Development of the Health economic assessment tools (HEAT) for walking and cycling (PASTA – WP4)
Core group meeting
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2-3 November 2016

MEETING REPORT
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Executive summary

Coordinated by WHO, steered by a core group of multi-disciplinary experts and supported by ad-hoc invited relevant international experts, the HEAT\(^1\) project holds regular core group and consensus meetings to discuss and agree upon methodological updates and new features of HEAT. This core group meeting was convened to 1) assess the feasibility and possible approaches to integrate emissions of carbon dioxide, morbidity and injury mortality into the HEAT, based on best available evidence, feasibility, and state-of-art knowledge; 2) make recommendations on the scope of the 5\(^{th}\) HEAT consensus meeting, to be convened in early 2017; 3) define the background documentation that would need to be developed to support the decisions to be taken at the 5\(^{th}\) consensus meeting; and 4) make recommendations on the future developments of HEAT. The meeting was attended by 8 members of the HEAT core group, 4 additional experts and one staff member of the WHO Regional Office for Europe.

Based on information presented in a detailed background document and by lead experts at the meeting, participants discussed possible options for further HEAT modules. Further developing a carbon module and a crash module for adoption at the 5\(^{th}\) consensus meeting in early 2017 was supported by the core group. With regard to a module on morbidity, the core group decided to develop an experimental, Excel-based draft tool presenting different result options to gain clear guidance on which of the possible metrics (cases of disease, health costs, DALYs or costs) would be most requested by which target audiences, and thus had the most chances to further increase the impact of HEAT on transport policy decisions.

Additional considerations were identified for further discussion at the next core group meetings, including on various HEAT elements as well as further dissemination and uptake of HEAT.

Acknowledgments

The workshop was organized by the WHO Regional Office for Europe and supported by the project on “Physical activity through sustainable transport approaches” (PASTA), which is co-funded by the 7th Framework Programme (http://pastaproject.eu).

It was carried out in close collaboration with the Transport, Health and Environment Pan-European Programme (THE PEP), jointly lead by the WHO Regional Office for Europe and the United Nations Economic Commission for Europe (UNECE).

\(^1\) www.heatwalkingcycling.org

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1 Introduction and background

Coordinated by the WHO, steered by a core group of multi-disciplinary experts and supported by ad-hoc invited relevant international experts\(^2\), a project was started in 2005, aimed at developing guidance and practical tools for economic assessments of the health effects from cycling and from walking. The main goal of the project is the development of the Health Economic Assessment Tool (HEAT) for walking and cycling, a harmonized method for economic valuation of health effects of cycling and walking, based on best available evidence and international expert consensus. HEAT calculates: if x people cycle or walk y distance on most days, what is the economic value of all-cause mortality rate changes? ([www.euro.who.int/HEAT](http://www.euro.who.int/HEAT)).

HEAT is primarily aimed at transport planners, traffic engineers, economists and special interest groups. Since this audience may not necessarily have ready access to epidemiological and economic expertise and modelling tools, HEAT is intended to be scientifically robust, yet easy to use. It is not intended to be a comprehensive health impact assessment tool but aims at providing an estimate of the health effects of regular walking and cycling (currently mortality only) based on minimal data input for use in economic analyses in transport planning, such as cost-benefit analyses of different transport and land use developments options.

HEAT is developed through an iterative process, consisting of the following main steps: a) review of approaches to the inclusion of health effects into economic appraisals of transport interventions related to cycling and walking; b) critical evaluation of these approaches and indicators regarding their relevance, accuracy and feasibility; c) achievement of scientific consensus on how to apply this knowledge within the “HEAT environment”; and d) regular review and update of the approach in view of user-needs and scientific developments.

Key in the development of HEAT is the achievement of scientific consensus on the approach to be taken in the development of the different functionalities and components of the tools. This is achieved through the organization of consensus building meetings which, under the coordination of the WHO, bring the core group together with international advisors invited on the basis of their scientific expertise in the aspects of interest, and develop consensus-based recommendations on possible ways forward for the further development of the tool. The most recent versions of the online tools for walking and cycling and of the user guide booklet were launched in 2014 \([1]\). The last consensus meeting was held in December 2014 to finalize the approach for a HEAT air pollution module, which is forthcoming.

