Journal of Transport & Health xxx (xxxx) xxxx

Contents lists available at ScienceDirect

Journal of Transport & Health

journal homepage: www.elsevier.com/locate/jth

5th International Conference on Transport and Health: ICTH 2019-Melbourne

Karyn Warsow[a], Professor Jennifer S Mindell[b]

[a] TPH Link / IPATH, Michigan, USA
[b] UCL, London, UK

We are delighted to introduce the 5th International Conference on Transport and Health (ICTH 2019), being held in Melbourne, Australia from 4th to 8th November 2019. The next item in this *Journal of Transport and Health* supplement describes the host organisation: the Future Urban Mobility Group of the Smart Cities Research Institute, Swinburne University of Technology, Australia. The organising committee can be seen at https://www.tphlink.com/programme-committee.html.

Further information about the ICTH series of conferences can be found at https://www.tphlink.com/transport–health-conference.html, from the first in London in 2015 to the fifth in Melbourne. Papers presented at these conferences that have also been published in the *Journal of Transport and Health* have been collated in 'virtual special issues':

- *2015-London* https://www.sciencedirect.com/journal/journal-of-transport-and-health/special-issue/10XJCGN85ZS
- *2016-San Jose* https://www.sciencedirect.com/journal/journal-of-transport-and-health/special-issue/10KLJB6N5DH
- *2017-Barcelona* https://www.sciencedirect.com/journal/journal-of-transport-and-health/special-issue/10B1N46737R
- *2018-Michigan* https://www.sciencedirect.com/journal/journal-of-transport-and-health/special-issue/10M2BL93ZGW

The rest of this supplement contains the accepted abstracts being presented at ICTH. This includes work from researchers and from practitioners; from specialists in public health, transport, planning, and a range of other disciplines; from universities, consultancies, local and national government agencies, and other types of organisations; covering a wide range of topics; and using a wide range of methods.

https://doi.org/10.1016/j.jth.2019.100654

2214-1405

Journal of Transport & Health xxx (xxxx) xxxx

Contents lists available at ScienceDirect

Journal of Transport & Health

journal homepage: www.elsevier.com/locate/jth

Research Agenda for Shaping the Future of Smart Mobility

Swinburne University of Technology is a world-ranked university focused on innovation, industry engagement and social inclusion. Our education, high-quality research and industry partnerships create positive change for students, staff and the community.

Our research is supported by a strong research environment comprising five research institutes. These include the Smart Cities, Social Innovation, Data Science, Iverson Health Innovation, and Manufacturing Futures research institutes. This research ecosystem fosters collaboration and links researchers with industry, business and community to maximise research impact.

1. Smart Cities Research Institute

Swinburne's Smart Cities Research Institute seeks innovative approaches to address the challenges facing the world's cities, with a unique transdisciplinary socio-technical approach. The Institute promotes research through solid collaboration with our partners in federal, state and local government, with industry and service providers, and with professional practice.

Our work at the Institute is focused on a set of grand challenges for large, fast growing cities. Addressing these challenges requires a multi-disciplinary team of social and technical researchers focusing on key areas of sustainable urban development. The Institute has four key research programs which include future urban governance, future urban mobility, future spaces for living, and future urban infrastructure. Through our research, we aim to identify and remove barriers to the scale-up of urban innovation, and develop disruptive interventions and technologies that will enable step-changes in key urban domains.

2. Future Urban Mobility Program

Swinburne's Future Urban Mobility Group undertakes research into the development and evaluation of new solutions and policy pathways with the likelihood of greatest impact in achieving sustainable urban mobility.

Our work focuses on making cities accessible to their populations through connecting the social, physical, economic, and information infrastructures. We achieve this by creating safe and resilient urban transport and mobility solutions that enhance access to services, places and economic opportunities, and improve the quality of life for citizens. Our research is primarily industry-focused and recognises the role of digital innovations and disruptive technologies in addressing the modern-day demands of urban living in the world's large and fast growing cities.

3. Key research areas

Our program comprises a multi-disciplinary research team that specialises in transport planning, transport engineering, computer science, information technology, data science, machine learning and artificial intelligence. The team also includes researchers with specialisation in logistics and urban freight, electric vehicles, software innovations, and active transport and health. We work on a range of topics divided into three streams, each with four themes.

3.1. Stream 1: intelligent transport systems and infrastructure

Research in this stream is focused on reducing the need for new transport infrastructure through better utilisation of existing assets. The capability in this area includes development of algorithms for network operations, and data-driven management of transport systems. It also includes researching new sensors and communication systems. The four themes under this stream include:

- Network management and control

https://doi.org/10.1016/j.jth.2019.100656

- Smart infrastructure and asset management
- Technology, sensors, communications, and control systems
- Enhanced personal mobility

3.2. Stream 2: transport modelling and traffic simulation

In this stream, our research focuses on evaluating the impacts of mobility solutions using transport and traffic modelling methodologies. These include a hierarchy of models ranging from strategic through to operational traffic simulation and agent-based models. Key facilities that support our research include Swinburne's Virtual Smart Mobility Research Facility, with state-of-the-art modelling platforms for the assessment of economic, social and environmental attractiveness of mobility solutions and land-use transport interactions. The four themes under this stream include:

- Large scale optimisation
- Gamification
- Predictive intelligence, traffic forecasting, AI and data analytics
- Agent-based traffic simulation and behavioural modelling

3.3. Stream 3: disruptive mobility

Research in this stream is focused on shaping the future directions of urban mobility through rigorous research that evaluates emerging and new modes of transport and business models. This includes estimation of transport demands for new solutions and scenarios of potential shifts in supply and demand. Our research looks beyond the hype and establishes long-term impacts of new technologies. It also develops rigorous but flexible evaluation frameworks for agile and outcome-focused regulations that encourage transport innovations. The four themes under this stream include:

- Emerging modes of transport and autonomous shared mobility
- Urban air mobility
- Low and zero emissions urban transport solutions
- End-to-end freight solutions

Our work at the Institute recognises that the transport sector requires fresh thinking and new approaches to meet people's demands for travel. Many solutions on the horizon offer immense opportunities that could transform transport and infrastructure investment and operation. There will be disruptions to established norms, and there will be broad societal challenges. Through rigorous research that determines when and how to take advantage of these technologies, our research keeps stakeholders informed of the opportunities provided by the rapid improvements in urban mobility.

Hussein Dia
Smart Cities Research Institute, Swinburne University of Technology, Melbourne, Australia
E-mail address: HDia@swin.edu.au, linkedin.com/in/husseindia@HusseinDia.

Journal of Transport & Health xxx (xxxx) xxx

Contents lists available at ScienceDirect

Journal of Transport & Health

journal homepage: www.elsevier.com/locate/jth

Oral Abstracts

#2519

THE IMPACTS OF SOCIO-CULTURAL DIMENSIONS ON ACTIVE TRANSPORTATION MODE CHOICE ACROSS SEVERAL COUNTRIES CASE STUDY OF KALAMAZOO (USA), SEOUL (SOUTH KOREA), JEDDAH (SAUDI ARABIA), AND SAMARRA (IRAQ)

Raed Hasan, Jun-Seok Oh, Valerian Kwigizile. *Western Michigan University, Kalamazoo, Michigan, USA*

Background: In the United States, the most economically and technologically advanced country, almost half of adults do not meet the health guidelines of the daily 30 minutes goal of the physical activity. In South Korea, the cycling network still has a limitation in its infrastructure and route destinations. Also, Saudi Arabia suffers from transportation issues that have been linked with weakness in current policies and practices for land-use planning and transportation. Iraq is one of the economically and technologically weak countries, which poses challenges in using active transportation. The differences in cultures, level of economy and technology across four case studies offers a unique prospect in examining the role of various socio-culture, roadway and environmental factors on the choice of active transportation mode. This study aimed to assess the social and cultural dimensions that affect people's choices of active modes of transportation.
Methods: This research was conducted through a series of surveys. Logistic regression was used to estimate the odds of a person choosing an active mode of transportation as opposed to motorized transportation given the predictor variables. The random forest was then used to predict a person's mode of transportation using cross-validation resampling technique. Measures of predictive model performance were accuracy, areas under receiver operating characteristics, precision, recall and F1-score.
Results: The odds of choosing active transportation was higher in South Korea (OD=4.32, $p<0.001$) followed by Iraq (OD=1.000,$p<0.001$), U.S.A (OD=0.152, $p<0.001$) and Saudi Arabia (OD=0.096, $p<0.001$). On average, males have higher odds of using active transportation (OD=1.933, $p<0.001$) than females after controlling for participant's country and other confounding factors. Further, security concerns (OD=0.596, p=0.035), societal concerns (OD=0.308, $p<0.001$) decrease the odds of walking and biking. The Random Forest achieved a predictive accuracy of 0.806 and area under ROC=0.8 using demographic, cultural, transportation and environmental predictors. Top five influential predictors of active transportation as indicated by variables importance plot were the distance from the origin to destination, body mass index (BMI), participant's country, societal norms associated with active transportation and gender.
Conclusions: The results of this study offer insight to planners and proponents of active transportation on factors that affect the use of active transportation across countries with different cultural, economic and technological advancements. The factors that were identified as important predictors of active transportation can be used to assess and identify areas were active transportation investment programs are needed.

#2520

INDIVIDUALS WITH DISABILITIES' PERCEIVED PUBLIC TRANSPORTATION ACCESS

Keith Christensen. *Utah State University, Logan, Utah, USA*

Background: Transportation plays an essential role in accessing education, healthcare, work, shopping, and other aspects of full community inclusion. A lack of private transportation options may make some groups, including individuals with disabilities, more dependent on public transportation systems. Despite increased use of public transportation, people with disabilities continue to report barriers accessing public transportation services. It continues to be imperative to identify public transportation system barriers to individuals with disabilities. While there have been some general national studies, few provider-specific studies have been conducted regarding specific barriers that individuals with disabilities face when accessing public transportation services.
Methods: The purpose of this study was to better understand the barriers and perceived accessibility of the Utah Transit Authority's (UTA) public transportation system for individuals with disabilities by examining through direct survey the travel behaviors and perceptions of individuals with disabilities residing within Utah's Wasatch Front region in relation to the availability and accessibility of fixed route and paratransit transportation services.
Results: The sample population represented 327 participants with disabilities over 18 years of age and residing in Utah's Weber, Davis, Salt Lake, and Utah counties. Participant's responses on a 22 question, with 45 barrier specific sub-questions, multi-language, skip-logic, incentivized online questionnaire were analyzed using descriptive, ANOVA, and Chi-square statistics. These descriptive statistics will be presented, as well as statistically significant results indicating type of disability specific perception of accessibility barriers, transportation service mode preferences, and frequency of

https://doi.org/10.1016/j.jth.2019.100635
2214-1405/

public transportation use. For example, the findings suggest that transportation service mode preferences explain a greater percentage of the variance in accessibility perceptions than do either type of disability or frequency of public transportation use; transport user's with disabilities chose transportation modes with the fewest perceived accessibility barriers, although the mode choice and perceived barriers are different according to types of disabilities. Additionally, the number of transfers necessary within a public transportation trip significantly worsens a user's perception of accessibility barriers.

Conclusions: Ultimately, while a single barrier may result in the perceived inaccessibility of public transportation, it is most often the interaction between clusters of barriers which lead to the perceived inaccessibility of public transportation, and these clusters of barriers are disability specific. The research findings not only have theoretical significance regarding accessible public transportation system planning and delivery and demonstrate a replicable assessment instrument useful to transportation agencies, but also directly support UTA's efforts to implement more accessible public transportation.

#2524

ADVANCING INDIAN NATIONS' MOTOR VEHICLE CRASH REPORTING

Kimberly Vachal. *North Dakota State University, North Dakota, USA*

Background: The American Indian/Native Alaskan population experienced a motor vehicle (MV) crash death rate of 16.25 per 100,000 population between 2012 and 2016 (CDC, 2018). This rate was 40% higher than that of the U.S. population as whole. Although preventable, a majority of these indigenous populations lack fundamental data needed to understand these events and effective countermeasures.

Methods: Case study analysis was conducted to establish the status of crash reporting by tribes. The cross-case study used field visits, electronic interviews, phone interviews, document review, and data collection to gain a better understanding of the MV crash reporting system for four tribes in North Dakota. The design was explanatory since the basic functions of this type of system are understood through previous tribal studies and synergistic work with state crash reporting.

Results: Each Indian Nation has its own culture and structure that influences crash reporting. Law enforcement agencies have the responsibility for documenting crash events, but they are not primary data users. Indian Nation crash events are often documented by federal law enforcement agents, but the narrative nature and access barriers seem overwhelming challenges to local use. The inventory process produced a pragmatic crash reporting approach that tribes can refine to fulfill local objectives for accountability, sovereignty, and system integrity. External support, however, is needed to ensure continuity for Indian Nations that commit to improved crash reporting.

Conclusions: Major shortcomings and challenges are evident in a review of Indian Nations' crash reporting. Huge safety benefits could accrue to tribal communities from more comprehensive crash reporting. The study shows that consistently documenting MV crash events is plausible with commitment from tribes and support from other stakeholders.

#2532

BUSY ROADS REDUCE WALKING AND AFFECT INDIVIDUALS AND COMMUNITIES: WHAT IS THE VALUE OF THOSE IMPACTS IN GREAT BRITAIN? *(HIGH SCORING POST-DOCTORAL/EARLY CAREER ABSTRACT AWARD SPONSORED BY SAM SCHWARZ TRANSPORTATION CONSULTANTS)*

Paulo Anciaes [1], Peter Jones [1], Jennifer S. Mindell [2], Shaun Scholes [2]. [1] *Centre for Transport Studies, UCL, London, UK;* [2] *Department of Epidemiology & Public Health UCL, London, UK*

Background: Motorised road traffic can be a physical or psychological barrier to the mobility of residents in the surrounding areas and reduce their propensity to walk. We estimated the economic value of the wider consequences of this reduction in walking on: self-reported health status, subjective wellbeing, neighbourhood social capital, and expenditure in local businesses.

Methods: We used the results of a survey in Great Britain (n=3038) to estimate two sets of models. The first set modelled characteristics of travel behaviour (the number of trips across the road, proportion of those trips made by walking, and amount of time walked for leisure) as a function of an index of the "barrier effect" of the road and other variables. The second set then modelled personal outcomes (self-reported health status, subjective wellbeing, and neighbourhood social capital) and per-trip expenditure on local businesses as functions of travel behaviour, personal income, and other variables. The economic value of the barrier effect on the personal outcomes was then estimated as the increase in income that would compensate for the deterioration in the outcomes associated with the barrier effect, via changes in travel behaviour. The impact on expenditures in local businesses was derived by combining the impact on number of trips to those businesses with impacts on per-trip expenditure.

Results: All three personal outcomes were negatively associated with the barrier effect of the road and positively related to personal income. The barrier effect was associated with higher per-trip expenditure on local businesses but lower total expenditure through reductions in trips made. The overall costs of the barrier effect were estimated to be £1119 per person per year. This value varied within the interval £998-£1146/person/year, depending on the assumptions made in the analysis. The highest costs were reduced wellbeing (£420/person/year). The costs in London and Northwest England and for city residents and those aged 25-44 were considerably higher than average. The road characteristics linked to the highest costs were traffic volume (£449/person/year), the number of road lanes (£255), and traffic speeds (£210).

Conclusions: By quantifying for the first time, at the national level, the costs of the effects of motor vehicles on the walking behaviour of local residents and the wider consequences of these effects, this study provides persuasive evidence on the urgent need for policies to reduce current levels of motorised traffic in residential areas.

#2535

HOW DO FEMALE PATTERNS OF UTILITY CYCLING, AND TRAVEL MORE GENERALLY, DIFFER FROM MEN? CROSS SECTIONAL SURVEY IN NEW ZEALAND

Caroline Shaw [1], Marie Russell [1], Michael Keall [2], Kirsty Wild [3], Alistair Woodward [3], Sara MacBride-Stewart [4]. [1] *University of Otago Wellington, New Zealand;* [2] *University of Otago, Wellington South, New Zealand;* [3] *University of Auckland, Auckland, New Zealand;* [4] *Cardiff University, United Kingdom*

Background: There are pressing health and environmental reasons to increase levels of sustainable travel, and cycling. However, in most low prevalence cycling countries women cycle less than men, and research suggests this may be difficult to shift. These cycling patterns occur within a wider context of distinct travel patterns by gender. We sought to quantify patterns of travel, travel-related health outcomes, and GHG emission profiles of female and male utility cyclists and non-cyclists in New Zealand.
Methods: We analysed the 2003-2014 results of the New Zealand Household Travel Survey a continuous, nationally representative, complex, cross-sectional survey of around 4600 households per year. Utility cyclists were defined as people who cycled at least 20 days in the preceding month per month. Outcomes included trips, METs from cycling and walking trips, tailpipe GHG emissions. Cross tabulations and logistic regression of personal, household and travel information were reported for male and female cyclists and non-cyclists.
Results: Women take more trips daily but travel less distance than men (e.g. female cyclists take a mean of 5.66 trips per day (95% CI:5.38-5.95) and travel a mean distance of 39km (35-44) compared to male cyclist who take a mean of 4.97 trips daily (4.77-5.17) travelling 44 km (40-47)).. Cyclists take more trips than non-cyclists but travel about the same distance as their non-cyclist same gender compatriots (e.g. non cycling women travel a mean 38 km daily (37-39) and men 46 km daily (45-47)). Cyclists have higher sustainable mode use but still largely car dominated travel (e.g. 80% of female cyclist's trips are by car compared to 90% for female non-cyclists). Two thirds of female and male cyclists achieve 600 METS or above per week through walking and cycling, compared to one third of non-cyclists. Cyclists have lower tailpipe GHG emissions from land transport compared to non-cyclists, however men overall have higher GHG emissions than women irrespective of cycling status. Regression analysis showed larger household size, children in household, older age and higher levels of car access are associated with lower odds of cycling for both genders.
Conclusions: Travel patterns for cyclists in New Zealand are more sustainable than non-cyclists but still highly dominated by car travel. Women's travel patterns are more sustainable than men's, however there is considerable opportunity for mode shift if appropriate policy and infrastructure that cater for women's travel requirements are implemented.

#2538

DROWSINESS DEVELOPMENT AND DETECTION IN SIMULATED ENVIRONMENT: A SYSTEMATIC REVIEW

Sónia Soares, Sara Ferreira, Antonio Couto, José Pedro Tavares, António Lobo. *University of Porto, Porto, Portugal*

Background: Drowsy and fatigued drivers are still one of the major causes of road crashes. When drivers are engaged in those states, both cognitive and motor capabilities are considerably compromised, resulting in driving performance impairments. In this sense, several studies reveal the frequent incidence and statistics associated with drowsiness and fatigue on the wheel. To illustrate that approach, studies show that approximately 16.5% of the fatal crashes in the United States involve drowsy drivers while up to 20% of traffic crashes in the United Kingdom are attributed to fatigue. These results are likely to be even accentuated on professional drivers, considering that these are more exposed to this type of risk behavior due to the long work journeys. Keeping in mind the significant and negative impact on road safety of driver drowsiness and fatigue, several studies have been conducted, usually having a driving simulator as the main tool.
Methods: Our purpose was to conduct a systematic review of international literature including studies associated with drowsy and fatigued drivers. The research focused on the detection and effects of drowsiness, and predominantly on studies based on driving in simulated environments. To achieve that purpose, the review was made in accordance with the PRISMA statement guidelines. In-Depth research was conducted in targeted databases with the combinations of the keywords and derived terms of "drowsy", "sleep", "fatigue", "road safety" or "traffic safety", "driver behavior" and "simulator".
Results: The selection process resulted in 19 studies who met the inclusion criteria. A total of 629 participant performances were analyzed. The results revealed that several factors can interfere with the development of drowsiness and fatigue levels along with the driving. For instance, time-on-task, sleep deprivation, monotonous roadways and darkness are associated with increasing sleepiness. To validate this, subjective measures (mainly international recognized questionnaires) and biometric measures (e.g. blink duration and frequency, percentage of eyelid closure or electroencephalography) are often correlated with driving dynamic parameters in order to identify the drowsiness evolution and its more accentuated events.
Conclusions: The analysis leads to a general conclusion that, even though the studies have divergent objectives and methodologies, a combination of biometric monitoring, subjective measures and driving performance variables are always the basis of analysis. Overall, this review presents structured information about driving simulator experiments oriented to the study of drowsiness and fatigue, providing the relevant knowledge under the scope and giving guidelines to future studies.

#2547

'IT FEELS LIKE I'VE LOST MY INDEPENDENCE…NOW I JUST FEEL LIKE I'M A PRISONER TRAPPED IN MY OWN CITY'- POLITICIZING THE TRANSPORTATION-HEALTH NEXUS: EVIDENCE FROM THE CANADIAN PROVINCE OF SASKATCHEWAN

Jacob Albin Korem Alhassan, Lori Hanson. *Department of Community Health and Epidemiology, College of Medicine, University of Saskatchewan, Saskatoon, Saskatchewan, Canada*

Background: In May 2017, the Saskatchewan Transportation Company (STC), a government owned bus company in Saskatchewan, Canada was shut down as part of a provincial government budget aimed at reducing the province's budget deficit. The company had existed since 1946 and was a vital

mobility link connecting 253 communities and travelling about 2.8 million miles per year. This research uses a critical political economy of health lens to interrogate the political context relevant for understanding the transportation-health nexus using the STC as a case study.
Methods: The study was an instrumental qualitative case study. It employed two analytical strategies -a Foucauldian Discourse Analysis (FDA) and Qualitative Content Analysis (QCA) to understand the political rationale for the closure of STC and the health impacts of the decision. The first part of the analysis involved a content analysis of thirty (30) responses from community members on the political rationale and health impacts of the closure of STC. The discourse analysis involved a documentary analysis of parliamentary hansards from December 2016-June 2018 to understand the political rationalization of the decision to shut down the company. Parliamentary discourses were then compared with the responses of community members to understand the complex relationship between politics, transportation and health.
Results: Community member responses revealed concerns over health impacts due to inability to attend hospital appointments for cancer treatment and dialysis, hitchhiking, problems with transporting medical equipment and a general concern with dispossession and isolation due to the closure of the company. Community members also described environmental concerns that might follow from the closure. The political rationale offered by community members was that the company's closure was deeply ideological. The analysis of parliamentary Hansards showed several discourses used to justify the closure of the company including the conception of transportation as non-essential, the trivialization of actual and potential impacts of the closure, the use of budgetary deficits as a reason for the closure and the justification of the closure on the grounds of political expedience.
Conclusions: The transportation-health nexus exists in the context of political choices (example: decisions to keep or shut down bus companies) that merits more attention. In the case of the closure of the STC, the transportation-health connection was trivialized through discourses of minimization. Using a neoliberal logic of austerity, a deeply ideological decision was made to dispossess several communities of access to public transportation with critical public health implications.

#2549
CAN POLICE AND HOSPITAL DATA RECORD LINKAGE BE IMPROVED THROUGH THE RELAXATION OF LINKAGE TOLERANCE THRESHOLDS?

Antonio Couto [1], Sara Ferreira [1], Marco Amorim [2], Murilo Santos [1], Melissa Silva [1], Joao Vasco Santos [3,4], Alberto Freitas [3,4].
[1] *University of Porto, Porto, Portugal;* [2] *Fraunhofer Institute for Industrial Engineering IAO, Stuttgart, Germany;* [3] *CINTESIS - Centre for Health Technology and Services Research, Portugal, Porto, Portugal;* [4] *MEDCIDS – Department of Community Medicine, Information and Health Decision Sciences, Faculty of Medicine, University of Porto, Porto, Portugal*

Background: A complete overview of casualties' characteristics is needed to fully assess the consequences of traffic crashes and monitor progress. To meet this objective, it is fundamental to obtain accurate and complete data, which is seldom possible from a single data set. Therefore, the linkage of traffic crash records has been widely used. In order to contribute to the success of record linkage, this study analysis the use of tolerances to link records of pedestrian victims gathered from police and hospital.
Methods: The linkage was performed using a mixed deterministic and weight-based probabilistic method and without access to key identifying data (e.g. names of the victims), which is a common issue to ensure the confidentiality of victims. Therefore, the personal identifiers were limited to age and gender. In addition, date of crash, date of admission to hospital, the location of the crash and the hospital name were also considered. Unfortunately, it is common to find numerical differences between data sets (i.e. errors), leading to a poorly linked dataset. To evaluate the influence of the linking variables in the linkage process, scenarios were created to analyse different numerical tolerances for two individual variables (age and date of the crash), comparing with the baseline scenario (i.e. without tolerance). Additionally, errors were generated in order to assess their impact on the linkage outcomes, as well as on the used tolerance.
Results: The findings of this novel analysis are mainly: 1) errors in age variable lead to a decrease in linkage rates; 2) linkage success is sensitive to the tolerance assumed for the variables particularly when the errors exist in the dataset.
Conclusions: The study supports the decision of using tolerances to link records of numerical variables to improve the success of the linkage process. This is especially true with respect to variables which are more susceptible of incorporating errors arising from the registration process, such as for example the victim age.

#2554
CAN ACTIVE COMMUTING IMPROVE WORKERS' HEALTH, LIFE AND JOB SATISFACTION?

My Dinh. *Loughborough University, UK*

Background: Active commuting has been shown to improve physical health and subjective well-being (SWB). However, there is a lack of research on how active commuting can affect job satisfaction (JS), even though commuting is an essential part of daily working life. Moreover, Health, SWB and JS are linked, and their pair-wise associations have been investigated to boost workers' welfare. Hence, looking at these four variables simultaneously and their causal relationships would be beneficial. As JS is related to workplace performance, exploring these connections would contribute to policy planning on commuting and, in turn, influence workforce performance and productivity.
Methods: The longitudinal Understanding society survey on 40,000 British households from 2009 to 2017 is the main data source. The dependent variable in each model is one of the variables of interest and the other three are included as the main predictors. Panel fixed effects models are incorporated to control for heterogeneity that stems from time-fixed individual characteristics. As the variables may have simultaneous effects on each other, the Generalised method of moments approach with valid instrument variables is used as a solution for the simultaneity bias.
Results: Active commuting modes can improve JS by 0.0185 units. We also find that there are reciprocal causal relationships between Health, SWB, JS and Active commuting. When heteroskedasticity-robust standard errors are required on all models, two reciprocal causal relationships between Health and JS and between JS and SWB are revealed. JS can improve a worker's health and well-being by 0.127 units and 0.0831 units, respectively. Thus, a person satisfied with their work will be likely to have better health and perceive their life more optimistically. Besides, Health has a significant effect in the model for JS (0.102 units), and as JS is a domain-specific factor of SWB, it is reasonable for a significantly positive relationship between them (0.0892 units). The literature has found some association between SWB and Health, and this study can justify that JS is a reason for the connection in the case of workers.

Conclusions: The reciprocal connections between Health, SWB and JS illustrate how intertwined these concepts are. Policymakers should take these results into account when considering policies on performance and productivity. The duration for active commuting does not seem to have great effects on Health, SWB and JS, although this should not be taken as a pessimistic sign because active commuting is perceived differently from recreational physical activities.

#2559

THE IMPACTS OF PARKING SUPPLY RESTRICTION ON MODE SHIFT: OBSERVATIONS FOR THE QEII MEDICAL CENTRE, 2009-2018 ***(2ND HIGHEST SCORING PRACTITIONER ABSTRACT AWARD SPONSORED BY SWINBURNE UNIVERSITY OF TECHNOLOGY)***

Alix Oakes. *Cardno, Perth, Western Australia, Australia*

Background: The QEII Medical Centre (QEIIMC) is the largest medical centre in the southern hemisphere. Redevelopment activities over the last 10 years have involved an amalgamation of several hospitals, specialist facilities and research organisations onto a single site. This redevelopment has been accompanied by a significant increase in transport infrastructure and supported through implementation of a best practice behaviour change program, TravelSmart. Throughout this redevelopment, changes relating to car parking supply have resulted in the ratio of bays to staff rising and falling over time.
Purpose: We compare the results from four Travel Plans which span a timeframe of 10 years to illustrate how mode shares have changed relative to development triggers.
Results: It was found that single occupancy vehicle mode share decreased from 75% in 2009 to 43% in 2012 following the implementation of the travel plan. Measures from the travel plan included the introduction of paid parking, parking permits, and a significant reduction in the parking bays during development, alongside incentive programs for employees to switch from the car to alternative modes. TravelSmart initiatives included the "TravelSmart Junction" information kiosk, "Green Commuter" permits, a car-pool scheme, end of trip facilities, subsidised bus fares and improvements to bus services. The 2017 Travel Survey coincided with the opening of the new multi-deck car park, prior to the occupancy of the new Perth Children's Hospital (PCH). Single occupancy vehicle mode share increased back up to 62%, despite the continuation of TravelSmart initiatives. This resurgence of driving modes can be directly attributed to the increased availability of parking on-site. In 2018, the opening of PCH on the site (without additional staff parking) meant that the parking supply ratio was again reduced proportional to the number of staff, and mode share returned to the lower level of 48%.
Conclusions: This presentation provides a synopsis of the effect of a constrained parking supply on the travel behaviour of QEIIMC staff. Through Travel Surveys, the impact of parking restrictions can be observed on the uptake of alternative transport modes, providing insights into employees' revealed transport preferences. The restriction of parking supply has had an obvious effect on single occupancy vehicle mode share by reinforcing travel behaviour change by staff. When removed, this constraint provided justification for staff to drive to work once more. This Case Study shows the importance of including parking restraint as a means of achieving mode share in congested locations and activity centres.

#2563

REDUCING CYCLIST CRASHES BY ASSESSING THE ROAD ENVIRONMENT: AN APPLICATION OF GOOGLE IMAGERY AND MACHINE LEARNING

Haifeng Zhao [1], Jasper Wijnands [1], Kerry Nice [1], Jason Thompson [1], Gideon Aschwanden [1], Jingqiu Guo [2], Mark Stevenson [1].
[1] *The University of Melbourne, Parkville, Victoria, Australia;* [2] *Tongji University, Shanghai, China*

Background: Cycling is an active and sustainable transportation mode, and is associated with health, environmental and societal benefits. Therefore, increasing the use of bicycles is being supported as a transport policy in many countries. However, despite these benefits, cyclists are vulnerable road users and are over-represented in traffic crash casualties compared to other modes of transport. The injury concern can discourage people from adopting cycling as a main transportation mode. Urban infrastructure that caters to cyclists' safety can potentially reduce crashes and therefore, injury morbidity and mortality.
Methods: This research uses cyclist crashes recorded by the state road authority from 2010 to 2013 in Greater Melbourne. Exposure data used anonymised bicycle trips recorded by volunteer users of RiderLog smartphone application from 2010 to 2013. Crash locations and control sites were sampled from areas with high cycling exposure. Google Street View maps and satellite images at crash locations and control sites were downloaded to capture information of the road environments where cyclists crash and never crash. Deep learning methods using generative adversarial networks were applied to explore features of road environments associated with cyclist crashes.
Results: A number of unique observations were identified namely, that locations that have low crash risk had more green space (trees or grass), and median strips (that separate traffic from opposing lanes on divided roadways) also decreased a cyclist's crash risk. Road environments with high-rise buildings casting shadows on the roadside are mostly seen in the environment in which crashes occurred. The experiments also identified factors that have been reported previously in the literature and statistical analysis, providing confidence in the presented methods. Such factors include tram tracks, intersections, on-road parking and off-road bicycle paths. Statistical analysis showed 52.6% of crash locations were within 5 metres of a tram line, while this percentage for control sites was 5.6%.
Conclusions: This research presents a method that takes advantage of the increasing availability of big datasets, computing power and the advances of deep learning techniques, to analyse the road environments of locations where cyclists crash from a new perspective. The findings give urban planners insights on how streetscapes might be reconstructed to improve safety situations for cyclists. The results also provide transportation engineers and cyclists with visual indications about what kind of streetscapes are safer.

