Wine, mistletoe’s seasonal partner, may be a feature of some merry Christmas nights. As we approach the culturally legitimised deviancy of festive drinking, we suggest that size does matter: look at the wine glass in your hand.

A sharp rise in wine consumption
Alcohol’s adverse effects are well documented: it is the fifth largest risk factor for premature mortality and disability in high income countries and the seventh largest worldwide. The amount and form of alcohol consumption in England has fluctuated over the past 300 years, largely in response to economic, legislative, and social factors. Until the later 20th century the forms most commonly drunk were beer and spirits, as wine was for the richer Scrooges rather than the poorer Cratchits. Alcohol consumption in general then began to increase, and wine consumption rose almost fourfold during 1960-80, almost doubling again during 1980-2004.

In the last 300 years, the size of wine glasses have been observed increasing dramatically. A sharp rise in wine consumption in England, along with other factors such as reduced price, increased affordability, availability, and marketing, and more liberal licensing has led supermarkets to compete. Environmental cues such as the design of drinking glasses—particularly their size—may also have contributed to increased drinking, particularly of wine. Larger tableware is known to increase food consumption: plate sizes have increased over the past 100 years, likely contributing to the prevalence of obesity and overweight. But less is known about glassware’s relation to how much we drink. Studying wine glasses’ capacity over time is an initial step in considering, first, whether any changes in their size may have contributed to the steep rise in wine drinking seen in the past few decades and, secondly, whether reducing wine glass size may help cut consumption.

We describe here the capacity of wine glasses in England since 1700, around which time glasses became the more common vessel for wine. This followed the development of lead crystal glassware by George Ravenscroft in the late 17th century, allowing for larger and less fragile glasses.

The wine glasses studied
We sought to measure the capacity of glasses used for unfortified wine (excluding sparkling wines) with a stem and foot that have been available or sold in England from 1700 to 2017. We searched online and contacted experts in antique glassware, including museum curators, although no single source captured wine glass size over the period of interest. We obtained measurements of 411 glasses from five sources:

- The Department of Western Art at the Ashmolean Museum of Art and Archaeology, the University of Oxford (years 1700-1800; n=43)
- The Royal Household, where a new set of glassware is commissioned for each monarch (years 1808-1947; n=24)
- eBay, the auction and retail website (years 1840-2016; n=65)
- Catalogues from Dartington Crystal, an English glassware manufacturer (years 1967-2017; n=180) and
- John Lewis, the department store with the largest online selection of wine glasses (year 2016; n=99).

Two of these sources, eBay and John Lewis, were in the public domain. We had to seek access to the other sources to obtain capacity measurements.

We recorded the total capacity of the bowl of the glasses. Glasses from the Ashmolean Museum and Royal Household were measured by calculating the difference

### Raise a glass: but make it a smaller one

Wine goblet capacity in England has increased sevenfold in 300 years. Could downsizing reduce consumption of the liquid grape? Theresa Marteau and colleagues investigate
between the wine glass’s initial weight and its weight when filled to the brim with water (1 g water = 1 mL water). The capacity of glasses for sale on eBay was already provided for 12 glasses as part of their descriptions, and we requested this from the vendors for a further 82 glasses, obtaining information on 53. From Dartington Crystal we obtained capacity information from its current and archived catalogues, and John Lewis listed capacities on its online platform (www.johnlewis.com, accessed on 24 November 2016).

Wine glass capacity since 1700
The figure shows wine glass capacity from the five sources over time, along with the non-parametric regression fit for the mean (solid line) and the corresponding pointwise 95% confidence intervals (shaded area). Capacity increased from 66 mL (standard deviation 21.69) in the 1700s to 417 mL (SD 170) in the 1900s, and the mean wine glass size in 2016–17 was 449 mL (SD 161). This increase was gradual until the 1990s, when it became more marked.

The range of capacities also increased over time, as would be expected given that the mean and variance typically increase together in such a context. Modelling the median shows that the steeper increase that started in the 1990s was not driven by outliers. Classic and robust regression estimates within each source suggested that glass capacity increased in all time periods from 1800 to 2017. Further details of the analysis are provided in supplemental materials.

Increasing glass sizes
To our knowledge, this is the first attempt to explore changes in wine glass size over time. Our findings suggest that their capacity in England has increased significantly in the past 300 years, including a marked increase since the 1990s. We consider the limitations of these observations, as well as their possible causes and implications.

We do not know how representative of their periods the glasses we observed are, in terms of the range of glasses or their popularity. We were unable to obtain sales data on the glasses in our sample. And we do not know whether the trends we observed in English wine glasses would be found in other countries.

Smaller wine glasses may have an endurance advantage over larger ones, which could help explain our findings. However, while endurance may have led to non-representative glass size samples in the museum’s 18th century collection and the glasses offered for sale on eBay, it would not explain the trend of increasing

Alongside greater capacity, the strength of wine sold in the UK since the 1990s has increased

size observed in the wine glasses in the Royal Household or Dartington collections. In the Royal Household, all damaged glasses are repaired or remade. In the Dartington collection, sizes were taken from catalogues (current and archived). Further evidence that the observed increased capacity reflects a real change comes from our analyses that show an increase in capacity within the data from each source, starting from the 1800s. This is further supported by historical trends in wine glass production, which we outline below.