The HEAT process is particularly designed to be open to continuous updating and further developing the tools. In previous HEAT meetings, the health effects from road traffic crashes as well as from diseases have

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\(^2\) See full lists at [www.heatwalkingcycling.org](http://www.heatwalkingcycling.org)
been identified as important topics for consideration. Including the carbon effects from active travel could further enhance the appeal of the HEAT by transport planners. Ahead of the workshop, the participants received a background document prepared by experts presenting considerations and options on possible approaches for the development of separate HEAT modules on carbon, morbidity and traffic crashes for discussion by the HEAT core group [2].

The specific objectives of the workshop were to:

- assess the feasibility and possible approaches to integrate emissions of carbon dioxide, morbidity and injury mortality into the HEAT, based on best available evidence, feasibility, and state-of-art knowledge;
- make recommendations on the scope of the next scientific consensus meeting, to be convened in early 2017, on the future developments of HEAT;
- define the background documentation that would need to be developed to support the decisions to be taken at the consensus meeting.

2 Welcome, election of the chair and rapporteur of the meeting, and introduction to the scope of the meeting

Francesca Racioppi welcomed the participants on behalf of the WHO Regional Office for Europe. She recalled the HEAT principles, motivation and aim and also highlighted the history and formal process of its development. She underlined that the possible options for additional HEAT modules were a foreseen key deliverable of the 7th Framework Programme project on “Physical activity through sustainable transport approaches” (PASTA), (http://pastaproject.eu) but that selected modules shall only be implemented when the key features of HEAT are preserved, in particular withstand scientific scrutiny and any assumption made fully transparent while providing a maximum of user-friendliness and simplicity. User experiences, e.g. from the HEAT webinars or direct work with users in administrations (e.g. in Barcelona or partner cities in an EU project called SPAcE) have shown that despite the perceived simplicity of the current HEAT, unexperienced users often are struggling to use it correctly. Therefore, additional complexity should only be considered if no other option would provide a scientifically sound solution.

Ms. Racioppi also thanked the experts who prepared the background document for their thorough and useful work to prepare the meeting (David Rojas-Rueda, IS Global, Barcelona, Thomas Göttschi and Alberto Castro, Epidemiology, Biostatistics and Prevention Institute (EBPI), University of Zurich, Christian Brand, Environmental Change Institute and Transport Studies Unit, University of Oxford).

Pekka Oja, formerly UKK Institute of Health Promotion Research, Finland, was elected chair of the workshop, and Sonja Kahlmeier was elected as rapporteur.
3 Considerations, discussions and conclusions on a HEAT carbon module

Christian Brand, University of Oxford, presented possible approaches for inclusion of carbon emissions into HEAT (for details see [2]. There are 3 main assessment stages to address:

1. Assessing mode shift from motorised travel to active travel (or vice-versa) (passenger-km, trips)
2. Assessing the carbon emissions from displaced motorised travel (gCO₂e/passenger-km, gCO₂e/trip)
3. Assessing the economic value of the social impact of changes in carbon emissions (€/tCO₂e)

For each of the 3 stages, varying degrees of complexity could be envisaged. Participants discussed the proposed approaches.

Preparation of a carbon module for adoption at the 5th consensus meeting in March 2017 was supported by the core group. Based on the standard user input on an amount of cycling or walking, a simplified version of the proposal will be further developed, as follows:

Assessing mode shift from motorised travel to active travel (or vice-versa)

For this step, it was decided to ask users for an estimation of the mode shift from/to motorized travel, and from/to public transport. It was discussed to omit asking on the share of public transport to simplify user input, but it was decided that this would considerably limit the appeal of the module for transport planners, where public transport often reflects a major consideration, especially in cities. The same visualization as for the air pollution module shall be used (circular sliders adding up to 100%), which are developed to show initially default values derived from a previous study [3]. The module would also use information on the share of cycling/walking that was not new but reassigned from other routes to a new (presumably more attractive) route or infrastructure. This question is already asked in the HEAT physical activity module and thus would not need to be asked separately.

