Cod liver oil and tuberculosis

Malcolm Green revisits an 1848 study of cod liver oil in the treatment of tuberculosis

The Royal Brompton Hospital is well known for studies evaluating the use of streptomycin and other chemotherapy for tuberculosis (TB) in the 1940s to 1960s, but it is less widely known that the physicians at the hospital were already investigating treatments for TB 100 years earlier. This is a report of a study conducted in 1848.

- Objective: to investigate the use of cod liver oil in the treatment of consumption (also known as phthisis, and now called tuberculosis or TB) in 19th century London
- Hypothesis: that cod liver oil might arrest progression or reduce the death rate from consumption
- Protocol: the study was conducted in 1848 at the Hospital for Consumption and Diseases of the Chest, Brompton. The results were presented to the hospital's Committee of Management in the *First Medical Report of the Hospital for Consumption and Diseases of the Chest* in 1849.[1]

In their report, the medical officers *felt it their duty to bear testimony to the judgement evinced in the selection of the site for the hospital: The hospital is built on a dry gravelly soil, in a suburb of the metropolis long celebrated for its salubrity, sheltered on the north and east by the metropolis and open to the south and west; the wards are lofty and the corridors light and capacious*.

542 inpatients with consumption were treated with cod liver oil, *in a dose of 1 drachm* (3.6 mL) *three times a day, gradually increased, in some few cases up to 1.5 ozs* (42 mL) *per dose. The oil is straw coloured, transparent and free from offensive smell. Patients take it in general without repugnance. It is usually administered in camphor-water, aromatic water, bitter infusions, milk or any other agreeable fluid. When there is great irritability of the stomach it has been given in mucilage of gum with a few drops of hydrocyanic acid*.

The patients treated with cod liver oil were compared with 535 patients who received standard treatment alone (without cod liver oil). Patients were *classed according to the amount of benefit they received*. The term *improved* includes patients in whom the symptoms are *relieved* or *much relieved*. The term *arrested* means *that all or nearly all of the symptoms have disappeared, the patients feel well and are able to pursue their ordinary occupations. The other terms speak for themselves*.

Results as shown in 1848 study

	Standard treatment	Standard treatment plus cod liver oil
Number of patients	542	535
Improved	60.8%	63.1%
Arrested	5.6%	18.1%
Deteriorated or died	33.3%	18.8%

Hospital for Consumption and Diseases of the Chest, Brompton, 1849

Results

There was no important difference in the number of patients who *improved* in the two groups (standard treatment 61% *v* cod liver oil 63%; table). However, in 18% of patients given cod liver oil, the disease was *arrested and when it is recollected that of the whole number otherwise treated the disease was arrested in only 5% the value of this remedy must be considered very great*. Furthermore, 33% of patients given standard treatment alone deteriorated or died, compared with only 19% of those given cod liver oil.

It was observed that *one of the most striking effects of the use of cod liver oil is an increase in the patient's weight. A gain in weight occurred in 70%, a loss in only 21% and in 9% the weight remained stationary*. However, the weight changes in patients in the control group were not recorded, so this observation remains anecdotal.

Discussion

The authors state in their report, *No other conclusion can be drawn than that cod liver oil possesses the property of controlling pulmonary consumption to a greater extent than any other agent hitherto tried*. The results seem to support this conclusion. Tuberculosis was arrested in 18% of the patients given cod liver oil, compared with 6% of those in the control group. Deterioration or death was reduced from 33% to 19%. For patients with consumption, these results represented a massive improvement in prognosis and must have been greeted with enthusiasm by doctors and patients alike.

MÖLLER'S COD-LIVER OIL

Gained the ONLY FIRST PRIZES at the Great Exhibitions of LONDON, PARIS, Etc.

IT IS NOT SUFFICIENTLY CONSIDERED that the quality of Cod-Liver Oil depends upon the condition of the Fish. The Lofoten Waters in Norway are the only known district where the Cod migrates for spawning, and in excellent condition. Hence the well-known superiority of Lofoten Oil; many reject the light brown on account of its unpleasant taste, arising from its being prepared from putrid livers. PETER MÖLLER, therefore, by a Special Process, prepares at Lofoten, a Pale Oil, distinctly different to the PALE NEWFOUNDLAND, retaining all the curative virtues with a remarkably pure smell and taste.

MOLLER'S COD LIVER OIL

THE LATE PHYSICIAN to the North London Consumptive Hospital, Abbotts Smith, M.D., M.R.C.P., affirms that Möller's Oil is more readily retained by delicate persons, and more efficacious.
THE MEDICAL SOCIETY OF NORWAY has, through its leading members, testified that Möller's Oil is preferred for its beneficial properties.
THE MEDICAL SOCIETY OF NORTHUMBERLAND AND DURHAM pronounced Möller's Oil the best.
PHYSICIANS TO LONDON HOSPITALS and other eminent men in the Profession, have certified to its superiority.
Dr. L. A. SAYRE, Professor of Orthopedic Surgery in Bellevue Hospital Medical College, New York, says: "Of late years it has become almost impossible to get any Cod-Liver Oil that patients can digest, owing to the objectionable mode of procuring and preparing the livers. * * Möller, of Christiania, Norway, prepares an oil which is perfectly pure, and, in every respect, all that can be wished."—Dr. L. A. Sayre, before Academy of Medicine. See MEDICAL RECORD, Dec., 1869, p. 447.
Dr. J. MARION SIMS says: "For some years I had given up the use of Cod-Liver Oil altogether; but since my attention was called by Dr. Sayre to Möller's Oil, I have prescribed it almost daily, and have every reason to be perfectly satisfied with it."
SOLD BY DRUGGISTS.
W. H. Schieffelin & Co., 170 & 172 William Street, New York,
SOLE AGENTS FOR THE UNITED STATES AND CANADAS.

The study, however, had several weaknesses:

- This report is not a new study and has been previously published, so fails the test for original work. However, the implications of the 1848 study for generations of children and adults over the succeeding 160 years merits recording it a place in the modern literature. The *First Medical Report of the Hospital for Consumption* is not widely available (indeed only one copy is known to exist) and is not referenced in PubMed or Google
- There is no bacteriological confirmation of the diagnosis, since *Mycobacterium tuberculosis* was only recognised and described by Koch in 1892, some 43 years later
- No radiographic confirmation was available until Roentgen's discovery of x rays in 1895
- No statistical analysis was done, not least because Fisher only introduced coherent statistical methods in 1922. There is no record of how patients were allocated to the two groups
- Ethical permission, patient consent, structured randomisation, and double blinding had not been invented. There were no local, regional, or national ethics committees to consider the protocol
- The present author (MG) cannot vouch for the collection of the original data or for its veracity. However, the recordings made in the report are convincing.