#2567

HOW DISTINCT ARE THE INATTENTION AMONG PROFESSIONAL AND NON-PROFESSIONAL DRIVERS?

Antonio Couto, António Lobo, Sara Ferreira. *University of Porto, Porto, Portugal*

Background: Driver inattention can be defined as insufficient attention, or no attention, to critical activities for safe driving and can be divided into several subcategories, such as distraction and drowsiness. These types of driver behaviour are associated with a degraded driving performance as well as with a significant detriment of cognitive performance. The present study uses retrospective data on drowsiness and distraction alerts collected from commercial driver monitoring systems (DMS) implemented to warn professional and non-professional drivers. During driving activity, the system issues alerts to the driver and stores several parameters related to event, such as the timestamp, GPS position, vehicle speed and type of alert. Objective: First, this work aims to validate the differences between professional and non-professional drivers in terms of driving profiles. Second, driver inattention is analysed according to driver profiles in order to identify risk factors related to the journey characteristics. A total of 53 professional drivers with 178 driving records and 277 non-professional drivers with 480 driving records were considered in this study.
Methods: Two distinct methods were used when considering the two defined objectives. First, a cluster analysis was applied to the data aggregated by driver. Afterwards, the data was aggregated by driving records, i.e., each observation corresponds to a period of continuous driving. Then, assuming distraction and drowsiness as safety-critical events, the risk factors were assessed separately for each event type by applying an ordered probit model.
Results: The first analysis showed that, despite the differences between professional and non-professional drivers, the two most relevant identified clusters are characterized by two distinct driving patterns: drivers of short-distance and long-distance journeys. Based on the probit model, the results indicate that the main risk factor of inattention is the continuous driving time (i.e., without stopping), and it is irrelevant how long the last break was, as well as the journey time. Moreover, results show that long-distance drivers, usually professionals, tend to be less prone to distraction but more prone to drowsiness than short-distance drivers.
Conclusions: Above all, the study shows that data gathered by DMS has the potential to contribute to the assessment of driver inattention risk factors. Particularly, the study leads to the main conclusion that ordinary drivers are more exposed to risk during long driving periods than professional drivers, however the former are not subject to any kind of travel time enforcement, in contrast to the latter.

#2570

MEASURING ACTIVE TRANSPORT ACCESSIBILITY FOR ELDERLY IN MELBOURNE

Kaniz Fatima, Sara Moridpour, Chris De Gruyter, Tayebeh Saghapour. *RMIT University, Melbourne, Victoria, Australia*

Background: The number of elderly (a person aged 65 & over) is increasing rapidly all over the world. Based on the population projections by the Australian Bureau of Statistics (2017), there will be 8.6 million people aged 65 and over by 2057 in Australia. This specific group of the population will require special attention about accessibility and mobility issues in combination with the transport system which undoubtedly can play a key role to support the elderly. Physical activities improve the chances of living longer with less disease. Physical activities may protect the elderly against heart disease, high blood pressure, high blood cholesterol, etc. It helps to reduce the chance of getting some cancers, including bowel and breast cancer, prevent type 2 diabetes, assists in controlling weight and promotes weight loss. It improves mood, aids sleep and relieves the symptoms of depression and anxiety. The active transport system is one of the used and popular policies for elderly physical movement. Walking and catching public transport helps the elderly to move and have physical activity.
Methods: The aim of this paper is to develop an index for measuring the level of accessibility to public transport for the elderly in Melbourne's 9510 Statistical Areas Level 1 (SA1s). Three steps have been considered to calculate the accessibility index for the elderly. Walk distance to the nearest public transport stops in-vehicle travel time, waiting time and walking time to stop or Point of Interest (POI). The Victorian Integrated Survey of Travel and Activity (VISTA) datasets has been used to evaluate the index and level of accessibility for Melbourne elderly. Four mostly travelled destination considered as POI for calculating the index.
Results: Elderly Public Transport Accessibility Indices (EPTAI) is developed to measure accessibility within Greater Melbourne region, Australia.
Conclusions: This paper presented the indices for the elderly which is direct to apply. The technical approach can be applied for any public transport mode in urban cities for the elderly. These indices also can be calculated for another point of interest elderly visit frequently. The indices are time-based and use available census data to calculate measures. This paper has analysed the sensitivity of accessibility based on a gravity measure using two main variables including travel time and the population of the elderly.

#2573

TURNING THE TIDE FROM CARS TO ACTIVE TRANSPORT: POLICY RECOMMENDATIONS FOR NEW ZEALAND

Sandra Mandic [1], Andrew Jackson [2], John Lieswyn [3], Jennifer S. Mindell [4], Enrique García Bengoechea [5], John C. Spence [6], Ben Wooliscroft [1], Celia Wade-Brown [7], Kirsten Coppell [1], Erica Hinckson [8]. [1] *University of Otago, Dunedin, New Zealand;* [2] *Consulting Jackson Ltd, Wellington, New Zealand;* [3] *ViaStrada, Christchurch, New Zealand;* [4] *UCL, London, UK;* [5] *University of Limerick, Limerick, Ireland;* [6] *University of Alberta, Edmonton, Canada;* [7] *Living Streets Aotearoa, Carterton, New Zealand;* [8] *Auckland University of Technology, Auckland, New Zealand*

Background: Despite national-level efforts to encourage active transport in New Zealand since 2005, rates of active transport have continued to decline in most parts of the country, with negative impacts on health and the environment.
Purpose: We describe the development of key policy recommendations for active transport in New Zealand as an outcome of multi-sectoral discussions held at The Active Living and Environment Symposium (TALES; www.otago.ac.nz/active-living-2019; Dunedin, New Zealand; February 2019). The goal was to establish a set of priority recommendations to inform active transport decision-making in central and local government, public health units and regional sports trusts in New Zealand.
Project Description: The development of recommendations was planned and led by a working group consisting of ten TALES symposium delegates working in academia, industry and non-governmental organisations with prior work experience in central/local government and the private sector. Symposium delegates provided input prior to the symposium (delegates submitted 1-3 policy recommendations); during the symposium (delegates challenged/discussed/modified the first draft of recommendations at a dedicated final day session); and after the symposium (delegates provided feedback on the second draft of recommendations and associated actions). Using an online survey, the working group members also independently evaluated importance and feasibility of each recommended action before inclusion in the document. The final 13 recommendations (and 39 associated

actions) were grouped across four broad categories: A) Evaluation, governance and funding; B) Education and encouragement/promotion; C) Engineering (infrastructure, built environment); and D) Enforcement and regulations. The report aligns with the New Zealand government's increased focus on wellbeing, walking, cycling, public transport and Vision Zero approach, and recommends national targets for walking, cycling and public transport by 2050. The report was officially launched in April 2019. Initial discussions of recommendations with relevant stakeholders were conducted in four major urban centres in April-May 2019.
Conclusions: This cross-sector effort resulted in a report that has the potential to stimulate the development of a new active transport strategy for New Zealand; prompt setting of targets and monitoring progress/outcomes; and inform New Zealand's response to the World Health Organization's Global Action Plan on Physical Activity 2018-2030. Key policy recommendations for active transport in New Zealand include: making a national-level commitment to change; establishing a nationally coordinated and funded programme of education and promotion of active transport; creating a commitment to design cities for people and not for cars; and developing a regulatory system that encourages the use of active transport.

#2574
THE ROLE OF TRANSPORT IN SUPPORTING AN EQUITABLE, LIVEABLE CITY: A REVIEW OF THE EVIDENCE

Hannah Badland [1], Jamie Pearce [2]. [1] *RMIT University, Melbourne, Victoria, Australia;* [2] *University of Edinburgh, Edinburgh, UK*

Background: The aspiration of liveable cities, underpinned by the New Urban Agenda, is gaining popularity as a mechanism to enhance population health and wellbeing. Less attention has been given to understanding how liveability may provide an opportunity to redress health inequities. Provision of accessible, affordable, and reliable transport has an important role in supporting a liveable neighbourhood. Yet, transport infrastructure is not always delivered evenly. Using an environmental justice lens, this review examines if transport is an appropriate lever for responding to reducing health inequities.
Methods: This review builds on two earlier review papers that examined associations between liveability, health, and wellbeing, by critically appraising transport literature through an environmental justice lens. Papers were initially sourced through a major liveability work program. Additional sources were guided by key reports focused on the social determinants and social gradient of health.
Results: Much evidence shows spatial patterning of public and active transport, with generally higher levels of transport infrastructure availability in inner city areas compared with middle and outer ring suburbs. A consequence from living in an auto-dependent neighbourhood was forced car ownership. If a car (or driver) was unavailable in an auto-dependent neighbourhood, opportunities for economic and social participation reduced drastically, which could stimulate a cycle of poverty through reduced opportunities for employment. Those who lacked access to public transport were more likely to experience 'transport disadvantage'. Those who experienced transport disadvantage were more likely to experience social exclusion, and further socioeconomic disadvantage due to the forced ownership and maintenance of private motor vehicles. A broader consequence of car reliance was the impact on the local environment. Low-income communities tended to face the burden of higher levels of pollution and were more susceptible to the health effects of exposure. Therefore, exposure to air pollution may have a more deleterious effect for those more disadvantaged, as per the social gradient.
Conclusions: Our review identified legitimate concerns that uneven implementation of transport interventions may exacerbate socio-spatial circumstances and further widen health inequities. Major contributors are transport disadvantage and pollution exposure, of which have social gradient patterning. Efforts should be put into urban fringe developments, which typically experience lower levels of public transport access, in an attempt to reduce the impacts of transport disadvantage.

#2575
ACTUALLY, DOING THINGS TOGETHER – GETTING NEW ZEALAND BIKEREADY FOR TRANSPORT AND HEALTH

Claire Pascoe. *New Zealand Transport Agency, Wellington, New Zealand*

Background: The links between transport and health are obvious to most working in these two sectors. Relevant government agencies commonly recognise the linkages and refer to them in strategy and policy documents. Taking collaborative action, however, is much rarer and the differences between the culture of transport and the culture of public health (including injury prevention) partly contribute to the challenge of co-delivering outcomes.
Project: This presentation will explore this topic, in the context of an attempt by the New Zealand Transport Agency, the Ministry of Health and the Accident Compensation Corporation in New Zealand to work together on the development and delivery of a national cycling education system, BikeReady. Through this project, some of the key differences between the tools each agency uses, and the way problems are framed within the two sectors were revealed. The linear 4-step transport model and the NZ Transport Agency Economic Evaluation Model stand in stark contrast to system dynamics modelling used in the health sector. The latter perhaps better acknowledges the complexity of the world but can struggle to put a figure on the value of investment from transport. The absence of an 'equity' lens in transport decision-making at the time, or specific population targeting became an obvious gulf in the policy settings of the different agencies. The project needed to justify itself in terms of preventing injuries, prolonging life, and avoiding sudden and tragic death to different audiences at different times. We tested how well the technical culture of the Transport Agency was set-up to deliver on socio-technical generational change, how well the policy-focused Ministry of Health was able to join in with a programme that built assets in schools and how far the Accident Compensation Corporation was legislatively able to go within its Return on Investment parameters to invest in preventing cycling injuries. We were also reminded of the importance of governance in general when it comes to effecting change.
Conclusions: Through the process there were some useful learnings to reflect on and opportunities for future collaboration. BikeReady was launched by the Associate Minister of Transport and Health in November 2018. The total investment from the Transport Agency, ACC and local government over the three-year period 2018-21 is around $23m. BikeReady, which is aligned with the school curriculum, is focused on using best-practice approaches to give people the skills they need at the right time in their life – from learning bike handling skills in primary school through to learning road rules and how to ride on-road when they are ready.

#2576

REDUCTIONS IN CARBON DIOXIDE EMISSIONS FROM AN INTERVENTION TO PROMOTE CYCLING AND WALKING: A CASE STUDY FROM NEW ZEALAND

Michael Keall [1], Caroline Shaw [2], Ralph Chapman [3], Philippa Howden-Chapman [4]. [1] *University of Otago, Wellington South, New Zealand;* [2] *University of Otago Wellington, New Zealand;* [3] *Victoria University, New Zealand;* [4] *University of Otago Wellington, Wellington, New Zealand*

Background: Policies promoting active transport, such as walking and cycling, can reduce transport-related carbon emissions. However, there are few studies that examine the carbon emission outcomes of such policies. This paper presents a case study of an intervention carried out in New Zealand that involved the construction of urban cycling and walking infrastructure in parallel with programmes to encourage such active travel.
Methods: Using vehicle licensing data in the context of a quasi-experimental study design, we evaluated transport carbon dioxide emissions saved. Vehicle distance travelled within the study area was derived from odometer readings that are recorded on the New Zealand licensed vehicle administration system. Using a representative sample of households in the intervention and control areas, we also estimated changes in the number of vehicles licensed per household.
Results: Consistent with increases found previously in walking and cycling trips, there was a decline of 1.6% in average distance travelled per passenger vehicle by the third year of the intervention. Averaged across the intervention period, there was a 1% reduction in distance travelled per vehicle and associated carbon dioxide emissions. It is possible that this estimate is conservative as there was indicative evidence from travel survey data that the number of vehicles per household also fell.
Conclusions: This is the first study we know of to have shown, using independent and objectively measured data, that the establishment of cycling and walking infrastructure is associated with reduced transport carbon dioxide emissions within a short space of time, even though the reductions found were modest.

#2579

HOW COULD THE DOCKLESS BIKE SHARE PROGRAMS IMPACT ON TRAVEL BEHAVIORS OF URBAN RESIDENTS IN CHINA? *(2ND HIGHEST SCORING RESEARCHER ABSTRACT AWARD SPONSORED BY MACKIE RESEARCH)*

Lin Lin [1], Sun-Young Kim [2]. [1] *Xi'an Jiaotong - Liverpool University, Suzhou, China;* [2] *National Cancer Center, Korea, Republic of (South)*

Background: The emerging dockless bike sharing programs have gained massive popularity in China since the programs launched in April 2016. Currently, there are more than 200 cities worldwide with the dockless bike sharing programs and majority of those cities are in China. Previous studies found station docked bike shares would result in reducing in motor vehicle uses and increasing in active travel. However, no similar studies have been carried out for dockless bike shares. This study will fill the research gaps by investigating how the emerging dockless bike sharing programs would impact on the urban resident's travel behaviors in China.
Methods: This study conducted online surveys in Beijing and Shanghai between April 3rd and April 30th, 2019. A total of 4437 completed surveys were collected, with 2305 surveys from Shanghai, and 2132 surveys from Beijing. In addition to socio-demographic information, the survey also included the information on respondent's travel behaviors, such as bike share usages, active travel, and travel behavior changes of users of dockless bike shares. We performed descriptive analysis for each question of travel behavior.
Results: The preliminary findings showed that even though more than half of the respondents have private cars in their households, more than three quarters (76.3%) were reported to be users of the dockless bike share programs. For those dockless bike share users, 84.4% reported to use dockless bikes to travel to metro stations, and 16.6% reported to switching driving to using dockless bikes for different travel purposes, including connecting to metro stations, maintenance, and commuting.
Conclusions: This is one of the first studies to investigate the impacts of the dockless bike shares on travel behavior changes of urban residents.

#2580

POLICY RECOMMENDATIONS FOR ENCOURAGING PUBLIC BUS USE TO SCHOOL IN DUNEDIN, NEW ZEALAND

Jennifer S. Mindell [1], Christina Ergler [2], Logan Copland [2], Debbie Hopkins [3], Sandra Mandic [2]. [1] *UCL, London, UK;* [2] *University of Otago, Dunedin, New Zealand;* [3] *University of Oxford, Oxford, UK*

Background: Adolescents' obesity rates are increasing while physical activity levels are falling in most high-income countries. Transport to school can be a significant contributor to daily physical activity among adolescents but in New Zealand, many adolescents are driven to school. Public transport journeys usually involve some active transport and therefore could contribute to increasing adolescents' physical activity when active transport for the whole journey to school is not feasible. This study examined environmental, policy and personal factors as well as perceptions of barriers and enablers of public transport to school among Dunedin adolescents.
Setting: Dunedin, the second largest city in South Island, New Zealand, has a population of approximately 130,000 with 12 secondary schools. Many of Dunedin streets are undulating and the city can be described as sprawling.
Methods: A mixed-method approach was used, drawing on: the public bus survey from Otago School Students Lifestyle Survey (1398 adolescents); Built Environment and Active Transport to School (BEATS) Study focus groups (54 adolescents, 25 parents, 12 teachers); semi-structured interviews (12 principals); interviews with three key informants from local, regional and national agencies; and a policy analysis of 10 relevant local, regional and national transport plans and strategies.
Results: Distance to school, cost, parental trip chaining, built environment features and the weather represent major barriers to Dunedin adolescents using public transport to school. Convenience and safety were also major factors. Current transport planning documents do not favour public health concerns. Policymakers felt that enticing adolescents to use public transport to travel to school is challenging in a society with an embedded car culture.

However, stakeholder interviews suggested a slow but positive change, with new investment in Dunedin's public bus network and real-time information technology to increase the user-friendliness of public transport and address some of the barriers mentioned by students, parents and school principals. Alternative ways of funding public transport were also explored. The findings from this study were used to develop a set of recommendations to inform policy makers.

Conclusions: Public transport use could be enticed by increasing parking prices to discourage driving and trip-chaining for parents; improving bus infrastructure and subsidies; and by changing bus/bus users' perceptions, which requires collaboration between different government authorities. A policy for secondary school students should be developed to address parental, adolescents' and schools' concerns and encourage collaborations between government authorities and schools.

#2584

REVEALING SENIORS' TRAVEL PATTERNS AND CONCERNS USING PUBLIC TRANSPORT - A CASE STUDY IN WOLLONGONG

Bo Du, Jun Ma, Rafael Benavent, Thomas Birtchnell, Theresa Harada, Michal Strahilevitz, Pascal Perez, Pauline McGuirk.
University of Wollongong, New South Wales, Australia

Background: Evidences show that active and proper transport services play an important role in increasing both physical and social wellbeing in older populations and enabling them to maintain social networks, which positively impacts their mental and physical health. It is difficult to design proper and tailored transport services for seniors without understanding their travel patterns and concerns, and this research aims to fill this gap.

Methods: Both quantitative (data analysis and visualization) and qualitative (semi-structured interview) methods are employed in this research. Smart card (Opal card in NSW) data offers a window to understand seniors' within-day and day-to-day travel patterns (like origin-destination distribution, travel frequency, travel demand) with comparison with other types of users (like adult and youth) in both temporal and spatial dimensions. Semi-structured interview with seniors serves as a complementarity to data analysis to gather the information not available from the data, for instance the major concerns for seniors to take public transport, like poor connectivity to public transport facilities, low flexibility and frequency, high cost of alternative transport services such as point to point transport providers, and safety issue.

Results: A preliminary study in Wollongong has been done. The smart card data analysis showed that seniors travelled much more during weekdays than weekends; different from adult and youth traveling much more during peak hours in weekdays, seniors travelled more during inter peak; a lot of trips between Wollongong and Sydney were identified for seniors; seniors used train more often in Wollongong compared with paid buses (free Gong shuttle services were available in Wollongong).

The interview revealed that most trips to Sydney during morning peak by seniors were for medical appointments; many seniors complained that poor accessibility to public transport facilities near their houses, especially in suburb area; seniors had safety concerns especially during boarding and alighting due to the gap between the train/bus and platform; many other issues like lacking of enough parking slots at train stations, lacking of flexible transport services and so on were identified as well.

Conclusions: Although most seniors in Wollongong could maintain trip activities, they showed serious concerns especially when they are getting older. The research outcomes are expected to assist relevant government sectors in better understanding seniors' needs and concerns, and then improving transport facilities and developing tailored transport services for seniors to enhance their social activities rather than social isolation, and furthermore to maintain their physical and mental health.

#2588

ANALYSING THE EFFECT OF A DISSONANCE BETWEEN ACTUAL AND IDEAL COMMUTE TIME ON COMMUTE SATISFACTION

Runing Ye [1], Jonas DeVos [2], Liang Ma [3]. [1] *University of Melbourne, Melbourne, Victoria, Australia;* [2] *Ghent University, Belgium;* [3] *RMIT University, Australia*

Background: Previous studies have found that longer trip duration could lower people's travel satisfaction (De Vos, 2017; Ye, 2017; Higgins et al., 2018; Mokhtarian et al., 2015; Morris & Guerra, 2015a; Olsson et al., 2013; Smith, 2017;). However, all these studies do not take people's preferred travel time into consideration. Redmond and Mokhtarian (2001) found that people's ideal travel time is strongly and positively correlated with travel-liking attitudes. Since the theory of cognitive dissonance (Festinger, 1957) indicates that a dissonance between attitudes and behavior results in feelings of psychological discomfort, it can be expected that a dissonance between travel-liking attitudes and travel duration will negatively impact travel satisfaction, which has not been analysed so far.

Methods: Relying on a survey (sample size 1484) conducted between August and November 2018 in Xi'an, China, this study aims to explore two research questions: (1) what are the factors that influence a possible dissonance between the actual and ideal commute time, and (2) how does this dissonance influence commute satisfaction.

Results: First, a majority (67%) of the commuters traveling longer time than ideal, but there are 17% of the commuters travelling shorter time than their ideal, suggesting a certain level of positive utility of travel. Second, people with a long travel duration (>60 minutes in one-way commute) are more likely in the group that the actual commute time is longer than the ideal (actual>ideal CT). Third, people walking, and bicycling have the smallest gap between actual and ideal commute time, comparing with those commuting by transit and car. Finally, commuters with a dissonance between actual and ideal commute time (in either direction) have a lower levels of commute satisfaction compared to those having a similar actual and ideal commute time. The larger the extent of the dissonance, the lower commute satisfaction is.

Conclusions: People travelling with their ideal commute time would have a higher level of commute satisfaction compared to those travelling either longer or shorter time than preferred, irrespective of actual commute duration or distance. Further, the dissonance between actual and ideal commute time and duration of the commute have independent effects on commute satisfaction. The dissonance influences commute satisfaction mainly because of the psychological discomfort created by the dissonance between actual and preferred travel time, and the commute duration affects commute satisfaction primarily through the paths of physical and mental fatigue, or negative feelings of missing out more desired activities.

#2589

WORK-RELATED INJURY AND DISEASE IN AUSTRALIAN TRANSPORT SECTOR WORKERS

Ting Xia [1], Ross Iles [1], Sharon Newnam [2], Dan Lubman [3], Alex Collie [1]. [1] *Insurance Work and Health Group, School of Public Health and Preventive Medicine, Monash University, Victoria, Australia;* [2] *Accident Research Centre, Monash University, Victoria, Australia;* [3] *Turning Point, Eastern Health and Eastern Health and Eastern Health Clinical School, Monash University, Victoria, Australia*

Background: The transport industry is one of the highest risk industries for work-related injury and disease in Australia. Transport workers are exposed to a unique set of conditions in their working environment (e.g., sedentary work, poor diet, long working hours and shift work, isolation, fatigue, sleep deprivation) that increase the risk for multiple morbidities (i.e., hypertension, cardiovascular disorders, obesity and diabetes). Poor health status is associated with increased crash risk and may contribute to a lower quality of life both during working life and after retirement and may result in a greater number of worker compensation claims and health care costs. Objectives: The objective of this study was to compare the rate and distribution of work-related injury and disease in transport workers with other workers in Australia.
Methods: All accepted workers' compensation claims from 2004 to 2015 were extracted from the National Dataset for Compensation-based Statistics. We used standardized industry and occupation coding systems to identify five groups of transport workers (truck, bus, automobile, delivery, and rail drivers). Negative binomial regression was used to compare claim rates between transport occupations and a comparator group of all other workers. Quantile regression was used to explore the differences between duration of working time loss due to work-related injury and illness between occupation groups.
Results: All transport worker groups were at greater risk of work-related injury and disease than other, non-transport workers, with rail drivers at 3.7-fold greater risk (95% CI: 3.21-4.17), followed by truck drivers (IRR: 2.39, 2.11-2.69). Truck drivers have the highest relative risk of fracture, with a 3.5 times greater risk than all other workers (3.27-3.65). Rail drivers were at a 33 times greater risk of psychological injury than other workers. Automobile drivers and truck drivers had significantly longer durations of time loss following work-related injury and illness, whilst rail drivers had shorter duration.
Conclusions: Professional drivers may face some unique occupational conditions that put them at higher risk of musculoskeletal and psychological injury than other occupations such as excessive pushing and pulling, climbing on/off a vehicle and exposure to traumatic incidents. Understanding work-related injuries in the transport industry is important for maximizing limited resources for injury prevention and promotion of health and well-being amongst workers in this industry.

#2590

USE OF OPIOIDS FOLLOWING WORK-RELATED INJURY AND ILLNESS IN TRUCK DRIVERS

Ting Xia [1], Ross Iles [1], Sharon Newnam [2], Dan Lubman [3], Alex Collie [1]. [1] *Insurance Work and Health Group, School of Public Health and Preventive Medicine, Monash University, Victoria, Australia;* [2] *Accident Research Centre, Monash University, Victoria, Australia;* [3] *Turning Point, Eastern Health and Eastern Health and Eastern Health Clinical School, Monash University, Victoria, Australia*

Background: Musculoskeletal injury is the most common type of injury for truck drivers, accounting for approximately 60 percent of all accepted work-related injury compensation claims in Australia. While physical therapy plays an important role in the treatment for these conditions, prescriptions for pain medications, and particularly opioid-based analgesics, have been increasing over the past two decades, despite concerns about their safety and efficacy. Prescription opioid use for occupational injuries has been associated with poor clinical outcomes, which may contribute to increased time off work and increased costs. Therefore, identification of high-risk injured truck driver groups receiving persistent opioid treatment is critical.
Objectives: To determine characteristics of truck drivers who are at risk for higher volume and long-term use of opioid medications following work-related injury and illness.
Methods: A retrospective cohort analysis was conducted using workers' compensation claims data from the state of Victoria, Australia. All accepted workers' compensation claims from truck drivers with date of lodgement between 1st July 2008 and 30th June 2013 were included. The mean and median number of opioid prescriptions and time loss were calculated. Group-based trajectory models were then used to identify injured truck drivers with similar longitudinal patterns of opioid use.
Results: Nearly one-quarter (23.8%) of all injured truck drivers had records of opioid prescription. Of these 8.3 % were only ever prescribed weak opioids and 15.6% were prescribed strong opioids. Injured truck drivers who used opioids had significantly longer duration of time loss than those who never used opioids. The trajectory model suggested three groups of opioid users: the "Short-term Low Volume" group (68.8%), the "Long-term Low Volume" group (25.7%), and "Long-term High Volume" group 5.5%). Overall, those receiving long term opioids were more likely to be prescribed strong opioids, to have used mental health and physical therapy services. In particular, the probability of belonging to the "Long-term High Volume" group increased by nearly 800% in injured truck drivers who had ever used mental health services compared to "Short-term Low Volume" group.
Conclusions: Our findings demonstrate the patterns of opioid use may be less influenced by demographic and working factors and more influenced by the health services received following injury. Therefore, it is import for clinicians to adhere the clinical guideline to achieve a better balance in addressing the treatment of pain while minimising misuse, addiction and diversion of these medications.

#2596

BEYOND "SAFE": CHILEAN "KOOL" ROUTES TO SCHOOL ADDRESS SOCIAL DETERMINANTS OF HEALTH

Lake Sagaris. *Pontificia Universidad Católica de Chile, Santiago, Chile*

Background: An abundant literature examines "safe routes to school" programs, to increase active transport and with-it physical activity, hence health. These have emerged mainly in the Global North, where they receive support from national networks and government. Conditions in developing countries differ considerably. While the obesity epidemic is rife, walking-cycling-public transport remain majority modes, accounting for 66% or more

of daily travel. This reveals a shared reality — the predominance of car-centred urban planning — and an important difference: car use is concentrated mainly among mid- to high-income elites rather than most of the population, making social justice central.
In a rapidly urbanizing world, conflicts arising from car-centred urban planning have increased, given transportation's negative effects. With 90% of its population already living in cities, Chile offers an excellent opportunity to study these issues. Both adults and children in Chile have extremely high rates of sedentarism (over 90%), and rates of both adult and child overweight and obesity are among the world's highest, raising interesting questions about potential impacts of programs to foster active transport to school in the Global South.
Methods: Using a participatory action research approach, we developed, tested and completed a "Kool" Routes to school program, with gender, urban planning, co-design and other components. Exploration began in 2016, in El Bosque, and produced a successful in-school program from pre-kinder to grade 8. As we expanded to the adjacent area, however, challenges of road-, crime- and gender-related violence emerged, requiring new, participatory urban planning strategies and new partners. To date the program has evolved through partnerships with a women's centre, additional local governments, and the town of Lautaro, revealing significant potential to create more liveable street environments for all.
Results: This research initially sought to explore potential for improving physical activity but results to date reveal a much broader potential for transformation, acting on gender roles, gender-related violence and social insecurity, road safety, traffic calming, environmental and civic education.
Conclusions: Results to date suggests that, at least in developing countries, suitable adaptations of these kinds of programs should offer effective responses to a broader public policy agenda, able to address many key factors involved in the social determinants of health. Specifically, social and infrastructure planning around schools should include residential and commercial areas and incorporate significant components of neighbourhood and local city government participation.