On the proposed additional question on “induced” cycling/walking (latent demand realized through new transport options – i.e. travel that would not have been made without these new transport options), no final decision was taken due to uncertainty on the impact that inclusion or exclusion would have on the results of the module. Further insights should be provided with regard to preparing a final proposal for the consensus meeting.

\[3\] Namely “When assessing the impact of an intervention it is prudent to assume that not all the cycling/walking, or increase in cycling/walking, observed is newly induced, that is directly attributable to the intervention. Estimate the proportion of cycling/walking which you would like to attribute to the intervention (i.e. you want to value) to the best of your knowledge” (current question 9).
With regard to the proposal to ask users to distinguish between utilitarian and leisure time cycling/walking, the core group preferred to provide guidance as part of the user instructions, rather than asking a separate question, given the focus of the module on estimating the effects of changes CO2 emissions resulting from modal shifts to/from motorized private or public transport. However, a final decision will be taken during the development process ahead of the consensus meeting.

Assessing the carbon emissions from displaced motorised travel (gCO₂e/passenger-km, gCO₂e/trip)

For this step of the module, the core group supported an approach, based on a “simple” travel activity & emission factor method (approach B in [2]). Background lookup tables will be developed that will be used by the tool, based on available data for each country and/or city in the WHO European region (e.g. average speed possibly at city level and fuel mix at the country level). As much as possible, also aspects from a more complex approach (named “option C” in [2]) will be incorporated, including e.g. speed-emissions dependency, real world uplift, cold start emissions and life cycle emissions, making the module more realistic and defendable. Average speed dependency of carbon emissions at the city level will be incorporated based on examples of cities with a selected number of specific traffic situations (e.g. “heavily congested”, “mildly congested”, “generally free flow”).

E-biking would be considered through life cycle emission factor for cycling (unlike other models that sometimes assume an emission factor of 0 here), e.g. based on a recent report of the ECF [4] that concluded that life cycle emissions per km travelled were comparable between electric and non-electric cycling (see also Table 2 in [2]). For now, a separate entry option for E-bikes was not considered suitable as also there are to date no specific relative risk estimates for related health effects that could be used.

To reflect that average emissions factors evolve over time as more efficient and cleaner vehicle enter the fleet, a defendable trajectory over time will be developed (e.g. percentage reduction in average car fleet emissions / year The trajectory would depend on several inputs affecting changes in fleet composition, including economic development, governance and regulatory considerations, fiscal incentives, technology progress and consumer preferences. The default trajectory will be based on a conservative assessment of available sources (e.g. modelling exercises and projections based on the mandatory new car CO₂ emissions standards for the EU [5]), in line with the HEAT approach of dealing with uncertainty of future developments.
Assessing the economic value of the social impact of changes in carbon emissions (€/tCO₂e)

For this last step, the damage cost (the “Social Cost of Carbon”, SCC) approach was adopted by the core group. Default value for each appraisal year will be provided, with a range around the central estimate, informed by information shown in the OECD database [6]. These can be replaced by the user if a local figure is available or prescribed by the policy process (similar to VSL or mortality rates in the current HEAT). A caveat will be provided to the user outlining the large uncertainties in valuing carbon emissions impacts, reflecting regional socioeconomic realities such as time preference rates and equity-weighting.

3.1 Next steps

A description of the methodology will be developed by Christian Brand up to the level of a functional Excel-based tool, so that examples and scenarios can be tested by the core group. A final proposed approach will be developed for adoption by the 5th consensus meeting.

In addition, disclaimers should be prepared for particular cases where the HEAT module on carbon would not be likely to provide robust results, e.g. for cities with expected very high shares of electric cars or public transport powered by very high shares of renewable electricity.