On the other hand, the study had a number of strengths:

- Studies on other treatments (inhalations, other animal and vegetable oils, naphtha) were reported as negative, although further details were not given
- The number of patients in the two groups probably gives the study sufficient statistical power
- The end points seem to be carefully recorded, particularly death.

The use of cod liver oil in the treatment of tuberculosis was widely practised in the late 19th and early 20th centuries. Cod liver oil was advertised and marketed across the world. Children were given cod liver oil, presumably as a preventive measure. This practice continues to the present day. In a random survey of doctors who entered Oxford University medical school in 1960, all 35 doctors recalled being given cod liver oil as children, but did not know why. A similar survey of medical students at Imperial College London in 2005 showed that just under 30% (10/32) had been given cod liver oil, but again did not know why.

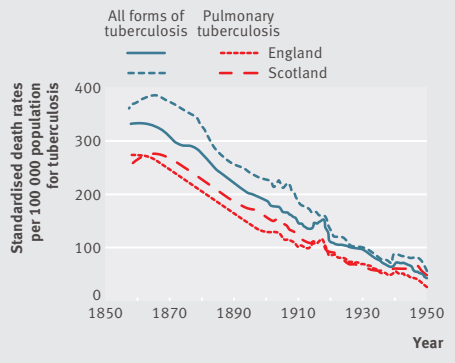
Death rates from tuberculosis in the United Kingdom and the United States declined steadily throughout the 19th and 20th centuries (figure).[2] This has been attributed generally to better living conditions: reduction in overcrowded living might have reduced transmission. Probably more important was improved nutrition. It could well be that the widespread use of cod liver oil encouraged by doctors played a significant part.

Vitamin D

Along with tuberculosis, rickets was a common and debilitating condition in children in the 19th and early 20th centuries. Studies of diet in animal models of rickets showed the beneficial effect of cod liver oil, and its anti-rachitic factor was identified in 1922 by McCollum and colleagues, who named it vitamin D.[3] A role of sunlight in preventing rickets had long been suspected and, in 1923, photosynthesis of vitamin D in the skin was described.[4]

FOX PHOTOS/GETTY IMAGES

Did it protect them against TB?



Mortality from tuberculosis

Vitamin D is now known to be involved in activating macrophages to inhibit multiplication of mycobacteria and to induce peptides which destroy mycobacteria.[5 6] Indeed, vitamin D deficiency could lead to an acquired immunodeficiency and an impaired host defence reaction to mycobacteria.[7] Patients presenting with tuberculosis tend to have lower levels of vitamin D than matched controls[8] and in one study, 76% were vitamin D deficient.[9] It is reasonable to conclude that a lack of vitamin D increases susceptibility to tuberculosis, and can contribute to clinical deterioration of the disease.

A role for vitamin D in combating tuberculosis gives a rational basis for sunshine therapy, which was widely practised for patients in sanatoriums before chemotherapy became available. Patients were put out on their beds to lie in the sun in summer and winter, and many were sent to Switzerland and other sunny countries for treatment.

A role for vitamin D in immune defence against tuberculosis might explain other curious findings. Immigrants from the Indian subcontinent have a higher incidence of active tuberculosis in the UK than in their own country.[10] They also have generally low levels of vitamin D, attributed to their diet and to the UK's relative lack of strong sunlight needed to synthesise vitamin D in darker skins.[11] Hindus have more tuberculosis than Muslims, perhaps because their vegetarian diet contains minimal liver oil or other sources of vitamin D (fish, meat, and dairy products).[12] The effect of vitamin D in stimulating macrophages could explain why non-respiratory tuberculosis was common both in the 19th century and now in immigrants; without effective macrophage function, mycobacteria could spread more easily from the lungs via the blood to other organs.[6]

Conclusions

The 1848 study is an early example of a two arm investigation addressing an important clinical problem. James Lind's famous treatise showing that citrus fruits can treat scurvy[13] preceded this study by 100 years, but relatively few therapeutic studies were reported in the intervening years. The physicians at the Hospital for Consumption and Diseases of the Chest used rational methodology in 1848 to establish the value of an important therapy, decades before any reasonable explanation for the use of cod liver oil was established. The results might have contributed to the widespread use of cod liver oil as a nutritional supplement, thus playing a part in the remarkable reduction in incidence of and deaths from tuberculosis. Their study must stand tall in the proud heritage of UK clinical investigation.

Tuberculosis is still a virulent and common infection, accounting today for some 3.5 million deaths worldwide.[2] The emergence of multidrug resistant bacilli is of increasing concern.[14] It could be that vitamin D supplements will again have a role in combating this terrible killer, possibly in some subsets of those patients with vitamin D deficiency through diet or relative lack of sunshine.[15]

Malcolm Green professor emeritus, Royal Brompton Hospital, London SW3 6HP, UK
malcolm@malcolmgreen.net

And physicians from the Hospital for Consumption and Diseases of the Chest, anonymous and long deceased

Competing interests: The author has completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declares: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Provenance and peer review: Not commissioned; externally peer reviewed.

References are in the version on bmj.com.

Cite this as: *BMJ* 2011;343:d7505

Political correctness: a step too far?

While conducting a postnatal ward round we found this notice fixed to the doors of every bay.

In 2005 the Department of Health for England published the document *Elimination of Mixed-Sex Hospital Accommodation*,[1] aiming to ensure the privacy and dignity of all patients during their stay in hospital. This was to be achieved by ensuring that adequate organisational arrangements are in place to secure good standards of privacy and dignity for all hospital patients.

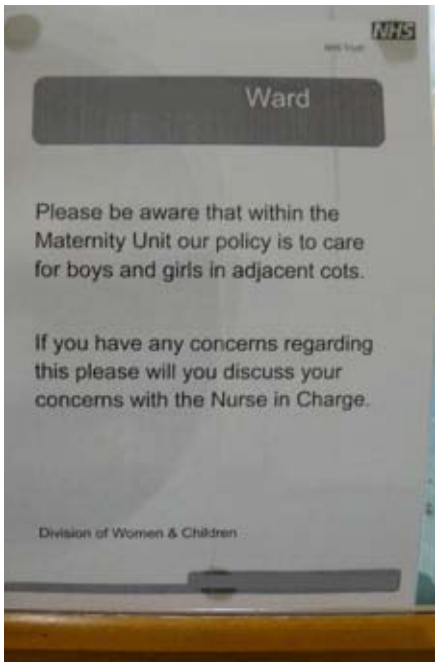
A 2010 press release from the department stated that "tens of thousands of patients are still being placed in mixed sex accommodation."[2] As a result the health secretary, Andrew Lansley, announced plans that from January 2011 "commissioners will be expected to apply sanctions to NHS organisations who declare a breach."[2]

We believe that all patients have the right to privacy and dignity. However, newborn boys and girls have been nursed in adjacent cots in postnatal wards for decades. A new born baby is unlikely to be aware of or worried about principles of privacy or dignity. None of the mothers we asked on the postnatal ward were worried about male and female babies in adjoining beds. Such a notice as this one does nothing but exacerbate a state of excess political correctness and indicates an organisation too much in fear of financial penalties.