#2597
THE EFFECT OF PERIPHERAL VISION ON PEDESTRIAN'S WELLBEING WITHIN URBAN SPACES

Adam Malekzadeh. *UCL (University College London), London, UK*

Background: It is well established that the perception through sight influences an individual's motivation to interact with the public realm. Less is known about how peripheral vision affects one's emotional profile. Pedestrians generally view the street using central and peripheral vision. Central vision is used to look at objects directly and to see details. Peripheral vision encompasses the rest of the visual field—areas that are visible, but not directly seen. Peripheral vision is used for getting the gist or general idea of a space or place. Some evolutionary explanation around being able to do detailed tooling while looking out for predators is suggested in current research. These phenomena still provide explanation of what people see and perceive in the streets and public spaces – in terms of peripheral and central vision, particularly the contrasts, edges, pattern, rhythm, line, shape, form, texture, complexity and surfaces. Some of physiological aspects of movement detection and the impact peripheral vision can have on emotional wellbeing for people in urban environments, specifically public spaces are also examined.
Method: Ten participants undertook a two-phased peripheral vision protocol to elucidate the effect of changing street rhythm urban environments on individuals with different peripheral vision properties. Empirical analysis - to qualify for the research, OPTOMAP was used to test the participants physiological for acuity (sharpness of central and peripheral vision). Peripheral vision testing participant's ability to determine horizontal vs vertical stripes in peripheral vision were tested and all participants were able to make the differentiation.
Likert scales on contentment were analysed using ANOVA (analysis of variance) to look at variance by image characteristics (i.e. storefront, vs. brick wall in the set of colour and black and white images. Qualitative analysis - Likert scale feedback on feeling when looking at images (0-10, with 10 being most content).
Results: The results suggest that peripheral vision has an effect on valence (feelings), as participants shown different preferences compare with their central vision. It was found that participants had different responses to different street facades texture and coloured images displayed on the screen. A positive correlation in contentment was reported with less crowding of objects and elements (windows, bricks) in the image. No significant difference was reported in observing images in black and white and colour images.
Conclusions: This research concludes that peripheral vision does influence wellbeing and analysis and classification models need to be further developed.

#2599
EXPLORING THE RELATIONSHIP BETWEEN TOUR COMPLEXITY AND HEALTH IN HALIFAX TRANSIT AND AUTO RIDERS

Linden Maultsaid-Blair, Muhammad Ahsanul Habib. *Dalhousie University, Halifax, Nova Scotia, Canada*

Background: This study explores the relationship between tour complexity and subjective health outcomes for travellers in Halifax, Nova Scotia, Canada, using data from a random household travel behaviour survey conducted in 2018. 2,333 households completed the survey, including 4,159 persons and 13,637 individual trips. Certain survey questions—such as subjective health outcomes—were asked only of the primary respondent, meaning that only 2,333 samples were used in this study.
Methods: Using tour choice patterns, the study explores the types of tours that Halifax travellers are taking, including their complexity, mode, and associated socio-demographic factors. The relationship between these tours and short-term health outcomes are examined with descriptive statistics. These subjective health outcomes are based on one of the survey questions, which asked primary respondents to report their level of typical weekday stress.
Results: In Halifax, 62% of all tours consisted of only two legs, meaning they are simple tours. The remaining 38% had three or more legs, meaning they are complex. Persons travelling by auto or active transportation (walking and cycling) were found to be more likely to make simple tours, or complex tours with fewer legs. However, the mode share of travellers using transit increases as tour complexity increases. This is consistent with other results from similar studies. Additionally, most respondents reported their typical weekday being 'not very stressful', 'a bit stressful', or 'somewhat stressful'. Few respondents (less than 20% total) reported their weekday being 'not at all stressful' or 'very stressful'. Ongoing analysis of the relationship between tour complexity and health using descriptive statistics continues to yield results.

Conclusions: This study utilizes a robust data set to illustrate the types and complexity of tours being taken by travellers in Halifax, Nova Scotia. It provides new insight into the connections between tour complexity and subjective health, allowing us to better understand how travel behaviour influences health. By furthering current research and filling necessary gaps, this research contributes to the growing field of transportation and travel behaviour. The intersection with health will be of interest to health researchers, and scholars who work at this intersection between transportation and health. As well, planners and decision-makers planning transportation systems in the future will be equipped to consider the health impacts of tour complexity by different modes.

#2606

JOINT ASSOCIATIONS OF WALKING AND CAR USE WITH CHRONIC-DISEASE RISK MARKERS: LINKING DATA FROM POPULATION HEALTH AND TRAVEL SURVEYS

Takemi Sugiyama [1,2,3], Rachel Cole [4], Mary Kynn [4], Neville Owen [2,3]. [1] *Australian Catholic University, Melbourne, Victoria, Australia;* [2] *Swinburne University of Technology, Melbourne, Victoria, Australia;* [3] *Baker Heart and Diabetes Institute, Melbourne, Victoria, Australia;* [4] *University of the Sunshine Coast, Queensland, Australia*

Background: Walking is known to be protective against obesity and hypertension, which are risk factors for chronic diseases, particularly type 2 diabetes and heart disease. However, less is known whether walking is protective against the risk in the presence of prolonged car use, which can be associated with higher risk. We examined associations of the area-level rates of high waist circumference and high blood pressure with residents' walking, prolonged car use and their combined presence, by linking population health and travel surveys.
Methods: The outcomes of the study were the age-standardised rates (ASR) of high waist circumference (≥94 cm for men, ≥80 cm for women) and high blood pressure (systolic/diastolic blood pressure over 140/90 mmHg). These were calculated at the level of Population Health Area (PHA) based on the 2014-15 National Health Survey. For walking and car use, we used the 2009 South-East Queensland Travel Survey (n=16,464). For each PHA, we calculated the proportion of adult participants who walked (≥10 min/day) but did not use cars over 1 hr/day (walkers); who walked and used cars over 1 hr/day (walker/car users); and who did not walk but used cars over 1 hr/day (car users). Linear regression analyses examined associations of the ASR of high waist circumference and high blood pressure with the proportion of three travel behaviour categories.
Results: For 131 PHAs in the study area (median size: 14 km2), the mean ASR of high waist circumference was 64% and that of high blood pressure was 23%. The mean proportion of walkers, walker/car users, and car users was 16%, 4%, and 40%, respectively. For high waist circumference, significant associations were found for the proportion of walkers (0.57% lower rates for each 1% increment in the proportion [95%CI: -0.68, -0.44]), walkers/car users (0.17% lower rates [-0.33, 0.00]), and car users (0.43% higher rates [0.28, 0.56]). For high blood pressure, associations were significant for the proportion of walkers (0.27% higher rates [0.10, 0.42]), but not for walker/car users (0.03% higher rates [-0.14, 0.20]) and car users (0.14% lower rates ([-0.30, 0.03]).
Conclusions: We found that PHAs with a high proportion of walker/car users had a lower rate of obesity, suggesting that walking may be protective against obesity even in the presence of prolonged car use. However, unexpectedly, we found that PHAs with a high proportion of walkers had a higher rate of hypertension. Further research on walking and hypertension is warranted.

#2607

LINKING TRANSPORT AND WELLBEING, ALL THE WAY DOWN

Bridget Burdett. *MRCagney, Hamilton, New Zealand*

Background: To deliver transport that improves wellbeing, empirical evidence must be combined with understanding about how transport investment decisions are made. Understanding political and process levers is critical if changes are to filter from policy rhetoric to concrete in communities. One way to improve wellbeing through transport investment is to find out who has most to gain, and to communicate that evidence in a transport decision-making context.
Project: This presentation will describe research that explored links between transport and wellbeing for a district comprising small towns and remote rural countryside in New Zealand's North Island. The methods combined review of literature, a community survey, and focus groups, to uncover some of the complexities associated with transport, participation in daily life, and wellbeing.
Results: The results of the project showed that wellbeing gains can be made in the study district through a focus on people who either live in a remote rural area; have no access to public or community transport; or identify with a disability. People who have barriers to access take fewer trips, or take longer or less convenient trips, with both immediate and long-term effects on their wellbeing.
Conclusions: The research identified that two ways to improve wellbeing are to make local walking environments more accessible (for example, to people with disability); and to support inclusive, low-cost, volunteer-based transport services. To improve accessibility of walking environments, it was recommended that local demographic information and activity centres are used to prioritise investment, including in high quality pedestrian crossings within a walkable catchment of a town's main commercial, educational, retail, and service centres. To improve community transport, funding increases should be accompanied by local government resource support to visit the community groups; identify gaps in service provision or inclusiveness; enable collaboration between service providers; and to communicate evidence of the investments' effectiveness to national policy makers.
It was also recommended that equity of participation is measured through observational and intercept surveys of people arriving at destinations. Simple observational surveys can use mobility aids as a proxy indicator of disability. More comprehensive intercept surveys can provide more information including where people travel from and by what mode. Data provides an important feedback loop to funding agencies. Beyond demonstrating the value of investment, monitoring can inform ongoing improvements, adapting priorities as communities inevitably change with time. In conclusion, a systems lens on transport decision-making can support policy changes that manifest in demonstrable wellbeing improvements for urban and rural communities.

#2616

GENDER TRANSPORT POVERTY IN LOW-MIDDLE INCOME COUNTRIES, AND ITS EFFECTS ON WOMEN'S HEALTH AND WELLBEING

Andree Woodcock [1], Deana McDonagh [2], Sana Iqbal [1], Komal Faiz [3], Yong Adilah Binti Shamsul Harumain [4]. [1] *Coventry University, Coventry, UK;* [2] *University of Illinois Urbana Champaign, Champaign, Illinois, USA;* [3] *DesignPak, Toronto, Canada;* [4] *Universiti Malaya, Kuala Lumpur, Malaysia*

The paper presents results from the recently completed, 18-month, AHRC (UK) funded, WEMOBILE project which aimed to understand the mobility experiences of women in Pakistan and Malaysia and the effects this has on their lives. Gender transport poverty is a relatively new concept. It may certainly be classed as a wicked problem. It has not, however, been widely applied to Low Middle Income Countries, where women's mobility is restricted by social, cultural, religious and gender issues, even before the step out of the house.

The project used quantitative methods (survey), and more qualitative approaches (World Cafe, (auto) ethnography, focus groups, empathic design) to understand barriers to women's mobility and the effects this has on their everyday lives. The team developed '10 stages of women' culturally sensitive personas to describe the interactions of gender and transport. Women's lives can be broken into two stages - where they are dependent on others for transport (at the beginning and end of their lives) and where they have an opportunity to be more self-reliant. In this middle period of their lives, as few women drive, they may be a little freer in their mobility, However this is curtailed by the need to ask permission to make journeys outside of the house(e.g. to go to work, the doctors), social and cultural barriers which restrict women's choice of transport (i.e. no walking, cycling, or riding motorbikes) and a lack of public transport provision.

The paper focuses on health and safety issues women face when travelling in terms of traffic accidents, exposure to pollutants, bullying and extreme forms of sexual harassment.

#2618

GENDER AND DIVERSITY SENSITIVE SMART MOBILITY: INTRODUCING THE H2020TINNGO PROJECT

Andree Woodcock, Jane Osmond. *Coventry University, Coventry, UK*

Efforts to develop smart, intelligent transport will revolutionise cities, building on 4G and 5G networks - connected and autonomous vehicles, on demand transport, drone technologies are already featured in near distance scenarios. The technology pull occurs at a time when gender transport poverty is a stark reality for many women. Gender mainstreaming and gender action planning have not reduced the gender gaps in transport employment, education and usage. Concerns have already been expressed by local authorities that new transport measures will be more divisive and less inclusive than current ones. The recently funded 3-year, EU funded, H2020 TInnGO project seeks to address these problems through the creation of a virtual Transport Innovation Gender Observatory, with 10 national hubs, leading to a step change in gender and transport. Each hub will focus on a key, local concern e.g. active forms of transport, women's safety, access to transport by women from ethnic and minority groups, monitor policy and practice and collect mobility data. These will be sent to a central hub, where they will be used to develop a set of tools and best practices for gender mainstreaming and gender action planning, which can be used to transform service delivery and planning. Each hub will also have an associated IdeasLab, an open innovation space for (women) to create gender and diversity sensitive smart mobility solutions to local problems, it is hoped that this innovative concept, once proven can be rolled out in more countries within and outside of EU.

The presentation will provide an overview of the ambition of the project and its rationale in terms of the state of the art in EU. The results from two initial surveys undertaken by the project will be used to 1) demonstrate the lack of female representation on decision making bodies which is critical if women's mobility needs are to be taken into account in the design of future transport solutions, 2) illustrate the way in which future designers address gender and diversity smart transport solutions.

#2624

TRANSPORT, PLEASURE AND THE FUTURE OF THE BODY: LESSONS FROM CYCLING RESEARCH

Kirsty Wild. *University of Auckland, New Zealand*

Background: As we enter a new era of technological innovation, the body, the original transport machine is increasingly being left to rust. How do our visions of transport success understand and promote the body as a transport technology? As exercise moves out of the wild and indoors, and the body becomes less a workhorse and more a ‘parcel to be moved around’ or a ‘pet to be walked’ (Solnit, 2000), how do we sell a vision of active transport in our cities?

Methods: Reflecting on results from our ‘Future of the Bike’ research programme at the University of Auckland, this session explores the future of active transport promotion, and the value of adopting a needs-based approach to transport in the age of the (autonomous) machine.

Results: We reflect on the key themes from our qualitative research on why cyclists are the happiest commuters: control over commute conditions, the mood-boosting effects of exercise, high levels of sensory stimulation, and greater social interaction. We then discuss how these results can be used to improve the effectiveness of active transport promotion.

Conclusions: We conclude that in an era of increasing social isolation, sensory deprivation and loss of access to natural spaces, paying greater attention to the experience of active transport users can provide important clues as to how to revive interest in and commitment to the the human body as a transport technology.

#2626

THE EFFECTS OF DRIVER FEEDBACK AND FINANCIAL INCENTIVES ON DRIVING BEHAVIOURS: A RANDOMISED CONTROL TRIAL

Mark Stevenson [1], Jasper Wijnands [1], Duncan Mortimer [2], Anthony Harris [2]. [1] *The University of Melbourne, Parkville, Victoria, Australia;* [2] *Monash University, Clayton, Victoria, Australia*

Background: Achieving further reductions in road trauma will require design and scaled delivery of novel road safety measures. Opportunities for 'at-scale' delivery of road safety measures are now viable through the novel technology of in-vehicle telematics.
Methods: A total of 174 drivers (aged 17-50 years) from across Australia, were recruited to participate in the study at the time they obtained their motor vehicle insurance. The consenting participants' driving behaviour was monitored for a 'baseline' period comprising 4 weeks. Following the baseline period, participants were randomly assigned to one of three intervention and observed for 24 weeks.
Group 1, the *control* group received no-intervention. Participants in Group 2 (the *feedback* only group) received trip-related feedback regarding safe and unsafe driving behaviours as well as providing the participant with a driving score and more detailed information about their individual driving behaviour and practices namely, the proportion of trips exceeding posted speed limits, harsh braking and night-time driving. Group 3 (the *feedback plus incentive*) participants received the weekly personalised driver feedback plus a weekly update on how their financial incentive was tracking. In this group, participants were informed that they would begin the 24-week intervention period with an initial balance of $200, with the potential to lose $25 every four weeks, dependent upon their driving behaviour.
The insurer's telematics software provided the important outcome measures namely, i) the drivers exceeding posted speed limits, harsh braking and harsh acceleration.
Results: One hundred and 74 drivers participated across the 4-week baseline and 24-week intervention period accruing 18,082 driving days. The three groups were balanced at baseline across driving exposure and risky driving behaviours although more women participated in the trial.
A ZINB model was fitted adjusting for gender, telematic device and baseline exposures. The results pointed to reductions (albeit non-significant) in harsh braking and harsh acceleration in both the feedback and feedback and incentive group with for example, a reduction of 0.35 ($p=0.17$) events per day in the feedback group and 0.2 ($p=0.08$) events per day in the feedback plus incentive group.
Conclusions: The findings highlight that feedback on driving behaviours reduces risky driving behaviours as reflected in a reduction in hard(harsh) braking. We do not find evidence that financial incentives add to this effect.

#2628

IS THERE EVIDENCE TO SUGGEST ASSOCIATION BETWEEN SOCIAL DETERMINANTS OF HEALTH, SAFE DRIVING BEHAVIOUR, AND/OR POST-ACCIDENT REHABILITATION?

Darren Hunter, Marnie Jewell, Laura Stones, Olivia Pantelidis. *Transport Accident Commission, Geelong, Victoria, Australia*

Background: Road trauma is widely recognised as a major contributor to death, disability and disease burden in modern society. Australian road safety campaigns aim to reduce the incidence of motor vehicle accidents, injury and fatality. Current strategies seek to influence safer roads, speeds, vehicles and people. Similarly, no-fault social insurance schemes coordinate healthcare provisions to meet the physical, psychosocial and vocational needs of injured road users. In Australia, social insurers are uniquely placed to simultaneously aid prevention strategies and rehabilitation services. This presentation aims to address the confluence of social determinants of health and safe driving behaviour that contributes to the occurrence of motor vehicle accidents, and resultant rehabilitation outcomes.
Methods: A comprehensive literature search was conducted across the databases of Medline, Proquest, PubMed, CINAHL and the Cochrane Library (keywords 'social determinants of health' and 'accidents, traffic'). Adherent to PRISMA guidelines, this search was confined to English language papers and human subjects. This study sought to draw evidence of causality between social determinants of health on both primary and tertiary motor vehicle accidents, and the health outcomes attributed with rehabilitation. A broad examination of local and international publications provided comparison and contrast.
Results: A review of current literature yielded twenty-three articles for analysis. Results revealed four key themes for discussion; (1) psycho-behavioural traits, (2) demographical variation, (3) socio-economic status, and (4) environmental factors. These results validate and endeavour to comprehend the complex and multifactorial association between the social determinants of health, the incidence of motor vehicle accidents, and health and wellbeing outcomes in the post-accident setting.
Conclusions: This study has identified a number of predisposing factors that may influence the occurrence of a motor vehicle accident in the first instance, and the resulting health outcomes for injured road users. Application of solutions to these findings with local contextualisation will allow social insurers to provide more appropriate resources to aid both the prevention of motor vehicle accidents and the healthcare response to road trauma. Further research should seek to quantify the impact attributed with safety and healthcare strategies that directly target social and environmental inequities.

#2631

RETURN TO WORK PATTERNS AMONG THOSE WITH COMPENSABLE TRANSPORT CRASHES IN VICTORIA, AUSTRALIA

Shannon Gray, Alex Collie. *Insurance Work and Health Group, School of Public Health and Preventive Medicine, Monash University, Melbourne, Victoria, Australia*

Background: Transport crashes can result in life-altering injuries that affect daily activities, including work. Injured individuals unable to work due to injuries sustained in transport crashes in the state of Victoria, Australia, may have treatment and income support provided either through the transport

crash compensation system or through workers' compensation. Return to work (RTW) pathways have been demonstrated to vary between individuals. The objective of this study was to determine RTW patterns in people injured in transport crashes.
Methods: Claims data from both the transport crash and workers' compensation systems were harmonised for accepted non-fatal claims between July 1 2003 and June 30 2013. Working age adults (15-65 years) who received at least one day of income support were included. Daily income support data were mapped to a matrix and RTW patterns identified, with income support gaps indicative of work engagement and partial income support indicating partial RTW. For each injured individual, RTW patterns were detected and defined, with multivariable logistic regression used to determine factors associated with relapse or graduated RTW attempt.
Results: Of the 36,640 injured individuals who received income support for work absence, successful RTW on the first attempt was achieved by 73.9%. Three percent did not RTW, 22.4% relapsed, and 16.7% attempted graduated RTW. Workers' compensation was a strong predictor of both relapse (OR:3.48, 3.18-3.80) and graduated RTW attempt (OR:3.96, 3.61-4.38), as was hospital stay of more than a week.
Conclusions: Using a novel method of analysing administrative payment data, this study defined RTW pathways among individuals with transport-related injury. Knowledge of RTW pathways is important in order to identify groups of people that may benefit from additional support to encourage RTW and reduce likelihood of relapse, such as encouraging graduated RTW. There were large and significant differences between compensation systems with respect to RTW pathways.

#2632
UTILITARIAN BICYCLING AND MENTAL WELLBEING: ROLE OF THE BUILT ENVIRONMENT

Liang Ma [1], Runing Ye [2]. [1] *RMIT University, Melbourne, Victoria, Australia;* [2] *University of Melbourne, Melbourne, Victoria, Australia*

Background: Although the physical health benefits of bicycling has been well studied, research directly addressing the impact of bicycling, particularly the bicycling for transportation purposes, on mental health is quite limited. This study aims to investigate (1) the effects of utilitarian bicycling on mental wellbeing, as measured by psychological distress and life satisfaction, and (2) the role of the built environment on utilitarian bicycling in Australian cities.
Methods: This study relies on data from Victorian Population Health Survey 2014 (VPHS 2014), which was conducted using computer-assisted telephone interviews (CATI). The survey collected a representative sample of population aged 18 years or older and lived in private dwellings in Victoria, Australia. The final sample size includes 33,654 respondents, distributed in 1,833 neighbourhoods in 79 local government areas (LGAs) in Victoria. Both fixed effects and random effects models were applied to estimate the effects while controlling for the hierarchical structure of the data and many unobserved confounders.
Results: Frequency of bicycling for transportation was negatively associated with psychological distress but positively associated with life satisfaction. As a comparison, walking for transportation was also included in the model and presented similar relationships with psychological distress and life satisfaction, but the magnitudes of these relationships were smaller than that for bicycling. This aligns well with our hypothesis that more intense bicycling may contribute to more mental health benefits than walking. Consistent with most of the previous studies, this study further found that such built environment characteristics as bicycle lane density, street connectivity, perceived accessibility and slope were significantly associated with the propensity of using bicycling for transportation purposes, while the percentage of commercial land use in a neighbourhood and accessibility to a train station were significantly related to the frequency of bicycling for transportation purposes.
Conclusions: Active travel, particularly the utilitarian bicycling, is significantly associated with mental health benefits. Investment on dedicated bicycling lanes, and encouraging compact neighbourhood design featuring connected street, mixed land use (particularly the mixture of commercial and residential land use), and accessible public transport helps to promote bicycling as a mode for transportation. However, as the data is cross-sectional in nature, we could not make rigorous causal inference. It is possible that people with better mental health are more likely to walk and bicycle for daily errands and commuting.

#2633
PERCEPTIONS AND PATRONAGE OF PUBLIC TRANSPORT – ARE WOMEN DIFFERENT FROM MEN?

Alison Carver [1], Mary MacKillop [1], Anna Timperio [2]. [1] *Institute for Health Research, Australian Catholic University, Melbourne, Victoria, Australia;* [2] *Institute for Physical Activity and Nutrition, Deakin University, Burwood, Victoria, Australia*

Background: Public transport reduces carbon emissions via fewer cars on roads and may benefit health. Walking or cycling to transit stops can contribute to meeting physical activity guidelines (at least 150 minutes/week of physical activity at moderate-vigorous intensity). Little is known about women's perceptions and use of public transport, and how these differ from those of men. This study aimed to examine perceptions and patronage of public transport (and associated walking/cycling) among those residing close to a metropolitan railway line.
Methods: Participants were 366 adults (59% female) residing within 1km of a metropolitan railway line in Melbourne, Australia (2012). They self-reported their perceptions of public transport, travel mode(s) to work/study, distance to work/study, frequency and duration of public transport trips, and demographics (e.g. age, gender, education level, employment status, cars/household). Chi-square analyses examined perceptions of public transport by gender. Linear regression analyses, stratified by gender, examined these perceptions as predictors of frequency of public transport trips to work/study per week.
Results: There were no significant differences in the proportions of women compared with men who reported travelling on public transport regularly to work/study (women, 30%; men 27%) and during leisure time (women, 40%; men 36%). The mean duration of walking/cycling to/from public transport exceeded physical activity recommendations among women (32.8 (SD 21.6) minutes/day), but not among men (27.8 (SD 17.6) minutes/day). Significantly higher ($p<0.05$) proportions of women reported feeling unsafe on public transport overall (37%, women; 22% men) and at night (68% women; 46% men). For women, convenience (B=1.65, 95%CI 0.33, 2.98), being too crowded (B=1.23, 95%CI 0.08, 2.38); taking too long to travel (B= −1.79, 95%CI −2.98, −0.60) and cost-effectiveness (B=1.39, 95%CI 0.09, 2.68) were significantly associated ($p<0.05$) with frequency of public transport trips/week. In addition, age (B= −0.77, 95%CI −2.98, −0.60), education level (B= −1.02, 95%CI −1.68, −0.36) and having two or more cars/household (B= −1.15, 95%CI −2.26, −0.05) were negatively associated with frequency of public transport trips among women. None of the examined perceptions were associated with frequency of public transport trips among men.

Conclusions: To encourage women to travel by public transport, interventions should promote safety. Regular services are required for convenience and fare structures should render public transport a cost-effective option particularly for women who, on average, earn less than men. Travelling by public transport may be useful to encourage incidental exercise, among women, who tend to be less physically active than men.

#2634

TRANSPORT EXPERIENCES AND TRAVEL BEHAVIOUR OF OUTER SUBURBAN RESIDENTS AND THEIR IMPACT ON HEALTH

Annette Kroen [1], Lucy Gunn [1], Melanie Davern [1], Cecily Maller [1], Chris De Gruyter [1], Robin Goodman [1], Elizabeth Taylor [2].
[1] *RMIT University, Melbourne, Victoria, Australia;* [2] *Monash University, Melbourne, Victoria, Australia*

Background: Many cities experience high levels of population growth, putting pressure on housing and infrastructure development which often occurs in greenfield developments on the urban fringe. With scarce local employment and services, residents in outer suburbs can spend 15 or more hours per week commuting which is exacerbated by a lack of public transport and amenity. Destinations such as primary and secondary schools, supermarkets, and doctor's clinics provide this amenity and are crucial for supporting local living and good health outcomes. Yet, they are often the last infrastructure elements to be delivered when building new suburbs.
Methods: We explored preferences and experiences of transport use, active behaviours, health, subjective wellbeing, and access to local living destinations using a quantitative and qualitative survey of residents in two outer growth areas of metropolitan Melbourne, and a GIS analysis of wellbeing indicator data related to transport and health. Descriptive statistics and GIS analysis of these datasets were explored and compared across established areas of metropolitan Melbourne.
Results: Preliminary results show that 86% and 66% of residents agreed that it was easy and pleasant to walk/cycle in their neighbourhood, yet only 24% and 7% actually walked or cycled at least sometimes for transport from home to any destination. 53% of respondents were either strongly or somewhat dissatisfied with their access to public transport and 69% said that they had suffered from transport limitations in the previous 12 months with 30% of those stating congestion as a reason. Findings were mixed for access to fresh food shops with residents in the more recently built area found to be more dissatisfied than residents in the more established area which had greater amenity. Research for the qualitative survey and the GIS analysis are still on-going. Our results show that people are impacted by a lack of access to public transport, fresh food shops and other destinations and for the less developed area there were higher levels of dissatisfaction with this access.
Conclusions: We found that whilst amenities are planned for in growth areas their timely delivery is lacking. Both the health and travel behaviours of residents in these areas are impacted, as well as broader city-wide problems such as congestion. We recommend that the government and private sector work together to create innovative solutions to better plan for sequencing of growth and the delivery of important infrastructure that affects the health of residents and efficiency of cities.

#2636

SUNDAY DRIVERS, OR TOO FAST AND TOO FURIOUS? ANALYZING SPEED AND RIDER BEHAVIOUR OF E-SCOOTER RIDERS IN SAN JOSE, CALIFORNIA *(2ND HIGHEST SCORING MASTERS/UNDERGRADUATE ABSTRACT AWARD SPONSORED BY HNTB CORPORATION - GREAT LAKES REGION)*

Juan Arellano, Kevin Fang. *San Jose State University, San Jose, California, USA*

Background: The recent proliferation of shared e-scooter systems in cities around the world have raised questions for governments as to how they should be regulated. As governments decide among a variety of policy options, they must at least implicitly judge e-scooters as compatible or incompatible with other road users. However, there is a lack of data on how e-scooters riders behave, and how that compares to other road users. As a result, this study sought to inform these debates by observing e-scooters riders in San Jose, California. We observed rider speed, traffic conflicts, and a number of other riding behaviours that could have an influence on the safety performance of e-scooters.
Methods: 330 e-scooter riders were observed in downtown San Jose. Observations were conducted during a mix of both dry and wet weather conditions between October 2018 and February 2019. Riders were observed on three types of transportation facilities: streets, sidewalks, and mixed-use paths. For comparison, 110 observations of cyclists were observed on the street only.
Results: Concerning speed, rider speed varies by facility with riders slowing down significantly in the presence of pedestrians (11.1 mph on streets, 9.6 mph on mixed-use paths, and 9 mph on sidewalks). Male riders traveled faster than females and varied less by facility. On streets, e-scooter riders traveled significantly slower than bicyclists observed on the same facility (12.2 mph). Regarding riding behaviors, 97% traveled in a straight line as opposed to traveling in a less predictable side-to-side motion, 16% of riders traveled in apparent groups, and 3% of riders traveled with two riders on one e-scooter. Only, 2% of e-scooter riders wore helmets. 16% of riders were observed wearing headphones, but just one person was caught using a cell phone while riding. Three minor collisions were observed, all on streets, between e-scooter riders and automobiles.
Conclusions: Overall, the presence of e-scooters does not introduce a new user with vastly different characteristics than existing travelers. In essence, e-scooter riders are similar to below-average to average-speed bicyclists. That e-scooter riders slow in the presence of pedestrians indicates awareness by scooter riders, although e-scooter riders were observed to be around two and a half times faster on sidewalks than people walking. A lack of helmet wearing indicates users do not perceive e-scooters as unsafe to ride. However, the number of collisions with vehicles observed in such a small sample is concerning.

#2638

GETTING MORE PEOPLE CYCLING – THE NEXT 4%

Christina Sorbello. *Love to Ride, Brisbane, Queensland, Australia*

Love to Ride are global leaders in cycling encouragement and behaviour change. Since 2007 they have worked across both the public and private sectors to engage people and workplaces, utilising a range of behavioural techniques and methodologies, to understand and influence active travel

behaviour.
Their focus has been upon cycling as the single most positive and impactful form of sustainable travel. This paper will explore the findings using data from Australian and New Zealand programs over the last few years – to answer the question:
Who are the next 4% of the population who will start cycling?
To create the most effective and impactful national and regional/city programs, we need to focus our engagement and support on the people who are most likely to take up cycling; but which groups make up the 'low hanging fruit' and are therefore the best people to target? Are they woman aged between 25 and 35 who have yet to have kids? Are they men aged between 45 and 55? And what role do regular and occasional riders have to play in inspiring the next group of new riders to participate?
By analysing the baseline and follow-up survey data from over 30,000 Love to Ride participants across Australia and New Zealand, we can determine to what extent different audiences have increased the amount of cycling they do and by how much. We can also learn more about what might motivate them to ride or ride more often, and what real and perceived barriers are getting in the way of progress.
When we examine the characteristics of these groups, we can also discern which people and groups who are most likely to take up cycling. We can also look at those who haven't increased their cycling and see what this tells us about who we should and shouldn't be targeting with our cycling promotions.
Summary: Much of what is created and delivered at Love to Ride focusses on encouragement and peer-to-peer support, underscored by various user features and functions of participation. This approach helps to foster strong connections and social interactions, ultimately resulting in big and lasting positive impacts for the individual and their community.
This will be an interesting presentation showcasing best practice behaviour change marketing from Australia and New Zealand. It will provide participants with practical tips and pointers that they can take home and apply to the work they are doing to encourage cycling.

