

## Evolution of cardio-vascular risk factors – light at the end of the tunnel?

The striking and essentially epidemic patterns of cardiovascular diseases (CVD) over the last half century in particular present a major public health challenge, in both explanatory and intervention terms. Age specific mortality trends have been falling in the United States of America and Australia for over 30 years and in most countries in Western Europe, more recent trends have been similar. The phenomenon of recent years has been the apparent change in patterns associated with the political upheaval in Eastern Europe. As Marmot and Bobak show [1], life expectancy has been improving continuously in Western European countries since 1970 but not so in Eastern Europe. Much of this is attributable to diseases in middle age, particularly of the cardiovascular system. This seems not to be an artifact of record keeping or attributable primarily to changes in treatment. The most currently available total and disease specific mortality trends from the World Health Organisation CINDI (country wide integrated non-communicable diseases intervention) project show remarkable patterns globally in keeping with previous evidence. In the period between 1985 and 1997 across 26 CINDI centres, all eight of the Western European Union countries and Canada have shown a consistent decline in total and cardiovascular mortality trends, the picture in former European Communist countries has been more mixed, with overall recent improvements in the Czech Republic and Poland and a continuing poor or deteriorating picture in Russia and the other participating former USSR block countries [2].

An apparent improvement in age specific mortality rates does not mask the fact that, due to an ageing population, coronary heart disease (CHD) is the largest single killer in adults throughout the developed world, and is an emerging problem throughout the developing world. While there have been secular declines in rates of both coronary heart disease and stroke, evidence suggests that the risk factor profile of these two conditions is different, stroke mortality being more highly related to arterial blood pressure than cholesterol profile [3]. Moreover, the incidence rates of CHD in particular may not necessarily be following the same pattern as mortality, since treatment undoubtedly has made an impact [4]. The profile of heart disease has also changed, so that we now see heart failure emerge as a more common chronic condition among older patients [5]. Type 2 non insulin dependent diabetes, which has a related risk factor profile, particularly as it clusters with obesity, is now climbing to epidemic proportions in both younger people in developed countries and as a very common condition among increasingly affluent develop-

ing countries who have adopted a more typical western type lifestyle [6].

CVD is therefore a worldwide public health problem. On the one hand there is apparent light at the end of the tunnel in that we know so much more than previously about aetiology and treatment, on the other many complex and puzzling questions have emerged. Further, risk factor modification and broader health promotion strategies have created controversy about effectiveness and interpretation of outcomes [7]. Improved diagnostic criteria and the contribution of standardised monitoring and surveillance systems have played their role in understanding these patterns, so that the MONICA (Monitoring Trends and Determinants in Cardiovascular Disease) project helped to attribute the relative contribution of treatment [4, 8] and alterations in established risk factor patterns [9] to outcome, discussed further below.

The paper in this issue of the journal by Ulmer and colleagues highlights four important issues [10]. First it concerns new data from the 1990s in Austria, a country with a relatively good health profile compared with its European neighbours. Second it shows trends in classical adult risk factors common to other Western countries that require interpretation. Third it shows the emerging importance of socio-demographic patterns in both predicting risk and explaining the aetiology of the condition. Finally, as a study set in a province with a long history of intensive primary intervention and surveillance, it raises the question of appropriate intervention strategies.

### International trends in risk factor profiles

The three repeatedly demonstrated adult risk factors, smoking habit, cholesterol profile and arterial blood pressure are all associated to some degree with lifestyle and the latter two are inter-related with family history and obesity. There are clear trends across the MONICA countries in the 1980s of declines in cholesterol concentrations, declines in blood pressure and rise in body mass index [9]. These trends imply rises in other obesity-related conditions like diabetes mellitus in the future. Smoking patterns among men have been declining but variable in prevalence between countries and in the case of women, are actually climbing in some countries.