Possible causes
Increases in wine glass size over time may reflect changes in several factors including price, technology, societal wealth, and wine appreciation. The “glass excise” tax, levied in 1746, led to the manufacture of smaller glass products. This tax was abolished in 1845, and in the late 1800s glass production began to shift from more traditional mouth blowing techniques to more automated processes. These changes in production reflect our data, which show the smallest wine glasses during the 1700s and no increases in glass size during that period, as the observed increase occurred from the 19th century.

Larger wine glasses can also increase the pleasure from drinking wine, which may in turn increase the desire to drink more.

Two changes in the 20th century probably helped to increase glass sizes further. Wine glasses started to be tailored in shape and size for different wine varieties, both reflecting and contributing to a burgeoning market for wine appreciation, where larger glasses were considered important. From 1990 onwards the US market’s demand for larger wine glasses was met by an increase in the size of glasses manufactured in England, where a ready market was also found (personal communication from Dartington Crystal’s head of design, 2017).

A further influence on wine glass size may have come from people running bars and restaurants, as well as their customers. If wine sales increased when it was sold in larger glasses this may have incentivised vendors to use them more. Larger wine glasses can also increase the pleasure from drinking wine, which may in turn increase the desire to drink more.

Glass size and consumption
We cannot infer that the increase in glass size and the rise in wine consumption in England are
causally linked. Nor can we infer that reducing glass size would cut drinking. Our observation of increasing size does, however, draw attention to wine glass size as an area to investigate further in the context of population health. The amount of alcohol people drink, particularly wine, has increased sharply since the 1960s. Along with lower prices, increased availability, and marketing, larger wine glasses may have contributed to this rise through several potentially co-occurring mechanisms.

A larger cup or glass increases the amount of beverage poured and, in turn, the amount drunk. This may reflect “the unit bias heuristic,” in which people consume in units (for example: one cup of coffee, one slice of cake, or one glass of wine) provided the portion is above a certain minimum amount. Given that people may perceive the same portion as less than “one unit” when presented in a relatively empty large glass than when presented in a fuller but smaller glass, consumption may be further influenced by reducing glass size.

**Wine sales**

In the first study to examine the impact of larger glasses on sales we found that serving wine (usually a 175 mL measure) in larger glasses increased sales by almost 10% when compared with smaller glasses. This effect was replicated in one of two additional bars studied. Further similar studies are under way.

Alongside greater capacity, the strength of wine sold in the UK since the 1990s has increased.

In England, unlike continental Europe, wine is increasingly served in 250 mL—realistic bottle of wine and a fifth of the weekly recommended intake for low risk drinking—is larger than the mean capacity of glasses available in the 1980s. Alongside greater capacity, the strength of wine sold in the UK since the 1990s has increased, so the amount of pure alcohol drinkers consume has likely risen in line with larger glasses.

**Policy options**

If the effect of larger wine glasses on drinking proves reliable, regulating glass size as part of licensing regulations would expand the policy options for reducing drinking outside the home. Reducing wine glass sizes in licensed premises may also shift the social norm of what a glass should look like, potentially influencing glasses people use at home—where most alcohol is drunk.

Another possible option for influencing the size of glasses we use at home is to encourage retailers to price them according to size, potentially increasing demand for smaller glasses. Encouraging wine producers and retailers to make non-premium bottles of wine available in 50 cl. and 37.5 cl. sizes, with proportionate pricing, may also encourage drinkers to downsize their wine glasses so that one bottle fills more glasses.

Raising public awareness of the increasing size of glasses and their potential to increase consumption will, of course, be important for the adoption of these measures. With moderate confidence we predict that, despite resistance to these suggestions, their palatability will be greater in the month of January than in December.

**WHAT IS ALREADY KNOWN ON THIS TOPIC**

- Falls affect a large proportion of the older adult population, placing a burden on healthcare systems
- Many established predictors of falls exist, including several psychological constructs such as fear of falling, pain, depression, and overconfidence
- The literal validity of the statement “pride comes before a fall” has not previously been investigated empirically

**WHAT THIS STUDY ADDS**

- People with higher levels of pride seem to be at lower risk of falling
- Pride may actually be a protective factor against falls, rather than an antecedent

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**ORIGINAL RESEARCH**

Longitudinal analysis of older English adults

**Does pride really come before a fall?**

D McMinn, S J Fergusson, M Daly

**Objective**

To test whether high levels of reported pride are associated with subsequent falls.

**Design**

Secondary analysis of the English Longitudinal Study of Ageing (ELSA) dataset.

**Setting**

Multi-wave longitudinal sample of non-institutionalised older English adults.

**Participants**

ELSA cohort of 6415 participants at wave 5 (baseline, 2010-11), of whom 4964 were available for follow-up at wave 7 (follow-up, 2014-15).

**Main outcome measures**

Self reported pride at baseline (low/ moderate/high) and whether the participant had reported having fallen during the two years before follow-up.

