Weather, climate, and public health

F Ballester, P Michelozzi, C Iñiguez

Seasonal changes and the impact on public health

"Whoever would study medicine aright must learn of the following subjects. First he must consider the effect of each of the seasons of the year and the differences between them. Secondly he must study the warm and the cold winds, both those which are common to every country and those peculiar to a particular locality..."

Hippocrates, *"Airs, Waters, Places"*, 400 bc¹

"As important as the overall tendency toward global warming may be to human health, the effects of the extreme and anomalous weather that accompany it be even more profound"

Paul R Epstein, 2002²

Many texts concerning epidemiology and public health, especially those on health matters related to environmental factors, start by quoting words written by Hippocrates more than 2000 years ago. As we see in the quotation above, this wise Greek doctor considered seasonal changes as fundamental factors in the explanation of health phenomena occurrence. Twenty four centuries later this matter still creates great interest not only among researchers and health professionals, but also among decision makers and the general population. One of the main reasons for this is the growing worry concerning the potential impact on health of an increase of ambient temperature because of the process of "global warming".

The relation between environmental temperature and health has been known for a very long time. Various diseases and disorders such as heat stroke and hypothermia are directly linked with temperature extremes. Furthermore, the results of a number of investigations suggest that the relation between mortality and ambient temperature appears graphically as a "U" or "V" shape, with mortality rates lower on days in which the average temperatures range between 15°C to 25°C, rising progressively as the ambient

temperature becomes hotter or colder. Investigations carried out in a large number of cities have shown that the temperature level corresponding to the minimum mortality level varies from place to place and country to country according to the usual climate of each zone and probably reflect adaptations of the population to the usual range of temperatures. The greater part of mortality linked to heat occurs during the first days after temperature increase, while the effect of cold has been described as being prolonged for several weeks.^{3 4}

A fairly well studied phenomenon has been the seasonal variation in mortality. In fact, the periodic changes in weather conditions are a fundamental factor in determining the seasonal behaviour of some forms of illness. Cardiovascular and respiratory causes of death are those most strongly linked to changes in temperature; and elderly people and those with impaired health or suffering from poor social conditions are the most susceptible to the impact of weather changes. Typically, rates of mortality increase each winter, referred to as "excess winter mortality". Initially this phenomenon was related to influenza outbreaks but has become a major issue in Great Britain where estimates show that around 40 000 extra winter deaths occur every year.⁵ The results of these studies suggest that exposure to both heat and cold have an important and direct effect on daily mortality that, in the case of cold, can only partially be explained by influenza incidence.

Among the causes speculated to explain the impact of cold are socioeconomic, mainly housing conditions. However, results have been contradictory up to now. In this issue of the journal, Healy presents an interesting paper examining variations in winter excesses on mortality and some potential related factors in 14 European countries.⁶ One of the major findings, as was described in the Eurowinter study⁷ is that countries with mild climates (as southern ones) show higher levels of excess winter deaths. Following the results from the authors, socio-

economic conditions and housing standards could play an important part in explaining these differences.

Previous articles do not find any association with deprivation indices^{6 8 9} although this could be attributable to methodological problems such as the ecological design that many of these studies have, or the low sensitivity of the indices used to discriminate social conditions or housing standards. On the other hand, there is greater evidence that some housing conditions, especially the presence of central heating and insulating systems may play an important part as far as protection is concerned. A recent report has showed a substantially greater winter excess mortality in people living in colder homes in England.¹⁰ This evidence has increased the development of different programmes to improve heating systems in homes having heating deficiencies in the United Kingdom.¹¹ Together with housing standards, other authors have highlighted the importance of clothes and the type of activity that people perform outdoors.^{7 12}

On the other hand, so called "heat waves" have been linked with increases in mortality, most notably due to cardiovascular and respiratory causes. The effects of a heat wave are more notorious at the start of summer, when vulnerable people have not had enough time to acclimatise themselves to the high temperatures,¹³ and could be explained, in a substantial part, as a harvesting effect, that is to say: a temporal displacement in the occurrence of death among frail people.³ Home air conditioning has been described as an important factor alleviating the impact of high temperatures.¹⁴

As well as temperature, the possible interaction with mortality of other meteorological phenomena such as humidity or wind has also been mentioned. These factors are usually treated as individual variables within the model, but also variables or indices that combine the most important element—temperature—with other meteorological variables are used (for example, dew point, "apparent temperature" index). Furthermore, a more holistic approach (the so called: synoptic approach) considering city specific climatic categories has been proposed.¹⁵

Because most of the studies examining the impact of weather on health are time series analyses, some methodological problems must be considered. Besides their ecological nature, one problem in these studies could arise from the fact of differential population being at risk in different months. That is, it is possible that fewer residents are in the city during the summer months.