M Green core trainee year 1, anaesthesia
mftgreen@doctors.org.uk
M Davison anaesthetic consultant

1 Department of Health. Elimination of mixed-sex hospital accommodation. www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsStatistics/DH_4112140.
2 Department of Health. Tens of thousands of patients still placed in mixed sex accommodation. www.dh.gov.uk/en/MediaCentre/Pressreleases/DH_118639

Cite this as: *BMJ* 2011;343:d7451



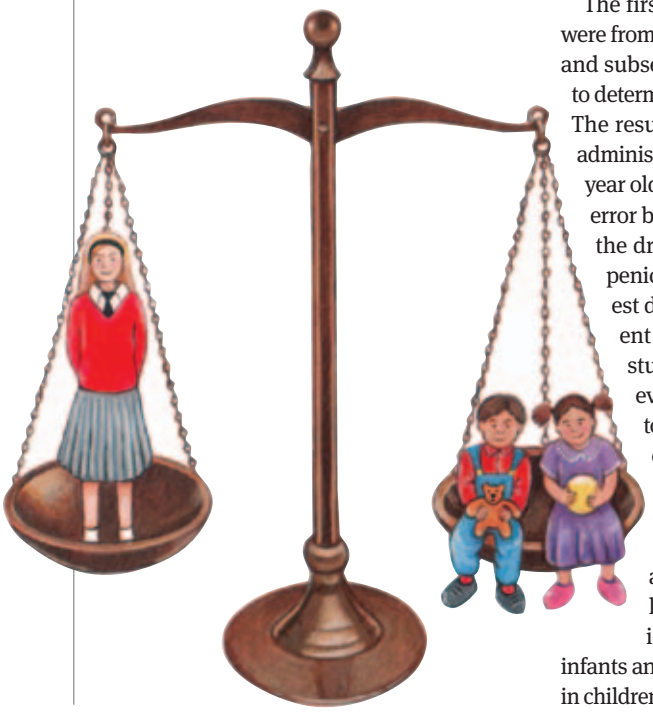
Dosing of oral penicillins in children

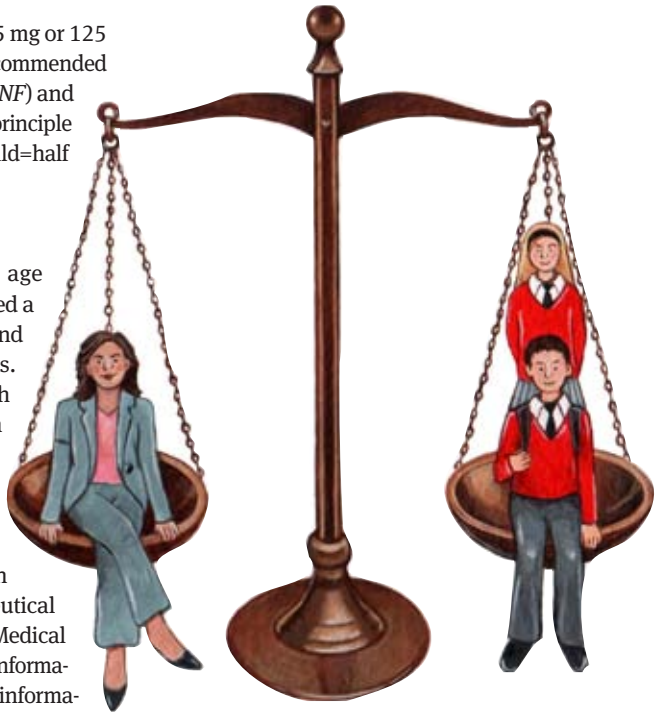
The **improving Children's Antibiotic Prescribing UK Research Network** thinks it's time to abandon historical rules of thumb

Is big child = half an adult, small child = half a big child, baby = half a small child still the best we can do?

The penicillins have been the most important antibiotics used in children for over 50 years. As well as combating the rapid emergence of penicillinase producing bacteria, the development of penicillin derivatives in the 1950s and 1960s allowed oral dosing, removing the need for painful intramuscular injections. Penicillin V, flucloxacillin, and amoxicillin account for nearly 4.5 million of the 6 million prescriptions for oral antibiotics given to children in England each year.[1]

Despite their wide use over many decades, guidance on the correct dose of oral penicillins for children remains confusing. For example, the 2011 summary of product characteristics for Amoxil paediatric suspension in children weighing <40 kg is 40-90 mg/kg/day for all indications,[2] whereas recommendations for amoxicillin, penicillin V, and flucloxacillin in the *British National Formulary for Children* are mostly based on age bands, although weight bands or weight based calculations (mg/kg) are given for some indications. The widely used doses of 62.5 mg or 125 mg are fractions of the adult dose recommended in the *British National Formulary* (*BNF*) and are still based on the original dosing principle of a big child=half an adult, small child=half a big child, baby=half a small child.





Limited evidence for dosing regimens

To understand the origins of the age band dosing schedule, we conducted a historical review of the literature and earlier UK prescribing formularies. This comprised an electronic search of PubMed (using a combination of terms including the antibiotic name, child/paediatric, dose, clinical trial, review, pharmacokinetic) and the summary of product characteristics, a manual search through the archives of the Royal Pharmaceutical Society of Great Britain and British Medical Association, and requests for dosing information submitted under the freedom of information acts to the UK Medicines and Healthcare Products Regulatory Agency and the US Food and Drug Administration. Electronic copies of all the articles recovered from our search are available on request.