**Results**

The findings did not support the contention that “pride comes before a fall.” Unadjusted estimates indicate that the odds of reported falls were significantly lower for people with high pride levels compared with those who had low pride (odds ratio 0.69, 95% confidence interval 0.58 to 0.81, P<0.001). This association remained after adjustment for age, sex, household wealth, and history of falls (odds ratio 0.81, 0.68 to 0.97, P<0.05). It was partially attenuated after further adjustment for mobility problems, eyesight problems, the presence of a limiting long term illness, a diagnosis of arthritis or osteoporosis, medication use, cognitive function, and pain and depression (odds ratio 0.86, 0.72 to 1.03, P<0.1). Because the confidence interval exceeded 1 in the final model, it remains possible that pride may not be an independent predictor of falls when known risk factors are considered. People with moderate pride did not have lower odds of having fallen than those with low pride in adjusted models. Participants lost to follow-up did not differ from those retained in terms of key variables.

**Conclusions**

Contrary to the well known saying “pride comes before a fall,” these findings suggest that pride may actually be a protective factor against falling in older adults. Future studies may seek to investigate the mechanisms underpinning this relation.

Full author details are on bmj.com.

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**Cite this as:** BMJ 2017;359:j5623
Table 2 | Logistic regression analysis of baseline factors associated with falls occurring in two years before follow-up. Values are odds ratios (95% confidence intervals)

<table>
<thead>
<tr>
<th></th>
<th>Adjusted for demographic factors and recent falls</th>
<th>+Physical function and health covariates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate pride(a)</td>
<td>0.97 (0.80 to 1.19)</td>
<td>1.01 (0.82 to 1.24)</td>
</tr>
<tr>
<td>High pride(a)</td>
<td>0.81 (0.68 to 0.97)</td>
<td>0.86 (0.72 to 1.03)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>1.04 (1.03 to 1.05)</td>
<td>1.03 (1.02 to 1.04)</td>
</tr>
<tr>
<td>Female sex</td>
<td>1.23 (1.07 to 1.40)</td>
<td>1.15 (1.00 to 1.32)</td>
</tr>
<tr>
<td>Wealth (log)(b)</td>
<td>0.98 (0.94 to 1.02)</td>
<td>1.02 (0.97 to 1.06)</td>
</tr>
<tr>
<td>No of recent falls, measured at baseline (0 is base category):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-2 recent falls</td>
<td>2.17 (1.87 to 2.52)</td>
<td>2.01 (1.72 to 2.33)</td>
</tr>
<tr>
<td>3-4 recent falls</td>
<td>6.64 (4.64 to 9.49)</td>
<td>5.33 (4.82 to 5.90)</td>
</tr>
<tr>
<td>≥4 recent falls</td>
<td>9.67 (6.0 to 15 55)</td>
<td>7.21 (4.44 to 11.72)</td>
</tr>
<tr>
<td>Activities of daily living, any problem</td>
<td>–</td>
<td>1.15 (0.94 to 1.40)</td>
</tr>
<tr>
<td>Difficulty walking quarter mile(c)</td>
<td>–</td>
<td>1.20 (1.10 to 1.32)</td>
</tr>
<tr>
<td>Eyesight problems:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glaucoma</td>
<td>–</td>
<td>1.06 (0.83 to 1.35)</td>
</tr>
<tr>
<td>Cataracts</td>
<td>–</td>
<td>1.11 (0.95 to 1.30)</td>
</tr>
<tr>
<td>Macular degeneration</td>
<td>–</td>
<td>1.10 (0.81 to 1.49)</td>
</tr>
<tr>
<td>Diabetic retinopathy</td>
<td>–</td>
<td>0.88 (0.58 to 1.35)</td>
</tr>
<tr>
<td>Sighted impaired (registered)</td>
<td>–</td>
<td>0.74 (0.33 to 1.70)</td>
</tr>
<tr>
<td>Eyesight fair/poor/blind</td>
<td>–</td>
<td>1.07 (0.86 to 1.33)</td>
</tr>
<tr>
<td>Limiting long term illness</td>
<td>–</td>
<td>0.99 (0.83 to 1.18)</td>
</tr>
<tr>
<td>Arthritis</td>
<td>–</td>
<td>1.19 (1.03 to 1.37)</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>–</td>
<td>0.92 (0.74 to 1.16)</td>
</tr>
<tr>
<td>Drug use(d)</td>
<td>–</td>
<td>0.96 (0.90 to 1.03)</td>
</tr>
<tr>
<td>Troubled with pain</td>
<td>–</td>
<td>1.16 (1.00 to 1.36)</td>
</tr>
<tr>
<td>Depression(e)</td>
<td>–</td>
<td>1.10 (0.90 to 1.35)</td>
</tr>
<tr>
<td>Cognitive function (z score)(f)</td>
<td>–</td>
<td>1.00 (0.92 to 1.08)</td>
</tr>
</tbody>
</table>

\(a\)Reference category for comparison is “low pride” (ie, those who reported feeling proud “not at all” or “a little” in previous month).
\(b\)Natural logarithm of total benefit unit net non-pension wealth measured in pounds.
\(c\)Scores range from 1=no difficulty to 4=unable to walk distance.
\(d\)Sum of whether drug was taken for each of high blood pressure, diabetes, cholesterol, chest pain, lung condition, asthma, and osteoporosis and whether blood thinning agents were taken.
\(e\)Score of ≥4 on eight item Center for Epidemiological Studies Depression Scale.\(14\)
\(f\)Combined score from executive function and memory tests (higher scores indicate greater cognitive ability).

