Electric Bikes and Health:
Evidence Review

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Electric Bikes and Health

Systematic approaches are needed to support and encourage people to be and remain active throughout their life in an effort to reduce chronic diseases and their related morbidity and mortality, and the wider impact on health and healthcare services (Jones et al., 2016). Walking and cycling ('active mobility') have a significant role to play in promoting moderate physical activity as part of daily travel routines, delaying biological aging and age-related conditions, and improving overall health and wellbeing (WHO, 2002; Saelens et al., 2003). Electric bikes (e-bikes) can be a technology to introduce active transportation to potential users, particularly sedentary individuals, and can promote longer trips and trips to multiple destinations (Langford et al., 2017). Facilitating active mobility, including e-bikes, is an effective way for cities to support lifelong health and wellbeing.

E-bike share systems can benefit communities in a number of ways:

- increased cycling and walking
- improved access and utilization of public transit
- reduced reliance on private vehicles
- improved air quality (Kelly et al., 2014; Hosford et al., 2019; Babagoli et al., 2019)

In implementing an e-bike share system, there are also considerations required to address safety of the users and supporting social equity.

Physical Activity

E-bikes have emerged in recent years as a new mode of sustainable transportation, as well as an active transportation option for individuals and communities. E-bikes have been shown to increase the amount of physical activity by older adults, and can serve as a gateway to active transportation for sedentary individuals, reducing the risk of chronic diseases and obesity (Langford et al., 2017). E-bike trips have been shown to be 13% longer than conventional bicycle trips, and seem to be a good option for those living too far away from work to walk or cycle with a conventional bike (Langford et. al., 2017; Berntsen et. al, 2017). E-bike riders reported higher levels of enjoyment and less exertion (Langford et al., 2017).

Mobility and independence are important constituents of wellbeing in later life as they allow older people to engage in meaningful activities outside their home and to gain a sense of control over the places they visit which in turn can help foster social engagement and a sense of belonging in the world (Handler, 2014). Studies in Australia, United Kingdom, the Netherlands and Canada also show that older adults prefer electric bicycles as an important measure to ensure active living and social connectivity (Leger, Dean, Edge, & Casello, 2019). The reason behind this is that the electric motor decreases physical exertion especially over uneven terrain or long distances, enabling those with health issues (e.g. post-stroke or knee replacement) to cycle longer.

Considerations for Action

- Promote continued expansion of our AT network in order to support building physical activity into our daily lives.

- Consider implementing an e-bike share system to contribute towards expanding cycling's mode share in Winnipeg and as part of an overall strategy to promote bicycle use as a healthy, sustainable mode of transportation.

Air Quality and Other Environmental Impacts

Addressing environmental impacts associated with e-bikes is important because both positive and negative health impacts have been described (e.g. cleaner air and mitigating climate change, vs. e-bike disposal, charging and redistribution). As a form of active transportation, e-bikes can support other transportation and environmental goals such as addressing congestion, energy consumption and greenhouse gas emissions (Langford, 2017). The use of electric bicycles decreases the use of private vehicles (Shao, Gordon, Xing, Wang, Handy, & Sperling, 2012). Several modelling studies using a life cycle assessment approach demonstrated favorable environmental impact of e-bike use including a decrease in greenhouse gas emissions (Astegiano, Fermi, & Martino, 2019; Mellino, Petrillo, Cigolotti, Autorino, Jannelli, & Ulgiati, 2017; Elliot, McLaren, & Sims, 2018). However, the impact of charging lithium-battery powered bicycles is significant unless a renewable energy source such as geothermal, wind or solar power is used (Mellino, 2016; Elliot et al, 2018).

Considerations for Action

- Integrate e-bike share systems with public transport systems to support an equitable and sustainable city (e.g., mobility hubs, where a wide range of shared and sustainable mobility infrastructure is co-located for ease of integration).
- Require e-bike share companies to monitor and report environmental impacts of an e- bike share system, including charging, redistribution, and waste.

Safety

With the increased use of e-bikes, studies have reported an increasing trend of injuries and deaths among e-bike riders in China (Feng, Raghuwanshi, Xu, Huang, Zhang, & Jin, 2010) and Israel (Siman-Tov, Radomislensky, Peleg, & Israel Trama Group , 2018). Compared to conventional bike riders, e-bike users have a higher risk for more severe traumatic brain injuries requiring neurosurgical interventions (Baschera, et al., 2019) and multiple traumatic injuries (Siman-Tov, Radomislensky, Peleg, & Israel Trauma Group , 2018; de Guerre, Sadiqi, Leennen, Oner, & G, 2018). In children, e-bike use is associated with more traumatic injuries compared to conventional bike users (Zmora, Peleg, & Klein, 2019).