While according to Ulmer et al. [10] the overall Framingham risk score remains little changed across the last decade, there have been trends of increasing overweight, particularly among women, and a rise in prevalence of smoking among women. Trends in blood pressure are more favourable in both sexes and improvements in cholesterol

**Table 1.** Percentages of 15 year olds reporting that they smoke at least weekly and at least daily by gender in the 1997 Health Behaviours among School-going Children (HBSC) International Survey [15]

Group	At least weekly smoking			At least daily smoking		
	Male	Female	Direction <i>F:M</i>	Male	Female	Direction <i>F:M</i>
European Union / Western Europe						
Austria	30	36	+	20	26	+
France	28	31	+	20	25	+
Germany	28	33	+	22	25	+
Belgium- Flemish	28	28	=	21	20	-
England	25	33	+	21	24	+
Finland	25	29	+	19	20	+
Ireland	25	25	=	19	16	-
Switzerland	25	25	=	17	17	=
Norway	23	28	+	18	21	+
Scotland	22	28	+	19	24	+
Wales	22	29	+	18	23	+
Northern Ireland	20	28	+	16	24	+
Denmark	20	28	+	15	21	+
Portugal	19	14	-	13	10	-
Sweden	18	24	+	10	16	+
Greece	18	19	+	13	14	+
Former Communist Block Countries						
Latvia	37	19	-	27	12	-
Hungary	36	28	-	29	20	-
Slovak Republic	28	18	-	20	10	-
Poland	27	20	-	22	14	-
Russian Federation	24	22	-	20	14	-
Estonia	24	12	-	17	8	-
Lithuania	24	10	-	15	6	-
Czech Republic	22	18	-	16	11	-
Americas / Others						
Greenland	52	63	+	45	56	+
Israel	25	12	-	18	7	-
Canada	21	26	+	17	21	+
USA	20	21	+	13	12	-

Mean percentages across the main European groups:

	Weekly	Daily
Former Communist Block Boys	27.8	20.8
Western European Girls	27.4	20.4
Western European Boys	23.5	17.6
Former Communist Block Girls	18.4	11.9

level, particularly among men. There is, as in other countries a trend according to educational status in respect of body mass index, smoking patterns and HDL cholesterol among women, though interestingly, not for men. Third, for a small subset, that is migrant, mainly guest workers, the overall risk score is worse for both men and women and there are patterns suggesting a metabolic syndrome x type cluster, with increased levels of overweight, raised triglyceride levels and a more adverse total/HDL ratio, in

both sexes. Thus are highlighted three of the paradoxes of modern epidemiology, the explanation for the falls in blood pressure but the rise in obesity, the continuing problem of smoking and the explanations for social variations in risk.

The Framingham risk score does not take account of central or peripheral obesity as measured by waist-hip ratio or more directly by simple waist circumference. Current evidence suggests however that central obesity is the

risk situation and that it predisposes to adverse lipoprotein profile, hypertension and type 2 diabetes [11]. Trends in blood pressure may well relate to improved detection and treatment, as in this study, because we know that adult monitoring has been strong in Vorarlberg [12]. On the other hand repeated surveys in Austria have apparently shown low awareness of hypertension as a risk factor, a phenomenon observed in other countries [13]. Recent evidence from the Glasgow study of students provides impressive evidence of secular trends in decline in average blood pressure across twenty years of student health surveillance, suggesting the importance of other factors, such as dietary change at a population level, associated with improved refrigeration techniques and supply of fruit and vegetables [14].

The pattern of smoking among women in these Austrian data is also interesting in that it shows increased prevalence among younger women. The International Health Behaviours among School-going children (HBSC) provides standardised monitoring of lifestyle risk behaviours among young people. The most recent surveys, undertaken to a standardised protocol in 28 countries worldwide, provide a salutary prediction of future trends [15]. Three-quarters of 16 western European or European Union countries reported that daily smoking among 15 years olds is higher among girls and weekly smoking follows a similar pattern (Table 1). Conversely, among former Soviet block or communist governed countries the pattern is reversed, with higher rates among boys. The average rank order for prevalence of smoking both daily and weekly, is boys from former Communist countries, followed by girls for Western European countries, boys from Western European countries and girls from former Communist countries. This clearly demonstrates two different kinds of cultural patterns, whereby assertive young women in the West continue to express themselves through smoking and males in less economically favorable regimes are more likely to smoke. Thus smoking is both a risk factor for ill-health and a social indicator. Interestingly in the context of Ulmer et al's study [10], Austrian 15-year old girls rank top in Europe for both daily and weekly smoking. Exercise patterns are interesting too in that they show a considerable decline in early teenage years among girls, though that phenomenon is much less obvious in Austria [16]. Across the emerging post Communist economies rates of inactivity and prolonged television watching are relatively high.