The first studies on oral dosing in children were from 1946 and used penicillin G.[3 4] These and subsequent studies all used child weight to determine dosage (units/lb body weight).[5-7] The results showed that the success of oral administration, particularly in children over 1 year old, was essentially a matter of trial and error because the variation in absorption of the drug was so unpredictable. If 1 mg of penicillin equalled 1667 units,[8] the highest dose of penicillin G that gave consistent bacteriostatic serum levels in these studies was equivalent to about 60 mg every 3 hours, but only in children up to 1 year old. This meant that oral penicillin G was not practical for children older than 1 year with severe illness, and subsequent studies focused on attempts to prolong the therapeutic action of a single injection of penicillin G. Two studies suggested that doses intermediate between those used in infants and adults should be clinically effective in children.[9 10]

By 1958 penicillin V had become available and was clearly the oral antibiotic of choice. A contemporary survey published in the *BMJ* showed that many UK general practitioners had adopted an age banding dosing system, with children aged under 5 years old receiving 60 mg every 3 hours and older children receiving what was then the recommended adult dose of 125 mg every 3 hours.[11] Prescribing based on age, albeit using a wider range of age bands, had first been suggested in 1953 at an antibiotic conference held in Vienna.[12] Based on the results of oral dosing studies conducted using the scheme for penicillin G described at the conference,[13] a general recommendation to use age banding for all antibiotics in children, irrespective of the type of penicillin or disease indication, was published in the *BMJ* in 1963.[14] Critically, these recommendations have remained unchallenged and unchanged to this day.

Many children may be underdosed

Recommended dosing regimens for penicillin V (fig 1) in children first appeared in the 1963-6 edition of the *BNF* and have not been changed since. The *BNF* recommends halving the single dose between successive age bands starting from the maximum adult dose of 1000 mg as follows: 12-18 years, 500 mg; 6-12 years, 250 mg;

1-5 years, 125 mg; <1 year, 62.5 mg. The same halving of single doses between age bands from the adult dose has also remained unchanged for flucloxacillin, which first appeared in the 1974-6 edition of the *BNF*, and for amoxicillin, which was first recommended for use in children in the 1976-8 edition. Adult penicillin doses have increased substantially over the years, presumably in response to concerns around increasing antibiotic resistance, but there has been no parallel increase in children's dosing (fig 1).

The 1963 *BNF* included average weight of a child with the age band dosing information: 10 kg (birth to 1 year), 13 kg (2 years), 18 kg (5 years) and 30 kg (10 years). But data used to compile the Health Survey for England 2009 gave the average weights of 5 and 10 year old children as 21 kg and 37 kg, respectively, significantly higher than the 1963 figures.[15] This suggests that the mg/kg doses may be even lower than those set in 1963.

We therefore analysed the actual dose that would be received today as both the mg/kg/dose and mg/kg/day for the oral penicillins based on the age bands recommended in the 2010-11 *BNF for Children* and the current weights of children based on the 2009 Health Survey for England data (fig 2). The main problem with age and weight bands is that at older age-weight ranges, substantially lower doses are always recommended. These doses seem strikingly low—for example, a 10 year old child weighing around 40 kg and receiving amoxicillin 250 mg three times a day will receive only around 18 mg/kg/day, much lower than the 40-90 mg/kg/day recommended in the summary of product characteristics for Amoxil.

Time for an update

The evidence base for many older medicines for children is limited, but we were surprised at the lack of recent evidence to support the *BNF*'s current dosing recommendations for such commonly used drugs as the oral penicillins. The same dosing recommendations seem to have been reused every year for the past 50 years (fig 1). In the 1940s and early 1950s dosing

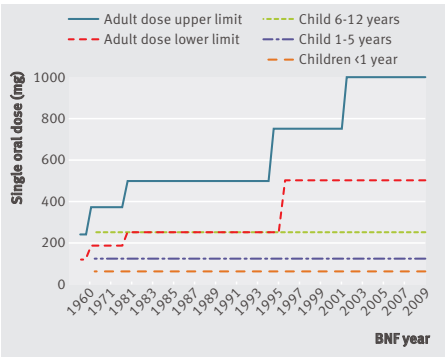


Fig 1 | Changes in the single oral dose of penicillin V for children and adults

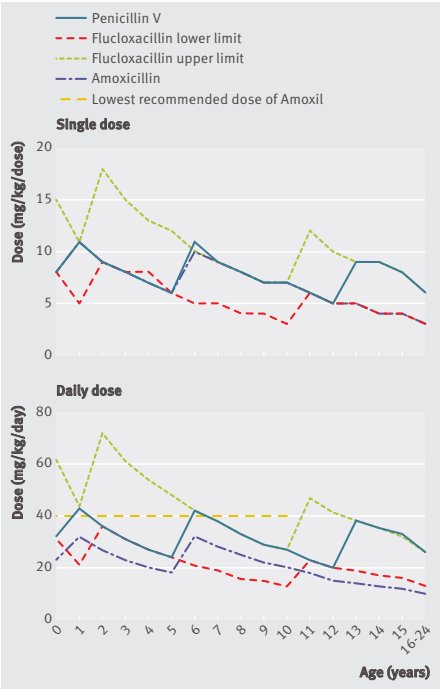


Fig 2 | Actual dose of oral penicillins received as both mg/kg/dose (top) and mg/kg/day (bottom) based on age bands recommended in the 2010-11 *BNF for Children* and current weights of children from 2009 Health Survey for England. (The lowest dose of Amoxil for children under 40 kg in the summary of product characteristics)

was based on weight, but age bands were introduced from the late 1950s alongside 2.5 mL and 5 mL spoons, which standardised practice and reduced the risk of medication error. The UK's age band dosing recommendations are much lower than the doses recommended by the American Academy of Pediatrics,[16] for example, but does this actually matter, or cause any harm?

Low dosing will lead to subtherapeutic concentrations at the relevant target organ (especially the middle ear), potentially driving antimicrobial resistance,[17 18] with consequences for both the individual and the community.[19] Underdosing may result in the need for retreatment and increases the risk of severe complications. All the published risk-benefit analyses on the therapeutic balance of antibiotic prescribing for upper respiratory tract infections assume adequate antibiotic dosing.[20] This is a real concern because clinically inadequate dosing would increase the number needed to treat to prevent any severe complications.

Studies of paediatric antiretroviral dosing noted that complex schedules using weight bands often led to clinically important underdosing since changes in growth and obesity had not been accounted for.[21] This work led to substantial changes in the dosing recommendations for children receiving antiretrovirals and to standardised treatment guidelines across Europe.[22] A similar programme of work is now required for oral penicillins. Not only do we need to determine the effective doses for children of all ages and weights but we also need to establish more clearly which children really need antibiotics in the era of pneumococcal conjugate (PCV 13), *Haemophilus influenzae* B, and meningitis C vaccines. The rates of prescribing of oral penicillins for children are now rising again in England (primary care trust prescribing data, 2010). Many of the 5 million children in England who receive oral penicillins each year may not need them, but those who do should receive them in an effective dose.

