Validity and reproducibility of different methods for determining route distances in physically active commuting

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Purpose

Distance is a variable of pivotal importance for a variety of aspects of transportation, including cost-benefit analyses and assessing health economic effects of physically active transports such as commuting (PAC). Thus, there is a need for accurate and reproducible methods for determining route distances in a context of human powered mobility. The aim of this study was therefore to scrutinize five different measurement techniques.

Methods

We have studied the validity and reproducibility of 1) subjective estimation, 2) the straight-line distance method, 3) route markings on paper maps measured with a digital curvimeteric distance measurer, 4) routes calculated with GIS-programs, and 5) global positioning system (GPS) devices attached to commuters during real life commuting. All subjects were recruited when they walked or cycled in the inner urban area of Stockholm, Sweden, in November 2005. The number of individuals in the tests varied between 19-133.

Results

No order effects were noted with any of the methods, and the reproducibility was high for all methods except the subjective estimation. Furthermore, subjective estimation overrates distances with about 8%. The same principal problem is true for the GIS and GPS systems used. One the other hand, GPS tracings showed that route markings on paper maps represent valid bases for distance determinations. It can therefore be used as a criterion method for distance measurements. This is so given that a valid and reproducible distance measurer is used which was the case in our study. From a point of simplicity, the straight line distance method is the second best given that the values are multiplied with a factor of about 1.25.

Conclusion

Route drawn maps represent a valid and reproducible basis for distance measurements. To what extent the method’s good results can be transferred to other forms of physical active transportation needs, however, to be tested. Commuting routes represents parts of the individual daily behaviours, and therefore route mappings can possibly be more accurate in this context than in less known environmental settings. In such environments the strength of the straight-line distance method appear more straight forward, since it only requires knowing the origin and destination points.

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