This bias may be differential if the rate between the summer population and the winter population changes in the groups being compared (wards, cities, countries; ages, social classes). On the other hand, concern has been raised on the possibility that weather and air pollution are confounders. This criticism is crucial for the "weaker" predictor, air pollution. In this sense, a number of studies have proved the independent effect of air pollutants on health using different approaches for weather adjustment.¹⁶⁻¹⁷

Several public health actions have been proposed to prevent negative health effects of temperature such as educational programmes to produce behavioural changes in the population (clothing, to limit time spent outdoors, adequate drink/food), social measures (home insulation, adequate domestic heating/air conditioning), and sanitary measures (advice to prepare emergency services, hospitals, and general practitioners for an increase in demand for services).

In large metropolitan areas in the United States, health watch warning systems, based on a synoptic approach and on forecast meteorological variables to predict and to alert city's residents of dangerous weather conditions during summer are applied,¹⁸ but have not been experimented with until now in European cities. These systems integrated with intervention activities (increasing emergency medical services, alerting groups of volunteers, guidelines for policy makers, and for specific subgroups of the population to avoid heat related illnesses) could be effective in reducing heat related mortality, and further studies to demonstrate the health benefits of these systems are needed.

The definition of public health programmes to prevent heat and cold related mortality needs further research to clarify: (1) the population at risk (elderly people, persons with cardiovascular and respiratory diseases, low social class groups, characteristics of the area of residence); (2) the lag time of the effect (few days, within one week, more than one week); (3) the effect on cardiovascular and respiratory morbidity (for example, analysing hospital admissions data); (4) the role of respiratory infections; (5) the significance of other meteorological variables (humidity, atmospheric pressure, wind, precipitation).

In conclusion, future epidemiological research that focuses on these specific questions will provide a more accurate measure of the full health impact and will assist in improving public health measures and mitigation actions to prevent heat and cold related health effects.

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REFERENCES

- 1 Lloyd GER, ed. *Hippocratic writings*. Harmondsworth, England: Penguin, 1978.
- 2 Epstein PR. Climate change and infectious disease: stormy weather ahead? *Epidemiology* 2002;13:373-5.

- 3 Braga AL, Zanobetti A, Schwartz J. The time course of weather-related deaths. *Epidemiology* 2001;12:662-7.
- 4 Huynen MM, Martens P, Schram D, et al. The impact of heat waves and cold spells on mortality rates in the Dutch population. *Environ Health Perspect* 2001;109:463-70.
- 5 Aylin P, Morris S, Wakefield J, et al. Temperature, housing, deprivation and their relationship to excess winter mortality in Great Britain, 1986-1996. *Int J Epidemiol* 2001;30:1100-8.
- 6 Healy JD. Excess winter mortality in Europe: a cross country analysis identifying key risks factors. *J Epidemiol Community Health* 2003;57:784-9.
- 7 The Eurowinter Group, Donaldson GC, Keatinge WR. Cold exposure and winter mortality from ischaemic heart disease, cerebrovascular disease, respiratory disease, and all causes in warm and cold regions of Europe. *Lancet* 1997;349:1341-6.
- 8 Shah S, Peacock J. Deprivation and excess winter mortality. *J Epidemiol Community Health* 1999;53:499-502.
- 9 Lawlor DA, Maxwell R, Wheeler BW. Rural, deprivation, and excess winter mortality: an ecological study. *J Epidemiol Community Health* 2002;56:373-4.
- 10 Wilkinson P, Landon M, Armstrong B, et al. *Cold comfort: the social and environmental determinants of excess winter deaths in England, 1986-96*. London: The Policy Press, 2001.
- 11 Olsen ND. Prescribing warmer, healthier homes. *BMJ* 2001;322:748-9.
- 12 Donaldson GC, Tchernjavskii VE, Ermakov SP, et al. Winter mortality and cold stress in Yekaterinburg, Russia: interview survey. *BMJ* 1998;316:514-18.
- 13 Diaz J, Jordan A, Garcia R, et al. Heat wave in Madrid 1986-1997: effects on the health of the elderly. *Int Arch Occup Environ Health* 2002;75:163-70.
- 14 Curriero FC, Heiner KS, Samet JM, et al. Temperature and mortality in 11 cities of the eastern United States. *Am J Epidemiol* 2002;155:80-7.
- 15 Kalkstein LS. A new approach to evaluate the impact of climate on human mortality. *Environ Health Perspect* 1991;96:145-50.
- 16 Samet JM, Zeger S, Kelsall J, et al. Does weather confound or modify the association of particulate air pollution with mortality? An analysis of the Philadelphia data, 1973-1980. *Environ Res* 1998;77:9-19.
- 17 Pope CA, Kalkstein LS. Synoptic weather modelling and estimates of the exposure-response relationship between daily mortality and particulate air pollution. *Environ Health Perspect* 1996;104:414-20.
- 18 Kalkstein LS, Jamason PF, Greene JS, et al. The Philadelphia hot weather-health watch/warning system: development and application, summer 1995. *Bulletin of the American Meteorological Society* 1996;77:1519-28.