#2639
TOWARDS A UTILITARIAN AGENT-BASED MODEL OF CYCLING IN MELBOURNE

Afshin Jafari, Dhirendra Singh, Claire Boulange, Billie Giles-Corti, Jonathan Arundel. *RMIT University, Melbourne, Victoria, Australia*

Background: Moving more people from motorised to active modes of transportation such as cycling is an important step towards improving health and wellbeing, and more generally reducing traffic congestion and improving air quality. However, designing effective interventions to achieve this mode shift is a challenging task. Simulation models can be helpful in this regard by allowing policymakers to test interventions before implementing them. Infrastructure Victoria (IV) has developed an agent-based and activity-based transportation model for the greater Melbourne area (hereafter IV-ABM). IV has already used the model to test future scenarios for road vehicles and public transportation, however to what extent it can be used for cycling interventions is not clear. In this paper, we have discussed how IV-ABM reflects real-world cycling behaviour, what are the key missing cycling-related components and steps to enhance the cycling aspect of the model.
Methods: Building upon Victorian Integrated Survey of Travel and Activity (VISTA) 2012-14 and Victoria In Future (VIF) 2015 projections, IV-ABM simulates Melbourne's transportation system including individual's trips (i.e. routes, modes and timing) and activities. We simulated a single day of Melbourne's transportation system using a 25% population sample (1,322,434 agents). The simulation outputs were then compared to the VISTA 2012-14 data to gauge how well the model represents cycling trips and to identify requirements for capturing cycling behaviour.
Results: The comparisons show that cycling mode share in IV-ABM's synthetic population across Melbourne and within its regions (both before and after the simulation) is underestimated. Furthermore, considerable differences appear when demographic factors such as age and gender of cyclists are taken into account. Cycling-related built-environment factors (e.g. bikeway availability/type, road gradient and end-of-trip facilities) which are important determinants for cycling behaviour are not included. Although adding these socio-ecological factors might not be critical for modelling road vehicles and public transport use (as initial target modes in IV-ABM), the literature strongly supports their impact on cycling behaviour.
Conclusion: Observed differences in cycling mode share and behaviour indicate the need for extending the model for better cycling representation. This process includes adding cycling-related features to the synthetic population and the transportation infrastructure (network), enhancing cycling-infrastructure interaction, and improving mode choice and routing process. Once these modifications are implemented and model is validated, it can be used as a comprehensive testbed for cycling interventions across Melbourne.

#2640
TE ARA MUA FUTURE STREETS: CO-DESIGNING AND SEEING AN ACTIVE TRAVEL INTERVENTION TO COMPLETION

Hamish Mackie [1], Karen Witten [2]. [1] *Mackie Research Ltd, Auckland, New Zealand;* [2] *Massey University, Auckland, New Zealand*

Background: Urban transitions for better health and environmental sustainability require a shift from car use to walking, cycling and public transport. Te Ara Mua-Future Streets is a controlled before-after intervention study of retrofitted suburban street design to prioritise walking and cycling. It has been a collaboration between a research team, local community and regional and national transport agencies. Community engagement, evidence-based design innovation and outcome evaluation have been led by researchers, and the regional transport agency has had responsibility for infrastructure funding, procurement and delivery. This paper presents outcomes of the intervention, challenges in the implementation process and learnings for future projects.
Methods: A co-design process involving residents, local government, researchers and transport planning professionals resulted in a modified street environment; key attributes being traffic calming, enhanced walking and cycling infrastructure, connected greenways networks and aesthetic improvements reflecting local cultural identify. Before and after outcomes measures included road-user behaviour, population health (e.g. physical activity, injury) and air quality. The strengths and challenges of the collaborative process were also investigated via pre and post construction via interviews with researchers and transport agency personnel.
Results: The on and off-street interventions were guided by design principles developed through engagement and informed by international research evidence. The project's vision of street design innovation was largely achieved albeit scaled back in response to budgetary constraints. Anticipated changes in road-user behaviour have been observed but significant mode shift changes have not as yet been measured. Challenges encountered during the design and implementation phases arose primarily due to: a fluctuating intervention budget and misalignment of research and delivery timelines;

contrasting professional ways of working, for example a linear – design, procure, deliver – engineering methodology conflicted with the researchers' iterative participatory design process; and divergent exposure to risk between parties, individually and organisationally.
Conclusions: Active travel intervention research is not for the faint-hearted. Six years of consultation, planning and negotiation has delivered a unique neighbourhood scale intervention in Mangere, Auckland, New Zealand. To track changes in physical activity and other health outcomes will require repeat measures over a number of years. Critical decision points surfaced differences in priorities, pressures and constraints, and precipitated conflicts between parties. Despite the difficulties encountered, a shared commitment to delivering a better street environment in this low income neighbourhood endured. Dedicated funding and planning mechanisms are needed to facilitate future innovative street design trials.

#2642
INCLUSIVE STREETSCAPES: DISABLED PEOPLE AND OLDER CITIZENS CHARTING A ROADMAP TO EQUITY

Shanthi Ameratunga [1], Julie Spray [1], Anneka Anderson [1], Janine Wiles [1], Karen Witten [2], Malakai Ofanoa [1], Roshini Peiris-John [1], Julie Wade [1], Dolly Paul [1], Esther Willing [3], Bridget Burdett [4]. [1] *University of Auckland, Auckland, New Zealand;* [2] *Massey University, Auckland, New Zealand;* [3] *University of Otago, Dunedin, New Zealand;* [4] *MRCagney, Hamilton, New Zealand*

Background: While transport is a well-recognised determinant of health, the extent to which streetscapes and transport options support the health of people is highly variable across multiple intersecting dimensions. This study explored the perspectives of disabled people and older residents in Auckland, New Zealand, on how transport systems influence their lived experiences and aspirations for wellbeing and meaningful social participation.
Methods: Drawing on Kaupapa Māori consistent and Talanga Pacific methodologies, this community-based participatory research study involved qualitative interviews conducted in seven languages incorporating Go-along and Photovoice methods. The 62 participants living with disability and/or aged over 60 years resided in four case study sites: Māngere (South Auckland) including Kaumātua (older Māori) at Te Puea Marae; Pacific communities (Samoan, Tongan, Tuvaluan, Tokelauan and Kiribati) in West Auckland; a multi-ethnic community in Glen Innes (Central Auckland), and European and Asian people in Howick (East Auckland). A thematic analysis was undertaken of the interviews.
Results: Participants who could access their communities often expressed a love for or strong connections to those neighbourhoods, finding the places, relationships, and resources supportive of their wellbeing. Difficulties in navigating barriers in streetscapes and limited transport options were reported often, but the access challenges and their impacts varied between sites and communities. Participants in more economically deprived neighbourhoods saw the legacy of historic and recent infrastructure changes as disruptive and damaging, with major consequences for their safety and physical, cultural and emotional wellbeing. Participants with higher levels of education, computer literacy and systems knowledge expressed greater confidence in navigating barriers and advocating for themselves, demonstrating the influences of power, affluence and privilege. Families were an important source of transport and for those with less social power, financial constraints, and language and technological barriers, families were often the only option. Interactive community workshops that followed interviews highlighted the enthusiasm of under-served communities to engage with policy makers to stimulate transformative changes in transport systems.
Conclusions: The 'lived experiences' of people of diverse cultures, social and geographical contexts, provide critical insights regarding how transport systems can enable or challenge community and personal wellbeing. They also highlight the need for more robust processes that engage with disadvantaged communities to address prevalent structural injustices in transport. The project's next phases integrate these findings with research engaging transport professionals to consider how the design, implementation and evaluation of transport systems can be more responsive to the needs of these communities.

#2646
AMBULANCE LOCATION OPTIMIZATION IN DELHI

Shayesta Wajid, N. Nezamuddin. *Indian Institute of Technology, Delhi, New Delhi, India*

Background: India has a fragmented system of emergency services with no set response time standards. Therefore, the aim of this study was to dig into the scope of optimization of emergency medical services in Delhi based on Double Standard Model (DSM) developed by Gendreau et al. (1997). Delhi has Centralized Accident and Trauma Services (CATS) as a government authorized agency with 150 ambulances across 9 districts.
Methods: Demand points were taken as clusters of fatal accidents (380) for the years 2014 to 2016 (Source: Traffic Police Headquarters, Delhi). 680 potential sites were identified. It was assumed that CATS ambulances serve only road traffic crashes and an ambulance is available for the time when the call is made. Travel time was computed using the Distance Matrix API feature of Google Maps API.
Single coverage model (MCLP) was applied to find secondary coverage standard (r2) of DSM. The primary coverage standard (r1) of DSM was chosen based on feasibility of the model at 0.85, 0.90 and 0.95 reliability value (α). Analysis was done under three scenarios, S1 (taking current ambulance locations), S2 (considering 680 potential ambulance sites) and S3 (S2 with Dantzig Wolfe decomposition principle).
Results: r2 for S1 in DSM was adopted as 21 mins and that for S2 and S3 as 15 mins (as obtained from MCLP). With α of 0.90 and r2 being fixed, the minimum feasible r1 value was found to be 13 mins for S1 and 8 mins for S2 and S3 scenarios. Coverage with S2 and S3 scenarios were near to 100% as compared to 90% for S1, for the standard of r1=13mins, r2=21mins, and α=0.9. S2 and S3 achieved higher coverage with 20 lesser ambulance than S1. The difference between the two optimized scenarios (S2 and S3) was observed at a lower response time standard of r1=8 mins, r2=15mins and α=0.9 which can be attributed to the redistribution of ambulances in scenario S3 owing to lower response time standards.
Conclusions: With this preliminary analysis, there is a huge scope of improvement for the emergency system in Delhi in terms of coverage as well as response time. The existing fleet of 150 ambulances of CATS must be redistributed in order to cater to the lower response time standards like the developed nations from west and enhance the level of coverage and level of reliability that needs to be provided.

#2651
THE OCCURRENCE OF MUSCULOSKELETAL SYMPTOMS DURING A LONG DRIVE IN A DRIVING SIMULATOR

Marko Cvetkovic [1], João Baptista [1], Raquel Oliveira [2], Sara Ferreira [1], Antonio Couto [1], Pedro Ferreira [1]. [1] *University of Porto, Porto, Portugal;* [2] *IPCA, Barcelos, Portugal*

Background: Professional drivers spend most of their working time seated in a static posture. In terms of work-related musculoskeletal disorders (MSD), prolonged motionless exposure of a worker's body may lead to a variety of diseases such as venous and cardiovascular disorders, lower limbs edema, among others. Spending years in such condition, repeating the similar movements and adopting the identical posture, results in musculoskeletal pain. An average of 57% of the total driver's population, had discomfort in a certain part of the body. The main purpose of this study is to compare the symptoms of musculoskeletal pain / discomfort resulting from driving over a long period of time in a driving simulator, with the prevalence values of WRMSD in professional drivers.
Methods: This study includes 48 randomly selected participants aged between 19 and 40. The selection of the subjects was based on clinical criteria and the possession of a valid driving license. The musculoskeletal symptoms of the participants were evaluated with the Nordic Questionnaire, that measures the prevalence and severity of MSD, as well as their anthropometric characteristics. The experimental process consisted of driving 120 minutes in a driving simulator (DriS), which allows to achieve a realistic driving. The experiment duration is highly important concerning musculoskeletal symptoms of the volunteers. For that reason, data is collected every 40 minutes to evaluate, with a scale from 1 to 4, the subjects' symptoms related to musculoskeletal pain. In order to evaluate if the driving time affects directly the occurrence of musculoskeletal pain or if it results in new symptoms (incidence), Friedman's ANOVA test was used. The statistical analysis was made to all the anatomic regions of the body considered in the Nordic questionnaire: neck, shoulders, elbows, wrists/hands, upper back, lower back, hips/thighs/buttocks, knees and ankles/feet.
Results: Results showed that musculoskeletal symptoms occurrence increase with the driving time. The results of Friedman's ANOVA test confirmed the increment in musculoskeletal symptoms for a significance level of 5%, except for the right upper limb (shoulder, elbow, and wrist). To estimate if the symptoms disorders depend on age, a Mann-Whitney test was performed and was concluded that the null hypothesis for all the parts of the body should be rejected.
Conclusions: The study has shown that the occurrence of musculoskeletal symptoms among the sample is statistically significant with the time of driving. The results obtained for the right upper limb suggest a deeper multivariate analysis and the influence of the sociodemographic factors should also be considered.

#2652
STREETSMART: EVIDENCE AND INSIGHT FOR BETTER TRANSPORTATION

Kelly Rodgers. *Streetsmart, Portland, Oregon, USA*

Streetsmart is a nonprofit research synthesis, resource clearinghouse, and collaboration platform that helps transportation and health professionals integrate climate, health, and equity into transportation. This presentation will share results from focus groups on challenges integrating health into transportation, as perceived by engineers, planners, and public health professionals, as well as list seven recommendations for improvement. Audience participants will share their own challenges and successes in integrating health and transportation in practice. Following that will be an interactive presentation of Streetsmart that will discuss the evidence base for research synthesis and the challenges of contextualizing research findings–from the neighborhood to international contexts. Finally, the audience will suggest revisions to Streetsmart, particularly regarding the three main areas of focus: setting goals and metrics to help translate policy intent into project-level work; providing climate, health, and equity implementation guidance; and documenting the success of projects through an online evaluation tool.

#2654
THE HEALTH-ORIENTED TRANSPORTATION MODEL: THE CURRENT AND POTENTIAL HEALTH BENEFITS OF ACTIVE TRANSPORTATION IN LONDON, ENGLAND

Samuel Younkin, Henry Fremont, Jonathan Patz. *University of Wisconsin-Madison, Madison, Wisconsin, USA*

Background: Physical inactivity has become one of the most common modifiable risk factors for multiple chronic diseases, not only in developed countries, but globally. The health benefits of physical activity are well established, yet due to pressures that arise from automobile-oriented environments, approximately twenty-three percent of the world's population does not meet recommended levels of physical activity. The world's population is increasingly concentrated in urban settings in which urban planning and design play important roles in the active transportation achieved by a community. The research question that we address here is: To what extent does active transportation currently benefit a given population and what is the potential health benefit of increasing these levels?
Methods: We have developed a statistical model, known as the Health-Oriented Transportation (HOT) model, to quantify the health effects in terms of a population attributable fraction. The model performs a comparative risk assessment using physical activity as the exposure variable. The amount of physical activity due to travel, or travel activity, is decomposed into three components: participation, frequency and intensity. To answer the above question, we construct two scenarios, one with no participation and one with complete participation. We apply the HOT model to the London area as part of our work with the Complex Urban Systems for Sustainability and Health research group, which aims to identify changes in urban settings that have transformative and sustainable effects on health. The London Travel Demand Survey, 2005-2016, along with data from the UK Department for Transport are used to estimate participation, frequency and intensity of active travel.
Results: We estimate that, in the inner boroughs of London, complete elimination of active transportation would result in an eleven percent increase in the all-cause mortality rate. If participation in active transportation is increased to one hundred percent, the all-cause mortality rate would decrease by two percent in the inner boroughs. The intensity of active travel in the inner boroughs steadily increased from 2005 to 2011, while in the outer boroughs it remained constant.
Conclusions: Impressive public health gains can be made by increasing population levels of physical activity. We believe an increase in active transportation must play a large part in preventing future epidemics of inactivity. The health effects of active transportation must be made accessible to decision-makers worldwide, and so we are developing an online tool to apply the HOT model to data from travel surveys across the world.

#2657

THE GREAT KIWI TRANSPORT CHALLENGE: THE PATHWAY TO WIN-WIN SOLUTIONS THAT REDUCE THE IMPACT OF EMISSIONS AND NOISE AS WELL AS IMPROVING THE LEVEL OF PHYSICAL ACTIVITY

Rob Hannaby [1], Jannette Farley [1], Iain McAuley [2]. [1] *New Zealand Transport Agency, Auckland, New Zealand;* [2] *New Zealand Transport Agency, Wellington, New Zealand*

New Zealand prides itself on a clean green image that is epitomised by the 100% Pure New Zealand tourism brand. By global standards it is a country with a very low population density, its people enjoy a high life expectancy and it is a relatively small emitter of greenhouse gas emissions.
These observations, however, do not mean New Zealand can sit back and relax when it comes to future living standards and well-being. In recent times the impact of rapid population growth coupled with an associated rise in urbanisation and an increase in motor vehicle use has created a range of environmental and public health issues.
The Government has signed the Paris climate change agreement and the transport sector, which accounts for 18% of the country's greenhouse gas emissions, has a significant role to play in helping the country achieve this commitment. Most transport emissions arise from road transport, especially light vehicles, in large urban areas – particularly Auckland.
The same pattern of emissions is true when it comes to harmful air pollutants, such as fine particulates, from road transport which account for shortening the lives of more than 250 people per year. Adding to this transport public health burden are: around 380 fatalities and thousands of serious injuries each year that arise from crashes on the road network as well as more than 13,000 people living near state highways who are exposed to harmful levels of road traffic noise.
In contrast, there is also a significant opportunity for the transport system to improve people's health outcomes, especially for the 50% of the population who spend less than 30 minutes each day being active, by increasing their levels of physical activity for example by choosing to more regularly walk and cycle when travelling.
This paper explores the above challenges in more detail, revealing the magnitude, inter-connectedness and spatial nature of not only the problems but also the potential solutions and their benefits. Focusing on the role of the New Zealand Transport Agency, the merits of a range of potential transport interventions, that could achieve multiple outcomes, are considered including:

- How best to invest land transport funds to reduce emissions and improve public health.
- Increasing the uptake of safer, cleaner and quieter vehicles and modes of travel.
- Better managing development and travel in key urban areas.
- Taking a more holistic approach to asset management, including consideration of existing public health harms.

#2661

HEALTH EQUITY, DISTRIBUTIVE JUSTICE AND THE TRANSPORT SYSTEM

Ed Randal [1], Michael Keall [1], Caroline Shaw [1], Alistair Woodward [2]. [1] *University of Otago, Wellington, New Zealand;* [2] *University of Auckland, Auckland, New Zealand*

Background: The transport system influences everyone's wellbeing on a daily basis. These impacts are both positive and negative and are borne directly and indirectly at a range of scales. However, these impacts are often distributed unfairly with people least able to use transport networks bearing the greatest costs. People also have different transport needs from each other and these needs change throughout an individual's life. Due to these complexities, there is no straightforward answer to how we should be providing transport fairly. Furthermore, the urgent need to decarbonise the transport system is highlighting the equity implications of carbon reduction policies. This paper reviews how social justice theories have been applied to transport planning and discusses how the strengths of these theories may be further tested through their application to transport policy and the broader impacts of transport on health and wellbeing.
Methods: This paper employs a narrative literature review to examine perspectives in the social and distributive justice, equity and transport literature. A model of how distributive justice theory might be used to guide transport policy is developed. This is then applied to the New Zealand transport system, with a focus on the equity of health impacts of recent transport policies.
Results: Few papers have explicitly discussed the application of social justice theories to transport. Of those that have, the predominant theory applied is the Capabilities Approach. More recently, authors have focused on defining a transport-specific capability and have proposed that augmenting this approach with principles from John Rawls' Theory of Justice may be useful for guiding transport planning. We applied the Capabilities Approach to transport policy in a novel way that conceptualises transport policy as a social conversion factor that influences individuals' ability to convert resources and opportunities into the beings and doings that individuals have reason to value. This more explicitly lays out the consequent role of transport policy to counteract negative influences on a wide range of capabilities. Using an example of a proposed 'feebate' scheme to increase electric vehicle uptake, this framework highlights the inequitable distribution of positive and negative effects on individuals' health and wellbeing through a range of important capabilities.
Conclusions: Taking a broader view of the application of social justice theory to transport allows for greater utilisation of the philosophies of these theories, as well as clearer conceptualisation of the impacts of transport on wellbeing and guidance on actions to improve transport justice.

#2663

THE IMPORTANCE OF URBAN STRUCTURE AND FORM IN ACHIEVING SUSTAINABLE AND HEALTHY COMMUNITY OUTCOMES

Michael Grosvenor. *University of Southern Queensland, Sydney, Queensland, Australia*

Background: Global aspirations for urban sustainability coincide with debate over the type of urban structure and form that underpins positive sustainability outcomes. More recently, the health research sector has also highlighted the role that urban structure and form plays in achieving improved community health outcomes. Much of the research in these areas have centred on the benefits of increasing residential densities in areas that contain good public transport accessibility. I argue that this focus on density as an important contributor to positive sustainability and health outcomes is problematic. Specifically, I argue that urban density measures are not a sufficient proxy for accurately representing urban structure and form differences across large metropolitan areas. Density measures tell us little about a neighbourhood's accessibility and design characteristics and - most importantly - its location within the metropolitan area, which is a critical element in the transport choice householders make, especially for the journey to work trip. Moreover, the focus on density may well be contributing to poorly located and designed development across metropolitan areas, with negative health outcomes resulting. This presentation will show why accessible urban structure contexts - not increased density - must be in place before more active land use and transport outcomes are achieved at the local community level.
Methods: Comparison of primary and secondary sustainable behaviour data collected in different urban structure and form case study areas using Chi square and ANOVA to measure the strength of the association that exists between these variables. Additional comparison of 2016 ABS Census journey-to-work and car ownership data in different urban structure and form case study areas in Sydney, Australia, that illustrate the transport use differences in different urban structure and form areas. Literature review summary of the association that exists between active transport use and healthy community outcomes. Detailed exploration of the urban design characteristics of these case study areas to further interrogate the association that exists between active land uses, active transport use and healthy community outcomes.
Results: The strong statistical association that exists between urban structure and the achievement of sustainable, active and healthy community outcomes, using Sydney, Australia as a case study. The importance of active localised urban form (the micro) taking advantage of macro urban structural advantages.
Conclusions: Urban planning policy makers must more fully consider the strong association that exists between an accessible urban structure layout; active land use urban form design; and active transport use, which ultimately is the major contributor to sustainable healthy cities and towns.

#2664

SHAPING CITIES FOR YOUTH – EXPLORING THE TRANSPORT, PLACE, AND WELLBEING NEEDS OF MARGINALISED YOUTH IN NEW ZEALAND

Rosee Hodgson [1], Greer Hawley [2], Alex Macmillan [1], Jennie Connor [1], Antoni Moore [1], Adrian Field [3], Karen Witten [4], Christina McKerchar [1], Robin Kearns [5]. [1] *University of Otago, Dunedin, New Zealand;* [2] *Mackie Research Ltd, Auckland, New Zealand;* [3] *Dovetail, Auckland, New Zealand;* [4] *Massey University, Auckland, New Zealand;* [5] *University of Auckland, New Zealand*

Background: Access to opportunities – employment, educational, cultural, or social - is a determinant of health. Urban planning and transport affect access and contributes to health disparities. Globally, there is growing recognition that reducing car use can improve health, social justice, and environmental wellbeing at a population level, but little is known about impacts on young people experiencing access difficulties. This study explored place and transport issues of marginalised youth in New Zealand cities by engaging them, their parents, and organisations who interact with youth. The purpose was to understand how the urban form and transport can meet the needs of this priority group, and the implications for health, social justice, and environmental wellbeing.
Methods: Peer Interviewers completed semi-structured interviews with fifty-two rangatahi/youth (rangatahi is the indigenous term for 'youth'). Participants were between 15 and 24 years, lived in one of four communities (located in Auckland and Christchurch), and had experienced being 'Not in Employment, Education, or Training' (NEET). Interviews explored their experience of moving around their city - barriers, enablers, and interactions between place and wellbeing. Twenty-one semi-structured interviews were conducted with parents of youth participants (5), employers (7), education providers (5), and youth organisations (4). Interviews focussed on their preferences, expectations, and practices around youth accessibility. Interview data were coded thematically in NVivo. Youth data and adult data were analysed separately.
Results: Rangatahi/youth were accessing opportunities any way they could; however, this 'multimodality' was described as a difficult reality rather than a choice. Cost, time, lack of control, and service provision inadequacies were barriers to public transport use. Walking and cycling were constrained by safety and distance, and negative perceptions of cycling were common. The spatial design of cities and infeasibility of alternative transport options underpinned the need for car-based solutions. Young people exhibited desires to drive and own a car, and there were strong explicit and implicit norms for driving and licensure from adults. Rangatahi/youth's cultural identity was central to place, how they spent their time, and their transport choices. Negative self-identity was reflected in instances of interpersonal and internalised racism while moving about their city.
Conclusions: A systematic and structural response to make alternative transport modes more feasible and attractive for marginalised youth is necessary to address current and future health and social inequities and meet environmental health goals. Immediate and long-term solutions are needed, which reflect the voices, culture, and positive identity of marginalised youth.

#2665

THE PATHWAY TO BEHAVIOUR CHANGE: PRELIMINARY FINDINGS FROM TE ARA MUA – FUTURE STREETS *(HIGH SCORING RESEARCHER ABSTRACT AWARD SPONSORED BY THE INSTITUTE OF TRANSPORTATION ENGINEERS)*

Melody Smith [1], Karen Witten [2], Adrian Field [3], Rebekah Thorne [4], Alexandra Macmillan [5], Bert van der Werf [1], Jamie Hosking [1], Hamish Mackie [4]. [1] *University of Auckland, Auckland, New Zealand;* [2] *Massey University, Auckland, New Zealand;* [3] *Dovetail, Auckland, New Zealand;* [4] *Mackie Research Ltd, Auckland, New Zealand;* [5] *Environmental Health, University of Otago, Dunedin, New Zealand*

Background: Physical environments can have a significant and enduring role in promoting or hindering active travel behaviours. Robust community-level environmental interventions are challenging to design, undertake, and evaluate. Te Ara Mua - Future Streets, in Māngere, Auckland, New Zealand is an area level randomised, controlled before and after community intervention study to make streets safer and easier for people to travel around actively. Intervention elements included widening footpaths, cycle lane installation, and cultural landscaping (see www.futurestreets.org.nz). This presentation will outline the research methods for measuring the effect of the intervention and preliminary results from the first wave of follow-up.

Methods: Baseline measures were taken in 2014 and follow-up occurred in 2016/17, 6-14 months post intervention completion. All households in the intervention and control areas were visited and enumerated to obtain a random sample of children/young people (aged 7-13 years) and those aged 14 years and older. Replenishment sampling was used at follow-up to replace participants who were no longer available to participate. The survey comprised sections on socio-demographic information, travel patterns, physical activity, neighbourhood perceptions, social wellbeing, road traffic injuries, and physical abilities. Qualitative face-to-face interviews, go-along interviews, school focus groups, and participatory mapping were undertaken in the intervention area to explore neighbourhood use and perceptions of place, accessibility, and barriers for active travel. Objective measures of traffic volume and speeds, air quality, road traffic injuries, and diabetes risk were collected. Video footage was collected to measure road user characteristics and behaviours. Quantitative data analyses are guided by a causal loop diagram. Generalized linear mixed models are being used to analyse changes in outcomes, accounting for repeated measures and intra-cluster dependencies. Qualitative data have been analysed using thematic analysis.
Results: At baseline, 1243 adults (response rate 65%) and 658 children (83%) participated in the survey. At follow-up, 1280 adults and 630 children participated. Survey and qualitative data show improved perceptions of walking and cycling in the intervention area. Sociocultural norms, safety concerns and practical limitations were identified as barriers to active travel. Qualitative, video and survey data all point to improved accessibility and more trips for people with disabilities. Significant reductions in vehicle speeds on local and collector streets and reductions in motor vehicle volumes on local streets have been found in the intervention area.
Conclusions: Early findings align with the theorised pathways from intervention to behaviour change. Analysis is ongoing including planned economic cost-benefit modelling. Long term follow-up is essential to determine whether changes in safety and perceptions translate to increases in active travel in residents and is scheduled for 2020.

#2671

LOCAL-INDIGENOUS AUTONOMY AND URBAN CULTURAL LANDSCAPES: LEARNINGS FROM MĀORI AND TE ARA MUA-FUTURE STREETS PROJECT

Kimiora Raerino [1], Alex Macmillan [2], Adrian Field [3], Hamish Mackie [4]. [1] *Mackie Research Ltd., Auckland, New Zealand;* [2] *University of Otago, New Zealand;* [3] *Dovetail, Auckland, New Zealand;* [4] *Mackie Research Ltd, Auckland, New Zealand*

Background: In settler countries, attention is extending to the wellbeing benefits of promoting indigenous-cultural identity of urban communities as a significant contributing factor to healthier and safer communities for all. Yet, efforts to (re)implement cultural identity into community redesign can be challenging and ineffective without the leadership and collaboration of local-indigenous peoples. Local-indigenous autonomy is evolving as an integral strategy to ensure the appropriateness and validity of cultural initiatives within urban retrofit projects. This paper reviews the emerging development of local-indigenous autonomy, as a re-indigenisation approach, centring on restoring, recognising and empowering the first occupants of a community in situ.
Methods: Employing a Kaupapa Māori (Māori-centred) research approach we focussed on the workings and perspectives of mana whenua (local-indigenous peoples) and community stakeholder engagement. This indigenous research methodology was selected because it privileges Māori voice and knowledge. Our data comprised of a recent literature review and a case study examination of Te Ara Mua – Future Streets, a community street retrofit project, undertaken in Aotearoa (New Zealand). Individual semi-structured interviews were undertaken with Māori and non-Māori stakeholder members involved in mana whenua engagement. An indigenous theoretical framework, Te Pae Mahutonga, was utilised in the data analysis to explore indicators of indigenous individual-collective agency, empowerment, and wellbeing.
Results: Stakeholders described the benefits and challenges of their involvement; including the outcomes and their aspirations for developing authentic cultural community redesign. They stressed the need for continued development of mana whenua capacity, and the tangible and intangible facets of shared power and control. Many argued the importance of mana whenua leadership and innovation in this project was crucial in resulting outcomes that were authentic and distinctive, and a defining feature of their involvement. Overall, local-indigenous autonomy was identified as a promising, if not obligatory, strategy for community street retrofitting and cultural landscaping.
Conclusion: The practice(s) and implications of local-indigenous autonomy in community street redesign is an evolving approach that needs further investigation. Local-indigenous autonomy and the re-indigenisation of communities cannot be regarded as a simple solution without acknowledging some complications. Our research demonstrates that developing capacity amongst indigenous communities is integral for effective engagement in the co-design, leadership and ownership of communities. The realisation of autonomy in community redesign projects can have broader implications for indigenous sovereignty, spatial justice and health equity.

#2672

HOW DO LEISURE ACTIVITIES AFFECT UNIVERSITY STUDENTS' WELL-BEING?

Nobuaki Ohmori [1], Takeru Sugeno [2], Teppei Osada [1]. [1] *Utsunomiya University, Japan;* [2] *Tamano Consultants Co., Ltd., Japan*

Background: Japan has been facing an aging society with fewer children. The number of teens is decreasing but the university entrance rate is rising. Universities in metropolitan cities are more popular and attractive for high-school students than those in local cities. This is recognized as a reason why many local cities face in decreasing young population. We hypothesize that the quality of life and well-being of university students would be affected by their socioeconomic characteristics including location of university campus and daily activities such as studying, club activities, part-time job, leisure activities, etc. This study examines what types of university students have higher subjective well-being in their daily lives, especially focusing on the effects of leisure activities.
Methods: In December 2016 and January 2017, we conducted a questionnaire survey for undergraduate and graduate students in a total of 15 universities (17 campuses) in Japan. Most of the respondents belong to department of civil engineering. The number of samples is about 1,300. Locations of each university campus are classified into three areas as Tokyo central area (4 campuses), Tokyo suburban area (5 campuses), and local cities (8 campuses). Information collected are: socioeconomic characteristics (sex, grade, living location, etc.); university life (study hours, club activities, part-time job, etc.); leisure activity (e.g., frequency, locations, with whom, money used for and satisfaction levels about two types of leisure activities: recreation and drinking); and subjective well-being ("0: very unhappy" to "10: very happy") for their daily lives.