Introduction
Falls affect many older adults, often leading to injury and death.\(^1\) The cost of falls to the UK government has been estimated at £1.1bn annually.\(^2\) Predictors of falls include impaired mobility and gait, polypharmacy, history of previous falls, sedentary behaviour, advancing age, female sex, visual impairments, impaired cognition, and environmental factors.\(^3\) In addition, fear of falling, pain, depression, and overconfidence have all been implicated in the risk of falling.\(^4\)\(^-\)\(^11\) The axiom “pride comes before a fall” (a paraphrase of Proverbs chapter 16 verse 18 from the Bible), purports pride as another possible psychological predictor of falling. The aim of this study was to interrogate whether this saying has literal validity, with the hypothesis that higher levels of pride would be associated with increased risk of future falls.

Methods
The English Longitudinal Study of Ageing (ELSA) is a multi-wave longitudinal study of health and quality of life in aged 50 years or older living in England. We used data from participants aged 60 years or over in wave 5 (2010-11; baseline) and follow-up data collected in wave 7 (2014-15; follow-up).

Levels of pride were measured by the wave 5 questionnaire using the item, “During the past 30 days, to what degree did you feel proud?” Response options on a five point scale were “not at all” (5.1% of participants), “a little” (12%), “moderately” (24.3%), “quite a bit” (32.6%), and “very much” (25.9%). We categorised participants as having low (not at all/a little), moderate (moderately), or high (quite a bit/very much) levels of pride. Falls were measured in wave 7 using the item, “Have you fallen down in the last two years (for any reason)?” The response was a dichotomous yes/no.

Statistical analysis
We calculated descriptive statistics to characterise the sample at baseline. Logistic regression assessed the association between pride level at baseline and odds of having fallen within the two years before follow-up. We treated pride as an ordered categorical variable, with “low pride” as the reference category, and estimated the association between “moderate” and “high” pride levels and subsequent falls in each model. We calculated unadjusted estimates first, before calculating adjusted estimates, firstly controlling for age, sex, household wealth, and history of falls, and then adding a broad
set of known risk factors for falls: mobility problems, eyesight problems, the presence of a limiting long term illness, a diagnosis of arthritis or osteoporosis, medication usage, levels of cognitive function, and the presence of pain and depression. Of the 6415 participants with baseline data, 4964 (77.4%) provided data at follow-up. Alongside regression models using imputed covariates for missing data, we did a complete case analysis including only participants with complete data on all covariates.

Results
Participants were predominantly female (54.6%) with an average age of 69.3 years at baseline (table 1 see bmj.com). More than half (58.5%) reported having high levels of pride, and more than a quarter (27.9%) had fallen in the two years before follow-up.

In the unadjusted model, both moderate (odds ratio 0.82, 95% confidence interval 0.68 to 0.99, P<0.05) and high levels of pride at baseline (0.69, 0.58 to 0.81, P<0.001) were associated with significantly lower odds of having reported falls in the two years before follow-up compared with low pride. After control for demographic factors and falls history, moderate pride was unrelated to subsequent falls (0.97, 0.80 to 1.19, P=0.77) but high pride remained closely associated with a reduced risk of a reported fall (0.81, 0.68 to 0.97, P<0.05) (table 2). Further adjustment for a large set of known predictors of falls partially attenuated the strength of the association between high pride and risk of falling (0.86, 0.72 to 1.03, P<0.1). Notably, the confidence interval exceeded 1 in this model, so it remains possible that pride may not be an independent predictor of falls when known risk factors are considered.

In the complete case analyses (n=4522), high pride remained a key predictor after adjustment for demographic factors and falls history (odds ratio 0.76, 0.63 to 0.91, P<0.005) and in a fully adjusted model (0.80, 0.66 to 0.96, P<0.05). In sensitivity analyses, exclusion of participants who had fallen within two years of baseline had minimal effect on the results (n=3652; fully adjusted model: 0.81, 0.65 to 1.01, P=0.06). This finding was replicated in the complete case analysis (n=3347; 0.74, 0.59 to 0.94, P<0.05).

Discussion
Unsurprisingly, this is the first study to investigate temporal associations between pride and subsequent reported falls in English older adults. Contrary to the proverb, our findings suggest that pride may actually be protective against falls rather than being a contributing factor. High levels of pride were associated with a 31% reduction in the odds of having had a reported fall within the two years before follow-up. This association remained after control for demographic factors and falls history. The strength of this association was only partially attenuated by adjustment for a large set of established predictors of falls. However, the confidence interval exceeded 1 in this model, so it remains possible that pride may not be an independent predictor of falls when known risk factors are considered. In contrast, high pride was robustly associated with a reduced risk of falling in a fully adjusted complete case analyses and also in participants without a recent history of falls. Adjustment for potential bias arising from selective loss to follow-up minimally affected our unadjusted estimate of the link between pride and falls, although this adjustment did attenuate the relation in our most stringently adjusted model.

