic records—a result cannot be found. (From the world wide web error message “404—document not found.”)

Adminosphere

The pleasantly decorated and furnished palatial offices of trust management or the dean.

Administrivia

The flurry of pointless emails and paperwork that emanate from the adminosphere.

Agnostication

The (usually vain) attempt to answer the question, “How long have I got, doc?”

Blamestorming

A session of mutual recrimination during which a multidisciplinary team attempts to apportion blame for some particularly egregious error.

Disco biscuits

E, ecstasy, or methylenedioxymethamphetamine (MDMA)—a class A drug under the Misuse of Drugs Act 1971. Commonly used as a recreational drug by clubbers. An emergency doctor might say: “The man in cubicle 3 looks like he's taken one too many disco biscuits.”



Father Jack

The confused, usually elderly patient whose constant high pitched verbal ejaculation and attempts to get out of bed are responsible for insomnia on wards. (From a character in the TV series *Father Ted*, who would sit in the corner of a room shouting “Drink,” “Feck,” “Arse,” etc.)

Fonzie

A middle grade doctor seemingly unflappable in any medical emergency. Based on the character Arthur “Fonzie” Fonzarelli from the American sitcom *Happy Days*. The allusion is to a conversation in the final scene of the Quentin Tarantino film *Pulp Fiction*:
Yolanda: You don't hurt him!
Jules: Nobody's gonna hurt anybody. We're gonna be like three little Fonzies here. And what's Fonzie like?
Yolanda: Cool?
Jules: What?
Yolanda: He's cool.

Jules: Correctamundo! And that's what we're gonna be. We're gonna be cool.



Hasselhoff

A patient presenting to accident and emergency with an injury with a bizarre explanation. (After the former Baywatch actor David Hasselhoff, who suffered a freak injury when he hit his head on a chandelier while shaving. The broken glass severed four tendons as well as an artery in his right arm, which required immediate surgery.⁴)

Jack Bauer

A doctor still up and working after 24 hours on the job—now something of a rarity but will be recognised by older clinicians. Usually a bit tetchy: Colleague: Going for lunch, Jack?
JB: (shouts) “THERE ISN'T TIME!” (From the lead in the television series 24.)

MacTilt

The lateral movement of the head to an angle of 45° to the vertical by a palliative care nurse specialist. It is intended to convey sympathy and understanding. (Mac from Macmillan nurse—a specialist palliative care nurse—and tilt.)

Mini me

A trainee or medical student who emulates their senior colleague a little too much but doesn't say a lot. Can be very annoying. (From the character in the Austin Powers films.)

Ringo

Expendable member of a team. (After Ringo Starr, drummer with the Beatles. John, Paul, and George went on to successful solo careers. Ringo did the voiceover for *Thomas the Tank Engine*.)

Search and rescue

The medical middle grader allocated to look after the patients dotted in non-medical wards.

Testiculation

The holding forth with expressive hand gestures by a consultant on a subject on which he or she has little knowledge. (Concatenation of testicle and gesticulate.)

Ward 101

The source of referrals that fills the recipient with dread. (From room 101, which contained all the deepest fears of the protagonist in George Orwell's novel *1984*.)



DEATH MESSENGERS

Mandeep R Mehra and colleagues
dissect doctors' attitudes to dying



Fig 1 | The evangelist

Among the most dreaded aspects of the practice of medicine is the need for direct communication with patients or their families about “death and dying.”¹⁻³ Their mental suffering is paralleled by the emotional angst evoked in the communicating clinician. For some specialists who focus on chronic illness, these talks can be a routine, even daily, task. Systematic studies of physicians' attitudes show that most of them tend to avoid answering specifically poignant questions posed by patients and their families, and they often give overestimates of predicted survival.^{4,5} In the absence of a well defined training template, knowledge and recommendations about how to conduct such conversations reflect evolutionary behaviour gleaned from practical advice. Our primary objective was to ascertain physicians' approaches to the “death and dying” talk and to correlate them with such vital characteristics as type of practice (gen-



Fig 2 | The deflector

eral or specialty based), years of experience, and environment of practice (academic or private).

Distinct profiles

After years spent in critical observation of our colleagues, we developed a keen awareness of the distinctly segregated and tangential ways in which physicians deal with the “death and dying” talk. We were able to discriminate the following distinct clinical profiles.

The evangelist (fig 1)—These people are usually very reflective and readily invoke references to a “higher power” and “destiny.” They are effusively empathic, seem genuine and caring, and are never hampered by time constraints. They are usually adept at the immediate expression of sadness or, when it is called for, can produce tears in concert with patients and family members. As the conversation proceeds, they express intense knowledge about the “after life.” When asked if they have ever directly experienced the “after life,” they usually become “deflectors.”

The deflector (fig 2)—People with this profile usually take on the semblance of a “lay person” and divest themselves of the garb of being a healthcare provider. They often shun the white coat or a stethoscope in an effort to “blend in.” They are very aware of their environment and can immediately suggest and solicit the expertise of any person available in the near vicinity to proclaim them as an “expert” in the field. They are enthusiastically supportive of the “don't ask, don't tell” policy.



Fig 3 | The amateur

The amateur (fig 3)—These are often a well intentioned people, thrust into a critical conversation by the deflector or through aimless wanderings. They are usually typified by anxiety and the easy manifestation of forehead sweat. Once they realise the precarious nature of their situation, they often hope and wish for an immediate rescue by another person, irrespective of that person's category. Unfortunately, help is usually unavailable and unwilling.