Results: Descriptive analyses showed differences in the reason to work part-time, money used for leisure activities, satisfaction levels for the number of opportunities for drinking and recreation activities, and the frequency, money consumption and satisfaction levels of leisure activities, among the three areas. Tobit model analysis revealed that graduate or undergraduate, location of university campus, having a boy/girlfriend, liking of out-of-home activities, participation in clubs, purpose of part-time jobs, frequency and satisfaction levels of recreation and drinking activities significantly affected the university students' subjective well-being.
Conclusions: Leisure activity engagement is an important factor for university students' well-being. From the perspective of city and transportation planning, the findings imply that providing appropriate opportunities of leisure activities with higher accessibility would contribute to increasing attractiveness of the university and students' well-being, especially in local cities. Also, it would help alleviate the concentration of young people to central area of Tokyo metropolitan area.

#2673
CHANGE TO WALKING - NUDGING PEOPLE TO WALK FOR SHORT TRANSPORT TRIPS

Alice Woodruff [1], Ben Rossiter [2]. [1] *Active City, Melbourne, Victoria, Australia;* [2] *Victoria Walks, Melbourne, Victoria, Australia*

With our lifestyles becoming increasingly sedentary, integrating physical activity into our daily travel routines is vital to support our health and wellbeing. This presentation will share the approach and outcomes of Change to Walking, a program that tested the effectiveness of specific 'nudges' to encourage walking for short trips to train stations and primary schools, over a six-week period. A 'nudge' is a small change that can be made in a setting that influences people's behaviour. The program was a pilot behaviour change initiative funded by VicHealth and delivered through Victoria Walks in five locations across Melbourne and regional Victoria. The program aimed to increase walking behaviours and embedded real-world testing and evaluation to build the evidence base for 'nudge' interventions in encouraging walking for short trips. While behavioural insights have been employed successfully for interventions in health settings there have been very few examples of well-evaluated 'nudge' interventions to increase levels of walking. VicHealth and Victoria Walks have expanded the evidence base on the use of 'nudge' theory for future programs to increase physical activity. As a result of Change to Walking in schools, the proportion of walking trips significantly increased ($p<0.05$) from 26% to 35% , which is a 34% increase in walking rates. The program strongly influenced the behaviour of children who are usually driven to school, as well as increasing the frequency of walking for those who usually travel that way. Active nudge interventions supported by school community interactions and communications achieved strong outcomes in the schools setting. For travel to train stations, passive nudge interventions were not enough to sway travel behaviour to train stations across all locations, in the face of other dominating influences of the weather and shorter daylight hours, although there was a 5% ($p<0.05$) net increase in walking at one of the three stations. People who usually walk to the station were walking more often at all locations (5% increase, $p<0.05$). This program provides valuable learning of how small changes or "nudges" can support choosing walking as an active travel option for short, regular journeys across a variety of settings.

#2676
EXPLORING THE BUILT ENVIRONMENT OF WALKING THROUGH WALKABILITY INDEX: A STUDY ON TWO DIFFERENT DISTRICTS OF THE UNITED KINGDOM

Farzana Khatun [1], Astrid Gühnemann [2]. [1] *ITS, UCI, Irvine, California, USA;* [2] *Institute for Transport Studies, University of Natural Resources and Life Sciences, Vienna, Austria*

Background: In the United Kingdom (UK), research show a gap in identifying and calculating an empirically measurable index to quantify the relationship between built environment and walking. Current guidance and studies mostly provide walkability indicators for specific routes and often relies on qualitative approaches. This paper develops an area-wide walkability index (WI) for the lowest level geographical unit (LSOA) of two districts (Leeds and York) of the UK based on existing (geographic information system) GIS data.
Methods: The WI is comprised of six partial indices: Connectivity Index (CI), Household Density Index (HDI), Commercial Density Index (CDI), Diversity Index (DI): Entropy Index (EntI), Environmental Friendliness Index (EFI) and Proximity Index (PI). Once calculated, the stability of results for these indices was verified with a sensitivity test through Monte-Carlo simulation. An area-wide walkability index can be correlated with other neighborhood characteristics for a possible utilization of such index values. To do so, we correlated the WI results to the UK "Deprivation index" to show a potential relationship between depravity and walkability in the study areas.
Results: We found that the final WI in Leeds (0.298) is higher than York (-1.196) due to the higher values of four partial indices in Leeds. The reasons of such results tie with the morphological pattern of the Leeds city: the traditional grid lock network pattern; high rise multi-storied retail shopping malls in the city center; diverse nature of land uses, and densely populated city center due to high rise dorms for the university students. The sensitivity analysis for the top 30 LSOAs showed that the rank of the LSOAs are less sensitive to weight changes except for connectivity partial index. We also found that the highly deprived areas close to the city center are more walkable as these areas are the residence of the low-income people.
Conclusions: Such measurable index is helpful to evaluate the causal relationship between walking and other relevant factors which again helps to formulate reasonable policy and development plans for walking.

#2679
MOBILITY INJUSTICE AND DISABLED YOUNG PEOPLE: APPROPRIATING THE SWISS CHEESE MODEL

Karen Witten [1], Melody Smith [2], Penelope Carroll [2], Octavia Calder-Dawe [1]. [1] *Massey University, Auckland, New Zealand;* [2] *University of Auckland, Auckland, New Zealand*

Background: The New Zealand Disability Survey found rates of participation in physical, social and cultural activities are low for disabled young people compared to same age peers without disabilities. Mobility enables participation and access to social; economic and community life is essential for health and a right of citizenship. Without mobility young people with disabilities can be excluded from the everyday activities that support wellbeing and engender a sense of place and belonging. This presentation will report on the mobility experiences of young people living in Auckland, New

Zealand who are hard of hearing or have visual or mobility impairments.
Methods: Thirty-five young people, aged between 12 and 25 years, with mobility, vision or hearing impairments participated in a mixed-method research project designed to understand their mobility practices and how mobility influenced participation in daily life. The young people were recruited to the study through schools, specialist education facilities and disability groups and networks. The research design combined objective (global positioning systems, accelerometers, geographical information systems) and self-report measures (travel diaries and questionnaires) along with in-depth interviews with young people and their parent or significant other.
Results: To navigate the physical, temporal, technological and peopled maze that constitutes our transport networks requires an alignment of system factors and relational opportunities. The possible impediments to smooth transit are infinite. If any step in this complex navigation process fails to materialize as planned (and often rehearsed), hopes of a trip being made are dashed. The outcome can be one more person with a disability missing from the street, the workplace, the party etc. Impediments are wide ranging and their disabling effects differ by travel mode and the young person's physical impairment. With reference to the 'Swiss cheese model' of the title, the converse of the many layers of defense that lie between hazards and accidents is required for a disabled young person to negotiate the city in an affordable, safe and timely manner. Access and mobility rely on an alignment of many system and relational factors.
Conclusions: The right to the city of young people with disabilities is compromised by transport networks and norms that privilege the movement of able bodies. Uncertainty is a constant in the everyday mobility experiences of these young people.

#2681
TE ARA MUA – FUTURE STREETS: ROAD USER BEHAVIOUR OUTCOMES

Lily Hirsch [1], Jamie Hosking [2], Bert van der Werf [2], Hamish Mackie [1], Greer Hawley [1], Nick Wilson [1], Zénobie Cornille [1].
[1] *Mackie Research Ltd, Auckland, New Zealand;* [2] *University of Auckland, Auckland, New Zealand*

Background: Te Ara Mua – Future Streets is a controlled before-after study of a neighbourhood street retrofit in the suburb of Māngere, Auckland, New Zealand. The project aimed to make it safer and easier to get around the neighbourhood, especially by walking and cycling. To assess the extent to which this aim was achieved, we evaluated changes in observed road user behaviours, including road user interactions, volumes of travel by different modes, and traffic speed. It is expected that changes in these behaviours are an important step before eventual outcomes for modal shift, injury reduction, and health improvement.
Methods: We collected pre- and post-intervention video recordings and vehicle counts and speed using pneumatic road tubes. Data were collected in selected streets in both intervention and control areas. For data analysis, we developed a video coding framework to understand road user behaviours and interactions, and to count people walking and cycling. Vehicle speed and counts were generated automatically.
Results: After the intervention, observed walking and cycling behaviour indicated easier and safer road use for those modes. Interactions between people walking and motor vehicles shifted to lower-energy, safer locations. Improvements to walking infrastructure facilitated group walking behaviour and improved accessibility for wheel-based footpath users. At some sites, people cycling shifted to the new cycle facility, reducing interactions with motor vehicles. Vehicle speeds and counts reduced substantially on treated streets. Walking and cycling counts are currently being analysed.
Conclusions: The Te Ara Mua – Future Streets intervention appears to have facilitated walking and cycling through safer road user interactions for those modes. Reductions in motor vehicle speed and traffic volume also contribute to the safety of walking and cycling in this neighbourhood. Longer-term follow-up will assess whether these changes translate into sustained increases in walking and cycling.

#2686
ACCESSIBILITY TO COMMUNITY INFRASTRUCTURE AND THE QUALITY OF LIFE

Md. Kamruzzaman [1], Billie Giles-Corti [2]. [1] *Monash University, Caulfield East, Victoria, Australia;* [2] *RMIT University, Melbourne, Victoria, Australia*

Background: Community (or social) infrastructure (CI) is defined as hard infrastructure, delivered by both the public and private sectors, and includes a mix of facilities and services that maintain quality of life such as schools, aged care, and hospitals. They are broadly classified into multiple levels according to the catchment population they serve. Despite the main goal of CIs is to maintain the quality of life, relatively little is known how different levels of CIs are linked to quality of life.
Methods: The two-step floating catchment (TSFC) area method was applied to derive accessibility scores to 27 different CI types categorised into four levels for all 56,371 meshblocks in Melbourne. Meshblocks are the smallest administrative boundary used to collect census data in Australia. The four levels of CIs are characterised by: Level 1 - Neighbourhood (1,250-2,000 people, 250m radius); Level 2 - Local (5,000-8,000 people, 800m radius); Level 3 - District (25,000-35,000 people, 3-5 km radius); and Level 4 - Sub-regional/ municipal (75,000-100,000 people; 12 km radius). These distances were respectively used to derive accessibility scores to CIs using the TSFC method. The accessibility scores were averaged to the next level (SA1) to match with the quality of life (QoL) data. QoL is measured by the time spent in recreational activities. The Victorian Integrated Survey on Travel and Activity data were used to extract total minutes spent on recreational activities in a day for 5,000 individuals. A multiple linear regression model was estimated to identify the impacts of accessibility to different CIs on activity duration, also controlling for respondents' socio-economic factors.
Results: Of the 27 CI types, eight were found to have a significant association with QoL (neighbourhood parks, aged care, childcare, government secondary schools, Catholic secondary schools, fire services, law courts, and hospitals). Results show that an increasing accessibility to lower level CIs (neighbourhood park, aged care, childcare) likely to increase activity duration in recreational activities. In contrast, an increasing accessibility to higher level CIs reduces the likelihood of engaging in recreational activities, except accessibility to hospitals.
Conclusions: Weak evidence was observed on the links between access to CIs and QoL in this study. However, QoL was measured by a single indicator and in an indirect way. Further investigation using more direct and multiple indicators of QoL is warranted to robustly infer the links.

#2687
STREET ENVIRONMENT FOR PEOPLE, SUSTAINABILITY AND HEALTH IN HAVANA (STEPS-HAVANA)

Ashley Dhanani [1], Adrian González González [2], Adriana Ortegon [1], Paulo R. Anciaes [1], Joiselen Cazanave [2], Emily Morris [1], Jennifer S. Mindell [1]. [1] *UCL, London, UK;* [2] *CUJAE (University of Technology of Cuba), Havana, Cuba*

Background: Havana's political and economic context has created a unique urbanisation pattern with low vehicle ownership; very low fleet replacement; low population; and little urbanisation and sprawl. Walking is convenient due to equitable approaches to spatial planning at the local and city scale for developing accessible destinations, particularly widespread affordable, accessible health and education services and high personal security. However, high risk of injury due to poor condition and layout of infrastructure; high vehicular emissions; and high speeds (low traffic volume plus driver attitudes) can make walking unpleasant.
Objective: To contribute to the development of sustainable and healthy mobility in Havana.
Methods: Practitioners, policy-makers, researchers and students developed a new classification of street networks in Havana (network model) then participated in a series of interdisciplinary workshops to discuss this in relation to a new, researcher-developed pedestrian demand statistical model for Havana and personal knowledge of Havana and compare and contrast findings of the two models. 22 participants then joined a walkshop scoring 23 questions on their perceptions of pedestrian conditions at each of 27 sites (13 on east side, 14 on west) along Galiano Street in Central Havana.
Results: In general, the two models reflected personal experience well. Participants felt more places have higher pedestrian demand in practice than the demand model showed; the model showed higher levels than reality in a few locations. Several streets were important for both movement and for use as place, which could cause conflict. Many intersections and potential pedestrian areas had no or inadequate provision for crossings.
Analysis of walkshop data found noticeable differences in mean scores between the east and west sides of the street, and between different sites along the street. The main problems on the street were a lack or poor quality of green space and plants; a lack of resting places; and high noise levels. The only positive attributes, on average, all related to the existence of colonnades providing shelter, wide pedestrian facilities without obstacles and with better quality surfaces. Non-infrastructure variables had an effect (sunshine, time of day, age and gender of participant).
Conclusions: The most frequently poor-scoring attributes – lack of green space and places to sit and presence of noise – are well-known to impact adversely on mental wellbeing. More research is needed to develop and improve methods that incorporate cultural and geographic differences in use of streets and people's needs.

#2691
MODELLING POTENTIAL HEALTH IMPACT BY REDUCING VEHICLE EMISSION THROUGH INTRODUCING ELECTRIC VEHICLE FLEET FOR SHORT TRIP METROPOLITAN DELIVERIES

Jean-Francois Delvaen. *Woodend, Victoria, Australia*

Background: The Technology and Supply Chains for Critical Industries – Urban Freight working paper (October 2017) commissioned by the Department of Infrastructure and Regional Development provides several avenues for improving the delivery of goods in metropolitan areas. Whilst the document proposes new and emerging technologies as catalysts for improvements, these enhancements mainly concentrate on the 'speed' of delivery and/or the time wasted in congestion chocked cities.
Methods: This paper suggests a different and novel approach that instead of trying to tackle the congestion problem, it proposes that a reduction of emission – which increases with congestion – with a shift to a non-exhaust fuel emitting fleet of trucks (e.g. electric trucks) would deliver significant health benefits to the population including drivers. Firstly, the presentation will review the available literature and data available for Australian capital cities with regards to air quality (pollution) and freight related vehicular traffic. It is estimated that air pollution causes around 60,000 adverse health impacts in Australia every year including 1,700 deaths. The second part of the presentation will propose a model for a change in fleet mix and a quantification of the health benefits from the proposed changes. Finally, the presentation will present a set of recommendations for consideration by various proponents affecting the model.
Results: The results are yet to be finalised; however, it is anticipated that a reduction of 5% to 20% of emission attributable to the freight task in metropolitan area can be achieved.
Conclusion: The introduction of nonexhaust-based freight vehicles (e.g. electric trucks) in a metropolitan area provides significant health benefits to the truck drivers and the population in general. The number of deaths attributable to respiratory disease can be reduced, which in turn diminishes the overall burden of disease on the wider community.

#2692
DAILY WALKING AMONG COMMUTERS: A CROSS-SECTIONAL STUDY OF ASSOCIATIONS WITH RESIDENTIAL, WORK AND REGIONAL ACCESSIBILITY IN MELBOURNE, AUSTRALIA (2012–2014)

Alison Barr [1], Suzanne Mavoa [2], Hannah Badland [3], Billie Giles-Corti [3], Jan Scheurer [3], Koen Simons [1], Lizzie Korevaar [1], Joshua Stewart [4], Rebecca Bentley [5]. [1] *University of Melbourne, Australia;* [2] *University of Melbourne, Melbourne School of Population and Global Health, Australia;* [3] *RMIT University, Melbourne, Victoria, Australia;* [4] *Department of Transport, Planning and Local Infrastructure, Victoria, Australia;* [5] *University of Melbourne, Mont Albert, Victoria, Australia*

Background: Most research on walking for transport has focused on the walkability of residential neighbourhoods, overlooking the contribution of work/education neighbourhoods and broader regional accessibility. Our objective was to examine if local accessibility (or walkability) around homes and work/education and regional accessibility of employment and tertiary education were independently associated with minutes of daily walking in commuters.
Methods: The sample of 4,913 adult commuters was derived from a household travel survey in Melbourne, Australia (2012-2014). Local accessibility

was measured as the availability of destinations within an 800m pedestrian network from homes and places of work or education using a 4 category Local Living Index (1: 0-3 destinations, 2: 4-6 destinations, 3: 7-9 destinations, 4: 10-12 destinations). Regional accessibility was estimated using employment opportunity contours, a comparison of commute travel time by mode and network analysis of public transport accessibility. Every individual's potential outcome for each strata of exposure (observed and counter-to-fact) was predicted from adjusted multivariate regression estimates and averaged. The averaged predicted minutes walking generated were used to estimate marginal differences in minutes of daily walking between strata of local and regional accessibility, quantified as the marginal mean effect.
Results: In mutually adjusted models, minutes walking differed for those in the highest category of Local Living at home (10+ destinations) by 3.8 minutes (95% CI 2.2, 5.3) (and at work or education by 8.1 minutes (7.1, 9.1) (compared to the lowest in both (<4 destinations)). Similarly, in these same models, walking was associated with better regional accessibility with the highest estimated minutes of walking 8.1 (6.8, 9.5) for Level of Public Transport Service: Work /education (comparison of the highest (score 2-3) and lowest (score 0) exposure strata)). Fully adjusted models that included a statistical interaction between Local Living and regional accessibility suggested people in the highest category of the Local Living Index at their place of work or education (10+ destinations) and high regional accessibility, regardless of the measure used, walked 10 to 12 more minutes each day than people experiencing low accessibility both locally at work and regionally.
Conclusions: Walkable neighbourhoods (particularly around where people work and study) and good regional accessibility have potential to support active travel and may increase walking by as much as 10-12 minutes per day.

#2695
PATH DEPENDENCE: A FRAMEWORK FOR UNDERSTANDING ACTIVE TRANSPORT IMPLEMENTATION

Karen Wright [1], Hussein Dia [2]. [1] *SGS Economics and Planning, Canberra, ACT, Australia;* [2] *Swinburne University of Technology, Hawthorn, Victoria, Australia*

Background: This research focuses on opportunities to shift suburban travel to more energy efficient modes, specifically active travel. Currently a significant percentage of trips in Australia are for distances that could be undertaken by cycling or walking however established travel habits still enforce a reliance on private vehicles for relatively short local trips. Path dependence provides a theoretical framework in which implementation of active transport in Australian cities can be understood. Path dependence originates in economic theory but is increasingly being used in other fields to provide a framework for research. It is defined as a series of events which determine a course by reinforcing the use of a particular technology. It is not used to predict outcomes, but to assist reflection and analysis of policy settings and to identify further opportunities for governance, policy and practice that will support stated policy ambitions to achieve increased walking and cycling.
Methods: This research investigates the impact of discursive and technical path dependence on active transport. Firstly, by analysing the historical policy settings to identify key themes and 'storylines' emerging that have influenced transport and land use. Analysis reveals that policy discourse prior to the year 2000 was directed primarily at facilitating car travel, including supportive infrastructure such as car parking and a focus on preventing traffic congestion. Discursive path dependence is explored in the current day setting through interviews undertaken with 'active transport influencers.'
Results: Key findings from these interviews include that recent policy has been influential in changing discourse and reflects a shifting focus towards more sustainable transport modes such as walking, cycling and public transport. However, this change in discourse has not been reflected in significant changes to active transport uptake, with a significant time lag between expressed policy intentions and actual change to practice and implementation. Identified gaps and barriers include funding/resources, safety, urban form, active transport priority versus car convenience, community and practitioner information and awareness, as well as attitude and culture.
Conclusions: Emerging policy rhetoric on active transport since 2000 suggests a major shift to active transport. However, until the balance of community travel activity and investment in transport infrastructure outweighs that directed to accommodating car travel it could be argued that a shift in path dependence is underway but not guaranteed.

#2696
DEVELOPMENT AND EVALUATION OF A PRECINCT LEVEL LOW CARBON MOBILITY DECISION MAKING TOOL

Damian Moffatt, Hussein Dia. *Swinburne University of Technology, Hawthorn, Victoria, Australia*

Background: This research presents a decision-making tool to help assess impacts of low carbon urban mobility interventions. Using a 'low carbon mobility calculator', end-users make quantifiable assessments about current carbon impacts of their transport network and review the impacts of transitioning private vehicle trips to other less carbon intense modes including walking and cycling. The tool helps the decision-making process of planners, policy makers, and other decision-making authorities at a local government level to reduce the carbon footprint of transport within their precincts.
Methods: The framework of the tool comprises of three components: A travel preference survey, traffic model, and calculator. Each of these components was developed in the context of a pilot study for Port Phillip Council in Melbourne. The travel preference survey was used to understand the mode preference of users to understand how commuters would react to a reduction in private vehicle travel. An online survey was conducted asking respondents to select their preferred and alternative modes of travel. The survey helped to define what mode of travel commuters would shift to. A traffic model was then used with input from survey to understand likely mode shift specific for precinct. The results from travel preference survey, traffic model, trip database and cost factors are all integrated, with input from the end-user regarding target level of carbon reduction, to calculate a new mode share distribution and carbon improvements
Results: This tool was used to assess Port Phillip Council pilot study area. Several scenarios were tested through the calculator to assess and value different planning options. With each option presenting industry standard metrics such as Carbon Dioxide Equivalent per person, and reduction in passenger vehicle kilometres, the end-user compares the results between multiple scenarios to find an outcome that meets their objectives. The results are at a detailed enough level for inclusion in policy, planning, and other strategic documentation
Conclusions: This research has demonstrated feasibility of a low carbon mobility calculator and its application to several scenarios in the context of a local council in Melbourne. The tool can be easily extended to other local councils using the methodologies and techniques identified in the work. The outputs from this calculator can be used to develop evidence-based policy and consultation purposes leading to a positive change.

#2698
GREENING TRANSPORT IN AUSTRALIA'S SUBURBS

Hussein Dia [1], John Stone [2], Sekhar Somenahalli [3], Stephen Cook [4], Jana Perkovic [2], Callum Sleep [3]. [1] *Swinburne University of Technology, Hawthorn, Victoria, Australia;* [2] *University of Melbourne, Parkville, Victoria, Australia;* [3] *University of South Australia, Mawson Lakes, South Australia, Australia;* [4] *CSIRO, Clayton, Victoria, Australia*

Background: The Australian suburbs are often envisaged as sprawling areas of low-density residential development around the city core. However, analysis of employment locations in Australian cities, such as Melbourne, shows that while the greatest density of jobs are in the city's core, more than three quarters of jobs are located in the suburbs. This decentralisation of jobs is not supported by public transit services and active transport infrastructure, as the focus of transport planning in the suburbs has been on increasing the capacity of road infrastructure. This emphasis on roads has meant suburban employment is predominately accessed by private vehicles, with increased demand and congestion affecting the liveability and productivity of these areas. Current travel patterns in Australia's suburbs also presents challenges for reducing transport emissions in our cities, while also presenting risks to public health and social inclusion. This case study paper describes a collaborative research project, which involved researchers and industry partners, to develop innovative approaches to better understand the barriers and opportunities for a transition to low carbon mobility in the suburbs.
Project Overview: There were several components to this project, with research and industry partners drawn from across Australia, which enabled a comprehensive approach for addressing high priority research gaps that could provide practical guidance for transport planners in reducing the carbon footprint of travel in Australia's suburbs. This paper will report on the three main components, which were:

1. Stated and revealed preference surveys to understand suburban travel demand and determinants of shifts to public transit and active transport modes.
2. Analysis of transport supply for a suburban employment precinct using a modelling tool that provides visualisation of the accessibility implications of different planning options.
3. An agent-based model that explored human behavioural responses to investment interventions designed to increase the uptake of low carbon transport modes in a suburban employment precinct.

Key Findings: The research project has provided a comprehensive overview of the challenges and opportunities to transition to low carbon transport modes in Australia's suburbs. There is a strong latent demand for low carbon transport modes. However, currently employment nodes are poorly connected by public transit services and lack safe active transport infrastructure. A key contribution of this work was to demonstrate how the modelling components could be integrated in providing a framework for supporting effective planning and investment decisions that increase the uptake of low carbon transport modes in the suburban context.

#2702
FIRST/LAST MILE ACCESSIBILITY TO HEALTHCARE WITHIN THE CONTEXT OF THE BEHAVIORAL MODEL FOR VULNERABLE POPULATIONS

Courtney Cronley [1], Erin Murphy [2], Noelle Fields [3], Dana Hill [4]. [1] *The University of Tennessee, Knoxville, Tennessee, USA;* [2] *The University of Texas at Arlington, Arlington, Texas, USA;* [3] *The University of Texas, Arlington, Texas, USA;* [4] *The University of Tennessee, Arlington, Texas, USA*

Background: First/last mile accessibility is a persistent challenge for environmental justice (EJ) populations. The issue is particularly acute in healthcare access considering that many EJ groups have higher rates of chronic health conditions and fewer healthcare options. Both Gelberg's Behavioral Model for Vulnerable Populations (BMVP) and Ryvicker's Behavioral-Ecological Model suggest that individuals' healthcare utilization is partly a function of macro-level factors many within the built environment, including transportation access. Thus, we sought to understand the experiences of EJ population members, in their own words, regarding first/last mile accessibility and how it relates to their healthcare utilization.
Methods: We conducted in-depth interviews with 18 individuals (14% female; 44% Hispanic; 11% Black; 33% using personal automobile). Participants were recruited with assistance from a community advisory board and intentionally selected to represent diverse groups. Team members independently coded the audio transcripts using open and axial coding with "healthcare utilization" and "first/last mile accessibility" as sensitizing themes.
Results: First/last accessibility intersects with chronic health conditions to intensify mobility challenges. As one person said, "two miles is kind of far to walk, especially people who have disability or people with wheelchairs." Another single mother reported, "I can't even take him [young baby] to go get formula. It's too far and too scary to walk." Likewise, urban planning suggests lack of forethought about the first/last mile. Another participant explained, "there's no shoulder, no leeway, nothing…how would you bring a bus there? You can't." The first/last mile inaccessibility meant that many rely on paratransit, which requires complex planning. As one participant explained, "[I] told him [the driver] to bring me here and drop me off. Another one [driver] would pick me up. I knew I had to make that doctor's appointment. I could not miss it." At times, though, lack of transport simply meant forgoing healthcare; as one participant said, "That why I have to slow down in the middle of the year, going back and forth to my doctor's appointment, because I'm gonna run out of rides."
Conclusions: Spatial distribution of individual and environmental factors influence travel and healthcare utilization. In lieu of redesigning the built environment, EJ population members are relying on paratransit, which presents unique mobility challenges. While emergent technologies like car- and ridesharing could reduce first/last mile barriers to healthcare, they must be implemented strategically, and transportation navigators could assist riders with lower technically proficiency. Share technologies may be especially useful for lower-income families.

#2703

HEALTH AND TRANSPORT SYSTEM IMPACTS OF REDUCING THERMAL DISCOMFORT: A CASE STUDY

Dana AbouKheir, Mohammad Khalifa, Ghassan Abu-Lebdeh. *American University of Sharjah, Sharjah, United Arab Emirates*

Background: Outdoor thermal discomfort due to extreme heat and high-level humidity in the United Arab Emirates (UAE) is a serious issue and an impediment to walking and cycling as sustainable healthy modes of transport. And the prolonged hot season compounds the problem even more. This in part explains the addiction-level of private auto ownership and use and thus the dominant auto-based travel. The unintended consequences are many, including significantly reduced physical activity thus higher than normal levels of obesity and related modernity health problems as diabetes and cardiovascular diseases.
Methods: This case study demonstrates the use of minimally intrusive changes to transport system components aimed at creating seasonally comfortable (closer) parking alternatives that minimizes user thermal discomfort by reducing length of walking trips thus reducing desirable walking health advantages. The study involved a combination of transport system and health impact assessment measures. Transport system changes included restructured traffic circulation and calming measures, and provision of mountable curbs to enable partial on-street over-curb parking spaces closer to user destinations. Changes in walking distances due to proposed parking and traffic circulation changes were estimated using ordinary transport mode attributes as distance and time. Health impacts were assessed using HEAT.
Results: The impacts on traffic operations and users' health (due to shortened walking distances) were respectively conducted using standard traffic impact assessment tools, and HEAT. The results demonstrated a minimum negative impact on traffic level of service (LOS) but there was a downside in the form of negative health impacts due to reduced walking, the annual cost of which is estimated at AED 29,000 (EUR 7,000). The positive outcome of reduced thermal discomfort resulting from shortened origin to destination distances was neither quantified nor monetized.
Conclusions: This study demonstrated how thermal discomfort can be partially mitigated with minimum negative impact on transport system operations and human health. The value of the present study stems from its integrated and systemic consideration of its congruent elements of thermal discomfort, transport system impacts and health impacts. Although thermal discomfort is a prominent transport mode attribute—and one that motivated this study—capturing its impact in quantitative terms within a transport mode disutility model is currently not available but is something that merit research and understanding. Thermal discomfort, seen as yet another attribute of transport mode is a novel proposition. A suitable disutility model with thermal discomfort as a mode attribute needs to be formulated.