Strengths and limitations
Pride was conceptualised as being a potential antecedent to physical falls in older adults. However, the saying “pride comes before a fall” more likely refers to metaphorical moral or ethical falls. Secondly, no precise definition of a fall was provided to participants, falls were self reported, and there was no external verification that participants had fallen. Finally, although we investigated the temporal association between baseline pride and subsequent odds of having had a reported fall, the possibility exists that reverse causality may play a role—that is, falling may influence subsequent levels of pride. Unfortunately, pride was not measured at wave 7, so the possibility of reverse causality could not be robustly examined. However, sensitivity analyses showed that the relation between pride and falls was observed among participants without a recent history of falls, providing some evidence against the reverse causality hypothesis. Strengths of the study include the large sample, adjustment for multiple confounders, and the rigorous well controlled data collection protocol.

Implications
Contrary to the biblical proverb that “pride comes before a fall,” these findings suggest that pride may be protective against falling. Do these findings undermine the validity of biblical wisdom in its application to contemporary health outcomes? The keen biblical scholar will have noted that the proverb is an inaccurate paraphrase of Proverbs chapter 16 verse 18, “pride goes before destruction, and a haughty spirit before a fall.” The original source material is more clearly describing an arrogance of attitude rather than a healthy self respect. In the absence of variables measuring destruction and a haughty spirit, the validity of biblical wisdom in relation to health outcomes remains empirically unchallenged.

Falls in older adults place a considerable burden on the healthcare system. Recommended multifactorial falls prevention strategies include elements of strength and balance training, home hazard assessment and intervention, vision assessment and referral, and medication review with modification or withdrawal. Such strategies target physical and environmental factors but not potentially important psychological elements. Although promoting pride-boosting interventions on the basis of this study alone would be a leap too far, these findings raise questions around the importance of promoting positive psychological states as a means of falls prevention. The first step in answering these questions may be to better understand the possible mechanisms driving such an association. Higher levels of pride are likely to be reflective, or a driver, of higher levels of general subjective wellbeing, which has been shown to have close associations with physical health. Physical manifestations of pride may also make people with high levels less likely to fall—for example, walking with the head raised high giving better sight of oncoming obstacles. Such phenomena may be linked to the role of a person’s level of self efficacy or confidence in their physical abilities, resulting in the completion of daily activities in a more assured manner. In this sense, by including several controls for daily physical functioning, our most stringently controlled models may have been over-adjusted.

Conclusions
In this longitudinal analysis of the association between baseline levels of pride and subsequent reported falls, data did not support the received wisdom that “pride comes before a fall.” Conversely, higher levels of pride may actually be protective against falls in older adults.

Find this at: http://dx.doi.org/10.1136/bmj.j5451
Cite this as: BMJ 2017;359:j5451
Things that go BONG! in the night

Big Ben’s disruption of sleep studies is a reminder of the importance of environment to a good night’s shut eye, say Michael Farquhar and Kirandeep van den Eshof

At midday on 21 August 2017, Big Ben, the bell at the heart of the great clock of the Houses of Parliament in London chimed 12 times and then fell silent. If all goes to plan it will not “bong” again until 2021, after essential repair and conservation work. Its silencing was controversial, attracting even the prime minister’s concern. Across the Thames, however, at St Thomas’ Hospital we greeted the silence with enthusiasm.

The Evelina London Children’s Hospital Sleep Centre sits within St Thomas’ original pavilions. We carry out more than 200 polysomnographies each year, enabling detailed analysis of children’s sleep to aid assessment and management of sleep difficulties. Polysomnography detects subtle disruptions to sleep that, cumulatively, can have major consequences.

Clearly audible throughout the hospital, Big Ben has chimed a tune called the “Westminster Quarters” every 15 minutes, every day, for the best part of 158 years. A longer version is heard on the hour, along with the bongs. As the bell tolls, polysomnographic arousals—sleep disruptions—are regularly seen in children asleep in our centre, particularly at midnight. We record these as “Big Ben arousals” (figure).

Sleep studies in our department are attended by a trained sleep physiologist, who analyses arousals and excludes those clearly caused by external factors—such as Big Ben or a parent’s snoring—so clinical decisions are not overly influenced by these.

Quality sleep depends on a good routine plus a favourable environment. A bedroom’s light, temperature, comfort, and noise can be overlooked, particularly in the context of other medical problems. Many children seen in our clinic have neurodevelopmental conditions such as autism and can be very sensitive to environmental stimuli. But this isn’t unique to such children.

In a survey of factors that affect sleep quality, 25% of respondents cited noise as the most common problem, second only to an uncomfortable bed. Even those of us not within earshot of Big Ben, sleep where the outside world can noisily intrude. This is especially true for inpatients in hospitals. In 2015 our trust implemented measures to improve inpatient sleep quality, focusing on reducing ward noise.

Environment should be evaluated as part of a sleep history, and noise reduction strategies, such as earplugs or use of white noise, should be part of plans to improve sleep quality.

Getting enough good quality sleep is essential for every aspect of physical and mental health. Even if we think we have slept long enough, poor quality sleep will make us feel tired and unrefreshed the next day. We are more likely to be irritable, impatient, and to find simple tasks difficult. Over time, even mild chronic sleep deprivation can increase lifetime risks of conditions such as heart disease, stroke, and hypertension.

Big Ben arousals remind us to think about the simple things that can help us sleep better. Our expanded sleep centre, due to open next year, will have better soundproofing, ready for the bongs’ triumphant return. In the meantime, we hope the only thing to disturb your sleep this Christmas will be Santa’s reindeer on the roof.