4 Considerations, discussion and conclusions on a HEAT morbidity module

David Rojas, IS Global, Barcelona, Spain, presented 3 different options for developing a HEAT morbidity module, based on:

1. Incident cases of selected disease, for which direct and indirect health costs would be calculated and the result presented in addition to the current HEAT result on reduced all-cause mortality (based on VSL);

2. Disability-adjusted Life Years (DALYs), based on which DALY cost per disease would be calculated (combining Years of Life Lost (YLL) and Years Lived with Disability (YLD), replacing the current HEAT result for physical activity based on VSL. To calculate costs, either a value for a DALY per disease would need be found, or the costs for a Value of a Life Year Lost (VLYL) could be calculated, based on VSL (see [2] for details).

3. a simplified approach based on a multiplication of the currently calculated HEAT result on reduced all-cause mortality (using VSL) with a multiplier which would need be defined.

Following the introduction, James Woodcock, University of Cambridge, raised an additional consideration with regard to possible approaches to including morbidity into the HEAT: while physical activity has shown positive effects on a range of diseases, it could be argued that in an economic assessment, not only the
reduced number of cases of disease but also the potentially higher number of people surviving with a certain disease and overall increased longevity would need to be taken into account. This could eventually lead to a higher number of people living with a certain disease within a given population and thus, eventually more cases needed to treat (assuming the additional life years would not be lived in good health). So, as some authors found [7], increasing physical activity could under certain circumstances even lead to higher costs to society. Though of relevance in the broader context of the scientific debate on the effects of risk reductions on the health quality of extended life expectancy, and the related costs and gains to society, the core group acknowledged that this discussion is for the time being of no direct applicability to the HEAT, which have adopted scientific evidence at a stage of sufficient clarity rather than being at the forefront of new scientific developments.

While approach 1 would provide a number of cases of certain diseases and related health care costs, that seem to be attractive outcome measure to some audiences (particularly from the health sector), it was acknowledged that there was no harmonized international database on direct and indirect health care costs to draw baseline data from. [Additional note: However, since the meeting a new publication has become available, containing data on annual average direct and indirect health care costs for 142 countries (including type 2 diabetes, colon and breast cancer, coronary heart disease, stroke) [8]. An alternative option discussed was to provide only the number of diseases averted as an additional HEAT result but not monetize them. However, some participants argued that HEAT was predominantly an economic tool and thus providing a monetized figure was a key purpose of HEAT.

Approach 2 based on DALYs would have the advantage of being able to be calculated based on the existing HEAT inputs, using disability weights for selected diseases available e.g. from the Global Burden of Disease study. However, incidence rates of the selected diseases would need to be collated as default values, e.g. based on databases providing such information, such as the WHO Health for All database and/or be provided by the user. As a disadvantage, some user groups might not find DALYs easy to understand and use, e.g. local transport planners. However, in some countries DALYs seem to be gaining traction even in the transport sector, e.g. in England where an update of the WebTag system is currently underway using a DALYs based approach.

The third approach, based on a multiplication of the currently calculated HEAT result based on VSL with a multiplier would on the one hand be the most easy to implement, following existing examples from e.g. the air pollution field [2]. It would also avoid having to select certain diseases only and omit others, for which e.g. no suitable relative risk function is currently available. Part of the participants felt that such a method would be fully in line with the HEAT approach in terms of simplicity, user friendliness and the main target audience being predominately transport planners (presumably less interested in number of cases of disease or

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4 Including lost productivity during a 3-month replacement period
health costs) and the main focus being policy rather than providing a detailed tool for a research-focused audience, as long as the approach and any assumptions to derive the multiplier would be made transparent. Other participants raised concerns with regard to scientific rigor underpinning the identification of a suitable multiplier and thus the defendability of such a simplified approach. A simplified calculation based on the costs related to YLL (adjusting for age) to derive costs related to YLD (e.g. based on the data used in the Global Burden of Disease study, possibly correcting for power purchase parity by country) was also proposed as an alternative option. An option considered was also to provide figures for YLL and YLD alongside the current, VSL-based HEAT results.

