Commentary: Physical activity and obesity; scientific uncertainty and the art of public health messaging

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The article by Luke and Cooper1 published in this edition of the International Journal of Epidemiology proposes that physical activity energy expenditure plays no role in either causing or moderating the obesity epidemic and that current guidelines for physical activity should be reformulated. We would take issue with these conclusions, arguing that the relationship between physical activity and the development of weight gain at the individual level and the link between secular trends in activity and the prevalence of obesity at the population level are complex and uncertain. Given this scientific uncertainty, we would argue for caution when considering altering public health messages as the risks for confusion of the public are considerable.

What role did declining energy expenditure play in the emergence of the epidemic of obesity?

As Luke and Cooper acknowledge, inferences about the role of secular changes in physical activity and the rise in the prevalence of obesity are weak because there are no objective measurements of energy expenditure conducted across the time frame of the development of the epidemic. The magnitude of the change in population levels of physical activity over time is likely to be large, driven mostly by decreased energy expenditure in work and transportation. In countries such as the USA and the UK, it is likely that major population decreases in energy expenditure happened gradually throughout the 20th century and that they pre-dated the more recent emergence of the obesity epidemic with average physical activity already being around 200 metabolic equivalents of task (MET) hours per week by 1960. However, in developing countries the change in physical activity is much more recent and the decline is much steeper. In China, Ng and Popkin have estimated that average energy expenditure has halved from 400 MET hours per week in 1991 in a single generation, a generation that has seen a dramatic increase in the prevalence of obesity and the emergence of non-communicable disease like type 2 diabetes which is now estimated to have a prevalence approaching 10%.2 Unfortunately these massive and important changes are poorly documented since objective assessment of physical activity energy expenditure has only recently been added to public health surveillance systems in some developing countries and has not been implemented in countries undergoing the nutrition transition.

The inferences about the links between trends in energy expenditure and obesity are therefore weak and one would be wary about drawing too strong conclusions about the importance of physical activity in the causation of the obesity epidemic because of the poverty of the data. The evidence that underpins Swinburn’s energy balance flipping point hypothesis which Luke and Cooper cite, is drawn from US Department of Agriculture estimates of food availability per person, computed as food production plus imports minus exports and non-human consumption, which is rather a long way from individual estimates of actual energy intake.3 Whereas it may be true that changes in energy intake in the context of already low energy expenditure are more likely to have been the immediate precipitant of the epidemic of obesity in the USA and other developed countries, it does not follow that physical activity is not part of the causation of obesity since the precipitants of epidemics are not the same as the causes. It would also be unreasonable to generalize a statement about precipitants in developed countries to developing countries where the temporal pattern of declining activity is different. Luke and Cooper also point to their own meta-analysis of doubly-labelled water studies in different...
countries, suggesting that neither total energy expenditure nor physical activity energy expenditure was related to the degree of development. Although this is a commendable meta-analysis pulling together data from 98 studies reporting 183 cohorts with 4972 participants, only a small fraction of those individuals (483) were in low- or middle-income countries. Thus a more appropriate conclusion would be that the meta-analysis did not detect any statistically significant differences between countries, rather than it demonstrated evidence of no difference.

What role does energy expenditure play in the aetiology and prevention of obesity?

The cross-sectional relationship between physical activity levels and obesity prevalence within populations is strong and consistent. However, the longitudinal relationship between activity and weight gain is much more complex. In general in prospective cohort studies there is an inverse relationship between physical activity assessed at baseline and weight gain over time. However, the magnitude of that association is generally rather small. Indeed, the opposite direction of association, with obesity predicting a decline in physical activity levels over time, tends to be somewhat stronger. Some have concluded that this means that activity is an unimportant determinant of weight gain, but that obesity is driving secular changes in physical activity levels. However, conclusions about the relative importance and direction of causality between factors like obesity and activity that are measured with differing degrees of imprecision are unsound. As Hutcheon and colleagues clearly demonstrated in a statistical article in the British Medical Journal, the use of an imprecise measure of an exposure variable will tend to underestimate its relationship with an outcome variable, the phenomenon of regression dilution familiar to all epidemiologists. In the situation of the study of physical activity and weight gain, this regression dilution would be considerable when activity is the exposure variable since it is so poorly estimated in epidemiological studies, particularly by contrast to weight, which is virtually perfectly measured. However, when the relationship is reversed and the more precisely measured trait (weight) becomes the exposure variable, the imprecision in what is now the outcome variable (physical activity) merely serves to increase the uncertainty in the estimate of the effect size as manifest in its confidence intervals and does not result in systematic underestimation of the association. Thus conclusions based on prospective cohort data that obesity is the cause of the decline in activity but that activity is not an important determinant of obesity would be statistically unsound. It is more likely that activity and weight gain have a complex bi-directional relationship.

Should public health messages be changed?

In a review of physical activity in the aetiology and prevention of obesity for the UK Foresight obesity review, we pointed out the relatively small magnitude of effect between activity and weight gain and concluded that it was unlikely that activity alone was the driver for population-level increases in obesity. However, there were methodological issues which could have explained the study observations and one could certainly not conclude that activity played no role in the development and prevention of obesity. Given these uncertainties, we concluded that there was no basis to alter public health recommendations of accumulating 30 min of moderate-vigorous physical activity in adults or 60 min per day in children, on at least 5 days per week. The process of translating scientific evidence into public health recommendations involves not only an assimilation of the strength of that evidence but also an appreciation of the complexity of the formulation of messages for the public and a need for consistency. In the UK, the latest recommendations from the Chief Medical Officers build on previous reports introducing specific targets of older people and children and adding in the notion that in addition to striving to reach the stated targets, there are public health benefits to increasing physical activity. This is especially true in the large proportion of people who are very inactive, for whom the 5 x 30 min recommendation is a distant and possibly unachievable goal. Rather than undermine the core target with a radical change in emphasis, the report left the target unchanged but added the additional nuance that population health benefits would stem from increases in activity of whatever magnitude. Given the uncertainty in the evidence base concerning physical activity and obesity, it would not be appropriate to alter these public health messages, as such changes would only serve to undermine public confidence in the message with potentially adverse effects. Indeed Luke and Cooper strongly support the notion of promoting physical activity for its health benefits beyond obesity. Here we would agree but perhaps with a slight difference in emphasis.

At the level of the individual who wishes to lose weight, it is obvious that a state of negative energy balance is required, regardless of how this may be achieved. For some people, increased activity alone may be a relatively ineffective strategy without reductions in calorie intake, but for others different approaches may be preferred. Among the wider population, public health messages about the importance of
promoting physical activity need to be clear and consistent and only change when there is unequivocal evidence to do so. Although the evidence concerning activity and weight gain is weak, it is not so weak that the current public health guidance should be altered. However, where a change is required is in the expectations of those responsible for public health who should be realistic that changes in population level physical activity on their own, even if they are achieved, are unlikely to result in a substantial reduction in the prevalence of obesity even though small changes could have benefits for other health endpoints.

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References

Commentary: Physical activity does influence obesity risk when it actually occurs in sufficient amount

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We appreciate the opportunity to comment on the recently accepted article entitled ‘Physical activity does not influence obesity risk: time to clarify the public health message’1. However we disagree with the