Iraq

Iraqi reconstruction: for an empowerment process

V Ridde

Humanitarian assistance in Iraq after the conflict

Between my missions in Iraq in 1994/95 and the latest in May 2003, the health of the Iraqi population has dramatically deteriorated¹ and what little remained of the health-

care system no longer exists. Total chaos reigns, healthcare centres have been looted,² and patients are not receiving treatment. Twenty million dollars per month would be needed to revive the

system.³ But for it to operate effectively, it is necessary to first reconstruct it. The purpose of this paper is to stimulate a debate on the possible effects of the current process of humanitarian assistance in Iraq, in which non-governmental organisations (NGOs) are involved, because it is necessary to meet the needs of the Iraqi people in an appropriate way.⁴

For some time now, humanitarian actors have been alarmed at the confusion that results from military implementation of humanitarian projects. When American forces bombarded Afghanistan in 2001, with grenades accompanied by daily food rations and medicines, NGOs drew attention to this possible confusion.⁵ On the other hand,

the humanitarian agencies are not exempt from reproaches (for example, their links with the war⁶ or the harmful effects of their interventions⁷). In Iraq, the English-American occupying power* granted itself the right to run the country. Hence, they have taken on the major responsibility for providing security and covering the basics needs of the Iraqi population.

NGOs and United Nations agencies working in Iraq have to deal with these new actors today. The challenges of doing so are immense, because of the great confusion surrounding the role of the occupying power: "US-led reconstruction is starting out in something of a historical vacuum". (page 2)⁸ As a result, the armed forces have established the Office of Reconstruction and Humanitarian Assistance (ORHA). Yet NGOs know nothing about this organisation. After insisting for a long time, as of the end of May, the new coordination body of NGOs (NCCI) had still not managed to obtain an information meeting about the ORHA's role and mandate. The occupying power maintains confusion by continuing to create new authorities, bodies, and daily meetings. Some NGOs have decided to work in total collaboration with the US military. They are considered "embedded" by other NGOs. In our view, we feel that such collaboration undermines the independence of NGOs and their various codes of ethics.^{8,9} The meaning of accepting financing grants from the American government (USAID) is different when one collaborates with an occupying army, when the money is given to one by someone in combat uniform† and when one acts as a contractor according to the modalities defined by the latter.

In our view, the current reconstruction process is not adequate. In a post-conflict situation, it is necessary to

coordinate assistance¹⁰ but also to favour the appropriation of change and the empowerment of individuals, communities, and organisations.^{11,12} It is particularly true for Iraq where the regime in power has always controlled all structures and systems and forbidden any personal initiative. The problem of nursing is a good illustration of this inappropriate process. The healthcare system is still based primarily in hospitals. There is an insufficient number of nurses, the quality of care they provide is inferior, and this profession is depreciated. To tackle these problems, two American military (nurses) were mandated (ordered?) to help the ministry to reorganise nursing care and training programmes. The interested NGOs are invited to participate. When military personnel arrive for meetings, they are adorned with their bullet proof jackets and M16s. They have downloaded training programmes on the internet and distributed them. After some days in Iraq, a member of an embedded NGO wrote to the ministry staff the *Iraqi Plan for Nursing Development*.

Not only is it necessary to be careful when promoting the training projects but especially important to act in a different way. At first, we believe that reflection concerning the reorientation of nursing has to be part of a more global discussion of the reform of the health system (that is, directed to primary health care). Then, it is necessary for NGOs to keep their critical role in the face of the reconstruction of a country by occupying forces and in the face of the importation of the Western biomedical model. Finally, the process of rehabilitation must be participatory and bottom up; considering capacities, values, and faiths of the population. To organise a consultative national forum of nursing is not enough, it is necessary that all actions reflect a will to empower professionals, population, and organisations more. It is necessary to plan reconstruction with the aim of social change¹³ and not simply for technical reasons. Individuals and organisations

in Iraq have to become aware that they have a window of opportunity to decide on their fate. To be able to act so is certainly not the culture conveyed in military academies.