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Kirandeep van den Eshof, chief sleep physiologist, Evelina London Children’s Hospital

Cite this as: BMJ 2017;359:j5615

Over time, even mild chronic sleep deprivation can increase lifetime risks of conditions such as heart disease, stroke, and hypertension
Brutalist medicine: a reflection on healthcare architecture

Will the fashion for evidence based medicine and technological solutions come to be viewed the same way as 1970s buildings, asks Benjamin Mazer

The current fashion in medicine is to label things as either “evidence based” or “not evidence based.” We use these labels to describe treatments, diagnostic tests, public health policies, and even people. This dichotomous world view, however, fails to capture the nuance of the medical landscape. The use of evidence to drive medical decision making should be lauded, but there will always be more to providing proper healthcare than reading statistics in a journal or following clinical algorithms. The shorthand we use to convey this reality is “the art of medicine.” I think a better analogy would be “the architecture of medicine.” After all, proper medical care has a structure built around a clear purpose: to improve the health of the patient. It is engineering with flair.

At the same time, an unyielding focus on utility and regulatory compliance is the cause of many of contemporary medicine’s vivid eyesores: the proliferation of rigid yet contradictory clinical guidelines; blunt point-of-care applications; and electronic medical record systems usually described as a hurdle rather than as a tool. Each of these engineering innovations promised medicine a new evidence based foundation but have instead been introduced without considering the longstanding traditions our community holds dear. This contradiction in today’s medical practice, its simultaneous focus and myopia, is reminiscent of the brutalist architecture movement.

Brutalism was a fashionable global architectural phenomenon that peaked in the 1960s and 70s, but the avant-garde structures were then rapidly rejected as ugly, socialist nightmares. Brutalism valued unabashed utilitarian design. It sought to make plain the elements of its construction, projecting durability over cleverness. Yet this architectural style was as much statement as function. Concrete and simple geometry reigned, even when more delicate structures may have done the trick. For a style so intent on being practical, it often got in its own way, making the users of such structures feel uncomfortable and unwelcome. Despite the current unpopularity of the style, many brutalist monuments still exist today as government and university buildings, where fiscal necessity has ensured their survival.

In a vigorous rejection of the “art of medicine,” we have placed a special emphasis on utility

Emphasis on utility
The brutalist architectural style is an appropriate analogy for the modern healthcare agenda. In a vigorous rejection of the “art of medicine,” we have placed a special emphasis on utility. Today’s physician must use interventions to produce outcomes, plain and simple. This new utilitarian strain believes evidence is the raw material, and hospitals and clinics will be built from this foundation into sturdy sanctuaries against disease. My definition of brutalist medicine is “medicine so intentionally functional that it erects its own barriers.”

One element of this brutalist mode in medicine is the clinical guideline. The proliferation of clinical guidelines promises to “operationalise” the research literature, turning it from an intellectual exercise into a rugged carapace for the vulnerable doctor. Small trends become universal guidance, contorted to apply to disparate situations. Like a geometric slab of concrete, clinical guidelines at first seem to ward off the dangers of our environment. Yet too often they are designed in isolation, so focused on being decisive that they cannot blend into their clinical milieu.

We all have stories of sepsis or stroke protocols being applied haphazardly, for example, producing absurd and sometimes dangerous results. The need to meet rapid treatment goals, the ease of automated order sets, and an over-reliance on metrics could lead a physician to deliver a fluid bolus to a patient who has pulmonary oedema not pneumonia. Clot busting drugs may be given to a patient during a “stroke alert” who would have been found to have have a conversion disorder if our system talked about “door to clinical history time” the way it emphasises “door to needle” time.

“Point of care” has become another one of brutalist medicine’s battlefronts. Academics and entrepreneurs alike are convinced that bedside applications, equations, and heuristics will save doctors from themselves. The PHQ-9 depression questionnaire is one of the iconic looks of this form of brutalist medicine. Instead of asking patients about how they’re feeling, we can simply administer these bedside applications, equations, and heuristics will save doctors from themselves. The PHQ-9 depression questionnaire is one of the iconic looks of this form of brutalist medicine. Instead of asking patients about how they’re feeling, we can simply administer these surveys. I suspect the numbers and boxes of the PHQ-9 will one day look as out of place in medicine as grey jutting geometries do in many of today’s neighbourhoods. Task specific applications may be the quickest path between symptoms and treatment, but strengthening patient understanding, comfort, and self efficacy require a more convoluted route.

Perhaps medicine’s most notable brutalist landmarks are electronic...
medical record systems. Many clumsy medical record systems are in use worldwide, but the dominant record keeping system for 200 million Americans is Epic, making it one of the US’s biggest landmarks.

Epic has achieved ubiquity and prosperity through its unfettered drive towards usefulness and compliance. Whenever healthcare faces a documentation quandary, Epic is right there. From documenting a patient’s blood pressure to reporting the patient’s autopsy results, Epic can do it. The evidentiary life of the patient lives in this behemoth piece of software.

It is in connecting to our existing infrastructure and creating pleasant useability that Epic falls short. The architectural equivalent is the grand but dysfunctional city of Brasília. As physicians succumb to burnout, they spend increasing time on the regulatory nightmare that contemporary medicine has become, with Epic taking over. We are tasked with not only doing more but documenting more. This responsibility comes from many angles. Reimbursement depends on it. The “standard of care” requires ever more rule-in and rule-out tests. Well meaning administrators and public health researchers “nudge” us towards the “right thing,” as evidenced by one or other clinical trial or case study. But the benefit to individual patients is not always apparent.