### Emerging importance of social variations

Geoffrey Rose, the great British epidemiologist, coined the question of whether we should be dealing with sick individuals or sick populations [17], and as we see increasingly the role that social variation plays, within and between countries, this remains a pressing issue. There is a clear class gradient to CHD within the countries where the best-documented data are available. This gradient is subtle and graduated and indeed is seen even in predominantly non-manual populations, such as the Whitehall civil servants [18]. This has led in recent years to a more sophisticated re-appraisal of the role of psychosocial factors in CHD. The extent for instance to which immediate so-

cial and working conditions exert an influence on our control and discretion and how in physiological or pathological terms this might contribute to risk has been studied in more depth [19]. Newer risk factors, like fibrinogen, fibrinolytic activity and other components of the clotting system generally, have not achieved the same status as the more traditional risk factors and are not necessarily part of adult lifestyle surveillance systems. Yet fibrinogen should be borne in mind in developing protocols for a number of reasons, because it is influenced in childhood [20], is an acute phase protein affected by psychosocial circumstances [20] shows regional variation [21], is related to smoking in a dose response manner [22] and potentially responds to treatment [23]. Recent evidence also suggests a re-appraisal of the role of cortisol regulation, as a psycho-social mediator, both in laboratory level and in as yet small scale studies like that in Swedish and Lithuanian men [24]. This line of enquiry has moved from individual level psychological assessment of personality factors like hostility and social support to concepts of demand and control and effort-reward imbalance in social situations like the work environment [19]. Social position may be measured by educational status, occupation or income, all inter-related but distinct conceptually. Some of trends in Eastern Europe may be due to behavioural patterns in alcohol consumption among men, but it is argued by some to relate directly to the psycho-social impact of uncertainty and emerging disadvantage [1, 25]. The relative income hypothesis postulates that perceived social position may have as important a role as absolute material disadvantage above a certain threshold of income [26] and that this is especially important in countries in a state of major upheaval.

While in no way precluding the importance of adult lifestyle the influences of early life, in utero, across the first year of infancy and later is also increasingly seen to be significant. Adult onset conditions like diabetes and hypertension, are each influenced at this stage of growth and development [6, 27]. This suggests a combination of physiological and social factors at play. CVD in particular relates to these early childhood factors, unlike other conditions, such as lung cancer, which are almost entirely attributable to adult smoking patterns [28].

Another significant part of this debate is a particular subset of people, migrants. Epidemiological migrant studies long ago established that those moving from traditional to other societies gradually adopt new lifestyles, including changes in patterns of smoking, diet, physical activity and alcohol consumption. However they are also more disadvantaged in both material and educational terms and this in itself may confer risk. Migrants similarly show adverse adult risk factor patterns in the study of Ulmer et al. [10], though the picture is not necessarily clear. Turkish migrants in Germany for instance have shown secular trends of declining risk, though not as steep as for native born Germans and the risk factor profile in Turkey itself is not well documented. [29, 30]. There may be a case for examining in this context a modified interpretation of the thrifty gene hypothesis proposed by Barker originally and now the subject of widespread study. This suggests that an adaptation to under-nutrition in foetal life yields permanent metabolic and endocrine changes that would be

beneficial if nutrition remained scarce after birth [6]. If nutrition becomes plentiful however, these changes predispose to obesity and impaired glucose tolerance in adult life. Such is the situation particularly with migrant workers from poor to more affluent countries. Ulmer and colleagues suggest correctly that more stringent health service provision might be important but there also needs to be a system of wider social support in place. Education level acts as a proxy for childhood circumstances as well as a predictor of health and this effect continues into adult life.