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REFERENCES

- 1 Ali MM, Shah IH. Sanctions and childhood mortality in Iraq. *Lancet* 2000;355:1851-7.
- 2 Kapp C. Anarchy pushes Iraqi health system to brink of collapse. *Lancet* 2003;361:1351.
- 3 WHO. A simple but ambitious plan: \$20 million to jump start the Iraqi health system. Geneva/Bagdad: WHO, 2003:2.
- 4 Barr DA, Miranda JJ. Iraq: time to focus our response. *J Epidemiol Community Health* 2003;57:395-6.
- 5 MSF. Médecins Sans Frontières dénonce la coalition militaire-humanitaire. (<http://www.paris.msf/Contents/News.nsf/0/aa6bb781ed2e3b988c125ae200584dff?OpenDocuments>).
- 6 Pérouse de Montclos M-A. L'aide humanitaire, aide à la guerre. Brussels: Complexe, 2002:205.
- 7 Ridde V. L'aide humanitaire et la santé de la population afghane sous le régime des Talebân. In: Conoir Y, Vera G, eds. *L'action humanitaire au Canada. Histoire, concepts, politiques et pratiques de terrain*. Québec: Presses de l'Université Laval, 2002:545-66.
- 8 van den Berg R, Dabelstein N. *Iraq and rehabilitation. Lessons from previous evaluations*. London: OECD/DAC Network on Development Evaluation, 2003:8.
- 9 Sphere. *Charte humanitaire et normes minimales à respecter lors des interventions en cas de catastrophe*. Geneva: Sphere, 2000:323.
- 10 Lanjouw S, Macrae J, Zwi AB. Rehabilitating health services in Cambodia: the challenge of coordination in chronic political emergencies. *Health Policy and Planning* 1999;4:229-42.
- 11 Laverack G, Labonte R. A planning framework for community empowerment goals within health promotion. *Health Policy and Planning* 2000;15:255-62.
- 12 Ninacs WA. *Types et processus d'empowerment dans les initiatives de développement économique communautaire au Québec*. [PhD thesis]. Québec: Ecole de service social, Université Laval, 2001:313.
- 13 Blum H. *Planning for health, generics for the eighties*, 2nd edn. New York: Human Science Press, 1981:462.

*So named according to the terminology of international law and the Geneva Conventions

†This point was raised by the general director of the NGO "Aide Médicale Internationale"

Whose health is it anyway?: enabling participation

E Russell, C Smith

Public and patient participation in the healthcare decision making process.

Current policy rhetoric promises the public and patients wider participation in decisions about health care, and in the research that informs it, with an implication that participation is likely to generate substantial health benefits. However, it is not yet clear what can be done to make it happen effectively.

The British National Health Service (NHS) was built on an ethos of community spirit, solidarity, and sharing. Current media coverage suggests that this ethos has now been replaced by individualism and the blame culture for which Britain is now rightly infamous. As a result, the focus of participation seems to have become complaint rather than constructive debate. Compensation for adverse events that occurred when the risks were unknown has been described as a "moral right" (M Smith (Scottish Health Committee Chair), BBC Radio Scotland, Thursday 9 Jan 2002). Yet there is no logical or ethical leap from individual freedom to be healthy to a societal obligation to provide the services that might improve that health. A screening test that, by definition, does not provide certainty leads to accusations of negligence by the screeners when false negatives become known. The drive to report "medical error" and the National Patient Safety Association are two of the manifestations in 2001 that reflect the government's moves to deal with the loss of trust and respect that has been so loudly expressed.

It should not be denied that mistakes and adverse events occur, but the current response to them fails to acknowledge that risk is a part of all aspects of life including science and medical care, and especially at the cutting edge of new techniques before they have been observed in practice. This sets a false basis for any discussion. If the aim of greater involvement of patients in care and of the public in decision making is cooperation and shared decision making then an adversarial position is an inappropriate first step. There is a real possibility that such participation will simply be regarded as

Key points

- The policy emphasis on public and patient participation is widely welcomed.
- However, if it is to be real then its effects on planning and priority setting must be accommodated.
- Mutual respect is the key to effective involvement at both individual and health system levels.

a right through which individual special interests can prevail, rather than as a path to mutual and common understanding of health issues and priorities.