#2706

A MIXED METHODS APPROACH TO INCREASE COLLABORATION BETWEEN PHYSICAL ACTIVITY RESEARCHERS AND TRANSPORT PLANNERS

Katie Crist [1], Jasper Schipperijn [2]. [1] *University of California, San Diego, California, USA;* [2] *University of Southern Denmark, Denmark*

Background: Collaboration between physical activity (PA) researchers and transport planners to increase active transport (AT) has been widely recommended. Despite overlapping agendas between these sectors, strategies to facilitate collaboration are not well understood. The goals of this research were to: 1) understand the benefits, barriers, and facilitators of collaboration, and 2) develop a quantitative analysis relevant to planners to demonstrate the utility of PA research data and collaboration potential.
Methods: This research used a mixed methods approach. First, a qualitative study was conducted using semi-structured interviews to understand the transport planning perspective. Based on results of a thematic analysis, GPS research data from utilitarian cyclists were used to augment a standard planning method, Level of Traffic Stress (LTS), to better understand the relationship between LTS and cycling route choice. All bikeable road segments were assigned an LTS score. Route trajectories were mapped to the LTS network, and the LTS and distances of observed, shortest and low stress routes were compared. LTS maps and animations were developed to highlight where low stress connections were lacking.
Results: The qualitative interviews (N=17) revealed that 1) AT-specific data were lacking and local, objective, individual, cyclist and pedestrian trip data would improve upon currently available data sources, and 2) research studies were often did not meet planners' needs. More regular engagement, identification of mutual goals, and use of novel data formats would facilitate collaboration. The LTS analysis addressed these findings by linking objective, cycling data to a commonly used planning methodology and providing visual data outputs. The inclusion of GPS data highlighted that, while only 15% of road segments were classified as high stress, nearly 30% of transport cycling trips occurred on the highest stress routes. For two-thirds of trips, a low stress alternative route either did not exist or required an unacceptable detour distance. Observed routes were slightly longer than the shortest path and had significantly fewer high stress segments, indicating cyclists may be willing to detour to avoid high stress routes.
Conclusions: The findings of this research provided empirical evidence to support collaboration between PA researchers and transport planners. The use of formal qualitative methods served as a systematic needs assessment, while the quantitative analysis demonstrated how research data and methods could be applied in the planning context. The mixed methods approach fostered a mutually beneficial research project, development of a multidisciplinary working group, and knowledge sharing with multiple transport agencies.

#2707

CHANGING THE TRANSPORT ECO-SYSTEM THROUGH PLACE-BASED LOCAL LEADERSHIP (HIGH SCORING PRACTITIONER ABSTRACT AWARD SPONSORED BY THE INTERNATIONAL PROFESSIONAL ASSOCIATION OF TRANSPORT & HEALTH)

Cassie Moore [1], Carolyn Wallace [2]. [1] *Royal Flying Doctor Service Victoria, Victoria, Australia;* [2] *Swinburne University of Technology, Hawthorn, Victoria, Australia*

One avenue of inspiration often overlooked by city-based planners and practitioners looking for transport solutions lies beyond city limits in rural and regional areas. This presentation looks at how the Royal Flying Doctor Service Victoria (RFDS) is working with local leaders in a small rural town to

change the transport eco- system through a proactive approach to secure, coordinate and capitalise on internal and external resources. Community leaders in the central Victorian town of Heathcote are well aware that transport is routinely listed as one of the top factors that impacts on the health of people in the Heathcote area, as it is for many rural and regional Victorians. Yet programs to address this need are plagued by limitations such as: short term funding; competitive and limited funding rounds; focus on new pilots rather than funding ongoing needs; narrow scope; and small amounts of funds. Through determination to address this, RFDS is working in collaboration with local leaders to integrate transport activities to address immediate need and change future practice. One of the central features is a free community transport pilot funded by the RFDS that uses RFDS transport scheduling software, a local coordinator, volunteer drivers and a small fleet of vehicles to transport people with a health care card to health appointments within a 50km radius. This highly visible and successful program is complemented by a volunteer pathway program with the local TAFE to train volunteer drivers and 'jockeys' who accompany passengers. A third piece of the local system is a Transport Champions program led by Advance Heathcote Inc. with a focus on changing behaviours about using available community, public and private transport options. Together these three programs are changing the way locals think about and use transport, increasing transport options and building community capacity to supplement existing private and public transport options. This presentation will outline the steps taken to support this integration activity, establish these programs, identify what's required to develop an integrated local transport eco-system and conclude with findings from the evaluation of the RFDS community transport program and plans for its continuation.

#2708

ULTRA LONGHAUL FLIGHT AND ITS IMPACT ON AIR TRAVELLERS

Chrystal Zhang [1], Xinru Jiang [2]. [1] *Swinburne University, Melbourne, Victoria, Australia;* [2] *Swinburne, Melbourne, Victoria, Australia*

Background: Advancement in technology enables airlines to initiate long haul and ultra-long-haul services, which posits physical challenges for both passengers and cabin crews. Travellers' in-flight health and wellness is becoming a growing concern globally which entails airlines to explore the prospect to improve and enhance a more comfortable and healthier cabin environment for travellers. However, there is a lack of understanding about travellers' comfort level and their needs on the ultra-long-haul flight. This is understandable given that ultra-long haul is still in its infant stage. Our research aims to uncover the factors affecting travellers' comfort level, their health and wellbeing. We also attempt to determine to what extent their needs have been satisfied by service providers such as airlines.
Methods: quantitative method of data collection is employed. 173 respondents in Australia participated in our online survey who have travel experience on ultra-long-haul flights with Qantas, United, Singapore and Emirates. Descriptive data analysis, ANOVA, and exploratory data analysis, e.g. factor analysis was conducted to identify the themed factors affecting travellers' comfort level and wellbeing, and the challenges they face. Co-relationship and regression analysis are also conducted to establish if there is any difference between various factors identified.
Results: seating arrangement in economy class has been identified as a key element affecting comfort level. Failure to sleep, dehydration, starvation, lack of movement, queuing for toilet are identified as the fundamental needs on board but also the most challenging object to overcome.
Conclusions: ultra-long-haul air travel posits unexpected challenge to both cabin crew and travellers, with a significant impact on their health and wellbeing. Airlines needs to endeavour to improve and enhance cabin offerings while travellers need to be educated and fully prepared for their travel.

#2709

COMMUTER CHOICES: INCREASING UPTAKE AND USE OF ACTIVE COMMUTING AMONG OFFICE WORKERS THROUGH SELF-REGULATION AND SOCIAL SUPPORT *(HIGH SCORING DOCTORAL ABSTRACT AWARD SPONSORED BY JOURNAL OF TRANSPORT & HEALTH)*

Anthony Walsh [1], Tracy Washington [2], Nick Petrunoff [3], Kristi Heesch [1]. [1] *QUT, Kelvin Grove, Queensland, Australia;* [2] *QUT, Brisbane, Queensland, Australia;* [3] *National University of Singapore, Singapore*

Background: Active commuting (AC) has health, financial and environmental benefits. Workplace interventions to increase AC are rare, with very few being theory-based, or using social support as a strategy. This research evaluated the impact of a workplace intervention based on social cognitive theory (SCT), to increase physical activity (PA) during commuting, among office workers in Brisbane, Australia.
Methods: Five workplaces were enrolled and assigned to a comparison group (n=2) or intervention group (n=3) for a quasi-experiment. Volunteer office workers participated in the study. *Commuter Choices*, a 6-week intervention based on SCT, was delivered to the intervention workplaces. It included personalised journey planning, seminars, goal-setting, and enlistment of social support. Data were collected pre- and post-intervention, using an online survey (commuting modes, predictors of AC), and a 7-day online diary (commuting behaviour, total PA). Generalised Estimating Equations were used to examine between-group differences in changes pre- to post-intervention in AC, total PA, and meeting PA guidelines. Models adjusted for education, parking cost and workplace.
Results: Sixty-six volunteers participated (19 comparison, 47 intervention): 70% female, mean age 36.5 years (SD=10.5) and median commuting distance 9.8 km (IQR=11.9). Participants were more active than the general population: 80% sufficiently active ($\geq$150 min PA over $\geq$5 days/week) at baseline. Pre-intervention, participants achieved a mean of 24.0 min/day of PA from commuting (SD=15.0), and 24% met PA guidelines from commuting alone. When asked about main commuting mode, 20% said motor vehicle, 58% said public transport and 24% used active modes (walking or cycling). Pre- to post-intervention, the intervention group added 7.5 min/day (95% CI=1.6–13.4, p=0.013) more PA from commuting than the comparison group. The intervention group added 56 mins/week (8–104, p<0.001) more total PA than the comparison group. Post-intervention, intervention participants were more likely than comparison participants to achieve sufficient PA from their commuting (33% vs 6%, OR=7.6, 4.2–13.7, p<0.001).
Conclusions: This pilot evaluates the impact of a low cost, easily replicable intervention based on SCT. The results demonstrated statistically significant increases in AC and PA that are meaningful for population health, and in achievement of sufficient PA through commuting alone. *Commuter Choices* focuses on supporting commuters to find ways to easily add PA to their commuting, rather than primarily focusing on mode shift. This approach has promise for future interventions, especially in sprawling cities where AC for the whole journey is less feasible.

#2713
BICYCLE PASSING DISTANCE LAW: EFFECTIVENESS AND NECESSITY

Jun-Seok Oh, Ahmad Feizi, Ron Van Houten, Valerian Kwigizile, Majid Mastali. *Western Michigan University, Kalamazoo, Michigan, USA*

Background: The interaction between motorists and bicyclists is a principal concern regarding bicycle safety, especially during passing maneuvers. Crash data reveals that 36% of bicyclist fatal crashes in 2016 occurred during a motor vehicle overtaking a bicycle. Ten states in the U.S. have enacted a law that requires motorists to keep a minimum lateral distance while overtaking bicyclists. The objective of the study is to illustrate the effect of the minimum passing law on drivers' behavior while passing a bicyclist, and to examine how drivers' overtaking behaviors are affected by various parameters.
Methods: An instrumented bicycle, equipped with a sensitive ultrasonic detector and a video camera, was utilized. The field experiment was carried out by riding the bicycle through the roadways and capturing drivers' behavior when they overtake the bicycle. We examined jurisdictions with a three-foot passing law, with a five-foot passing law, and without a passing law. To facilitate the comparison purpose of different sites, the study examined two-lane and three-lane roadways with four types of configuration, which are including: presence of bike-lane, shared use lane (sharrow), paved shoulder, and without bike services.
Results: A total of 2857 vehicle-bicycle overtaking maneuvers were derived from 25 hours of video recording. The one-way analysis of variance (ANOVA) revealed that the passing distance in the roadways with sharrow was significantly less than the roadways with a bike lane ($P < 0.001$), shoulder ($P < 0.001$), and those without bike facility ($P < 0.001$). Additionally, analysis using t-test mean comparison indicated that average passing distance in two-lane roadways was significantly ($t = 10.46$, $P < 0.001$) less than three-lane roadways. Results of a one-way ANOVA indicated that the passing distances in cities with five-foot law were significantly higher than cities with the three-foot law. An ordered probit model was also applied to find more factors that are influential on drivers' overtaking behaviors. Besides from number of lanes, the model revealed that presence of paved shoulders and high truck percentages are associated with significantly narrower passing distance.
Conclusions: The significant level of the five-foot law variable in the proposed model properly describes the prominence and the necessity of such a law to enhance bicyclists' safety. In addition, the greater violation rate in areas with five-foot law (14%) compared to areas with a three-foot law (2%) reveals that the five-foot law is more reasonable for probable police enforcement in the future.

#2720
INVESTIGATING HEALTH ISSUES OF MOTORCYCLE TAXI DRIVERS: A CASE STUDY OF VIETNAM (2ND HIGHEST SCORING POST-DOCTORAL/EARLY CAREER ABSTRACT AWARD SPONSORED BY THE NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE)

Hang Nguyen [1], Long Truong [2], Richard Tay [3]. [1] *University of Transport and Communications, Hanoi, Viet Nam;* [2] *La Trobe University, Bundoora, Victoria, Australia;* [3] *RMIT University, Melbourne, Victoria, Australia*

Background: Motorcycle taxis have been an integral part of transport systems in many cities in the Global South, particularly in South-East Asian countries like Vietnam where traffic is dominated by motorcycles. The recent booming of ride-hailing services has further increased the popularity of motorcycle taxis. Motorcycle taxi drivers often have a heavy workload and are exposed directly to the weather conditions. However, little is understood about health conditions among emerging types of motorcycle taxi drivers, including ride-hailing and hybrid taxi drivers (i.e. a combination of traditional and ride-hailing taxi drivers). This paper aims to investigate health conditions among motorcycle taxi drivers in Hanoi, Vietnam. Traditional, ride-hailing, and hybrid motorcycle taxi drivers are considered explicitly.
Methods: Data were obtained from a structured questionnaire survey of motorcycle taxi drivers in Hanoi, Vietnam. Logistic regression was adopted to explore factors associated with health issues among motorcycle taxi drivers.
Results: A total of 549 motorcycle taxi drivers participated in the study. The average age was 29.2 years old. Only 2.7% were female and 34.6% worked fulltime. The proportions of traditional, ride-hailing, and hybrid motorcycle taxi drivers were 9.1%, 78.1%, and 12.8% respectively. Approximately four out of five motorcycle taxi drivers had a normal range of body mass index (82.3%). It was found that 22.6% (95% CI: 19.1-26.1) of the motorcycle taxi drivers suffered from fatigue. This was followed closely by low back pain that had a prevalence of 22.0% (18.6-25.5). The prevalence of upper back pain was lower at 12.8% (10.0-15.5). About 13.7% (10.8-16.5) indicated that they had a vision problem. A prevalence of 11.8% (9.1-14.5) was found for headache. Approximately 7.5% of the motorcycle taxi drivers (5.3-9.7) reported having a respiratory problem. Less than half of them (44.4%, 40.3-48.6) indicated they had no health issue. Logistic regression results indicated that compared to traditional motorcycle taxi drivers, ride-hailing and hybrid taxi drivers had a lower risk of upper back pain. In addition, being overweight, alcohol consumption, and prolonged riding hour were found to be associated with self-reported health issues. Regression results also indicated that upper back pain and low back pain were associated with crash involvement.
Conclusions: Back pain and fatigue were more prevalent health issues among motorcycle taxi drivers in Hanoi, Vietnam. The relationship between back pain and crash involvement was evident.

#2721
RELATIONS BETWEEN FREQUENCY OF VISITS TO URBAN GREEN SPACES AND MENTAL HEALTH

Olta Braçe, Gina Patricia Suárez-Cáceres, Marco Garrido-Cumbrera. *University of Seville, Seville, Spain*

Background: Urban green spaces actively participate in the reduction of air pollutants, improve the microclimate in cities, provide spaces for socialising and offer environmental benefits that affect both physical and psychological health. From a medical and health management perspective there is an urgent need to uncover more focused measurable evidence for relationships between green spaces and specific measures of mental health. In addition,

the quality of life of citizens is affected by urbanisation processes, urban expansion, and densification which lead to a growing loss of contact with nature and force people to live in less green environments. The evaluation of urban green spaces as therapeutic landscapes has been addressed in the scientific literature, with a particular emphasis on how these therapeutic places and spaces work in relation to experiential and emotional geographies and interactions that promote human health and well-being. The aim of the present study was to evaluate possible associations between the frequency of visits to urban green spaces in relation to anxiety and depression in a Mediterranean context.
Methods: This is a cross-sectional study extracting information from the 'Urban Green Spaces, Commuting, Daily Habits and Urban Health Survey' carried out during the spring and autumn of 2018 in Carmona, a medium-sized town located in Southern Spain. To evaluate anxiety and depression, the Hospital Anxiety and Depression Scala (HADs) was administered alongside questions on urban green spaces including frequency of visits to such areas. Urban parks and gardens are considered to be urban green spaces. The study also included socio-demographic variables (age, gender, civil status, educational level, and job status), lifestyle variables (smoking, alcohol intake, physical activity, and sleep) and additional health measures (motion impairment, illness and self-perceived health status). Associations were tested using Mann-Whitney and Chi-square tests. A multiple linear regression model was used to explain the frequency of visits to urban green space.
Results: The variables job status and physical activity were associated with frequency of visits to urban green spaces. The regression model showed that frequency of visits to urban green spaces were mainly explained by physical activity and secondarily by anxiety. Individuals who are physically active and those with anxiety were likely to visit urban green spaces more frequently.
Conclusions: The use of urban green spaces can help to improve the mental health status of the population and, in particular, reduce the risk of suffering from anxiety.

#2724
HOW DOES PSYCHOGEOGRAPHY OF URBAN SPACE HELP IN SHAPING MENTAL HEALTH POSITIVELY?

Iqra Rafiq, Tina Pujara. *IIT Roorkee, Uttarakhand, India*

Background: Creating healthy places for urban planners and designers has become complex but brings an opportunity of creating thriving, resilient urban cities; ensuring citizens realize their potential, cope with normal stresses of life. Experts in various fields feel that mental health is concept of happiness or complex or lower priority than physical health when as, World Health Organization states that mental health should be priority for city makers as they have 40% increased risk of depression, over 20% of anxiety and risk of developing schizophrenia as compared to people living in countryside. Mental disorder can cause more disability than other non-communicable disease and are responsible for about 14% of entire world's disease.
Methods: Mix method approach is carried out where mapping and graphic expression technique explores how physical environment influences mental health and by how altering Psychogeography can reinforce positive experiences that impact mental health. The study examines the relationship between urban space and mental health outcomes in a study area that includes a spectrum of urban environment.
Results: The research demonstrates psychological principles may be brought to bear on the relationship between a space, mind, brain with the movement/attitude of the bodies which tend to be related to the acknowledgement of gradations of spatial accessibility that would distribute activities coherently to determine big questions in urban psychology.
Conclusions: The study explored psychological effects of an urban environment and the unique relationship one has with their built environment by addressing the key factors in the disciplines like psychology, architecture urban planning and mapping to understand how neuroscience affects urban space. This paper demonstrates the importance of different spaces in an urban area that could provide possible options to achieve minimum mental stress. Future-work: This paper reveals the potential of Psychogeography holds key opportunity in understanding the urban environment, therefore, can provide a framework for future studies which can later be included in academics and implementing policies.

#2729
INTERSTATES TO BOULEVARDS: A LEGACY OF TRANSPORTATION AND HEALTH TRANSFORMATION

Ron Deverman. *HNTB Corporation, Chicago, Illinois, USA*

A result of the Federal Aid Highway Act of 1956, the United States Congress authorized President Eisenhower's Interstate Highway System. This national highway system was built for economic growth, mobility and national defense purposes. As part of this Interstate network, freeway spurs were constructed and rammed into the heart of major city downtowns across the country. In most cases, these high-speed highways were built within lower income and minority communities, obliterating historic and thriving neighborhoods, such as Black Bottom and Paradise Valley in Detroit and the redlined neighborhoods in West Oakland. Interestingly, State Department of Transportation (DOT) managers and city leaders viewed these infrastructure projects positively as slum clearance opportunities. Moreover, with no mandated national policy to engage the general public and specific residents the roads were affecting, concrete canyons were created, separating families from their livelihoods, sense of place and cultural heritage. This was true in cities as diverse as West Oakland, California, Chicago, Ilinois, Detroit Michigan, and Baltimore, Maryland.
Now in the 21st century, United States DOT and respective State DOT leaders have realized they must right past wrongs. Interstate to boulevard infrastructure projects, managed within the context of open, respectful and collaborative stakeholder relationships, are now revitalizing downtown environments into holistically healthy communities. These projects greatly advance efforts for walkable neighborhoods and multi-modal streets that foster health and social equity for all human populations. This presentation highlights the challenges and successes of four major cities in redeveloping highway spurs into boulevard streets that reconnect neighborhoods, invigorate community quality of life, and inspire health initiatives that before could never be realized.

#2730
WOMEN AND ACTIVE TRAVEL: REVEALED AND STATED PREFERENCES

Katie Crist. *University of California, San Diego, California, USA*

Background: The low rates of cycling and walking for transport in the U.S. in general make it difficult to assess gender differences in active travel. The aims of this research were to assess, by gender: 1) reported comfort on different cycling facility types, likelihood of active commuting (biking or walking) and transport-related physical activity (TPA), and GPS-assessed cycling route choice, based on Level of Traffic Stress (LTS).
Methods: This research used data from two active transport studies in San Diego, CA. The first was a survey of commute behaviors and perceptions in a sample of university staff, students and faculty. Multivariable logistic and linear regression models assessed associations between gender and primary commute mode and TPA. Nonparametric tests compared differences in reported comfort across cycling facility types with varying degrees of separation from traffic.
The second was a sample of GPS cycling route data from adult, utilitarian cyclists. Participants wore a GPS device for 1-5 days and GIS data for the street network was used to create an LTS classification (i.e. the degree of stress a cyclist experiences) for all road segments. The GPS routes were overlaid onto the LTS road network to determine the proportion of trips at each LTS level.
Results: We observed a clear trend of increased comfort on facilities with greater separation from traffic for both genders ($p < 0.0001$). Men reported significantly greater comfort levels on all facility types: street with no bike lane, street with a bike lane, and separated paths, compared to women ($p < 0.0001$). We did not observe significant differences in the odds of active commuting by gender. However, women were 16% less likely to get any TPA ($p=0.026$), and among those that did, had 31 fewer minutes per week ($p<0.001$), compared to men. The GPS cycling data revealed that women had a greater proportion of cycling trips on low stress routes (74% vs 70%), compared to men. Conversely, 28% of trips by men were on the highest stress routes, compared to 25% among women.
Conclusions: Our results suggest that feeling less comfortable cycling and a preference for low stress cycling facilities may explain, in part, the lower odds of active travel among women in San Diego, compared to men. Our results support the implementation of separated cycling facilities, in conjunction with education and encouragement programs targeted specifically to women, to encourage more active travel.

#2739

CHARACTERIZING PARATRANSIT AND MICRO-TRANSIT USERS: UNDERSTANDING THE SCOPE OF ALTERNATIVE MOBILITY OPTION FOR OLDER ADULTS THROUGH MODE SHIFT

Farah Naz, Kate Hyun, Stephen Mattingly. *University of Texas at Arlington, Arlington, Texas, USA*

Background: The rising trends of enriched data optimization, augmented use of smartphone technology, and increased cost associated to car ownership have made micro transit more affordable and useful than ever. On the other hand, operating paratransit can often be expensive and pose a financial burden to the city public transportation systems that runs the operation. Understanding the overlap between these two services can be especially beneficial from both agency and user perspective. A potential mode shift of the users from paratransit to micro transit can offer an enormous savings in per trip cost for the para-transit agency and a possible growth in trips can provide extra financial support to the micro transit system. On the other hand, the user of para-transit service can gain more flexibility in scheduling and possibly less cost associated to the trip by shifting to the on-demand micro transit system.
Methods: The research team characterized the differences in the travel patterns and demographics of users of a para-transit service, Handitran and micro transit service, Via in the city of Arlington, Texas. The study also identified user profiles and examined how Handitran and Via match their demands in the city. Knowledge on frequent user locations would allow certain vehicles to be dispatched in advance and minimize wait time for riders, which eventually maximizes the use of the limited number of vehicles. In addition, the study will explore potential operation strategies that optimize fleet scheduling, routing, and vehicle allocation, which are important factors in setting the service quality, especially with a limited fleet capacity.
Results: The result indicates an interesting increase in canceled trips and decrease in completed trips pattern over the years for the Handitran riders. Also, 66.7% of the Handitran customers didn't accompanied a device 75.7% times of their trips. Additionally, 79.9% Handitran customers had no Physical, Mental or Visual disability who made 70.7% of the trips. The study also explored seven expansion scenarios including trips generation and addition of customers to VIA service.
Conclusions: This study findings will have important implications for Arlington as an age-friendly community. Also, data from this study will support efforts to invest in smart technologies that enhance transportation infrastructure for all residents across income-levels and demographics and ultimately promote employment and economic activity.

#2740

BEAUTY OR THE BEAST? IMPACTS OF AUTONOMOUS VEHICLES ON PUBLIC HEALTH

Soheil Sohrabi [1,2], Haneen Khreis [2], Dominique Lord [1]. [1] *Texas A&M University, College Station, Texas;* [2] *Texas A&M Transportation Institute, Texas, USA*

Background: Although the impacts of Autonomous Vehicles (AVs) on communities have been covered in several studies, the discussion around the impacts of AVs on public health is still in its infancy. Better framing the impacts of AVs on public health will help practitioners, policymakers, and automobile manufacturers to maximize the effectiveness of AVs and address the adverse consequences. The objective of this study is to investigate the potential impacts of AVs on public health through a systematic framework.
Method: We propose a conceptual model comprising three stages, (1) investigating the impacts of AVs on transportation systems, (2) uncovering the links between transportation and public health, and (3) identifying the impacts of the AVs on public health based on the knowledge gained from the previous steps. The impacts of AVs on public health is discussed through seven points of impacts; transportation infrastructure, land-use, and the built environment, traffic flow, transportation mode choice, transportation equity, transportation jobs, and traffic safety. Then, we describe fourteen health risk factors associated with transportation in the literature. Finally, we identify both the positive and negative impacts of AVs on public health.
Results: The positive impacts of AVs on public health include providing access to jobs, healthy food and health care for individuals with different abilities, reducing the stress associated with transportation, increasing traffic safety, improving the energy efficiency of traffic flow, reducing the need of transportation infrastructure and potentially reducing transportation emissions. In contrast, several unintended consequences of AVs can affect public health negatively. Potential changes in travel cost, time, and comfort will encourage more traveling, longer distances, and switching from public and active transportation to private cars. This can be translated to a reduction in physical activity and an increase in vehicle-miles traveled and

transportation emission, which adversely impacts public health. Malfunctioning of AVs' sensors and devices, cybersecurity problems, and complexities in AVs reaction during unavoidable crashes can jeopardize the safety promises of AVs. The equipment and devices required for AVs operation are known as a source of electromagnetic fields with potential adverse health effects.
Conclusion: Despite the promising contribution of AVs to public health, the unintended consequences of AVs implementation needs to be identified and addressed. Equipping AVs with electric motors, regulating urban area development, implementing traffic demand management, controlling AVs ownership, and imposing ride-sharing policies are the strategies that can reinforce the positive impacts of AVs on public health.

#2749
DO COMMUTING TIMES INCREASE PSYCHOLOGICAL DISTRESS?

Olta Braçe, Marco Garrido-Cumbrera, David Gálvez Ruiz, Enrique López Lara, Jose Correa-Fernandez. [1] *University of Seville, Seville, Spain*

Background: Commuting is an important part of daily life for many people and commuting times have steadily increased, becoming a rising problem. Longer commutes can cause stress and poor psychological health. The aim of the present study was to evaluate possible associations between daily commuting (travel to and from work) and poor psychological health.
Methods: This is a cross-sectional study extracting information from the 'Commuting, Daily Habits and Urban Health Survey' from January to April 2015 in Mairena del Aljarafe, a municipality of 44,388 inhabitants, located in the Seville Metropolitan Area (Spain). A representative sample of 294 workers (16–64 years old) were interviewed face-to-face. To detect persons at risk of poor psychological health, the 12-item General Health Questionnaire (GHQ-12) was administered. The study also included socio-demographic, lifestyle and commuting variables. Associations were tested using Mann-Whitney and Chi-square tests.
Results: Out of the analysed sample (employees), mean age was 43±9.9 years old, 46.6% female, 49% university students, 970±510.17 €/month, 38.4% smoked, 80.3% slept <7 hours/day, 7.8% had poor psychological health (GHQ-12 >3), 44.5% experienced overweight/obesity. 88.8% had a private vehicle (car/motorbike), spent 51.9±52.7 min/day on private transport, mean commuting expense was 92±66 €/month, 21.4% worked in the municipality of residence (Mairena del Aljarafe). Psychological health (GHQ-12) was not associated with any of the commute variables (daily commute time and monthly commute expenses). However, educational level was associated with greater private car ownership (university/high school 85.0% vs 54.2% primary; p=0.001); commute times >40 mins/day (university/high school 75% vs. primary 52.5%; p=0.012), and commute expenses >70 €/month (university/high school 76% vs. primary 44.3%; p=0.001). In addition, 76.2% of non-smokers spent more than 40 mins/day (p=0.032) and more than 70 €/month commuting (p=0.009).
Conclusions: The results from this study indicate that the psychological health of employees was not associated with daily commuting. Further research is needed to confirm these findings.

#2752
MINDFUL WALK, TALK AND DANCE IN AN EVOLVING URBAN TRANSPORT LANDSCAPE

Eleanor DiPalma. *New York City Department of Transportation, State University of New York at the Fashion Institute of Technology, New York, New York, USA*

Walking and cycling are human-powered means of transport widely documented for physical, social, economic, environmental and mental health benefits. Increased access to pedestrian and bicycle friendly facilities in the urban transport provides viable options for people to make physical activity a significant part of a healthy lifestyle. Multimodal transport supports travel options for people to walk, cycle and ride public transit. While transportation programs are expanding to sustain active transport, psychotherapists and counselors are walking, talking and dancing with clients in public spaces. In "Mindful Walk, Talk and Dance" dance movement therapists interact with clients through traveling movements in pedestrian paths, communal greenways, streets and public plazas. Psychotherapeutic movement interaction experienced in open natural spaces has transformative effects on mind and body. Health care researchers agree that therapeutic movement interaction in healing natural environments reduces anxiety, stress and depression and facilitates behavioral change.
"Mindful Walk Talk and Dance," conducted by a creative arts psychotherapist (DMT), is a process that uses movement and dance as the primary means of communication together with verbal expression to facilitate behavioral change toward cognitive, social, emotional and physical integration. Therapeutic goals are established through a holistic behavioral assessment leading to therapeutic outcomes affecting the whole person in mind and body.
DMTs work with people who have diverse physical and mental abilities, individually and in groups. Clients express thoughts and feelings that arise while traveling and interacting therapeutically in the natural healing environment. Through this therapeutic relationship, awareness of self, others and the environment unfold. For example, while exploring the basic elements of movement (time, space, weight and flow) and experiencing ranges of walking-movement dimensions between polarities (in/out; forward/backward; up/down; slow/fast; direct/indirect), clients verbally express associated thoughts and feelings. As this process develops, clients expand their movement repertoire while gaining self-awareness and self-confidence. Trust is facilitated by therapist through "mirroring," a movement interactive technique in which the therapist initiates synchrony with the client's expressive walk in time, space, weight and flow. Mirroring enables clients to reflect on the old while creating and developing new movement qualities. Clients develop unity of mind, body and emotions striving for health, self-awareness and improved coping to handle life's challenges successfully while traversing safely in an urban transport landscape.
Conference participants will be introduced to "mirroring," a DMT technique practiced in "Mindful Walk, Talk and Dance" as they walk in the transport landscape of Melbourne, Australia.

#2757
MODELLING POTENTIAL HEALTH IMPACT, ACTIVE TRANSPORT AND TIME-USE-CASE STUDY COMPARISONS

Horst (Oz) Kayak. *Town and Country Planning Association (TCPA), Victoria, Australia*

Background: By using the available Spatial Data Infrastructure available through The Victorian Transport Statistics Portal, which covers out-of-home activity and travel for most days of the years over the period 1994 to 2014 in the State of Victoria, the spatially referenced time use pattern profiles of the residential population are estimated. The latest sample data included quantifies activity for more than a total of 18,152 households and 46, 562 people in the latest VISTA survey, which was conducted over four financial years from 2012 to 2016.
Methods: There is a widely accepted evidence-based view that twenty to 30-minute bouts of personal physical activity in the form active transport potentially benefits the maintenance of sound health and well-being. The urban sub-regions of Melbourne and surrounds with a 30-minute existing and/or health benefiting time-use potential as part of normal life are documented elsewhere. The presentation summarizes the most recent published evidence that there is health maintenance and recovery benefit to be gained from the shorter bouts of personal physical activity that form part of normal life. Summaries use micro data mapping of surface temperatures demonstrating the UHI phenomena, mapping of air composition, including 1, 2.5- and 5-micron particulates and toxins. Mapping variations in the physiological stress of active transport users in "green" transport corridors.
Results: The average daily time-use allocated by 80% of the local population to active transport by residents in inner Melbourne and nearby regions varies by a factor greater than five. Many elderly and/or ambulatory constrained people are limited to short activity bouts.
Conclusions: The presentation concludes by modelling and mapping to allow comparing of one inner sub-region of Melbourne where there is opportunity with more shade and seating to benefit the well-being of an aging population by facilitating active transport, including walking frame use with the regional Woodend Township. The nature of this presentation is such that spatial time use approximations are necessary, the approximations may fall outside accepted numerical statistical criteria used by some researchers. The form of soft edge spatial vector analysis applied in conjunction with inference methodology is at a level that is needed to address and progress the topic of interest. The topic is too complex to apply normal statistics rigorously at this phase.