Participants were reminded that there have been recurrent requests, predominantly from the health sector but in some cases also from transport, to include morbidity-related effects into the HEAT. It was also pointed out that several studies have applied approaches to including morbidity related burden of disease and in some cases related costs into wider health impact assessments or cost studies. Thus, there would be examples available to base a defendable, robust tool on as long as the methodology could be sufficiently simplified to be feasible for the HEAT. Also, an initial simpler module could be developed initially which could be updated later, as additional scientific evidence (e.g. on possible longevity effects on health costs) becomes available.

The main issue encountered by the core group related to a lack of clear guidance on which of the possible metrics (cases of disease, health costs, DALYs or costs) would be most requested by which target audiences, and thus had the most chances to further increase the impact of HEAT on transport policy decisions, and possible relevant policies in other areas (e.g. NCDs, energy, air pollution etc.).

4.1 Next steps

Participants concluded that the main area of investment was a clearer understanding of user needs and expectations with regard to a morbidity module, in particular regarding the way to present the results (cases of disease, health costs, DALYs or costs). Therefore, it was decided that David Rojas, with support from the core group, will develop an experimental, Excel-based draft tool presenting different result options. This would not need to present a finalized methodology but could be based on assumptions, for the time being. The main purpose would be to have a tool with different options for a more in-depths exchange with different stakeholders and target audience for an improved understanding of which options would have most impact on policy and planning decisions. This work would be led by Nick Cavill. An initial version of this tool and a concept for exchange with stakeholders will be presented at the next core group meeting back-to-back with the 5th consensus meeting in March 2017.

An additional issue raised related to the current age range that HEAT is using, with upper limits of 64 years for cycling and 74 years for walking. These were chosen on the one hand due to an initial focus on walking
and cycling for transport, evidence that active transport behaviour changes at pension age (particularly for cycling) and the availability of default mortality rates for these age ranges. However, some of the studies included in the meta-analyses used for HEAT [9] comprise also higher age ranges and thus the relative risks used could also be applied to higher age ranges. In addition, the age limits lead to comparably lower results for HEAT, compared to other approaches, as presented by James Woodcock. This consideration, however, was marked as an item for more in depth-discussion, e.g. in preparation of the next consensus meeting in March 2017 (see also chapter 7).

5 Considerations, discussion and conclusions on a HEAT crash module

Thomas Götschi, University of Zurich, presented options for inclusion of crashes into HEAT. He recalled that safety concerns are a key barrier to active transport, in particular cycling. This area is considerably less developed for health impact assessments as other areas and is confronted with additional challenges. For example, while for physical activity, the same relative risks apply more or less everywhere, the equivalent of a “background crash risk” is strongly dependent on local circumstances (e.g. traffic mix and infrastructure, speed limit enforcement, existing level of cycling, etc.)

For all HEAT modules but even more so for a crash module, the use case is of particular relevance, determined for example by:

- geographic scope (e.g. national, city-wide, specific piece of infrastructure)
- infrastructure type (e.g. mixed with traffic vs. separated)
- temporality (status quo vs. before-and-after scenarios).

Additional criteria to consider would be: type of data sources, cyclist attributes, types of cycling, mode shift scenarios, etc.

Mr Götschi presented 4 possible approaches for inclusion of crashes into HEAT, with increasing levels of complexity but also applicability in terms of lower geographic scale (for details see [2]). Each approach could focus on fatalities only, or aim at including also injuries, by severity. Conceptually, a module could also distinguish between collisions and falls.

1. Basic approach: „crash risk estimate“ multiplied with „local exposure“

This approach would require the compilation of “background crash rates” for specific use cases (most likely only applicable to national level applications) and a feature for locations not covered, such as „How would you rank cycling (walking) safety in your city compared to the countries / the cities in the data base?“.

5 Mean age at entry from 20 to 93 years for both walking and cycling.
Applying such a risk estimate to a specific use case would only be valid if the “local exposure” would be sufficiently comparable to the “generic exposure” the risk estimate was derived from. Therefore, the user, in addition to the standard HEAT input (i.e. quantitative exposure), would also have to provide some basic qualitative information on their observed cycling/walking (e.g. through sliders from “highly trafficked” to “trail without traffic”). Since a complete “match” in exposure quality would be a major constraint, the tool would have to be able to handle a certain level of mismatch in exposure quality (i.e. adjustment of risk estimates), or provide clear criteria for appropriate use cases.