A symposium in Aberdeen last year brought together some relevant perspectives to address the question, "Whose health is it anyway?" The main conclusion was that, until relationships between doctors and patients, between health systems and the public, between researchers and researched, become more honest and, crucially, respectful, there is not going to be much progress towards the 21st century paradigm of participation that is internationally espoused in recent legislation. So how can mutual respect be established? The starting point of the symposium was to try to understand what was undoubtedly a marked change in the relationship between medicine and its users during the 20th century. Kenneth Boyd, in a superb analysis of the doctor-patient relationship since the time of Hippocrates, noted that participation in health is hardly a new idea. Hippocrates said "It is not enough for the physician to do what is necessary, but the patients and the attendants must do their part as well and circumstances must be favourable".¹ This was said in the context of the need to establish a "therapeutic friendship between strangers", a need that was the stimulus to develop medical ethics as we still know it. Boyd argues that this "therapeutic friendship" was severely challenged in the 18th and 19th centuries by the creation

of a tacit contract between patients and hospital doctors to exchange taking part in experimental medical technology for the possibility of new benefits to their personal health. Anecdote suggests that this tacit contract, based on the hope of a win-win outcome, continued until the second half of the 20th century, when access to health care became an expectation and the success of medical science, in the media and the public mind, became a certainty not a hope. We forgot the end of the Hippocratic definition of medicine, which says: "knowing that everything is not possible to medicine".² In the view of the majority, who are healthy, medical care has become something that in the UK we have on tap, that we have a right to use when we need it, and that will make us better. Although sometimes when one became a patient (or close to a patient) the perception of absolute access and absolute certainty began to waver, it is only very recently that this perception is more widely expressed.

Trust in the NHS has had two very important effects for public health. Firstly, on prevention, if you believe that rescue is available and effective there is little need to invest in prevention, or to vote to ensure that there is enough rescue to go round. Secondly, the fact that in society as a whole solidarity is being eroded by individualism has led to a failure to recognise that giving everybody the same as each of us wants individually from the NHS adds up to a lot of resource. And again the professions have been no different from the public, as Alan Maynard was not slow to highlight at the Aberdeen symposium. Those who can use evidence based medicine have the strongest card in the pack for their particular funding need to be met without comparison with the needs of others. On all counts, there was unanimity that unless a more honest relationship between government, the NHS, public health, and the public is opened up soon then there is very little hope of achieving effective participation in health related decisions, whether individual or communal.

Easily said, but everyone recognised that this will be a long slow and sometime difficult process. Nick Partridge, who chairs the Consumers in NHS Research group, showed with examples how participation can help both service and research to become more relevant and effective. The first task of that group was to recommend how consumer involvement could be enhanced at each stage of the research and development (R&D) process. The consumers said that they found it hard to get involved because they did not understand the structures. Slowly,

however, by clarifying the different parts that consumers might play at successive stages of R&D, and by training them for the task, their involvement is “reaching audiences that other researchers just can’t reach”. But it takes time, information, and respect to empower consumers to play a part. And it may be most difficult for medical doctors, as Sarah Stuart-Brown pointed out. Years of being trained that one’s role is to take responsibility for other people’s wellness is extremely difficult to reverse when it comes to trying to empower, to enable, to share, and to compromise with what your consumers want.

So the issue really is, how do we enable people to have realistic expectations of their health care and how do we then deliver a health service that meets these expectations? Workshop participants at the symposium recognised that there are many different publics. Rather than seeking a single “public” value for something, planners and researchers should accept and adapt to the fact that people value interventions differently when they are well to when they are ill, and that professionals sometimes reflect their own values as patients as well as practitioners. Honesty and explicitness—currently sadly lacking in

government and service pronouncements about the NHS—require open discussion of rationing, and negotiation on the basis of values and expectations of (sometimes uncertain) outcomes. However, planners and researchers, especially in public health, must be aware that gesture politics to involve potential end users could be counter-productive if the latter’s views were blatantly ignored. We could learn from non-health state bodies about how honestly and productively to move forward, and it should be expected that as a result of involvement both public health and research goalposts would move. The practical challenge is how to give people the information they need to enable them to discuss their expectations and then, crucially, to see that the system meets the expectations that emerge. Both individuals and the health system must respect people’s views and work to earn their respect in return. It will be slow, but it needs to begin; if ever there was an issue that epitomises the tension for public health between advocacy and meeting needs, it is participation in health.