#2776

PEDESTRIAN OCCUPANCY DETECTION (POD) USING AN OPTICAL SYSTEM AT TRAFFIC SIGNALS

Anthony Fitts, Elizabeth Lee. *Department of Transport, Melbourne, Victoria, Australia*

The Department of Transport has approximately 3350 traffic signal intersection in Victoria where around 1500 are Pedestrian Operated Signal (POS) and 325 of them are Pedestrian User Friendly Intelligent (PUFFIN) crossings using overhead radar detectors to optimise the pedestrian signal settings. The PUFFIN detectors are used to detect all pedestrians crossing the carriageway. The output is used by the traffic signal controller to extend the walk and/or clearance times while a pedestrian is on the crossing. However, there is no information on how many pedestrians and cyclists are waiting to cross at pedestrian crossings.
The Department of Transport is testing a new Pedestrian Occupancy Detection (POD) device which is using an Optical system to detect and monitor the pedestrians and cyclists waiting to cross the road. The main feature of this type of detection is the occupancy mode which allows traffic signal operation to be dynamically adjusted dependent on the volume of people waiting to cross. This is ideal for sites which have a varying influx of people using the crossing, e.g. school or sports complex.
The type of operational improvements for pedestrians being tested with the POD are longer walk and clearance times to cater for a large number of pedestrians and cyclists. When the occupancy ratio is high it improves pedestrian safety by avoiding pedestrians spilling onto the roadway, it can also force the operation of two pedestrian movements in one cycle to reduce the waiting time for pedestrians. For very wide crossing areas, when a pedestrian is detected in the wait zone, it can place a demand for the pedestrian movement.
A virtual detection zone of $30m^2$ can be set up over an area where pedestrians are waiting for a pedestrian phase. The detection zone can be mapped for irregular shaped waiting areas.
The purpose of the trial is to determine how effective the operation of the Pedestrian Occupancy Detection (POD) device is and inform the Department of Transport regarding whether to adopt this device at other locations in future.

#2783

THE JOURNEY TOWARDS PUTTING MORE FOCUS ON PEDESTRIANS

Juliet Bartels, Rachel Carlisle. *Department of Transport (Roads), Melbourne, Victoria, Australia*

Background: The Transport Integration Act (2010) requires a multi-modal approach to transport in Victoria. Its objectives include safety, health and wellbeing, environmental sustainability, social and economic inclusion. The focus on car travel is being challenged to make way for a more multi-modal people-focused approach. Traditionally staff have had a lesser focus on pedestrians than other modes.
Walking is central to our transport system. Everyone walks. Every trip includes walking, and walking underpins all other transport modes. Recent figures for pedestrian deaths have been trending downwards, however this year the number of pedestrian deaths has seen a significant increase and this needs to be addressed. This is the first action plan, with a focus on walking, developed by the Roads Authority.
Methods: The Department of Transport (Roads) has developed an internal pedestrian action plan (Plan) to guide how staff can plan, build, manage and operate the road network to improve pedestrian outcomes. Developing the Plan involved a literature review; 30 stakeholder interviews involving 41 people; and a series of workshops involving internal and external stakeholders.
Results: Staff and stakeholders involved were highly engaged and supportive of developing of the Plan. The Plan sets out a vision "Walking is the safe, attractive and natural choice for all short trips, including to public transport stops and stations" and 5 principles:

1. Start with walking: walking is the priority
2. Plan for outcomes: plan the pedestrian network to meet future goals.
3. Universal design and equity: walking is the most equitable form of transport. Design for all ages and all abilities, with system-wide consistency and legibility.
4. Human behaviour: behaviour of all road users is guided by the built environment.
5. The whole journey: user experience for the whole journey is paramount, walking plays as an access mode for all other modes.

The Plan includes 67 actions and five priority actions: safer traffic signals; lower speeds; safe access routes to public transport, activity centres and schools; infrastructure improvements; and strengthening key guidelines to focus more strongly on walking.
Conclusions: Developing the Plan has prioritised actions to increase pedestrian safety and walking as a transport mode. Input from a wide range of internal and external stakeholders has distilled key actions and built momentum for walking and implementing priority actions. Developing this plan has built the profile of pedestrians as a transport mode by illuminating their needs, challenges and solutions across the road's portfolio.

#2785
OVERVIEW AND OUTCOMES OF VICTORIA'S PASSING DISTANCE CYCLING SAFETY PUBLIC EDUCATION CAMPAIGN

Jonathan Nolan [1], Allison McIntyre [2], James Sinclair [1], Rachel Carlisle [3]. [1] *Passbox, Victoria, Australia;* [2] *Allison McIntyre Consulting, Victoria, Australia;* [3] *Department of Transport (Roads), Melbourne, Victoria, Australia*

Background: The 2016 findings from a Victorian parliamentary inquiry recommended the development of a public education campaign around the distance motorists should leave when passing cyclists. Research from New Zealand shows that close passing is associated with discomfort while cycling and the level of safety felt by cyclists.
TAC developed a public education campaign to address passing distance and encourage more empathy towards cyclists. The main campaign components were aired in November 2017 and March 2018. The message was that drivers should allow cyclists at least one metre's space in speed zones up to 60km/h and 1.5 metre's space in higher speed zones.
Methods: Data were collected via three research components:

1. Post campaign surveys measuring the recall and understanding of the advertising.
2. Surveys before and after the campaign which included measures of:
    - o endorsement of the recommended 1m and 1.5m passing distance,
    - o ease of judging a metre when passing cyclists,
    - o mutual respect among cyclists and drivers.
3. The Passbox naturalistic study of passing distance. Data were collected in Melbourne during November 2016-March 2017 (pre) and January - March 2018 (post). A Passbox device (video, sonar, GPS) was fitted to bicycles of participants; 18 participated in both waves of the study. Data from about 20,000 passing events was collected and included:
    - Passing distance to the cyclists' left and right
    - Number and width of vehicle lanes
    - Bicycle lane presence and type
    - Passing vehicle type
    - Parking bays and parked vehicles

Results: Key survey results included:

- Recall of the advertising was higher than TAC norms
- 90% who saw the advertising understood the intended message
- Endorsement of 1m passing distance
- Small but significant improvements in mutual understanding and ease of judging a metre when passing a cyclist

Passbox results:

- 13,000 passing events from the cyclists and locations present in both waves of the study.
- Regression modelling (comparing like with like) showed a significantly lower (1.99%) rate of close passing post-campaign.
- Regression modelling on all passing events showed that two or more lanes, narrow road width and presence of parking were associated with highest rate of close passing; bicycle lanes were associated with lowest rate.

Conclusions: TAC's campaign implementation was effective. Some of the results from surveys and Passbox indicated small but significant changes in the desired direction. It will be important to monitor if these positive beginnings can be sustained. The Passbox study shows that infrastructure characteristics have a clear role to play in passing distance. Comparisons to literature and methodological issues will be discussed.

#2786
ARTIFICIAL INTELLIGENCE TO MOVE THE WORLD FORWARD; ONE STEP AT A TIME

Jose Mantilla. *Motus Science, Melbourne, Victoria, Australia*

Health, policy, infrastructure and planning decisions that collectively amount to trillions of dollars per annul of public and private funds are largely based on inaccurate, unreliable, incomplete, untimely and costly data. Thus, little is known about most of the daily travel for most people in cities. Crucial to achieving the aims of public and private agencies is knowing what people do today and what people may be able (and willing) to do tomorrow. This 'ignorance' contributes to poor planning of cities worldwide, sedentary lifestyles, inefficient transport systems and reliance on private cars for most trips.
Most individual-level behaviour change interventions to influence travel decisions and promote physical activity have yielded disappointing results as

they provide generic information (intrinsically unable to have true personal relevance) and require people to set aside time for exercise even though it is well-known that people are much more likely to be physically active if 'exercise' is part of the normal routine (as it requires a lower commitment threshold and since lack of time has been demonstrated to be one of the primary deterrents to exercise across all sociodemographic groups). Promoting sustainable and active travel remains a key challenge in the transport and health sectors.

In response, we are pioneering data-driven and evidence-based approaches to promote human health and well-being, tackle climate change and establish smart cities by using artificial intelligence to move the world forward...literally one step at a time. Our platform processes movement and vibration data from smartphones and wearable sensors to determine what people do, where they go, at what times, for what purpose and how they move and travel every day – all in real-time. We empower individuals to change their travel behaviour by providing personalised recommendations that are commensurate with their physical capabilities and embedded into their daily routines. Our system identifies those trips (or portions of them) that are realistic candidates for change based on individual behaviour patterns and capabilities. We bestow upon people the gift of time to be physically active, contribute to tackle climate change and promote a cleaner, resilient and sustainable world.

Conference participants will be introduced to our revolutionary technology and have the opportunity to be part of an in-vivo demonstration and experience firsthand its power to understand movement patterns and inform decision-making.#

#2787

20-MINUTE NEIGHBOURHOODS: CREATING A MORE LIVEABLE MELBOURNE

Rory Shannon [1], James Mant [2], Marcus Dessewffy [2], L. Harrison [2]. [1] *Department of Environment, Land and Planning, Melbourne, Victoria, Australia;* [2] *Department of Environment, Land, Water and Planning, Melbourne, Victoria, Australia*

Neighbourhoods are the foundation of our city - they are the places where we live, connect and build communities.

Healthy and walkable neighbourhoods are key to maintaining Melbourne's liveability and we know that the most walkable areas in the city are often the most liveable. Walkable areas feature higher density, a diverse mix of uses, a range of destinations, and multiple active and public transport options. There is overwhelming evidence that active, walkable places produce a wealth of health, social, economic and environmental benefits.

The Melbourne metropolitan planning strategy, Plan Melbourne 2017-2050, is guided by the principle of 20-minute neighbourhoods. 20-minute neighbourhoods are our vision for creating a liveable city where everyone can meet their daily needs within a 20-minute walk from home, with access to safe cycle routes and local public transport options.

The 20-minute neighbourhood pilot program was launched in 2018 to test the practical delivery of 20-minute neighbourhoods in Melbourne. The Victorian Government has been working in partnership with the Heart Foundation, Victoria Walks and local governments to deliver projects in Croydon South, Strathmore and Sunshine West. These projects tested approaches to delivering 20-minute neighbourhoods in partnership with the community.

This presentation shares insights from the program and demonstrates how undertaking a place based approach to planning through community partnerships, has provided a roadmap to create a more liveable Melbourne.

The presentation will also discuss early learnings from stage 2 of the pilot program, exploring how the principle can be delivered in greenfield areas. Coordinated by Resilient Melbourne, research projects led by Monash and RMIT are looking at how we can fast track social infrastructure and community development in new neighbourhoods.

Journal of Transport & Health xxx (xxxx) xxx

Contents lists available at ScienceDirect

Journal of Transport & Health

journal homepage: www.elsevier.com/locate/jth

Pecha Kucha Abstracts

#2527

SPATIALLY EQUITABLE PUBLIC TRANSPORTATION PLANNING FOR INDIVIDUALS WITH DISABILITIES

Keith Christensen. *Utah State University, Logan, Utah, USA*

Background: Transportation is fundamental for individuals' need to engage with their community for employment, goods and services, health, education, and socializing; with individuals with increased access to transportation reporting greater quality of life and lower levels of social isolation. Indeed, the disability community recognizes increased transportation access as a primary means to improve individuals with disabilities' independence, self-determination, and community integration. Individuals with disabilities, who often lack private transportation options, are frequently more dependent on public transportation systems. It is imperative that public transportation systems be planned to better meet the transportation needs of individuals with disabilities, and other disadvantaged populations.
Methods: The purpose of this study was to spatially and analytically assess the transportation needs and behaviors of individuals with disabilities, and other disadvantaged populations, residing within Utah's Wasatch Front region to provide recommendations to improve the design, planning, and management of the Utah Transit Authority's public transportation system. The study objectives included; developing a topological accessibility Index of Transit Provision to represent fixed-route bus and light-rail service patterns and capacity, developing an Index of Transit Need representing the spatial-temporal organization of individuals with disabilities' activities of daily living and indicators of transportation disadvantage, and using these two measures comparatively to develop an Index of Transit Disparity between transit Need and Provision to identify under-served areas within the Wasatch Front from the perspective of individuals with disabilities.
Results: The findings suggest that 58.7% of individuals with disabilities living within the Wasatch Front Region do so in areas with greater than average transit disparity, or both less than average access to public transit and above average need based on socioeconomic factors. Correlation between an area's population with disabilities and its measure of transit need is positively significant, with a moderate effect.
Conclusions: In general, the study's approach was found to be relatively straightforward in the context of the data available to a metropolitan region and yields meaningful results that may be used to more fully consider individuals with disabilities, and other disadvantaged populations, in the planning and management of public transportation systems. The results identify 26 areas with very high transit disparity, 92 with high transit disparity, and 516 which are above average. Addressing those areas of higher transit disparity by prioritizing new transit investment or the reallocation of existing transit services may contribute to greater equity in individuals with disabilities' access to activities of community living across the region.

#2581

STUDY ON THE GENERATION MECHANISM OF MACAO'S HIGH-DENSITY BUILT ENVIRONMENT FROM THE PERSPECTIVE OF HEALTHY URBAN DESIGN

Mingyu Chen. *Tsinghua University, China*

Background: Characteristics of high-density urban environment elements such as the number, area, and aspect-ratio of the public open space and the distribution, height and form design of the surrounding buildings, which have influence on the human health who are living in there. Through the quantitatively space measurement, improving urban environment quality can be achieved by the healthy high-density urban design. This study chooses Macau as the research object which is a typical high-density area and its average population density is more than 20000 people / ㎡, while local area such as Youhan community is about 100000 people / ㎡.
Methods: Using ArcGIS analysis tool to quantify the Macau's high-density built environment aims to identify types of the main public space organization in the process of evolution and conduct the compare research with the population density, the actual usage information and so on.
Results: The city presents distinct public space landscape organization and design methods at different stages of development. The building volume and texture of the old city, the new residential areas and the huge structure of the casino areas constantly interweave and accumulate.
Conclusions: Finally, the essay indicates the principles and methods to optimize Macau's public space organization from the perspective of health urban design, providing the reference and support to improve the quality of the urban design under the background of high-density urban environment.

https://doi.org/10.1016/j.jth.2019.100636
2214-1405/

#2625
RECHARGING OUR CAR PARKING SPACES: GUIDANCE FOR PROVIDING ELECTRIC VEHICLE CHARGING FACILITIES WITHIN THE PUBLIC REALM

Chirag Safi. *O'Brien Traffic, Hawthorn East, Victoria, Australia*

Local Governments continue to encourage the use of low carbon and sustainable transport options. With the rise of Electric Vehicles (EV's), Councils are considering how they can promote the use of EVs and provide benefit to the community. An option to promote the use of EV's is to ensure publicly available EV charging facilities are provided at suitable locations.
The question facing Councils is: How and where should EV charging facilities be provided within the public realm? O'Brien Traffic is working with the City of Greater Dandenong (in Victoria) to consider this question.
Although numerous on-street and off-street parking spaces within the public realm have been (and continue to be) allocated for EV charging facilities, almost no Australian-based policy guidance has been prepared for how or where these should be installed.
Following a review of literature and discussion with Councils and charging facility providers, this presentation outlines:

- The challenges and risks that exist with the installation of charging facilities within the public realm
- The criteria that should be used when locating charging facilities within the public realm
- The criteria that should be used for the design of the spaces used for charging facilities
- The viewpoints of charging facility providers
- The opportunities of placing charging facilities within the public realm.

#2666
TRANSFORMING CITIES FOR HEALTH AND SUSTAINABILITY

Mel Crane [1], Catalina Turcu [2], Simon Lloyd [3], Melody Ding [1], Anthony Capon [1]. [1] *University of Sydney, Sydney, Australia;* [2] *UCL, London, UK;* [3] *London School of Hygiene and Tropical Medicine, London, UK*

Background: There is an urgent need for large-scale transformation in cities to address public health and environmental sustainability issues. A number of theories and models from different fields have emerged to explain how transformation occur. Nevertheless, there is little guidance how to transform cities to improve urban health and sustainability in practice.
Methods: This conceptual study assesses the various theories and models for urban transformation to determine key drivers and mechanisms for transformation for health and sustainability.
Results: We develop a framework to enable transformational changes at the city level. The framework focuses on the levers and responsibilities and potential interventions.
Conclusions: The presentation will discuss the various definitions of transformation, highlight some of the key drivers and mechanisms for change and attempt to answer some of the key questions for implementing changes in policy and practice in areas such as urban planning and transport infrastructure development. The results of this study are being used to inform a global research project to assist decision-makers in decisions, which affect health and sustainability. The project, Complex Urban Systems for Sustainability and Health (CUSSH) is a Wellcome Trust project initiating participatory research in cities in Kenya, China, France and the UK using cutting-edge research methods.

#2697
FOUR STRATEGIES FOR REDUCING URBAN TRANSPORT EMISSIONS AND IMPROVING HEALTH: AVOID, SHIFT, SHARE AND IMPROVE

Hussein Dia. *Swinburne University of Technology, Hawthorn, Victoria, Australia*

Background: Cities around the world have many opportunities to reduce emissions, but this requires renewed thinking and real commitment to change. In Australia, transport is the third-largest source of greenhouse gases, accounting for around 17% of emissions. Passenger cars account for around half of these transport emissions. The transport sector is also one of the strongest factors in emissions growth in Australia. Emissions from transport have increased nearly 60% since 1990 – more than any other sector.
Methods: This research aimed to identify strategies and solutions for reducing urban transport emissions in urban areas. The project researched various strategies to move cities on pathways to achieving emission targets. These strategies can be grouped into four broad categories: avoid, shift, share, and improve. The project also identified major policy, behaviour and technology changes required to make these strategies work.
Results: Avoid strategies aim to slow the growth of travel. They include initiatives to reduce trip lengths, such as high-density and mixed land use developments. Other options decrease private vehicle travel – e.g. through car/ride sharing and congestion pricing. Shift strategies encourage travelers to switch from private vehicles to public transport, walking and cycling. This includes improving bus routes and service frequency. Policies that include incentives to make electric vehicles more affordable have been shown to encourage the shift. Share strategies affect car ownership. New sharing economy businesses are already moving people, goods and services. Shared mobility, rather than car ownership, is providing city dwellers with a real alternative. Carpooling services in London have been shown to achieve a reduction of more than 1.1 million driving kilometers in just six months. Improve strategies promote use of technologies to optimise performance of transport modes. These include intelligent transport systems, urban information technologies and emerging solutions such as autonomous mobility. Research undertaken in this project showed that sharing 80% of autonomous vehicles will reduce net emissions by up to 20%. The benefits increase with wider adoption of autonomous shared electric vehicles.

Conclusions: The urgency and benefits of steering our cities towards a path of low-carbon mobility are unmistakable. This was recognised in the past, but progress has been slow. Today, the changing context for how we build future cities – smart, healthy and low-carbon – presents new opportunities. If well planned and implemented, these four interventions will collectively achieve transport emission reduction targets.

#2704

ASSESSMENT OF HEALTH IMPACTS OF CONTINUOUS WALKWAYS IN HARSH CLIMATE: A CASE STUDY

Nada Elsamahy, Mohammad AlKhatib, Karim AlMohtadi, Hisham Haikal, Ghassan Abu-Lebdeh. *American University of Sharjah, Sharjah, United Arab Emirates*

Background: The United Arab Emirates (UAE) is a fast-developing country in the Middle East with a notable high personal income and modern transportation infrastructures. Personal travel in the UAE is predominantly auto-oriented even for the shortest of trips. The culprits are auto affordability, auto-centric urban design and the harsh climate. The sedentary lifestyles that hence ensured coupled with harsh climatic and easy access to fat-rich fast-food are at least partly responsible for the higher than typical level of obesity in the Country, 71% by some recent accounts. Concerted efforts by the UAE government to address health issues through interventions in the build environment have begun taking shape. For the purpose of this study harsh climate is one that combines extreme heat and high humidity levels.
Methods: Key attributes of walking as a travel mode were identified using focus groups and the transport network of a small college campus in Sharjah, UAE. Provision of shading, safety (measured by potential conflict with motorized traffic), and continuity of walkways topped the attribute list. Based on those key attributes, candidate links and nodes were identified for improvements that would create a continuous (but not travel time-minimizing) walkway network. Volumes of walking trips were estimated based on first, continuity of walkways and then walking travel times between origins and destinations. The new network was then contrasted with the existing (no change) one. Estimates of results were presented in the form of ranges to account for inherent uncertainty in the distribution of trips (between origins and destinations). Costs of network modifications were estimated using standard construction cost databases.
Results: The yearly increase in walking distance ranged between a low 72,827 and a high of 140,850 kilometers. The Health Economic Assessment Tool (HEAT) was used to assess the health and economic value of the increased walking activities. Premature death prevention in 10 years ranged between 0.3 and 0.7; monetized at AED 410,00 to 861,000 (EUR 100,00 to 210,000). The Benefit to cost ratio range is 3 to 8.
Conclusions: Harsh (hot & humid) climates pose unique challenges to making active transport modes mode of choice. This case study demonstrates how pointed analysis and assessment of the relative importance of key attributes of active (walking) modes in harsh climate can be used to devise transport network changes that can mitigate the deterring influence of harsh climate and thus preserve, or even boost their desired health impacts.

#2737

ARE CAR-SHARING LOCATIONS PLAYING SOCIAL EQUITY TO TRANSPORTATION ENVIRONMENTAL JUSTICE POPULATION?

Farah Naz, Kate Hyun. *University of Texas at Arlington, Arlington, Texas, USA*

Background: Over the past 20 years, car-sharing technology has become an important transportation option in population-dense, car-centric cities in the U.S. as it provides mobility without vehicle ownership. Pro-car-sharing policies and incentives have also actively supported the successful implementation of car-sharing programs. Members of low-income communities may especially benefit from the technology due to lower rates of vehicle ownership and high dependency on public transit. To maximize the benefit, researchers must understand the extent of car-sharing services within transportation Environmental Justice (EJ) population and travel behavior of individuals using these car-sharing services.
Methods: In this study, the research team used 2017 National Household Travel Survey (NHTS) data to investigate the effects of individuals' socio-economic characteristics, travel behavior and technology access on car-sharing usage. Using a zero inflated binomial regression method, the study investigated the relationships between socio-demographic, travel behavior and financial related variables and car-sharing usage. For qualitative analysis social workers and transportation engineers collaborated to understand the needs, accessibility, affordability, and willingness to use car-sharing. The mixed methodology includes spatial analysis, mathematical modeling and qualitative focus groups.
Results: The results from the qualitative analysis indicates that transportation EJ population tend to use car sharing service as their mobility option. Rideshare which is another form of shared mobility option complements carsharing service while public transit shows an opposite role.
Conclusions: To respond to the positive aspects of shared mobility, governments have implemented pro-carsharing policies including allocating more parking zones in cities for carsharing operators, giving start-up funds to establish programs, and allowing DOT to use carsharing for work activities. Not only carsharing users but policy makers consider carsharing to be an efficient, economical, and environmentally- sustainable transportation alternative which can replace personal automobiles and promote sustainable transportation options. However, not much attention has been given to lower-income communities when starting carsharing programs or to providing incentives to the operators if they provide fair accessibility and sufficient opportunities to achieve social equity.

#2741

TRANSPORTATION AND PUBLIC HEALTH: A BURDEN OF DISEASE ANALYSIS OF TRANSPORTATION NOISE

Soheil Sohrabi [1,2], Haneen Khreis [1]. [1] *Texas A&M Transportation Institute, Texas, USA;* [2] *Texas A&M University, College Station, Texas, USA*

Background: Noise pollution is a growing health concern with road noise being the most dominant contributor to environmental noise. The World Health Organization has recently reviewed its noise guidelines by conducting a series of systematic reviews which established that noise contributes to serious outcomes such as cardiovascular disease, annoyance, sleep disturbance, adverse birth outcomes, cognitive impairment, hearing impairment, among others. Several studies quantified the health impacts of transportation noise, mainly focusing on cardiovascular diseases. This study quantifies the burden of mortality attributable to transportation noise at the census tract level for the first time. Assessing the burden of disease attributable to transportation noise at a finer resolution enables planners, engineers, health practitioners, and policy makers to intervene and make more informed

decisions to improve public health.

Method: This study employed a standard burden of disease analysis framework previously used in the literature to quantify premature mortality cases attributable to road and aviation noise. In this context, the baseline exposure level was compared with 30 dB and 35 dB exposure scenario for road and aviation noise, respectively, which were treated as thresholds under which no impacts occur. The burden of disease was quantified using exposure-response functions extracted from a mega-cohort study. Employing mortality data and transportation noise exposures, we estimated attributable premature mortality in the city of Houston in 2016. We also investigated the distribution of premature mortality cases attributable to noise across the city at the census tract level for further spatial and economic analyses.

Results: The results of this study show that 302 premature deaths in Houston (adults 30 to 75 years old) could be attributable to transportation noise in the year 2016 alone. This implies that transportation noise was responsible for 2 out of 100 all-cause premature deaths across the city. The spatial distribution of the estimated premature mortality cases demonstrates a relation between living in the central business district, and the vicinity of highways and airports with the burden of premature mortality from transportation noise. We also showed that the burden of disease was higher in households with lower income.

Conclusion: This study uncovered the significant contribution of transportation noise to premature mortality in the city of Houston. The estimated premature death rate attributable to transportation noise is comparable with the death rate caused by suicide, influenza, or pneumonia in the US. Policy, planning, and engineering efforts should focus on reducing transportation noise emissions and exposures.

#2747

CORPORATE SOCIAL RESPONSIBILITY AND TRAFFIC CONGESTION: A MIXED METHOD STUDY ON IMPROVING HEALTH AND PRODUCTIVITY

Bukola Bakare, Joseph Szmerekovsky. *North Dakota State University, Fargo, North Dakota, USA*

Background: Most metropolitan areas know that traffic congestion is a challenge; however, most areas don't know about the adverse health effects: the skin or eye irritations, respiratory problems, sedentary lifestyles, or even first-responders delays. This study explores the relationship between corporate social responsibility (CSR) ratings and traffic congestion, that impact human health. Specifically, this study investigates the level of corporate community involvement as it relates to traffic congestion, active transportation infrastructure (cycling and walking) improvements, and employee and community health. Further, this study explores communities living in metro areas, and how the stress, personal safety, crime, noise, and air pollution issues impact them.

Methods: A mixed-method approach is used with three objectives. Objective one uses a quantitative analysis using the National Performance Management Research Data Set traffic to analyze the volume and trend of traffic congestion. In addition, the study uses rating dataset from CSR Hub for corporations that have a substantial presence in urban metropolitan areas in the United States in terms of their community involvement, such as active transportation infrastructure improvement. In a previously identified metro area, high-ranking corporations are compared with low-ranking corporations to determine the effect of traffic congestion and social responsibility on employee productivity and community health. Objective two uses qualitative data collection, through interviews collected by the researcher, to assess and understand corporate, community member, and agency perceptions of congestion mitigation efforts on improving active transportation infrastructure in the identified area and whether that results in increased productivity and improvements in health (e.g. increased physical activity). Objective 3 uses the results from both the quantitative and qualitative analysis to explain the research findings.

Results: Initial analysis of traffic congestion data using linear regression shows that total travel time is dependent on the travel time of personal vehicle and freight on a particular road segment. Additional results will be discussed.

Conclusions: This study provides a new understanding of how CSR could bring about health and economic benefits to corporations, employees, and residents in the surrounding community. Community revitalization efforts to reduce congestion and improve active transportation infrastructure seem to be a viable solution, but an important stakeholder in the community, the corporation, is often neglected. More research is needed to explore the influence of increased corporate social responsibility and community involvement in green redevelopment and how it improves healthy active traveling (cycling and walking); a significant vacuum this study strives to fill.

Journal of Transport & Health xxx (xxxx) xxx

Contents lists available at ScienceDirect

Journal of Transport & Health

journal homepage: www.elsevier.com/locate/jth

Poster Abstracts

#2521
TRAFFIC AND PARKING STUDY OF STATION ROAD, VALSAD

Utsav Domadia [1], Dhaval Barot [2]. [1] *University of Texas at Arlington, Arlington, Texas;* [2] *Government Engineering College, Valsad, Gujarat, India*

Background: With the increasing number of vehicles and mobility facilities, traffic and parking problems are ubiquitous in urban areas. Valsad is a situated in the southern part of Gujarat state, India. Valsad railway station is connected by India Railway services with the major cities namely Surat, Ahmedabad in North and Mumbai in South. During peak hours when the train arrives or departs, this road is heavily congested. Traffic is interrupted as nearby shop visitors park vehicles on the roadway as a result of inadequate parking facilities. Footpath encroachment by parked vehicles decreases pedestrian safety. The station road is one of the high-volume roads in Valsad in terms of vehicular and pedestrian traffic. The emissions from vehicles result in high air pollution due to the improper on-street parking facility. Regular road cleaning is also difficult to execute. A parking solution is needed.
Methods: A parking study was conducted on Station Road to determine parking demand and parking characteristics. A parking survey was run for three days at station road. Valsad. License Plate method (IRC 12) was used to assess on-street parking. The road was divided into 19 different segments for accurate and rapid data collection. In the analyses, parking accumulation, volume, load, duration, turnover and parking index were calculated.
Result: Peak hour parking demand for two-wheeler, car, auto-rickshaw and Light Commercial Vehicle (LCV) was 281, 9, 22 and 3 respectively.
Conclusion: Based on peak parking demand, angled on-street parking using odd-even parking system and parking meters can be introduced to improve the design and proper execution of parking policy. Footpath facility can be regulated with regular cleaning and maintenance to address pedestrian safety and public health concerns.