Umar Ahmed pharmacist, Centre for Paediatric Pharmacy Research, School of Pharmacy, University of London, London WC1H 9JP, UK and Boots The Chemist, London, UK
Nikos Spyridis consultant in paediatric infectious diseases, Paediatric Infectious Diseases Unit, St George's Hospital, London, UK and P and A Kyriakou Children's Hospital, University of Athens, Athens, Greece
Ian C K Wong professor of paediatric medicines research, Centre for Paediatric Pharmacy Research, School of Pharmacy, University of London, London WC1H 9JP, UK and Department of Pharmacology and Pharmacy, Li Ka Shing Faculty of Medicine, University of Hong Kong, Hong Kong
Mike Sharland professor of paediatric infectious diseases, Paediatric Infectious Diseases Unit, St George's Hospital, London, UK
Paul F Long senior lecturer in pharmacognosy, Centre for Paediatric Pharmacy Research, School of Pharmacy, University of London, London WC1H 9JP, UK and Institute of Pharmaceutical Science and Department of Chemistry, King's College London, London, UK **paul.long@kcl.ac.uk**
On behalf of the improving Children's Antibiotic Prescribing UK Research Network (iCAP)

References are in the version on bmj.com.
Cite this as: *BMJ* 2011;343:d7803

FIONA BLAIR

High salt meals in staff canteens of salt policy makers

L M Brewster and colleagues hit the canteen trail

Objective To assess the salt content of hot meals served at the institutions of salt policy makers in the Netherlands.
Design Observational study.
Setting 18 canteens at the Department of Health, the Health Council, the Food and Consumer Product Safety Authority, university hospitals, and affiliated non-university hospitals.
Intervention A standard hot meal collected from the institutional staff canteens on three random days.
Main outcome measure Salt content of the meals measured with an ion selective electrode assay.
Results The mean salt content of the meals (7.1 g, SE 0.2 g) exceeded the total daily recommended salt intake of 6 g and was high at all locations: 6.9 g (0.4 g) at the Department of Health and National Health Council; 6.0 g (0.9 g) at the Food and Consumer Product Safety Authority; 7.4 g (0.5 g) at university hospital staff canteens; and 7.0 g (0.3 g) at non-university hospital staff canteens. With data from a national food consumption survey, the estimated total mean daily salt intake in people who ate these meals was 15.4 g. This translates into a 23-36% increase in premature cardiovascular mortality compared with people who adhere to the recommended levels of salt intake.
Conclusion If salt policy makers eat at their institutional canteens they might consume too much salt, which could put their health at risk.

ADAM DI CHIARA AFTER VINCENT VAN GOGH

When the chips are down, add more salt

Introduction

Excess salt intake is estimated to cause 30% of all hypertension, and many countries have nationwide programmes to reduce salt intake.[1-6] We investigated how much salt might be consumed by policy makers if they eat at their institutions' canteens.

Methods

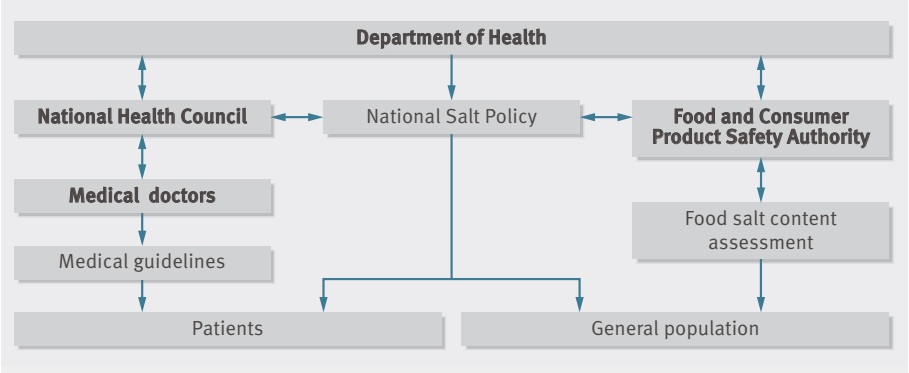
Network of stakeholders

We focused on policy makers (figure)[7] because we assumed they would have a greater awareness of the risk of high salt intake and a sense of urgency, combined with power and legitimacy, to formulate guidelines for salt reduction.

In the Netherlands the Department of Health receives advice from the National Health Council, an independent scientific organisation. It advised the Department of Health to reduce the recommended salt intake in the general population to 6 g a day[8] and recommended that the food industry reduce the salt content of commercially available prepared food voluntarily. Such food is monitored by the Food and Consumer Product Safety Authority. The advice is implemented in the National Prevention of Disease Act, which is used by doctors in university and non-university hospitals to formulate guidelines on reduction of salt intake.

Locations and consent

Meals were collected at 18 locations in the Netherlands (see table). We did not inform the hospitals but had to notify the security services of the Department of Health, the Health Council, and the Food and Consumer Product Safety Authority that we would visit the building. We were allowed to make unannounced visits to the staff restaurant without revealing our objectives.



Collection and analysis

We collected a typical hot lunch (soup and the non-vegetarian hot dish) at each location on three separate randomly chosen weekdays. All canteens visited provided only one non-vegetarian option, served in standard portions. For full details of salt analysis see the appendix on bmj.com. After the collection, we asked whether the policy makers had an institutional salt policy and whether they had outsourced catering or provided it locally. We also randomly sampled 100 employees and asked them how often they ate the hot lunch provided and the type of meal they ate for dinner at home after they had had the hot lunch.

Outcomes

The primary outcome was the mean total salt content, rather than the sodium content of the hot meals, according to NICE guidelines.[3] Other outcomes were the salt content per 100 g meal and the salt content at different locations. We first calculated the mean salt content at separate locations and tested for heterogeneity before pooling the data. We also used a national food consumption survey to obtain a detailed description and quantification of foods, recipes, and supplements consumed during the preceding day.[9] With these data we estimated the probable average daily salt intake of a person who ate the lunch, using data on food intake for the rest of the day from the survey and the employees' questionnaire, assuming similar salt intake at the weekends.[10] We used this estimated total salt intake to determine the probable associated health risk of eating in this way.[4 11] Data are expressed as means and standard errors. All analyses were done with SPSS version 16.0 (Chicago, IL).

Results

The mean salt content of the hot meals analysed was 7.1 g (SE 0.2), ranging from 5.3 g (0.7) to 9.0 g (2.4), with a median value of 7.0 g (table). There was no heterogeneity in the means between institutions. The mean salt content of the meals exceeded the recommended total daily allowance of 6 g. Of the 54 meals collected, 36 (67%) contained more than 6 g of salt.