The context of the symposium was the NHS of the United Kingdom. The principles are likely to be relevant to other publicly funded health systems. In the private sector the community and the consumer become the customer. North American total quality management and continuous quality improvement programmes derived from commercial and industrial settings depend on customer satisfaction and feedback to drive improvements in quality of care. Community and patient participation in the developing world is encouraged by bilateral and multilateral funding agencies who require such participation as a condition for the development of funding application. However, it is as yet unclear in

developing countries to what extent such participation improves health and health care, but then that is also true in the developed world.³ This lack of evidence is not the same as absence of effect. Healthcare providers need to enable participation by patients and by communities as a matter of accountability to those for whom the service is provided, who in many countries also fund the service.

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REFERENCES

- 1 Lloyd GER, ed. *Hippocratic writings*. London: Penguin Classics, 1983:206.
- 2 Lloyd GER, ed. *Hippocratic writings*. London: Penguin Classics, 1983:139–47.
- 3 Crawford MJ, Rutter D, Manley C, et al. Systematic review of involving patients in the planning and development of health care. *BMJ* 2002;325:1263–5.

Policy implications

- Invitations to communities and public to participate in decision making about health care will be counterproductive unless they carry a commitment of time and effort to allow people to feel that they are active partners, and unless policies and plans are open to change as a result of their contribution.

Osteoarthritis

Shoes and lower limb osteoarthritis

E Pascual

Is there an association?

Osteoarthritis (OA) is among the most common types of joint disease and a frequent cause of pain and physical disability. It is the fourth most frequent predictor of health problems worldwide in women, and the eighth in men¹; in countries such as the United States, United Kingdom, or

Canada its total economic costs have been estimated as 2% of the gross national income, second only to cardiovascular diseases.² OA is now considered as a dynamic process in which what appears to be the consequences of the older idea of mechanical wear and tear of the joint coincides with remodelling

Key point

- Different mechanical factors weigh heavily in the development and progression of bearing weight joints in osteoarthritis, and also in the occurrence of symptoms in this condition, for which treatment is essentially symptomatic. Chances are that specific shoes, by modifying these factors, are likely to result in symptom reduction and decrease in the need for medication. Research in this field to produce evidence seems to be worthwhile.

of joint structures, increased cartilage turnover, incomplete repair and new bone formation, more marked in the joint margins.^{3,4} Joints at the lower extremity, mainly knees and hips, are frequently affected in primary OA, resulting in various degrees of walking pain and difficulty. Although the causes of primary OA remain undefined, it is well established that mechanical factors play an important part in its development and progression. Obesity is an important risk factor for symptomatic knee OA,⁵ and both men and women with a body mass index of 30 to 35 have a fourfold increase of knee OA compared with normal weight controls.⁶ Prospective data on women suggest that the risk for known OA increases by about 15% per each kg/m² of body mass index above 27, and that reduction of a similar weight resulted in a similar decrease of incident knee OA,⁷ proving that this is a modifiable factor. At the knee, being overweight is also a risk factor for the development of OA at the patellofemoral compartment.^{8,9} Besides, longitudinal studies suggest that obese people with knee OA have a higher risk of experiencing disease progression than thinner people.¹⁰ The association between hip OA and overweight is not as strong as that of knee OA; in general the studies focusing on radiological hip OA have been inconsistent, while those reporting on symptomatic hip OA have in general found association.¹¹ Weight can act on the bearing joints through the obvious mechanism of increasing the forces across the bearing joint, but also the bearing force carried by the knee and hip joints during walking is two to three times the body weight,¹² and in the case of overweight the multiplied extra weight is a substantial added burden.

It seems that overcoming the mechanical tolerance of weight bearing joints—probably by damaging some of their less tolerant structures—is an important risk factor for OA. It is not surprising that the risk of knee OA is doubled by having a job involving at least medium physical demands and knee bending compared with a sedentary job.¹³ Increased risk for OA of the knee in persons with activities that entail repeated knee bending or squatting have also been found by others.^{14,15} There is a link between knee injury and OA,^{16,17} also found at the hip joint.¹⁶ Other data support the importance that mechanical factors seem to have for the incidence and progression of OA, such as knee alignment,¹⁸ or having suffered an open meniscotomy.¹⁹ The relevance of mechanical factors in the develop-

Policy implications

- It seems worthwhile to support research aimed at the development and testing of shoes designed to decrease the impact on the joints of the lower limb when walking or standing, or to correct specific alignment or mechanical alterations.

ment of knee OA justify the search of a possible relation between this condition and a long history of high heel shoes wearing, as carried out in the paper by Dawson *et al* printed in this issue of the journal,²⁰ although such a relation was not found. Of interest, persons with lower bone mineral density osteoporosis have less OA in knees and hips than those with higher bone mass^{21,22}; this may be attributable to differences in mechanical stress through the bearing joints, and it has been suggested that more stiff subchondral bone with less deforming capacity under loading may lead to easier cartilage damage.²³ OA affects preferentially to persons in the later stages of life and is a common cause of pain and infirmity for them. The reasons probably include factors other than accumulated work on the bearing joints such as the increased vertical impact of the feet by walking in this age group,²⁴ declines in balance and lower extremity strength of older people with chronic knee pain,²⁵ decreased muscular strength at the leg muscles,²⁶ or a combination of all.