2. Basic plus: providing crude features („sliders“) for users to adjust the crash risks to reflect specific use cases

This option would make the tool better suited for specific bike policies or projects, e.g. to assess separated facilities, or safety improvement policies, as for such use cases, where it would make little sense to base assessments on large scale averages. The key question, however, would be sufficiently robust literature can be identified to quantify „relative risks“ for different local settings.

3. Non-linear approach, including an adjustment (reduction) of crash risk with increase in exposure

This approach would take into account the so called “safety in numbers”-effect for pre-post and hypothetical scenario use cases. The tool could either predict the „safety in number discount“ (i.e. provide a default approach that a user could tick, or not), or the user should specify it; with the latter option avoiding a “black-box” effect and thus possibly better dependability of such an approach.

4. Interaction approach with a simultaneous consideration of driving and cycling (and walking) volumes

Studies that apply such an approach consider bicycle-vehicle interactions and use coefficients to specify the model equation to local settings. More sophisticated approaches also consider e.g. the type of modes involved in the crash or the severity of injury and control for age and population density.

While conceptually the soundest approach, and from a calculatory complexity probably within reach of (an improved) HEAT, quantifying such a model (i.e. estimating required parameters) would require substantial research efforts, even if there are studies available that have used this approach already.

Participants discussed the proposed approaches and issues and took the following conclusions: preparation of an initial HEAT crash module, based on approach 1 (basic approach) was adopted. It would initially be developed as a separate calculation, only applicable to use cases of national and possibly city-level (but not for smaller scales, such as specific facilities) and decided later if crash effects would also be subtracted from the all-cause mortality effect (similar to the treatment of air pollution effects in HEAT).
5.1 Next steps

Thomas Götschi and Alberto Castro, University of Zurich, will continue the work to develop a more refined proposal for a HEAT crash module for the consensus meeting in early 2017. This work will include in particular:

- confirmation of the use cases and geographic scope that such a simplified module could be applied to (national level only, national “urban” settings, or also cities, etc.)
- identification of data to inform such crash module (crash data and corresponding exposure data)
- developing an option including a safety-in-number effect in pre-post assessments, for discussion at the consensus meeting.
- determine additional questions needed to ask HEAT users wanting to apply this module
- identifying “key concepts” (e.g. traffic volumes, infrastructure factors, age of cyclists/walkers, level of experience, etc.) which are most influential for crash risks at a sub-national scale and hence most relevant to develop a robust and simple approach for a HEAT module that could be applied at the sub-national/sub-city level.

While an initial tool could focus on mortality only to complete the “mortality suite” of HEAT, it would be cost-effective to also collate injury data from databases and data sources used, for possible later inclusion.

6 Dissemination and uptake of HEAT—lessons learned and recommendations

Nick Cavill, University of Oxford, presented the results from a recent study [10] that he had carried out in collaboration with Sonja Kahlmeier, University of Zurich, and support from WHO Regional Office of Europe, on behalf of the European Cyclist Federation, aiming at gaining insights on the extent that HEAT has been used by different user groups and how the HEAT could be disseminated more widely and effectively to facilitate greater policy influence.

Information on the HEAT use was collected from a wide range of sources. In addition, semi-structured interviews were carried out with selected HEAT users. Eventually, 92 HEAT applications could be documented, as shown in Table 1 below.
Table 1: Overview of documented HEAT uses by type of document

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reports</td>
<td>51</td>
<td>47%</td>
</tr>
<tr>
<td>English</td>
<td>30</td>
<td>28%</td>
</tr>
<tr>
<td>Non-English</td>
<td>21</td>
<td>19%</td>
</tr>
<tr>
<td>Academic paper/abstract</td>
<td>28</td>
<td>26%</td>
</tr>
<tr>
<td>Government papers/guidance</td>
<td>14</td>
<td>13%</td>
</tr>
<tr>
<td>Other (slides, website etc.)</td>
<td>7</td>
<td>6%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>92</td>
<td>100%</td>
</tr>
</tbody>
</table>