The salt content averaged 6.5 g (0.4) in non-medical settings versus 7.2 g (0.3) in hospitals; 7.0 g (0.2) in non-academic hospitals versus 7.4 g (0.5) in academic hospitals; and 7.1 g (0.3) in the 13 locations with local catering versus 7.3 g (0.4) with outsourced catering. Only two university hospitals and the Food and Consumer Product Safety Authority had a policy on salt restriction. The salt content of the lunches from these institutions was 7.2 g (0.3) versus 7.1 g (0.6) in those without such a policy. We found similar direction and magnitude of outcomes per 100 g meal (data not shown).

Mean salt content of staff meals at institutions of salt policy makers, including academic medical centres and affiliated hospitals in same region

	Salt content (g)	
Location	Range	Mean (SE)
Ministry of Health and National Health Council*	6.5-7.3	6.9 (0.2)
Food Consumer Product Safety Authority*†	5.0-6.8	6.0 (0.5)
Academic Medical Centre:		
Amsterdam 1*†	5.2-11.0	7.5 (1.8)
Affiliated hospital	4.9-9.5	7.4 (1.4)
Amsterdam 2*	6.9-9.6	8.2 (0.8)
Affiliated hospital	5.3-10.2	7.0 (1.6)
Groningen	5.6-8.1	6.8 (0.7)
Affiliated hospital	5.9-10.6	8.1 (1.4)
Leiden	4.8-13.1	9.0 (2.4)
Affiliated hospital	5.1-9.3	7.1 (1.2)
Maastricht	4.2-6.6	5.3 (0.7)
Affiliated hospital	5.2-8.1	6.3 (0.9)
Nijmegen	5.2-6.8	5.9 (0.5)
Affiliated hospital	5.3-6.7	5.9 (0.4)
Rotterdam	6.1-10.5	8.2 (1.3)
Affiliated hospital	5.4-7.9	6.7 (0.7)
Utrecht	6.6-10.7	8.5 (1.2)
Affiliated hospital*	7.3-8.1	7.7 (0.2)

*External food service provider.
†Institution stated to have policy to reduce salt intake.

Of the interviewed employees, 63 out of 100 ate the hot meal at work. Of these, 40 (63%) had another hot meal for dinner at home that day. We used these data, and data from the National Food Consumption Survey,[9] to estimate the daily salt intake, based on 63% of the people eating another standard dinner at home in the evening and the remainder eating a standard bread meal.[9] In people who ate the hot lunch, the estimated daily mean salt intake was 15.4 g (9.4 g higher than the recommended 6 g). Salt intake tends to be similar or higher at weekends,[10] and we used a conservative estimate of overconsumption of 9 g a day to estimate health outcomes based on systematic reviews.[4 11]

Results in context

In a meta-analysis of longer term trials, He and MacGregor studied the dose-response between salt reduction and fall in blood pressure and compared this with two well controlled studies of three different levels of salt intake.[11] All three studies showed a consistent dose-response to salt reduction within the range of 3-12 g a day. A reduction of 3 g a day predicted a fall in blood pressure of 3.6-5.6 mm Hg systolic and 1.9-3.2 mm Hg diastolic in people with hypertension and 1.8-3.5 mm Hg and 0.8-1.8 mm Hg, respectively, in those with normal blood pressure. The effect would be doubled with a reduction of 6 g a day and tripled with a reduction of 9 g a day. A conservative estimate indicated that a reduction of 3 g a day would reduce strokes by 13% and ischaemic heart disease by 10%. The effects would be almost doubled with a reduction of 6 g a day and tripled with a reduction of 9 g a day. Reducing salt intake by 9 g a day could reduce strokes by about a third and ischaemic heart disease by a quarter. Other recent meta-analyses studied smaller decreases in salt (2.0-2.3 g) and found less impressive effects.[12 13]

Thus, overconsumption of 9 g of salt could translate into an average increase in systolic blood pressure in those with hypertension of 11-17 mm Hg, with a diastolic increase of 6-10 mm Hg. In people with normal blood pressure, the estimated systolic increase is 5-11 mm Hg, and diastolic 3-5 mm Hg,[11] with the greatest rises predicted to occur in older people and in black people.[4] If people eat the meals served at the institutions we studied, they run an estimated increase in cardiovascular risk of 32-36% more deaths from stroke and 23-27% more deaths from coronary heart disease compared with people who adhere to the guidelines.[4 11]

Conclusions and policy recommendations

It is impossible for salt policy makers to adhere to their guidelines for salt intake if they eat the hot lunch provided in their workplaces. The mean salt content of the meal alone exceeded the total daily allowance, translating into up to a 36% increase in mortality compared with adherence to the guideline.

Details of the strengths and limitations of our study are in the appendix on bmj.com.

To comply with the recommendation to reduce salt intake, one needs to be first aware of it, then intellectually agree with it before deciding to adopt it and adhere to it.[15] The salient stakeholders pair high awareness, agreement, and adoption of the salt policy with power to change guidelines, a sense of urgency, and legitimacy to act.[7] Still, the salt policy makers' institutions do not adhere to the guidelines.

L M Brewster, senior research fellow, Department of Internal Medicine, Academic Medical Centre, University of Amsterdam, Meibergdreef 9, 1105 AZ, Amsterdam and Department of Vascular Medicine, Academic Medical Centre, University of Amsterdam, Amsterdam and Department of Social Medicine, Academic Medical Centre, University of Amsterdam, Amsterdam, Netherlands

C A Berentzen, research assistant, Department of Internal Medicine, Academic Medical Centre, University of Amsterdam, Meibergdreef 9, 1105 AZ, Amsterdam

G A van Montfrans, associate professor of internal medicine, Department of Internal Medicine, Academic Medical Centre, University of Amsterdam, Meibergdreef 9, 1105 AZ, Amsterdam and Department of Vascular Medicine, Academic Medical Centre, University of Amsterdam, Amsterdam

Correspondence to: L M Brewster **l.m.brewster@amc.uva.nl**

References, and strengths and limitations of our study, are in the version on bmj.com.