The goals in the management of OA are limited to symptom control to make the disease tolerable; it has to be kept in mind that for the patient the problem is not OA itself, but its symptoms.²⁷ Surgical salvage procedures in some joints—such as the hip and knee—can be used when symptom control fails. The attempts to pharmacologically modify the disease progress have not produced substantial results so far. Analgesics and non-steroidal anti-inflammatory drugs (NSAIDs) are widely used for this condition; because of the high prevalence of OA—and thus the size of the market—pharmaceutical companies have maintained efforts to develop new more effective or better tolerated drugs, and this has resulted in an important number of controlled studies and continuous attention to this essentially symptomatic therapeutic approach. The action of analgesics and NSAIDs on joint pain is quite independent of the mechanism of pain; one of the reasons for the success of these

drugs in OA results from their efficacy relieving joint pain with independence of its cause. The origin of pain in the OA joint is poorly understood; a joint such as the knee may be affected by OA in different areas, and pain probably arises through different mechanisms—possibly related to the different ways in which a joint can be mechanically changed. In weight bearing joints, and particularly in the knee, symptomatic improvement also results from measures that decrease the load on the affected joint, such as weight reduction,⁷ or the simple use of canes, crutches, or walkers. Also patients generally note that pain increases with the use of the affected joint and may report that pain worsens if they carry weight, or when they gain it. Occasionally patients may report that comfortable shoes may reduce their symptoms. Shoes may help through different mechanisms, such as reducing the vertical impact of the feet, which is increased in older people,²⁴ acting as shock absorbers—as some sports shoes do—, helping to improve the balance, which is reduced in older people with knee pain,²⁵ or modifying the ways in which joints change. Wedged insoles have been found to reduce the load of the medial knee compartment²⁸—the most frequent location of OA in this joint—, and randomised controlled studies have resulted both in failure²⁹ and confirmation³⁰ of the symptomatic effect of this intervention. Shoes have received very little formal attention as therapeutic measures for symptomatic knee or hip OA. If one considers the relevance that mechanical factors have on the development and progression of OA and in the presence of symptoms in the affected joints, it seems worthwhile to evaluate whether shoes—by modifying mechanical factors—may result in lessening of the symptoms and perhaps disease progression. Indeed, ingenuity is needed to develop properly designed trials to produce evidence of the benefits of shoes if there is any. Also better understanding of the mechanisms of pain in OA of knee and hip appear necessary, as well as a possibility of grouping the patients according to the overcharged or overstressed structure or structures from which the pain may arise, in order to design the shoes accordingly. But in the end, if shoes prove useful in reducing the symptoms of some types of lower limb—or perhaps lower spinal—OA, and the use of drugs for this aim can be reduced, the benefit will doubtless be for all of us.