In no country, the use of the HEAT was found to be mandatory (as in most countries toolboxes for transport economic appraisals usually take the form of non-mandatory guidance) but it was included in official national guidance in England and Sweden and officially promoted in Austria, Finland and France. However, in view of a weekly average number of visitors of about 170 on the HEAT website, the number of countries having officially endorsed it is still quite small, as is the number of documented applications. Regional and local-level use is far more prevalent than national use (but often, it has been mentioned that national level endorsement and/or promotion would be helpful for local implementation). Main reasons for not using HEAT in a wider survey were “no time” (57%), “no data” (38%), “no use” (17%) and a range of other, less often quoted reasons (28%).

Continuous communication and dissemination of HEAT and specific case studies was found to be crucial for its uptake. For example, key people first learned about HEAT thought presentations at conferences or press releases that included results for their city. Nevertheless, it was stated a number of times that especially local level planners still “never heard about the HEAT”. Continued and strategic further dissemination is thus another key task for the future, along with translation of the user guide and potentially the website.

The study identified the following HEAT success factors:

- Active transport has enormous positive impacts on health; HEAT helps to quantify these.
- It is issued and endorsed by the WHO.
- It is recommended by the United Kingdom’s Department for Transport in their official guidance and has been used or recommended by a number of national agencies.
- It is tangible and produces clear results.
- It is clear and in easy to use (once you have data on cycling / walking).
- It gives traction and allows justification for investment in walking and cycling.
- It will have a positive impact on the benefit:cost ratio of investments for cycling/walking.
Recommendations to further strengthen dissemination and increase uptake were:

- Focus on countries with the highest potential, fulfilling fulfil one or more of the following:
  - Economic assessments are a routine part of decision-making.
  - There are transport problems that have been identified that can be addressed by cycling and walking (e.g. congestion, overload of the public transport system or lack of one, pollution, and climate change).
  - There is a culture or initial steps towards sustainable transport.
  - There is a transport infrastructure that allows for at least some cycling.
  - HEAT is already used – perhaps by local experts or academics.
  - There is a (possible) champion in or close to the Department of Transport.

- Create a network of HEAT ‘super-users’ which can foster dissemination and uptake within key organizations and/or countries.

- Encourage key stakeholders to ‘give it a try’, as people who have used it have been universally impressed with the size of the health impacts.

- Encourage its use in larger-scale modelling and scenarios

- Aim for the HEAT to be recommended for use by national transport administrations and the European Commission, as local transport planners – and consultancies supporting them – tend to focus on applying tools and elements that are part of the official cost-benefit analysis guidelines.

- Invest in data collection, as the survey revealed that lack of data on walking and cycling is a key barrier to use of the HEAT. Users from the interview stated that trying the HEAT often had an unexpected outcome of helping them realize that the gaps in their dataset.

- Promote its use more generally, e.g. through press releases with specific HEAT calculations that have been conducted for cities / countries, using the available case studies more frequently, widely and strategically, presenting HEAT in new fora, specifically also targeting national key stakeholders and local transport planners, etc.

In addition, it was suggested that visibility and possible impact could also be increased by promoting the inclusion of HEAT into other tools or platforms, or by making more visible where this is already the case, e.g. in the Propensity to Cycle Tool (PCT)\(^6\) [11].

ECF in collaboration with WHO/Europe will develop next steps in consideration of these recommendations and related to the recently launched development of a European Cycling Action Plan, which is foreseen to be launched in 2019 at the next High-Level Meeting on Transport, Environment and Health\(^7\).

\(^6\) http://pct.bike/
\(^7\) https://www.unece.org/transport-health-environment-the-pep/about-us/the-pep-high-level-meetings.html
7 Conclusions, next steps and closing

In conclusion, the core group endorsed the development of proposals for a carbon module and a crash module for adoption by the consensus meeting in March 2017 and decided on next steps for the development of an experimental module would be developed for morbidity, presenting different outcome measures, to facilitate a more in-depths understanding of user needs and preferences.

