IMPROVING ESTIMATES OF TRAVEL ACTIVITY AND AIR POLLUTION EXPOSURE THROUGH UBIQUITOUS SENSING TECHNOLOGIES

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Background: Travel activity may have important influences on health, potentially contributing meaningfully to both physical activity (PA; walking and cycling) and inhaled air pollution. Ubiquitous sensing technology is a promising innovation to track locations of travel activity and associated levels of energy expenditure. We present results of a pilot study testing the use and performance of Calfit, a novel smart-phone based software that continuously records geo-positioning and PA estimated from an accelerometer integrated into Android cell-phone technology.
Methods: We equipped 36 volunteers with an Android phone that had Calfit software installed. Subjects were monitored during 5 days of regular activities in Barcelona, Spain. Volunteers kept a travel diary and wore two additional commercially-available accelerometers (Actigraph and Bodymedia Sensewear). We identified travel periods and compared energy expenditure levels as measured by the three devices for their activities. We estimated the contribution of transport to PA and to overall daily air pollution exposure of nitrogen dioxide estimated by a land use regression model.
Results: Preliminary results show the cell phone measurements of energy expended (kilocalories) correlated highly with the Actigraph (Spearman coefficient > 0.90 for each of 4 travel modes) and correlated well against the Bodymedia Sensewear, for which the lowest correlation was for cycling trips (Spearman coefficient 0.63). We estimated inhaled dose for a subject who spent 2% of their time daily in active travel (walking or biking). Active travel contributed disproportionately to inhalation dose, accounting for about 12% of the daily total.
Discussion: Ubiquitous sensing technology provides unparalleled data collection opportunities to measure travel-related PA and route choices, which can be highly relevant for built environment research and air pollution exposure assessment. In addition to monitoring large populations, cell phone technology may in the future improve activity measures compared to accelerometry by accounting for speed and topography collected using GPS.