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REFERENCES

- Murray JL, Lopez AD eds. *The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injury and risk factors in 1990 and projected to 2020*. Cambridge, MA: Harvard University Press, 1996.
- Badley EM. The economic burden of musculoskeletal disorders in Canada is similar to that for cancer, and may be higher. *J Rheumatol* 1995;**22**:204–6.
- Brandt KD, Lohmander LS, Doherty M. Pathogenesis of osteoarthritis: the concept of osteoarthritis as failure for the diarthrodial joint. In: Brandt KD, Lohmander LS, Doherty M, eds. *Osteoarthritis*. Oxford: Oxford University Press, 1998:70–4.
- Felson DT, Lawrence RC, Dieppe PA, et al. Osteoarthritis: new insights. Part 1: the disease and its risk factors. *Ann Intern Med* 2000;**133**:635–46.
- Felson DT, Chaisson CE. Understanding the relationship between body weight and osteoarthritis. *Baillieres Clin Rheumatol* 1997;**11**:671–81.
- Anderson JJ, Felson DT. Factors associated with osteoarthritis of the knee in the First National Health and Nutrition Examination Survey (NHANES 1): evidence for an association with overweight, race and physical demands of work. *Am J Epidemiol* 1988;**128**:179–89.
- Felson DT, Zhang Y, Hannan MT, et al. Risk factors for incident radiographic osteoarthritis in the elderly: the Framingham study. *Arthritis Rheum* 1997;**40**:728–33.
- McAlindon T, Zhang Y, Hannan M, et al. Are risk factors for patellofemoral and tibiofemoral knee osteoarthritis different? *J Rheumatol* 1996;**23**:332–7.
- Manninen P, Riihimäki H, Helivaara M, et al. Overweight, gender and knee osteoarthritis. *Int J Obes Relat Metab Disord* 1996;**20**:595–7.
- Dougados M, Gueuguen A, Nguyen M, et al. Longitudinal radiologic evaluation of osteoarthritis of the knee. *J Rheumatol* 1992;**19**:378–83.
- Felson DT, Chaisson CE. Understanding the relationship between bodyweight and osteoarthritis. *Baillieres Clin Rheumatol* 1997;**11**:671–81.
- Schipplein OD, Andriacchi TP. Interaction between active and passive knee stabilizers during level walking. *J Orthop Res* 1991;**9**:113–19.
- Felson DT, Hannan MT, Naimark A, et al. Occupational physical demands, knee bending, and knee osteoarthritis: results from the Framingham Study. *J Rheumatol* 1991;**18**:1587–92.
- Kivimäki J, Riihimäki H, Hanninen K. Knee disorders in carpet and floor layers and painters. *Scand J Work Environ Health* 1992;**18**:310–16.
- Coggon D, Croft P, Kellingray S, et al. Occupational physical activities and osteoarthritis of the knee. *Arthritis Rheum* 2000;**43**:1443–9.
- Gelber AC, Hochberg MC, Mead LA, et al. Joint injury in young adults and risk for subsequent knee and hip osteoarthritis. *Ann Intern Med* 2000;**133**:321–8.
- Cooper C, McAlindon T, Snow S, et al. Mechanical and constitutional risk factors for symptomatic knee osteoarthritis: differences between medial tibiofemoral and patellofemoral disease. *J Rheumatol* 1994;**21**:307–13.
- Sharma L, Song J, Felson DT, et al. The role of knee alignment in disease progression and functional decline in knee osteoarthritis. *JAMA* 2001;**286**:188–95.
- Roos H, Lauren M, Adalberth T, et al. Knee osteoarthritis after meniscectomy: prevalence of radiographic changes after twenty-one years, compared with matched controls. *Arthritis Rheum* 1998;**41**:687–93.
- Dawson J, Juszczak E, Thorogood M, et al. An investigation of risk factors for symptomatic osteoarthritis of the knee in women using a life course approach. *J Epidemiol Community Health* 2003;**57**:823–30.
- Hart DJ, Mootoosamy I, Doyle DV, et al. The relationship between osteoarthritis and osteoporosis in the general population: the Chingford Study. *Ann Rheum Dis* 1994;**53**:158–62.
- Sowers M, Lachance L, Jamadar D, et al. The associations of bone mineral density and bone turnover markers with osteoarthritis of the hand and knee in pre- and perimenopausal women. *Arthritis Rheum* 1999;**42**:483–9.
- Radin EL, Paul IL, Rose RM. Role of mechanical factors in pathogenesis of primary osteoarthritis. *Lancet* 1972;*i*:519–22.
- Robbins S, Waked E, Krouglicof N. Vertical impact increase in middle age may explain idiopathic weight-bearing joint osteoarthritis. *Arch Phys Med Rehabil* 2001;**82**:1673–7.
- Messier SP, Glasser JL, Ettinger WH Jr, et al. Declines in strength and balance in older adults with chronic knee pain: a 30-month longitudinal, observational study. *Arthritis Rheum* 2002;**47**:141–8.
- Slemenda C, Brandt KD, Heilman DK, et al. Quadriceps weakness and osteoarthritis of the knee. *Ann Intern Med* 1997;**127**:97–104.
- Hadler NM. Knee pain is the malady—not osteoarthritis. *Ann Intern Med* 1992;**116**:598–9.
- Kerrigan DC, Lelas JL, Goggins J, et al. Effectiveness of a lateral-wedge insole on knee varus torque in patients with knee osteoarthritis. *Arch Phys Med Rehabil* 2002;**83**:889–93.
- Maillefert JF, Hudry C, Baron G, et al. Laterally elevated wedged insoles in the treatment of medial knee osteoarthritis: a prospective randomised controlled study. *Osteoarthritis Cartilage* 2001;**9**:738–45.
- Toda Y, Segal N. Usefulness of an insole with subtalar strapping for analgesia in patients with medial compartment osteoarthritis of the knee. *Arthritis Rheum* 2002;**47**:468–73.