Capital4Health - health economic analysis to study the cost-effectiveness of physical activity interventions

Vijay GC[1], , Alexandra Sauter[2], Lisa Boyer[2], Anne Herrmann-Johns[2,3], Christina Müller[4], Holger Hassel[5], Marc Suhrcke[6]

[1] *Department of Nursing and Midwifery, School of Human and Health Sciences, University Of Huddersfield, UK*
[2] *Department of Epidemiology and Preventive Medicine, Medical Sociology, University of Regensburg, Germany*
[3] *School of Medicine and Public Health, University of Newcastle, Australia*
[4] *Institute for Sport Sciences, University of Wuerzburg, Germany*
[5] *Institute of Applied Health Sciences, Coburg University of Applied Sciences and Arts, Germany*
[6] *Luxembourg Institute of Socio-Economic Research (LISER), Luxembourg*

Short report

Insufficient physical activity (PA) is a key risk factor for many adverse health consequences globally, including non-communicable diseases and premature death. Engaging in (and increasing) regular PA would bring significant population health gains. However, changing behaviour is challenging, and in particular, the struggle to find ways of achieving sustained physical activity increases at the population level continues. In this context, the Capital4Health (C4H) research consortium has implemented four subprojects to increase PA by implementing interventions using a cooperative planning process in different settings.

As part of the C4H consortium, in the cross-cutting evaluation project EVA an economic analysis was undertaken to estimate the long-term costs and health outcomes associated with C4H subprojects. We developed a simulation model to predict longer term costs and health consequences. The model follows a cohort of six-year-olds up to age 82, which is the average life expectancy in Germany. Based on their activity level, the model assigns cohort members to one of four PA groups recommended by the WHO (inactive, low, moderate, high). In the subsequent year, cohort members either remain in the same PA group, move to a lower PA group or develop chronic conditions (type 2 diabetes, coronary heart disease, stroke, heart failure, breast cancer and colorectal cancer). These events are associated with costs and health-related quality of life. The model predicts disease events based on the PA level and future disease burden in the cohort. The effect of an intervention is incorporated in terms of moderate to vigorous PA minutes. When the intervention effect is incorporated, the cohort members move from a lower to a higher activity group. The long-term health gains from the increased activity are estimated in terms of Quality Adjusted Life Years (QALYs).

The cohort characteristics, such as demographics and incidence of diseases, are based on population-level data. The baseline PA levels for children (6-17 years) and adults (≥18 years) were populated using data from the German KiGGS survey (German Health Interview and Examination Survey for Children and Adolescents) and DEGS1 survey (German Health Interview and Examination Survey for Adults). As the children grow older, their PA level decreases with age. This is incorporated in the model using data from the International Children's Accelerometry Database (ICAD), which contains objectively measured PA (accelerometer data) from 20 studies in ten countries. Once the short-term costs and effects associated with the intervention are loaded, the model simulates the future longer term outcomes (costs and health outcomes). Health benefits associated with PA and further parameters (such as mortality associated with the disease conditions modelled, utility values) were derived from the published literature.

The intervention effect data were taken from the QueB II subproject (https://www.capital4health.fau.de/ueber-uns/projekte/queb/) of the C4H consortium. The subproject aimed to improve the physical activity of children under six years who were in childcare centres. For the model,

data from a pre-post study from eight childcare centres were used. The cost of the QueB II intervention was estimated by measuring and valuing the resources used to deliver the intervention.

The QueB II results suggested that for those who were in the low activity group at baseline, 75% of boys and 44% of girls moved to moderate, and 17% of boys and 7% of girls moved to the high activity category at the next data collection time point. Our findings show that the model-predicted PA levels are similar to those observed in large survey studies, such as KiGGS and DEGS1. We summarised the relative cost-effectiveness of QueB II compared to usual care alternatives as an incremental cost-effectiveness ratio. It is calculated by taking the ratio between the incremental cost and the incremental health outcome (QueB II versus usual care), here QALY, which gives cost per additional QALY gained. The long-term model results suggest that the intervention can be cost-effective should the decision makers be willing to pay €50,000 per additional QALY gain. However, there are some uncertainties around the trajectory of PA over a lifetime which is based on cross-sectional survey data. Furthermore, the effectiveness data was from a pre-post study rather than a randomised controlled trial.