Collisions with an automobile are a common mechanism of injury among e-bike riders (Siman-Tov, Radomislensky, Peleg, & Israel Trauma Group, 2018; Tenenbaum, et al., 2017). In one study crash risk was higher among men; among riders with lower educational level; and riders travelling on icy or wet streets or crossing a curbstone (Hertach, Uhr, Niemann, & Cavegn, 2018). A field survey of e-bike and

conventional bicycle users demonstrated that e-bike riders engaged more frequently in unsafe behaviours such as ignoring a red light while making a left turn (Wang, Neitzel, Xue, Zheng, & Jiang, 2019). Lastly, lower helmet use is reported in e-bike riders compared to conventional bike riders (Siman-Tov, Radomislensky, Peleg, & Israel Trauma Group , 2018; Chi, Chen, Saleh, Tsai, & Pai, 2019).

According to Canada's Motor Vehicle Safety Regulations (Government of Canada, 2019), an e-bike or "power assisted bicycle" can only travel a maximum speed of 32km/hour with a motor that provides no more than 500 watts of power. According to Manitoba's Highway Traffic Act (Province of Manitoba, 2019), operators must be at least 14 years of age and must wear a helmet. Issues of speed differentials in bike lanes are of particular concern where individuals riding conventional bicycles may be vulnerable when sharing space with e-bikes or e-scooters that are larger or may be travelling at significantly faster speeds (Edge et al., 2018). Most e-bikes are manufactured to automatically turn off the electrical motor so they do not exceed speeds of 32 km/hour; nevertheless, there are many instances of riders modifying the technology, tampering with speed capabilities (Edge et al., 2018).

Considerations for Action

- Monitor the nature and burden of significant injuries. This will require new methods to capture e-bike share deaths and injuries and impacts on health/police/EMS services and insurance claims.
- Prioritize investment in active transportation networks, including separated bike lanes.
- Require e-bike share companies to ensure riders are informed of local regulations and safety recommendations.
- Require e-bike share companies to provide a helmet for each bike rented by attaching a helmet to the bike so there is a 1:1 ratio. This way the helmet is always present, and optional to use.

Social Equity and Accessibility

E-bikes are perceived as having the potential to encourage a wider range of individuals to incorporate cycling into their commutes instead of relying on a car. E-bikes were praised as a well-suited mobility option for individuals unable to afford a car, but who would value the autonomy to maintain personal control over travel time and routes which transit does not (Edge et al., 2018). Groups such as newcomers and suburban women were identified as potential future e-bike users, as they currently experience barriers to car ownership (Edge et al., 2018). One e-bike store owner reports that the price of an e-bike typically runs between $3500 and $5000 CAD (Griffin, 2019). Although cheaper than a private car, this would still be a costly option for many individuals.

An e-bike share or lending program could be an effective means to reduce barriers for potential users and increase the use of e-bikes (McQueen, MacArthur, & Cherry, 2019). Additional measures such as strategic locations of e-bike hubs and cash or debit payment options would likely be helpful in increasing equitable access to e-bikes. Incentives such as rebates and point of sale discounts have also been described. An example is the Scrap-It program in British Columbia, where residents exchange their old vehicles for $200 or money that can go towards the purchase of a new electric vehicle, e-bike, bus pass

or car share credit (BC Scrap-It Program, n.d.). Specific to e-bikes, participants can receive $850 off the purchase of a new e-bike that has a minimum price of $1000.

E-bikes are also seen as promising for enabling more active modes of travel amongst individuals with mobility restrictions brought on by aging or physical limitations (Edge et al., 2018). A robust active transportation infrastructure will help to support the use of e-bikes for all. Separated lanes for e-bikes, electric mopeds and e-scooters can improve uptake and safety of micro-mobility options (Shared Mobility Cities Index, 2019)

Considerations for Action

- Develop strategies to address and monitor access for people with lower incomes (through distribution requirements, discounted rates, ability to pay cash, etc.).
- Ensure the e-bike share company provides cycling safety equipment and accessories on all their bikes (e.g. helmets, lights/reflectors) (WRHA, 2017).

Summary

Shared micromobility options, including an e-bike share program, could enhance Winnipeg's sustainable transportation and Towards Zero strategies. From a public health perspective, this program should be designed to: align with current active transportation goals including safety, efficiency, and equity; mitigate climate change and improve air quality by shifting trips away from motor vehicle use; prevent fatalities and serious injuries on Winnipeg's streets; and consider strategies to promote access for lower income and structurally disadvantaged citizens.

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