#2564
THE IMPACT OF MOTIVATION FOR DRIVING AND TRANSPORT ENVIRONMENT SATISFACTION ON TRAVEL BEHAVIOUR AND BMI: NATIONWIDE PERSON TRIP SURVEY IN JAPAN

Kunihiro Fumoto [1], Ayako Taniguchi [2]. [1] *University of Tsukuba Graduate School of Systems and Information Engineering, Tsukuba, Japan;* [2] *University of Tsukuba, Japan*

Background: Lifestyle-related diseases account for 30% of increases in medical expenditure in Japan. In this study, we used the body mass index (BMI) as a health index to investigate how people's perceptions affect their travel behaviour and BMI.
Methods: Data from the 2015 Japanese Nationwide Person Trip Survey were used to investigate the daily travel behaviour of people living in 70 Japanese cities (N=7,474). The participants were also requested to rate their satisfaction with their transport environment (13 items), reasons for driving a car (motivation for driving, four indices), travel behaviour (annual frequency of use of six travel modes), and BMI. We used structural equation modelling (SEM) to analyses how satisfaction with the transport environment and motivation for driving affect travel behaviour and BMI, and non-significant variables were deleted.
Results: In the case of men, BMI was found to increase with the annual frequency of car driving ($p < 0.001$) and bus use ($p = 0.028$) and decrease with annual walking frequency ($p < 0.001$). A higher annual frequency of driving was associated with higher satisfaction with car usability ($p < 0.001$and punctuality of bus services ($p < 0.001$), and lower satisfaction with the number of bus services ($p < 0.001$) and distance to the nearest railway station ($p = .008$). Furthermore, lower annual driving frequencies were associated with living outside the three major metropolitan areas and listing "Driving a car is convenient" or "I have no other choice but to use a car" as motivations for driving ($p < 0.001$for all relationships). Conversely, in the case of women, BMI was found to increase with decreasing the annual frequency of railway use ($p = 0.009$), higher satisfaction with car usability ($p = 0.032$) and the inclusion of "I like driving" as a motivation for driving ($p = 0.012$). The annual frequency of railway use increases with satisfaction with the distance to the nearest railway station ($p = 0.006$) and the number of rail services ($p = 0.002$), and lower satisfaction with car usability ($p < 0.001$) and punctuality of bus services ($p < 0.001$). We also found that lower annual frequencies of railway use are associated with living outside the three major metropolitan areas and the listing of "Driving a car is convenient", "I like driving" or "I have no other choice but to use a car" as motivations for driving ($p < 0.001$for all relation).
Conclusions: According to our results, the motivation for driving and satisfaction with the transport environment affect both travel behaviour and BMI.

https://doi.org/10.1016/j.jth.2019.100634
2214-1405/

#2565

E-BIKE APPLICABILITY QUANTIFICATION BY COMPARING CONVENIENCE

Liling Liu, Tsutomu Suzuki. *University of Tsukuba, Tsukuba City, Japan*

Background: E-bikes are a growing market around the world and public policies regarding their usage are varied among cities. There is a need to inform policy decisions about integrating e-bikes into urban transportation systems. While previous studies on bicycle convenience focused on the cycling environment itself, assessment of a new transport mode, like e-bikes, requires insights into their potential and limitations when introduced into the existing urban transportation system. This study is a part of research to explore the applicability of e-bikes in urban areas with different characteristics, and spatial design when considering employing e-bikes into the transportation system.
Methods: E-bike applicability is defined as the change of convenience due to their introduction and the service area is adopted as a measure of convenience for a transportation mode. Indices for e-bike applicability are proposed by comparing the service area of e-bikes to public transit and to conventional bicycles considering travel time and physical energy expenditure as two measures. The methods are applied to four Japanese cities to assess applicability on two scales, namely a community-wide scale and a city-wide scale.
Results: On the community-wide scale, e-bikes are applicable to areas with steep road gradients, areas with geographical obstacles requiring detours, and areas lacking public transportation. E-bike applicable communities with high likely e-bike demand are selected. On the city-wide scale, e-bikes are applicable to short distance trips in cities with well-developed transit systems, with applicable travel time and physical energy expenditure range of 65 min and 1.25 MET-h round trip, respectively. E-bikes are a promising alternative means of transport in local cities; they also have limitation in terms of physical energy expenditure compared to transit.
Conclusions: The indices can be valuable tools providing urban planners with knowledge about e-bikes on a community-wide scale and a city-wide scale.
In the following research, traffic flow including e-bikes will be analyzed to improve road space efficiency. Taking the coexistence with other existing means of transportation, cycling traffic flow will be explored using microscopic simulation in three perspectives, road links, intersections, and network. Transport efficiency and emission will be the main evaluation indices.

#2600

UNDERSTANDING POTENTIAL EXPOSURE OF BICYCLISTS ON ROADWAYS TO TRAFFIC-RELATED AIR POLLUTION: FINDINGS FROM EL PASO, TEXAS, USING STRAVA METRO DATA

Kyuhyun Lee, Ipek N. Sener. *Texas A&M Transportation Institute, Austin, Texas, USA*

Background: As bicycling on roadways can cause adverse health effects, there is an urgent need to understand how bicycle routes expose bicyclists to traffic emissions. Limited resources for monitoring reveal that bicycle travel patterns may constrain such understanding at the network level. This study examined the potential exposure of bicyclists to traffic-related air pollution in El Paso, Texas, using fitness tracking app (Strava Metro) data that revealed bicycle patterns across the city networks.
Methods: The study area was El Paso, the sixth largest city in Texas (by population), situated on the border between the United States and Mexico. An initial spatial mapping analysis was conducted to explore the spatial patterns of bicycling and traffic pollutant emission in the region, followed by exploratory descriptive statistics. Next, a spatial bicycle model (with three types of spatial terms: spatial lags of dependent variables, spatial lags in error terms, and spatial lags of explanatory variables) was developed to explore factors influencing bicycling activity in El Paso.
Results: Analysis results indicated significant associations between greater bicycle volume and both higher levels of particulate matter ($PM_{2.5}$) emissions and more frequent bus services, implying adverse health concerns related to traffic-related air pollution. The results also indicated significant effects of various environmental characteristics (e.g., roadway, bicycle infrastructure, topography, and demographics) on bicycling. The findings encourage extending this study to provide guidance to bicyclists whose regular trips take place on heavily trafficked roads and during rush hours in this region and to evaluate the net health impacts of on-road bicycling for the general population. Finally, the study results highlight the potential of crowdsourced data in exploring bicycling that might be especially critical for regions where relevant data are unavailable or limited.
Conclusions: Understanding how people make bicycle trips and how much they are exposed to the less visible threats of traffic is a critical part of decision-making, especially for cities faced with public health and environmental issues like the El Paso region. The study results can be a basis of future work for policy makers to design safer, healthier, and better adopted bicycle networks. An evaluation of traffic-related air pollution, integrated with a knowledge of influential factors on bicycle trip-making decisions and patterns, will play a key role in the development and calibration of regional network models.

#2603

SUSTAINABILITY VIA ACTIVE GARDENING EDUCATION (SAGE): THE ASSOCIATION BETWEEN WALKING FOR ACTIVE TRANSPORTATION AND CARDIOMETABOLIC HEALTH AMONG PRIMARILY HISPANIC WOMEN

Elizabeth Lorenzo [1], Jacob Szeszulski [2,3], Rebecca E. Lee [1]. [1] *Center for Health Promotion and Disease Prevention, Edson College of Nursing and Health Innovation, Arizona State University, Phoenix, Arizona;* [2] *Center for Health Promotion and Prevention Research, University of Texas Health Science Center at Houston, Houston, Texas;* [3] *Michael Susan Dell Center for Healthy Living, University of Texas Health Science Center at Austin, Austin, Texas, USA*

Background: Physical activity (PA) improves health and reduces risks for numerous chronic conditions; however, a majority of Hispanic women in the United States do not achieve the 2018 minimum recommended guidelines. Active transportation (AT) is any human powered method of transportation for any part of a commute and is related to increased PA levels and improved cardiometabolic risk in adults. Walking for AT is the most common method of AT, and the relationship between walking for AT and cardiometabolic risk among Hispanic women is unknown.

Methods: Female caretakers of children attending early care and educations centers in predominantly Hispanic neighborhoods completed International Physical Activity Questionnaire transportation-related and demographic surveys (2017 and 2018). Body mass index (BMI), body fat percentage (BF), systolic (SBP) and diastolic blood pressure (DBP), and waist circumference (WC) were measured by trained research assistants according to protocol. Unadjusted bivariate associations and simultaneous multiple regression models controlling for age, education, income, Hispanic ethnicity, food insecurity, and household size were performed.
Results: Women (N=114, mean age 32.0±7.2 years) were 77.5% Hispanic; 78.1% of those women walked for AT for 312.7±596.6 mean minutes per week. Women who walked for AT had lower BMI (30.5±6.4 kg/m2 vs. 33.1±6.9 kg/m2), BF (38.8±7.2% vs. 41.6±7.6%), SBP (109.4±12.5 mmHg vs. 110.4±10.0 mmHg), DBP (72.9±10.7 mmHg vs. 75.0±9.2 mmHg), and WC (98.3±15.5 cm vs. 104.0±15.25 cm) than those who did not, with only BMI and BF approaching significance (t=1.787, p=0.077; t=1.746, p=0.084). Higher minutes of walking for AT was significantly associated with lower BMI (β=-0.212, t=-2.189, p=0.031), BF (β=-0.237, t=-2.458, p=0.016), and WC (β=-0.329, t=-3.539, p=0.001), and DBP (β=-0.185, t=-1.908, p=0.060) trended towards significance. SBP was not related to minutes of walking for AT (p>.05).
Conclusions: These findings demonstrate a dose-response relationship may exist between minutes of walking for AT and BMI, BF, DBP, and WC in this sample of primarily Hispanic women. This is consistent with current PA literature, which states the more PA the better for health. Practitioners should encourage Hispanic women replace motor vehicle trips with walking AT, where appropriate, to improve cardiometabolic health. Policy makers and urban planners should advocate for changes in the built environment that promote walking for AT, and further research should be conducted to determine if a causal relationship exists between walking for AT and cardiometabolic health.

#2620

PSYCHOLOGICAL EFFECTS OF A COGNITIVE TEST ON ELDERLY DRIVERS: A MAIN EFFECT AND A SIDE EFFECT *(HIGH SCORING MASTERS/UNDERGRADUATE ABSTRACT AWARD SPONSORED BY AAA FOUNDATION FOR TRAFFIC SAFETY)*

Misato Nemoto [1], Ayako Taniguchi [1], Kuniaki Sasaki [2], Kenji Hagita [3], Hanae Kosuge [4]. [1] *University of Tsukuba, Japan;* [2] *Waseda University, Japan;* [3] *National Research Institute of Police Science, Japan;* [4] *Institute for Traffic Accident Research and Data Analysis, Japan*

Background: The Japanese population is ageing at the fastest rate worldwide, and elderly drivers whose cognitive function is impaired frequently cause traffic accidents. Since 2009, drivers in Japan older than 75 years wishing to renew their driving license have had to take a cognitive test, the results of which may be: (i) no concerns regarding cognitive decline, (ii) at risk of cognitive decline, or (iii) at risk of dementia. Those judged as (iii) and then diagnosed with dementia have their license cancelled or suspended. Those judged as (i) receive the primary message that their cognitive function is presently satisfactory, but they may also receive the meta-message: "Both my cognitive function and driving skills are high." Although the cognitive test is intended to promote traffic safety, this meta-message may render a driver overconfident. Therefore, we explored the psychological effects of the primary message and the meta-message on examinees.
Methods: We surveyed 59 persons aged 70–73 years who had never taken a legally required cognitive test. The experiment was conducted with all 59 examinees as below. a) A questionnaire survey regarding behavioural intentions of car use reduction / license surrender and confidence in driving skills b) Simulative cognitive test c) All examinees were told their test scores d) A follow-up questionnaire with similar contents to that in step a) The cognitive function examination form and the notice letter published on the website of the National Police Agency, and we used them at b) simulative cognitive test.
Results: Eight persons were classified as (ii) and 51 as (i). Comparing pre-survey data with post-survey data, among those classified as (ii), the percentage with the behavioural intention of surrendering their driver's license significantly increased. Those classified as (i) had significantly lower scores on four scales such as behavioural intention of car use reduction / license surrender. Their confidence in their driving also increased significantly. Comparison of the two questionnaire surveys indicated that the expected meta-message side effect was indeed in play.
Conclusions: The cognitive test had both a main effect and a side effect (a meta-message). In particular, the meta-message is considered a risk factor for elderly drivers. In the future, countermeasures to reduce this side effect will be considered.

#2635

THE EFFECTS OF COMMUTING ON THE HEALTH OF HIGH SCHOOL STUDENTS

Daisuke Seto [1], Ayako Taniguchi [1], Takayuki Matsuda [2]. [1] *University of Tsukuba, Japan;* [2] *Gunma Prefectural Office, Japan*

Gunma Prefecture, which lies approximately 70 km northwest of Tokyo, is heavily dependent on cars; the use of public transport is declining. High school students are commonly driven from home to a railway station or school and back. Car dependency reduces walking and compromises physical health. Also, reduced contact with local communities and nature may adversely affect mental health. Therefore, a questionnaire survey was conducted among students and their parents in Gunma Prefecture for the purpose of understanding 1) the relation between the commuting of high school students and mental and physical health;2) the relation of the perception to commuting of the high school between students and their parents. In October 2018, authors used a questionnaire to explore the effects of commuting on student mental and physical health and the perceptions of students and their parents in this regard. We targeted first-grade students of two private high schools (School A: n = 421, School B: n = 320). Students were requested to complete questionnaires distributed and collected by teachers. Students received questionnaires for their parents; these were completed at home and returned by the students. We explored how students traveled to and from school, their attitude and behavioural intention about such travel modes, their activities after school, and the extent of parental dependency by referring to previous studies. The results are shown below; 1) There was no significant difference in BMI by transportation, but male students commute with cars driven by their parents had higher BMI than students using other modes of transportation. 2) The intention to use a bicycle was negatively related to commuting on public transport (rail/local bus) and 3) the intention to use public transport or to walk was negatively related to commuting by bicycle. 4) Being driven by a parent was positively related to the intention to use a car, 5) negatively related to the intention to employ public transport, and 6) positively related to attitude towards being driven. In other words, students who used public transport had an intention not to use bicycles, and students who used bicycles had an intention not to use public transport. Furthermore, students commuting in parent-driven cars intended to continue such transport and, thus, not use public transport; they preferred the car. Quantitatively, bicycle and public transport, and car and public transport, competed in terms of the commute to and from high school.

#2645

TRAVEL MODES BY FRAIL OLDER ADULTS IN JAPAN: DIFFERENCES BETWEEN METROPOLITAN, SUBURBAN, AND RURAL AREAS

Takumi Abe [1,2], Akihiko Kitamura [1], Satoshi Seino [1], Yuri Yokoyama [1], Hidenori Amano [1], Yu Taniguchi [3], Takemi Sugiyama [4,5,6], Shoji Shinkai [1]. [1] *Tokyo Metropolitan Institute of Gerontology, Japan;* [2] *Japan Society for the Promotion of Science, Japan;* [3] *Center for Health and Environmental Risk Research, National Institute for Environmental Studies, Japan;* [4] *Baker Heart and Diabetes Institute, Melbourne, Victoria, Australia;* [5] *Australian Catholic University, Melbourne, Victoria, Australia;* [6] *Swinburne University of Technology, Melbourne, Victoria, Australia*

Background: Having access to a range of travel modes is important to ensure access to services and social inclusion. This is particularly the case with frail older adults, for whom travel options can be limited due to their functional impairment. It is possible that frail older adults living in regional areas may be disadvantaged in access to transport options, compared to those in urban areas. However, little is known how different travel modes are used by frail older adults in different localities. This cross-sectional study investigated whether frail older adults living in metropolitan, suburban, and rural areas of Japan differed in their use of walking, car, and public transport (PT).

Methods: Data were collected from cohort studies in metropolitan (n=4880; frailty, 22.0%), suburban (n=2818; frailty 13.8%), and rural areas (n=1237; frailty 15.1%). A total of 1650 frail older adults (mean age 75.3 years; 743 women) were included for analysis. Participants were categorized into walker or not, car driver or not, car passenger or not, PT user or not, based on their weekly use of each travel mode. A standardized screening questionnaire was used to assess frailty. Poisson regression analysis was performed to calculate adjusted prevalence ratios (APRs) of using each mode for the suburban and rural areas (reference: metropolitan areas), adjusting for age, gender, underweight, overweight, comorbidities, and living arrangement.

Results: Overall, the proportion of weekly walkers, car drivers, car passengers, and PT users were 67.2%, 29.2%, 19.8%, and 47.2%, respectively. After adjusting for covariates, the suburban and rural areas showed a significantly lower prevalence of walking (suburban: APR [95%CI] =0.65 [0.59–0.73]; rural: 0.88 [0.78–0.99]) and PT use (suburban: 0.45 [0.38–0.54]; rural: 0.36 [0.27–0.47]), while these areas had a greater prevalence of car use as driver (suburban: 2.61 [2.27–3.01]; rural: 1.61 [1.26–2.05]) and as passenger (suburban: 2.92 [2.38–3.57]; rural: 3.13 [2.44–4.00]) in comparison to the metropolitan areas.

Conclusions: This study found that frail older adults in this Japanese sample living in suburban and rural areas relied more on cars for their travel, compared to those in metropolitan areas. Our findings suggest the need for providing alternative travel options in suburban and rural areas so that frail individuals without constant access to cars can travel to meet their needs and engage in activities.

#2656

AGE-RELATED VARIATIONS IN DISTANCES WALKED TO AND FROM LOCAL DESTINATIONS: IMPLICATIONS FOR DETERMINING BUFFER SIZES

Rachel Cole [1], Akio Kubota [2,3], Masaaki Sugiyama [2,4], Neville Owen [5], Takemi Sugiyama [6]. [1] *University of the Sunshine Coast, Queensland, Australia;* [2] *Mary MacKillop Institute for Health Research, Australian Catholic University, Australia;* [3] *School of Physical Education, Tokai University, Japan;* [4] *Graduate School of Human Life Science, Osaka City University, Japan;* [5] *Swinburne University of Technology, Melbourne, Victoria, Australia;* [6] *Baker Heart and Diabetes Institute, Melbourne, Victoria, Australia*

Background: Health benefits of physical activity are well established, with walking being a key element of public health approaches to enhancing population health. Research has found that having various destinations (transit stops, shops, services, and parks) within the local area to be important in facilitating walking. However, research on the built environment and walking has been using different geospatial boundaries within which environmental attributes are calculated (buffer sizes). Identifying appropriate buffer sizes is important to ensure environmental attributes are measured in an area where walking takes place. It is possible that appropriate buffer sizes to various destination types may vary by age. This study sought to identify the distances adults of different ages walk to/from public transit (PT) stops, shops/services, and parks.

Methods: Data from the 2009–12 South-East Queensland Travel Survey, a large household travel survey, were used. The study sample consisted of 2,105 adults (18–84 years) who reported at least one home-based walking trip to/from those destinations. Participants were categorised into four age groups: younger (18-34 years), younger middle (35-49 years), older middle (50-64 years), and older (65-85 years). We reported the median (with the 80th percentile) distances walked to/from each destination category by age groups. The 80th percentile was chosen since previous studies used this value as the distance threshold of walking trips. Multilevel regression analyses examined whether the distances walked to each destination differed by age groups.

Results: Participants reported 4,029 walking trips, with the median distance of 0.68 km and the 80th percentile of 1.35 km. The median walking distance (80th percentile) to/from PT stops, shops/services, and parks was 0.53 (0.95) km, 0.77 (1.50) km, and 1.15 (2.27) km, respectively. The overall median walking distance by age groups was 0.62 km for the younger, 0.67 km for younger middle, 0.79 km for older middle and 0.72 km for older groups. Regression analyses with the older middle-aged as the reference category found that older middle-aged adults walked significantly longer overall than any other age groups and walked longer to/from shops/services than older adults.

Conclusions: Our findings support buffer sizes around 600 to 1200 m for studies examining environmental correlates of walking for utilitarian purposes. For recreational walking to get to natural features, a larger buffer size (e.g., 2000 m) may be suitable. We did not find consistent evidence supporting the use of different buffer sizes for different age groups.

#2670

MODELLING PHYSIOLOGICAL STRESS CHANGE USING "GREEN" MEASURES OVER TIME

Daniel Meyer, Huang Long, Mateo Gatto. *University of Melbourne, Parkville, Victoria, Australia*

Background: Active transport corridors are used throughout the world and for many, is the only form of transportation employed to commute to work. However, they are designed with corridors for vehicular transport, which is a significant contributor to the release and suspension of particulate matter. Particulate matter is found to be the cause of a myriad of physical and mental stress issues including but not limited to; asthma, lung cancer, cardiovascular diseases and decrease in perceived mental well-being. However, there is a lack of research investigating the link between mental stress, particulate matter and active transport corridor design. This study is a proof of concept, which aims to use mental stress indicators such as electro-encephalography signals (EEG) to measure variations in mental stress during active transport. EEG values such as Alpha, Beta, Theta and Gamma Waves can be used to indicate variations in mental stress.
Methods: The study involved self-experimentation performed by 3 individuals, that walked through varying forms of active transport infrastructure, while particulate matter PM_1, $PM_{2.5}$ and PM_{10} exposure was recorded using an airbeam2. During active transportation, the subject's physiological alpha, beta, delta, theta and gamma brain wave responses were also recorded using the Muse Meditation Band. By analysing the increasing and decreasing trends in EEG signals and PM exposure, a correlation with PM exposure and mental stress could be determined. The variations in active transport infrastructure used for experimentation included the subjective classifications categorised as commercial streets, minor arterial roads, urban boulevards and shared paths away from roads.
Results: The greatest R^2 correlation between brainwaves and PM_{10} exposure found during a morning peak traffic trial experiment located at a minor arterial road corridor, Elgar Road. The results yielded an R^2 value of 0.16, 0.15 and 0.12 for Beta, Theta and Alpha waves respectively. It was found that subjects travelling through minor arterial road corridors experienced the greatest particulate matter exposure, with a median $PM_{2.5}$ exposure of 5 μ/m^3 per second.
Conclusions: This paper found that when considering active transport, both increasing the distance from vehicular traffic and the amount of greenery are useful in reducing pedestrian exposure to particulate matter. It was also shown that the Muse headband is useful in determining changes in stress levels without surveys. Further research needs to be conducted to determine methods of isolating fluctuations and reducing errors in EEG readings. For a meaningful correlation between PM exposure and EEG signals to be identified, further research should be conducted at a greater scale to adequately control for variables and increase sample size.

#2688

DON'T HOP IN THE BUS GUS – AN ANALYSIS OF RECENT TRENDS IN OCTA (ORANGE COUNTY TRANSIT AUTHORITY) BUS RIDERSHIP *(2ND HIGHEST SCORING DOCTORAL ABSTRACT AWARD SPONSORED BY THE TRANSPORT & HEALTH SCIENCE GROUP)*

Farzana Khatun [1], Jean-Daniel Saphores [2]. [1] *ITS, UCI, Irvine, California;* [2] *Civil and Environmental Engineering and Economics Department, Institute of Transportation Studies, University of California, Irvine, California, USA*

Background: Orange County Transit Authority (OCTA) bus ridership has been falling over the last few years. From 2012 to 2016, it dropped by ~19% despite the launches of the OCTA Bravo! program (2013) and of the OC Bus 360 program (2015). Changing socio-economic conditions, poor connectivity, poor service quality, and increased competition from TNCs are some possible factors behind this negative trend. Another likely factor is the implementation in 2015 of California Assembly Bill 60 (AB-60), which requires the California DMV to issue a driver's license to applicants who can prove California residency even if they are not legal residents of the United States. Our literature review suggests that public transit in Orange County has received little attention from academics. In this context, the objective of this study is to analyze how recent (2014 to 2016) changes in OCTA bus ridership can be explained by the implementation of California Assembly-Bill 60 (AB-60), after controlling for changes in transit supply, socio-economic variables, gas prices, and the built environment.
Methods: To explain changes in annual average weekday bus ridership from 2014 to 2016, we developed a fixed effect panel regression model to account for the unobserved heterogeneity of bus routes. Our explanatory variables include both internal (bus frequency, vehicle revenue hours) and external factors (such as unemployment rate, population, gas price, train vehicle revenue hours and a binary variable for AB-60).
Results: Our results indicate that transit internal factors, such as vehicle revenue hours, are statistically significant in our fixed-effects panel model. Among external factors, we found that train vehicle revenue hours have a significant positive impact on bus ridership. The likely explanation is the complementary nature of bus and train services. As expected, increasing unemployment rates negatively impacted bus ridership between 2014 and 2016. More importantly, AB-60 had a huge negative impact on bus transit by making it easier for a large segment of the captive Orange County ridership to be able to drive private cars.
Conclusions: Overall, our results suggest that bus services in Orange County are not convenient enough to be competitive with private vehicles. Enhanced transit convenience and full pricing of motor vehicles externalities should be considered to make transit more sustainable. Although we focus on OCTA, our methodology should be widely applicable to better manage transit.

#2738

SUSTAINABLE TRANSPORTATION AS A PANACEA FOR POVERTY REDUCTION IN NIGERIA

Remi Adewunmi [1], Rebecca Adewunmi [1], Abimbola Odumosu [2]. [1] *Nigerian Institute of Transport Technology, Nigeria;* [2] *Nigerian Institute of Transport Technology, Zaria, Nigeria*

Background: Transport is central to development. It provides physical access to jobs, health, education and markets. Moving people or goods from place to place is very crucial in any economy and must be undertaken safely. In Nigeria, significant proportion of internal goods and passenger movements depend on the road transport sub-sector. Considering the size of the country, quite a large number of people are dependent on road transport for the movement of their goods and services across the length and breadth of the country. It is against this background that we examine how the local provision can be used as a mechanism for poverty reduction. In addition, the health implication of the passengers moving within the city metropolis and inter-connectivity with other cities in Nigeria were examined to reduce the effect of overcrowding of the existing passenger buses.
Methods: Instead of importing a complete bus, a bus head plus chassis can be purchased. Then build other parts with local citizenry. The work force to build it into a complete bus are already on ground and well trained. They are categorized under the informal sector of the economy. For a complete bus to be made, a total of thirty-two categories of worker sand laborers are needed.

Results: The choice of used tractor head is informed by the astronomical cost of purchasing new ones which is in the range of =N= 35 million to =N= 42 million depending on the company of manufacture. This will raise the total cost to about =N= 45million to =N= 52 million per truck. Deductions from tables one to five revealed that if there is annual increase of 5%, by the end of the fourth year, this would have increased to 20%. Consequently, a total of 10, 213,810 people have been elevated from poverty level as a result if this process of Bus building
Conclusions: Government cannot finance everything. Public-Private Partnership (PPP) is the element used to modernize the public sector, providing greater efficiency and effectiveness and ultimately better-quality customer service. In the process a whole range of projects can be financed through the Public-Private Partnership. Finally, Governments should allow the private sector provide infrastructure services to the maximum extent possible, with governments concentrating on planning, policy and regulation, and the private sector efficiently investing capital and improving the quality of service to be provided to eliminate bus overcrowding and reduce the poverty level in the country

#2744
ACTIVE TRANSPORTATION AND SELF-IMPRESSION OF HEALTH: EVIDENCE FROM 2017 NATIONAL HOUSEHOLD TRAVEL SURVEY DATA

Farinoush Sharifi, Soheil Sohrabi, Reza Farzaneh, Haneen Khreis. *Texas A&M Transportation Institute, Texas, USA*

Background: Active transportation refers to any human-powered mode of transportation such as walking and biking. While sedentary lifestyle is a major cause for the increasing rate of obesity and heart diseases, active transportation can change this trend by bringing more physical activity into human lives. Transportation agencies are also actively engaging in multiple projects to support more livable and sustainable communities by developing mixed-use neighborhoods and enhancing facilities.
Recent National Household Travel Survey (2017 NHTS) in the United States (US) has shown that bike and walk trips in the US account for 9.67% of total trips. Also, 2017 NHTS has provided the number of physical exercises during a typical week as well as the health status of respondents in five classes (excellent, very good, good, fair, poor), based on the self-judgment of the overall health condition. It indicated that more than 80% of the respondents who both walk and bike feel healthy. This percentage decreased to 61% for the respondents who neither walk nor bike. The addition of this health feature enables transportation planners to examine the relationship between active transportation behavior and self-reported health status through disaggregate models and using a unique national survey.
Methods: Ordinal logistic regression (OLR) technique was implemented to predict the self-reported health status of individuals based on their active transportation behavior (number of biking and walking trips in the past week), physical exercise activity (number of light, medium, or vigorous physical exercise in the past week), and sociodemographics (age, race, and, gender).
Results: It was shown that biking and walking has a significant impact on the self-reported health status of participants (p-value < 0.001). However, comparing the odds ratios for the number of biking and walking trips (=1.07) and the number of physical exercises (=1.16) from the OLR model suggests that a unit of increase in number of active trips is not as influential as a unit of increase in number of physical exercises. Additionally, older adults and males have a lower level of self-reported health status.
Conclusions: Active transportation behavior has a direct impact on the self-impression of health status and may improve the air quality if replaced with other modes. Though this study shows that active transportation promotes health status, it should be noted that the selection of a wrong location for the walking and biking facilities can increase users' exposure to pollution.

#2745
DO THEY BLOCK THE WAY IN SAN JOSE? WHERE DO RIDERS PARK DOCKLESS, SHARED ELECTRIC SCOOTERS AND THEIR IMPLICATIONS FOR SIDEWALK USERS

Kevin Fang. *USA*

Background: Since 2017, dockless, shared, electric kick-scooter systems have popped up in cities around the world. While popular with riders, some critics argue dockless scooters are strewn about town and block pedestrian access, particularly for individuals with disabilities. Numerous news articles and social media posts illustrate this argument with images of scooters left haphazardly on sidewalks. In this research we sought to explore the prevalence of parking issues through a case study of San Jose, California.
Methods: We observed and photographed 530 parked shared scooters in Downtown San Jose. Using the photographs, we then documented several attributes about where and how each scooter was parked. In particular, we looked for overall patterns, compliance with applicable laws, and "blocking" of doors, infrastructure for the disabled, and excessive sidewalk widths.
Results: Given the inherent free-form nature of a dockless system, one might expect great variation in how shared scooters are parked. However, clear patterns emerged. The majority of scooters - 72% - were parked on sidewalks. Most of the rest (23%) were parked off the streetscape on adjacent properties. Fewer than 1% were parked on the vehicular right-of-way of streets.
While most scooters were parked on sidewalks, scooters tended to not block sidewalks. Of the scooters parked on sidewalks, 90% did not overtly disrupt pedestrian traffic. These scooters were either on the "edge" of the sidewalk (with some portion of the scooter within about a foot of the edge) or in the already-obstructed "street furniture zone" where objects such as benches, newspaper racks, and planter boxes already block pedestrian through-flow along that portion of a sidewalk's width.
Even among the 10% of sidewalk-parked scooters that failed to be tidily parked on the sidewalk edge or in the street furniture zone, most did not actually impede pedestrian traffic. An extremely small number of scooters - just 11 - were observed blocking pedestrian travel in any way.
Virtually all scooters - 97% - were parked upright, as required by California state law. Additionally, most users avoided parking scooters in the middle of open spaces. Seventy-two percent of scooters were parked within a foot of some other vertical object, such as a wall or street furniture.
Conclusions: Despite some of the rhetoric in media about the scourge of poorly parked scooters in public space, at least in the case of San Jose, parked scooters appear to be minimally disruptive. While most often parked on sidewalks, scooters appear to have limited impact on sidewalk function.