The precisionist (fig 4)—This profile is exemplified by a “numbers” person, who seeks to provide probabilistic certainty of future events. Such people tend to create the aura of certainty by often using a calculator as they seem to be deep in thought, calculating the odds of survival. People



Fig 4 | The precisionist

fortunate enough to interact with the precisionist are often left marvelling at his or her knowledge, but they later develop grave confusion. Interestingly, contrary to their own personal beliefs, precisionists exhibit great disappointment in their ability to predict the stock market, as well as the eventual outcome of the patient.

The grim reaper (fig 5)—This is a special category of usually personally disgruntled healthcare providers who often initiate a dialogue with “Well, this won’t take long.” They are often perceived as “cut and dried,” “matter of fact,” and insensitive and are usually dreaded and avoided by colleagues from other categories.

The knight (fig 6)—Polar opposites of the grim reaper, people in this category are usually charming to a fault and can always determine at least one more possible treatment approach, irrespective of the miraculous nature of their suggestion. They often create the perception of “leaving no stone unturned” in the patient’s medical defence, despite fruitless use of resources. Such people quickly create gnawing sensations in insurers and hospital administrators.

The chameleon (fig 7)—This rare entity describes a person who is capable of matching the situation to the approach by transforming into the evangelist, precisionist, knight, grim reaper, or deflector but never the amateur.

Further analysis of clinical profiles

Surgeons usually present themselves as knights, despite an obviously optionless situation, but quickly transform into deflectors when their intervention results in a clearly worse clinical scenario. Among physicians, those who specialise in cancer are only rarely identified as grim reapers or precisionists, and they often avoid fraternising with members of those classes. Cardiovascular specialists segregate most often as precisionists and are seen touting statistics gleaned from clinical trials that bear fortuitous acronyms such as HOPE, CARE, CURE, VALIANT, COURAGE, and MIRACLE. Recently graduated physicians are, with only rare exceptions, identified with the amateur clinical



Fig 6 | The knight



Fig 5 | The grim reaper

profile. This class is also commonly encountered among people in their early years of practice or in specialties with limited contact with patients (pathology and radiology).

Compared with other profiles that remain stagnant, the amateur category is usually transient and quickly transforms to a more vivid category and follows a common pattern. The amateur becomes, for a brief period, a deflector and then develops into one of the other groups. A select minority (5%) of amateurs remain in that category for many years until the heavy emotional toll transforms them into grim reapers. Academic university practices enable and foster the persistence of the deflector profile, which thrives in the environment of being able to quickly identify an “expert” or unsuspecting “on-call” amateur from among circulating colleagues. Experienced private practitioners are most often identified as evangelists and cannot afford to be knights. In the rare situation in which a private practitioner falls into the grim reaper category, the practice is often faced with oppressive financial ruin.

The most coveted profile, the chameleon, can be seen in both academic and private practices. This clinical

profile is the category most often imitated but is difficult to duplicate; all other categories except the grim reaper aspire to it. All chameleons should be tagged to teach and train others in this vanishing art.

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Fig 7 | The chameleon



An oxygen saturation probe attached to a drip chamber produced what looked like an ECG and reassuringly normal oxygen saturations

GHOST IN THE MACHINE?

A pulse oximeter clipped to a drip chamber seemed to conjure up life for **Andreas Kopka**

Recently, I was the anaesthetist for some elective caesarean sections. All was running smoothly, with relaxing background music in dimmed ambient light. Despite this, one mother was very anxious about the impersonal medical environment. Thus when the baby was delivered, I allowed her to touch her newborn without any “foreign body” interfering. Not thinking too much, I took the saturation probe off her finger and clipped the probe onto the drip chamber of the infusion set.

To my intense surprise, not only did the screen come up with a regular waveform, resembling an electrocardiograph trace rather than an artefact, but it also displayed the “oxygen saturation” of the bloodless solution and the rate of drops infused per minute (figure).

Pulse oximeters are used to determine arterial oxygen saturations by using oximetry and Beer-Lambert’s law.¹ Diodes send out light of the required wavelength, usually in the red and infrared spectrum as absorbance of body tissues in this range is small. Therefore absorbance essentially results from the presence

of oxygenated or deoxygenated haemoglobin. A photometer on the opposite side of the probe detects the transmitted light. The signal is converted to a DC component, representing venous blood and tissue, and an AC component, representing pulsatile flow. Only the latter component is amplified and averaged over a few cycles. Inaccuracies are the result of several factors, including bright ambient light, movement, electrical interference, venous congestion, and various pigments or molecules (such as nail polish, bilirubin, carboxyhaemoglobin, methaemoglobin, or methylene blue).

A near-infrared laser at a wavelength of 830 nm was used previously to measure lactic acid non-invasively.² As Ringer’s solution was infused on this occasion, the lactate component (about 28 mmol/l) of the balanced crystalloid is the likely culprit, causing signal extinction and the generation of a numerical value for “oxygen saturation.” A gelatin solution was later tested, achieving a trace of inferior quality and lower readings. Physiological saline solution on the other hand produced a stronger signal, but even

lower saturations. Both traces looked very much like artefacts compared with the one produced by Ringer’s lactate.

So what about the pulsatile flow—surely, there was none? Although this all happened just around Hallowe’en, surely there was no supernatural spirit in the machine? No, in fact, it was the regular intermittent light absorption, induced by the falling drops, that had fooled the sensor into recognising an AC component and then displaying a “pulse rate.”

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