**Lessons from brutalism**

I don’t mean to sound too sardonic. I love brutalist architecture: the buildings are insistent, powerful, and dependable. Endearingly, they mirror the ungraceful way that people age, accruing both structural cracks and new uses over time.

But brutalism’s flaws must also be recognised. These buildings can get in the way. Hanging up a picture or repainting when your wall is made of concrete isn’t exactly an intuitive act. Heating and cooling these buildings can require some deft physics.

If as physicians we are going to be architects of useful, dependable care, we should heed the lessons of this movement. Our systems must not stand alone. They must not define themselves solely as “evidence based” or “standardised.” As Epic shows, our tools will not be our refuge, no matter how complete they are. Many of medicine’s instruments, regulations, and practices are currently designed as monuments to themselves.

At the same time, we may wish to adopt brutalism’s desire to ignore unnecessary adornments. Both healthcare and architecture use pretentious flourishes as dazzling distractions. Let’s reflect on whether high resolution imaging, precision genomics, or unflinching screening protocols are really making patients better.

Medicine is neither a planned community nor a city of monuments. I think there is wisdom within the chaos of the clinic or hospital. The power of evidence based medicine is its isolation of an intervention, which promises to clarify a universal principle. But many solutions in medicine are self emerging and local, not engineered and universal. The look of relief on a patient’s face will never surrender itself to a metric, nor will the wellbeing of my community. If the outcomes can never be fully defined, medicine’s structures and tools must also incorporate leniency.

Let’s begin to imagine what a post-modern architecture in medicine could look like. Urban activist Jane Jacobs famously described the “eyes on the street”: the loyal residents who keep a neighbourhood safe and liveable. In medicine, our eyes on the street are patients, who maintain a natural awareness of the values most meaningful to them. Evidence based medicine is a fine raw material and must not be discarded. But I am certain that evidence based medicine’s utopia does not look like today’s healthcare landscape.

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Cite this as: **BMJ** 2017;359:j5676
Features of shell shock and related disorders

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Shell shock</th>
<th>Functional neurological disorders</th>
<th>Post-traumatic stress disorder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of use</td>
<td>1915–1920s (banned by British army in 1917)</td>
<td>21st century* (functional nervous disorder used in 19th century)</td>
<td>1978 to present</td>
</tr>
<tr>
<td>Triggering stressor</td>
<td>Yes (military combat)</td>
<td>No</td>
<td>Yes (severe psychological trauma)</td>
</tr>
<tr>
<td>Limb weakness, movement disorders, blackouts, speech impairment</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Exhaustion, impaired memory, poor concentration</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Flashbacks, situational hypervigilance and avoidance</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*Hysteria from 19th century; conversion disorder from early 20th century onwards.
†Originally termed post-Vietnam syndrome; formally defined as post-traumatic stress disorder in 1980, where triggering stressors extend beyond military context.
‡Although the identification of psychological stressors (including trauma, especially childhood abuse) was previously an essential diagnostic criterion, this is no longer the case as a substantial proportion of patients do not have such stressors.

**Different shell, same shock**

As we approach the centenary of the end of the first world war, **Stoyan Popkirov and colleagues** review the German and British medical films that tell the same story of illness and healing.

In both war and illness, we tell stories to frame our suffering. We create cultural narratives of national ideology or neurophysiology to cope with adversity. And those stories are not always beholden to history or histology but instead to creating meaning. One narrative with cultural tremors that reverberated throughout the 20th century, sparking changes in politics and medicine alike, was that of shell shock during the first world war.

Never fully defined, at times overused, and even banned, shell shock became as much a story as a diagnosis. Its causes and presentations varied greatly, from blasts to breakdowns and from blindness to paralysis, shaped as much by the terror of those affected as by the conceptual frameworks of the times (table above). The incomprehensible new horror of industrialised warfare manifested itself in a severe and mysterious epidemic affecting tens of thousands of soldiers on both sides of the war. It was a medical conundrum that led to a crisis in military personnel and needed to be understood urgently given the ongoing deadlocked war. Initial theories of blast related neuropathology were soon abandoned in favour of psychological aetiologies. The presentations of shell shock were recognised as functional disorders, highlighting beyond any doubt that “hysteria” could affect men too, and in large numbers. One way in which the story of shell shock was told was through the recently developed technology of film. Physicians produced short medical films showcasing patients, their ailments, treatment and recuperation. These were some of the first medical films, made mainly to promote treatment strategies and to aid training of health professionals.

In Britain, Arthur Hurst (1879–1944), a general physician treating men with shell shock in Hampshire and Devon, recorded a 27 minute film called *War Neuroses* in 1917–18. Around the same time in Germany, Max Nonne (1861–1959), professor of neurology in Hamburg-Eppendorf, produced an 11 minute film *Funktionell-motorische Reiz—und Lähmungszustände bei Kriegsteilnehmern und deren Heilung durch Suggestion in Hypnose*.