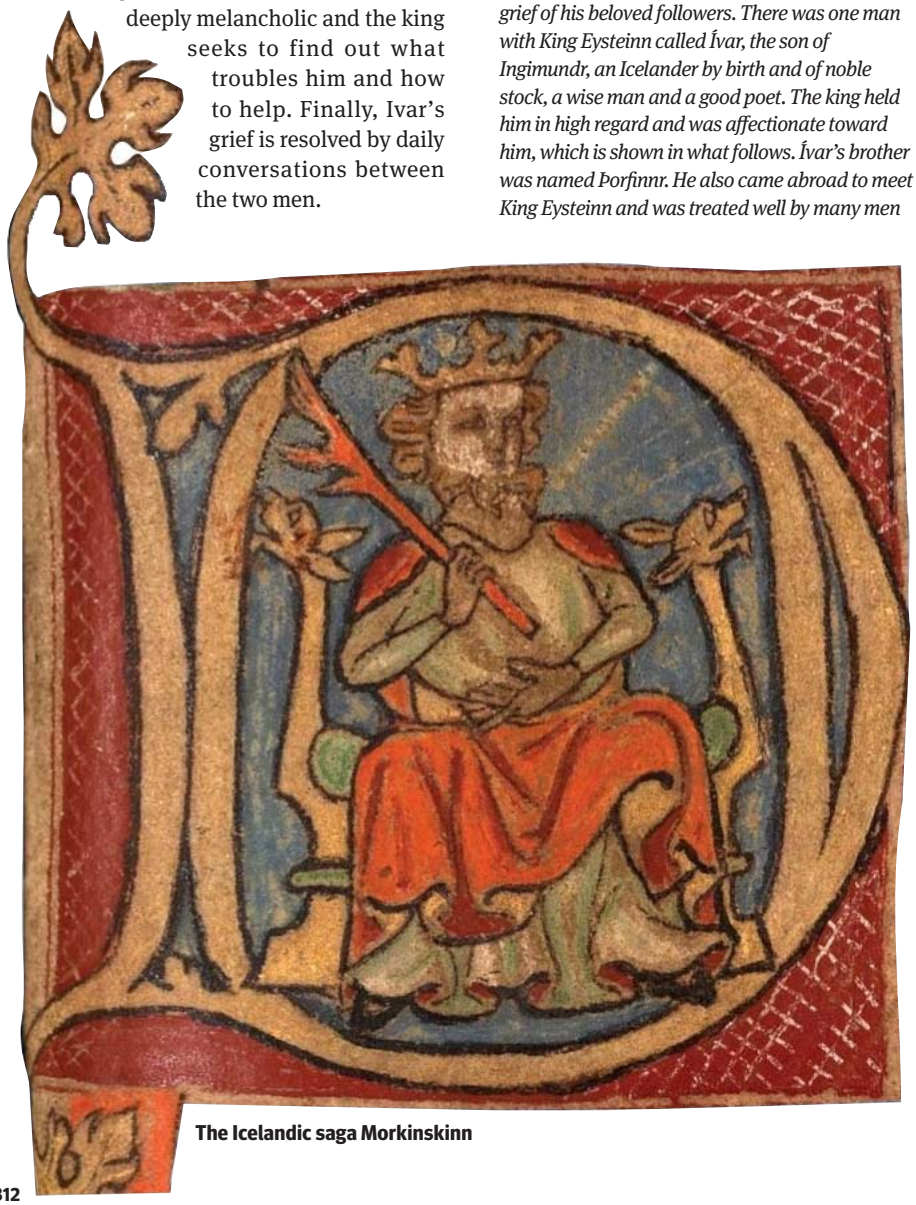
Cite this as: *BMJ* 2011;343:d7352

Royal road to healing: a bit of a saga

Linn Getz and colleagues describe how a Norwegian king beat Freud to the talking cure

In the face of another person's suffering, a listener can offer to be a competent, dedicated, and attentive co-thinker—not pretending to know the solution, but trusting the healing power inherent in an empathetic relationship.

In an atmosphere saturated with diagnostic labels, antidepressants, and standardised cognitive therapy schemes, we want to highlight the therapeutic potential of dialogue. We present an anecdote written around the year 1220 in the Icelandic saga Morkinskinna.[1-4] There, we meet the Norwegian king Eysteinn, who ruled in Norway 1103–1123, and an Icelandic skald (highly respected court poet), Ivar Ingimundarson. Ivar has become deeply melancholic and the king seeks to find out what troubles him and how to help. Finally, Ivar's grief is resolved by daily conversations between the two men.



The Icelandic saga Morkinskinn

To recognise patients as people

We often hear that medicine should be practised according to a "bio-psycho-social model,"[5 6] where patients are treated as "whole persons." However, personhood and subjective experience cannot easily be integrated with biomedical knowledge.[7] To engage with the unique suffering person can be demanding, but it is possible—and a privilege,[8-11] as this story shows. Here follows the complete anecdote about King Eysteinn and Ivar.

A timeless account of relational healing

In this part it is noted, as I am about to tell, what a glorious man King Eysteinn was, and how true a friend and how mindful he was in attending to the grief of his beloved followers. There was one man with King Eysteinn called Ívar, the son of Ingimundr, an Icelander by birth and of noble stock, a wise man and a good poet. The king held him in high regard and was affectionate toward him, which is shown in what follows. Ívar's brother was named Þorfinnr. He also came abroad to meet King Eysteinn and was treated well by many men based on his brother's reputation. But it weighed heavily on his mind that he enjoyed favour for his brother's sake and not his own, and he soon grew tired of serving under the king and prepared to return to Iceland. Before the brothers parted, Ívar asked Þorfinnr to carry a message to Oddný Jóansdóttir that she wait for his return and not marry; he estimated her the highest among all women. Then Þorfinnr left and had good voyage, and decided to ask for Oddný's hand for himself, and they married. Some time later Ívar arrived in Iceland and learned of this and he thought that Þorfinnr had acted badly towards him.

Bound by blood ties and codes of conduct, Ivar cannot publicly accuse his brother or seek revenge.

He [Ívar] was not at all settled and went back to the king thereafter, and was given good favour as before. Ívar now becomes very low spirited. The king noticed it and gathered Ívar to speak with him and asked him why he was so listless—"and when you were with us before we had much amusement from your words. And I did not broach this before because I did not know of anything I had done against you. You are such a wise man that you would not come forth with groundless suspicions, so tell me what it is."

Ívar answered: "That which is, my lord, I cannot say."

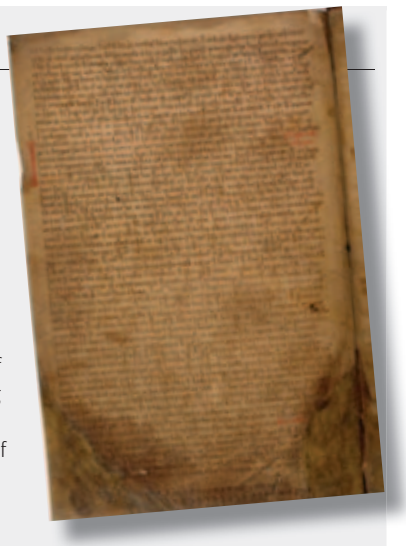
Although Ivar refuses to tell the reasons for his sadness, the king does not feel rejected.