### Interpretation of health promotion and preventive strategies

This paper [10] also highlights an important continuing question, that is the effectiveness of risk detection versus population based strategies and in turn whether these should be directed at individual, group, or social level. This opens up issues of equity of access to care and likelihood of personal lifestyle modification, always more achievable by the more affluent. The Vorarlberg initiative over 30 years, represents intensive and in population terms, highly penetrating rates of participation [10, 12]. This paper does not assess directly to what extent frequency of risk factor monitoring or consequent degree of behavioural modification achieved, affects major event outcome, though these data suggest that would be a valuable exercise. In countries like the United States there has been a strong focus on mass screening, particularly for instance in settings like the work environment [7]. The advantage of such an approach, where resources allow, is that it certainly identifies those at highest absolute risk and also acts as a re-enforcement for achievable behavioural change. Arguably too, men, notoriously difficult to involve in general health education programmes, are more interested than women in clinical approaches. The disadvantage is that it is hugely resource intensive, is highly dependent on effective behavioural modification for effective outcome and in opportunity cost terms may mean resource diversion from other strategies. Increasingly, where there is a class gradient to risk and where the more affluent and empowered are more likely to effect change there is an argument that such an approach in isolation could promote widening inequity. Other countries have gone for a comprehensive combination of individual level and intensive social change, like Finland [31] or varying degrees of intervention, as in the United Kingdom [32]. A recent meta-analysis of primary care interventions implies modest benefit from mass screening and suggest a more cost effective strategy would be high risk intervention only, plus policy reform [32]. However the quality of the health promotion initiatives was highly variable and not directly evaluated. Success of individual level behaviour modification is mixed; hypertension detection and follow up, if adequately resourced, is successful [33]. Cholesterol modification by dietary means alone is difficult to achieve and sustain [34], and in medication terms, has a price. It is worth remembering too that both primary and secondary prevention might be more cost effective with simpler remedies like aspirin and there has been little debate on the use of warfarin rather than lipid modification since the

publication of the Thrombosis Prevention Trial [35], even though it is much less costly. Strategies to modify smoking have been most successful for middle class men to date. For women a different social/feminist approach appears to be needed and worldwide more stringent tackling of the tobacco industry and social controls is called for if the epidemic smoking patterns are to be stemmed [36]. More focused and structured schools health education programmes are required [37] and interventions promoting social change achieve most, for blue collar employees in the work environment [38].

### Conclusions

The health experience in Austria is relatively good by European and World standards, with a comprehensive health care system [39]. Clearly its patterns of health have diverged from its near geographical neighbours for a variety of mainly socio-economic reasons. These novel data suggest no net change in cardiovascular risk however. This situation is consistent with the available international data. Several international networks now exist to assess the situation. The European Union funded Health Risk Monitoring (EHRM) group, comprising membership of a wide variety of countries, particularly participants in both CINDI and MONICA surveillance networks, is attempting to recommend on standard core risk factors to be monitored across the European region. Other EU sponsored groups are also assessing the relative influence of social variations and factors like diet. Finally, the European Science Foundation's social variations programme on health expectancy in Europe is concerned with the importance of life-course, meso social situations like the work environment and macro-social factors on health, wellbeing and disease specific outcomes like CHD.

The public health priority remains a combination of policy and settings initiatives, as well as a more proactive primary care assessment. Taking the combination of evidence into account, from the classical risk factor surveillance work to newer research into the relative influence both of lifecourse and established social variations in risk, a concerted multi-sectoral strategy to combat heart disease is called for that provides a high quality health care service but also a strong social support system, starting at the early stages of pregnancy and in early life of children.

*C. Cecily Kelleher*

### Acknowledgements

The views expressed here are the author's own. Cecily Kelleher is a participant in the EHRM group, a steering committee member of the ESF social variations programme, a contributor to the Irish government's strategy document, Building Healthier Hearts and a member of its national Task force on cardiovascular disease.

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Correspondence: C. Cecily Kelleher, MD FRCPI MPH FFPHM MFPHMI, Professor of Health Promotion/Director Centre for Health Promotion Studies, Clinical Sciences Institute, National University of Ireland, Costello Road, Shantalla Galway City, Republic of Ireland,  
E-mail: cecily.kelleher@nuigalway.ie