Both films have recently been made freely available online. Looking at them through the opaque lens of time, we see several striking similarities. They portray the same functional neurological disorders, refer to similar treatment approaches, and show the same spectacular restoration of health. Furthermore, the films are both authentic artefacts of medical history and staged storytelling.

**Telling stories through film**

Nonne documented his suggestion-based treatment of shell shock in a film that shows 14 patients with various neurological dysfunctions related to combat trauma. Each case is preceded by a brief title card stating the condition, followed by a portrayal of the symptom and then the restitution of normal function. The film starts with a soldier who developed severe stutter after a shell explosion. The man is shown almost naked, struggling to articulate. He is opening his mouth widely and awkwardly, in a way that allows us to grasp his inability to produce a coherent sound even in a silent movie (fig 1). Then the imposing figure of Nonne himself appears in a long white coat, and an excerpt of his “suggestive-hypnotic” treatment is shown, as he manipulates the face and mouth of the soldier (although some see these gestures as merely highlighting the dysfunction).

“After the cure,” as the intertitle informs us, we see the man with his doctor, now talking effortlessly. This pattern of presentation is then repeated for men with various forms of tremor, paresis, dystonia, spasms, and complex hyperkinetic movement and gait disorders (fig 2). Each soldier is cured by a treatment only alluded to, never properly shown, creating the sense of an almost miraculous cure. This film created to document and popularise Nonne’s approach, did so by framing it in the most basic narrative structure of bare crisis, magical intervention, and complete convalescence, 14 times in a row.

In all probability none of these patients were severely affected neurologically when the movie was made. Nonne usually recruited “cured” patients, instilling previous symptoms through hypnotic suggestion, which was then reversed. This reproducibility of symptoms was considered a feature of shell shock, and the restaging of symptoms, treatment, and health for demonstration purposes was considered entirely justified.

Hurst’s movie follows a less rigid structure, narrating the fate of 18 men treated at Royal Victoria Hospital in Netley and at Seale Hayne in Devon. The functional neurological disorders shown are surprisingly similar to those in Nonne’s film. Treatment mainly relied...
on suggestion, supplemented by occupational therapy, and is usually only alluded to by means of title cards.

The story arc of “puzzling disability”—“behind-the-scenes treatment”—“complete rehabilitation” is repeated, often in a more dramatic and engaging form than in Nonne’s film. For example, we follow Private Meek from a devastating state of amnesia, mutism, and paralysis, sitting contortedly in a wheelchair, to complete recovery, applying his pre-war proficiency in basket making (fig 4). Similarly, Sergeant Bisset, unable to walk properly after being buried alive in an explosion, is shown with normalised gait after two months (fig 4). Cases are framed dramatically by adding personal details and contrasting the horrific combat related injuries with bucolic scenes of basket weaving, cow herding, and feeding chickens.

The film ends with a staged battle re-enactment, referred to as “The battle of Seale Hayne,” that provides a backdrop to the soldiers’ stories. But this is not the only enactment in the movie. Observers have noted that the background to the Sergeant Bisset scenes showing before and after recovery include the same nurses, bystanders, and smoke rising from the chimney, showing that it was a re-enactment rather than an authentic medical record (fig 4).

An interesting parallel exists between the involuntary enactment of neurological dysfunction in a primal attempt at sense making (or, in neurocomputational terms, at reducing uncertainty), and its reiterated enactment for documentation, prompted and directed by physicians trying to impose a secondary narrative of illness and healing. Few historical artefacts capture the interlinked narratives of personal and societal crises as succinctly as these two wartime films, produced independently yet seemingly in concert on both sides of the front lines.

Creating meaning
Current models of functional neurological disorders are returning to concepts that were popular before the era dominated by Freudian (psychological trauma) theory. It is increasingly accepted that beliefs about bodily dysfunction can trickle down the hierarchical neural architecture of the brain to produce “expected” symptoms beyond the conscious control of patients. Similarly, medical dogma will guide doctors in their perception and treatment of disease, moulding it into preconceived shapes in the process. Both neural systems and medical sciences rely on determining the most likely interpretations using pre-existing ideas to reduce uncertainty. To underestimate top-down influences in this complex interplay of thoughts and currents, to neglect the power of ideas and ideology, is to misunderstand how our brains work.

Shell shock persists in the English language as an expression of the stuporous reaction to the devastatingly unexpected (unlike its German equivalent *Grausamkeitswirkungenfolgen*, which has slipped out of common parlance). In medical textbooks, having temporarily occupied the same pages as “hysteria” and “neurasthenia,” shell shock has been reduced to a footnote, making space for “functional neurological disorders,” the contemporary umbrella term for movement, sensory, or speech disorders. Since disorders of cognition and mood such as anxiety, panic attacks, and nightmares were also considered manifestations of shell shock, it has often been described as a precursor of “post-traumatic stress disorder,” although the symptoms are mostly different.

The history of shell shock, so vividly encapsulated in these films, reminds us that whatever names we choose for such illnesses, however scientifically minded the stories we tell of them are, they will often be both descriptive and prescriptive, creating meaning with each retelling. Furthermore, a century later, when functional disorders of the nervous system are once again coming into the focus of scientific inquiry, and when the political unity of Europe is being newly challenged, these films remind us that our struggles are not new, national, or hopeless.

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Cite this as: BMJ 2017;359:j621