Further issues mentioned during the workshop warrant a more in-depth discussion at future core group meetings, including the next one foreseen to take place back-to-back with the 5th consensus meeting, in particular:

- a more systematic compilation of use cases and assessment of applicability of different HEAT modules
- assessing the argumentation and impact of increasing the current upper age limits of HEAT in more detail.
- understanding the need to update or amend certain HEAT elements, e.g. the days-per-year-cycled, default discounting rates, default VSL values, calculation of impacts using attributable fraction formulas, etc.
- options and needs for different HEAT versions, in addition to the online version (e.g. Excel-version, R-based version, etc.)
- need and possible scope to invest into a HEAT input modules to support suitable data collection efforts;
- developing a more standardized approach to applying the HEAT core principles, in terms of sequence and process.
- further developing ideas to create a “HEAT lab”, i.e. a developer space that would allow to create simulation frameworks for the HEAT to assess the importance (i.e. sensitivity analyses) of different aspects on the HEAT end results (e.g. age ranges vs. relative risks used vs. traffic composition, determinants for the propensity to walk/cycle etc.) , to test different methodological approaches to understand their impact (e.g. multistate life tables or age-adjusted YLLs), to test possible default values, or to use travel survey data from different countries in different ways and to run more systematic sensitivity analyses. Such tasks would support and facilitate the further development and refinement of HEAT modules in terms of understanding where additional complexity would actually increase validity of the HEAT and where it would not be necessary.
- investments in further increasing user friendliness and promotion of HEAT, next to its scientific and content-related development (scenario analyses, case studies, press-releases, web-interface, etc.)
- strategic development of further HEAT modules, user interfaces, definition of target audiences, products and dissemination (i.e. what is the space we want to occupy and how do this best)
Francesca Racioppi closed the workshop with warm thanks to the experts who prepared the background work to guide the discussions, the chair for excellent guidance through the meeting and to Sonja Kahlmeier for coordinating and facilitating background work and preparations. Finally, she expressed appreciation on behalf of the WHO to all participants for the valuable support and inputs provided to the HEAT process.
References


### Annex 1  Meeting programme

**Wednesday, 2 November 2016**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>16:30 – 17:00</td>
<td>Registration and refreshments</td>
</tr>
</tbody>
</table>
| 17:00 – 17:15 | Welcome, election of the chair and rapporteur of the meeting, and introduction to the scope of the meeting  
Francesca Racioppi, WHO/Europe |
| 17:15 – 17:35 | Introduction of considerations on a HEAT carbon module  
Christian Brand, University of Oxford, United Kingdom |
| 17:35 – 19:00 | Discussion of a HEAT carbon module  
Chair |
| 20:00         | Social dinner                                                         |

**Thursday, 3 November 2016**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>09:00 – 09:15</td>
<td>Welcome coffee</td>
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| 09:15 – 09:45 | Recap of day 1, discussion (ctnd.) and conclusions on a HEAT carbon module  
Chair |
| 09:45 – 10:05 | Introduction of considerations on a HEAT morbidity module  
David Rojas, IS Global, Barcelona, Spain |
| 10:05 – 10:30 | Discussion of a HEAT morbidity module  
Chair |
| 10:30 – 11:00 | Coffee/tea break                                                    |
| 11:00 – 12:15 | Discussion and conclusions on a HEAT morbidity module  
Chair |
| 12:15 – 13:15 | Lunch                                                              |
| 13:15 – 13:30 | Introduction of considerations on a HEAT crash module  
Thomas Götschi, University of Zurich, Switzerland |
| 13:30 – 14:45 | Discussion of a HEAT crash module  
Chair |
| 14:45 – 15:15 | Coffee/tea break                                                    |
| 15:15 – 16:00 | Discussion and conclusions on a HEAT crash module  
Chair |
| 16:00 – 16:30 | Dissemination and uptake of HEAT– lessons learned and recommendations  
Nick Cavill, Cavill Associates, United Kingdom |
| 16:30 – 17:00 | Next steps and closure  
Chair |
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