The king said: "Then I will guess. Are there some men whom you do not like?" "It is not that, my lord," answered Ívar. The king said: "Do you think that I have given you less honour than you desire?" "That is not the case, my lord," he answered. "Have you seen some things," said the king, "in the country that disturb you?" He said "it is not that." "It is becoming difficult to guess," said the king, "do you want authority over some property?" He denied it. "Are there any women in your country," the king said, "that you could be missing?" He answered: "So it is, my lord."

At first, the king believes he can solve the problem by the use of power.

The king said: "You should not feel miserable about this. When spring comes you will return to Iceland. I will give you money and a letter with my seal for those men who decide these matters, and I do not know of any man that will not yield to either my kind messages or to my threatening words to give this woman in marriage. Ívar answered: "It cannot be so." The king spoke: "This is impossible," said the king; "As I further declare:

MORKINSKINNA—A KING'S SAGA WITH AN UNRULY TOUCH



Morkinskinna, which means "mouldy parchment," was originally the name of a book sent from Iceland to Copenhagen's Royal Library in 1662, where it is still preserved (numbered as 1009 fol). The saga was written in Iceland around the year 1220. It describes the history of the Norwegian kings from 1030 until 1157, when the text ends abruptly, as the last part of the manuscript has been lost. The author is unknown, but Morkinskinna was evidently a central source for the later and far more renowned saga Heimskringla.[4] A distinctive feature of Morkinskinna is its numerous inserted anecdotes. Many of these describe the relationship between a Norwegian king and an Icelandic guest or man of court. The literary format of Morkinskinna has long been considered unwieldy and of lesser quality than other more stringent sagas, but literary scholars have recently been captivated by its charm and distinctive human touch.[4]

though another man has the woman I can still get her for you, if I want." Ívar answered: "The case is worse than that, my lord. My brother is now married to the woman."

The king still cannot see the whole picture because he knows nothing about Ivar's request to his brother.

Then the king spoke: "Let us abandon this route," he said; "but I have a suggestion. After the Yule-celebration I will attend feasts, and you will come with me, and there you will see many courteous women; and if they are not of royal blood then I will get one for you." Ívar answered: "My lord, my case is even more difficult; whenever I see beautiful women then I am reminded of this woman, and my anguish grows even more."

The king said: "Then I will give you some authority and some property, as I offered you before, for your entertainment." He answered: "With this I do not feel content." The king said: "Then I should obtain for you some movable property, and you will go trading to whichever lands you want." He said he did not want that.

The king has now offered every possible remedy in his armamentarium of royal wealth and influence—but Ivar has still not been able to speak about the rage, shame, and powerlessness that render his distress so malignant.

Then the king said: "It becomes difficult for me now that I have tried my best; and now one last thing remains, insignificant compared to what I have already offered, although I do not know what the best remedy is. You will now each day, while the tables are set and I am not occupied with pressing issues, come and meet with me, and I will chat with you. We shall talk about this woman every way, as you like and may come to mind, and I will give my time to this, because it happens sometimes for a man that his torments are lifted after talking about them. And I will add to it that you will never go away empty handed from our meetings." Ívar answered: "This suits me, my lord, and thank you for your quest."

Having accepted that Ivar must find his own way, the king turns to a timeless concept of a therapeutic process. Presenting the patient with a gift after each session, however, is no longer in fashion. Perhaps it symbolises the king's awareness of being enriched by Ivar's confidence.

And now they arranged it so that regularly when the king is not dwelling on pressing issues he talks often with Ívar about this woman. This arrangement worked and Ívar's suffering was now relieved sooner than one could hope for. He became happier after this, returning to his normal self as before, entertaining and merry. And he remains with King Eysteinn.

Talk is medical work

The healing conversations between Ivar and King Eysteinn took place almost 800 years before Sigmund Freud in 1895, together with Joseph Breuer, formally presented the "talking cure." King Eysteinn's inquisitive style may not follow current advice regarding open, clinical communication. But it does build an elegant literary plot, which culminates beautifully, as the king abandons the idea that he can find the solution to Ivar's suffering and reveals his insight into the healing powers of a respectful human relationship.

Had Ivar been an ordinary man who came to see a doctor or psychologist nowadays, would he have been met with the same insistent attempt to understand his suffering?[12] The irresolvable conflict troubling Ivar's mind might have gone unnoticed. But it is this conflict, and not simply a "depression," that affects Ivar on all existential levels.[13 14]

Frontline researchers conceptualise depression as a "whole body disease."[15] Physiologically speaking, Ivar experiences allostatic overload. His body's adaptive, life preserving systems are likely to be damaged if the stress is not resolved.[16] The best way to help Ivar is to help him verbalise how deeply humiliated, deceived, and powerless he feels. By integrating the essence of the conflict into his biography, Ivar can reconcile and reorient himself,[17] thereby restoring his self respect and self esteem. The best facilitator in this healing process is a person whose reason, integrity, and authority Ivar truly respects.

The experience of care or neglect, trust or treachery, belonging or loneliness, power or powerlessness, fairness or unfairness, can maintain health or engender disease.[14] This rapidly emerging evidence sheds new light on Morkinskinna's old tale of talk as a royal road to healing.

Linn Getz associate professor, General Practice Research Unit, Department of Public Health and General Practice, Norwegian University of Science and Technology, 7491 Trondheim, Norway and Landspitali University Hospital, Reykjavik, Iceland **linn.getz@ntnu.no**
Anna Luise Kirkengen professor, General Practice Research Unit, Department of Public Health and General Practice, Norwegian University of Science and Technology, 7491 Trondheim, Norway and Institute of Community Medicine, University of Tromsø, Tromsø, Norway and Centre for Health Promotion, Akershus University Hospital, Lørenskog, Norway
Halfdan Petursson research fellow, General Practice Research Unit, Department of Public Health and General Practice, Norwegian University of Science and Technology, 7491 Trondheim, Norway
Johann A Sigurdsson professor, Department of Family Medicine, University of Iceland, Reykjavik and Centre of Development, Primary Health Care of the Capital Area, Reykjavik

The anecdote has been translated from Icelandic to English for this paper by Christopher Crocker in collaboration with the authors. We thank senior lecturer and reader in Old Icelandic literature at the University of Iceland Ármann Jakobsson for assistance.

References are in the version on bmj.com.

Cite this as: *BMJ* 2011;343:d7826

Good King Eysteinn