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Cycling as a means to improve the health and Wellbeing of both locals and visitors of national parks

Muhammad Shaker¹, Elke Hermans¹, Ammara Zahoor²

¹UHasselt – Universiteit Hasselt, Transportation Research Institute (IMOB), Agoralaan, 3590 Diepenbeek, Belgium

²University of Engineering & Technology Lahore, G. T. Road, Lahore Punjab

Abstract

The cause of numerous illnesses are obesity, anxiety, and hypertension. Physical activity reduces the higher risks of factors associated with various cardiovascular diseases. Cycling is a prominent type of physical activity. Locals, as well as visitors, can perform cycling. It is important to motivate locals and visitors coming to National Parks to reduce car usage and enhance bike usage; this can be achieved by highlighting the associated health benefits and reduced risk of diseases. Past research has identified many methods to promote cycling usage by highlighting its advantages, such as reducing the effect of multiple diseases e.g. all-cause mortality, cancer mortality, cardiovascular diseases, and obesity morbidity. This research, via literature review, identifies the health **and wellbeing** benefits. Additionally, it proposes a few strategies (healthy streets, kilometer allowances, and cycle superhighways), along with an implementation approach, to promote cycling within and around National Parks.

Keywords: cycling, national parks, visitors, diseases, health benefits

Introduction

The World Health Organization recommends a minimum of 150 minutes of physical activity per week (WHO, 2010). Increasing proportions of western and other populations fail to achieve this level of activity (Götschi et al., 2016a). The recommended physical activity level can be achieved by integrating cycling into daily routine exercise and promoting cycling in national parks. There are many types of physical activity, such as walking, cycling, swimming, etc. However, this study focuses on cycling. Nature provides room for cycling, and cycling leads to several health benefits. There is an important relationship between mental health and nature, as physical activity and open space are directly linked to psychological comfort (Bratman et al., 2012; Douglas, 2012; Kaplan, 2001; Maller et al., 2006; Sullivan et al., 2004; Wood et al., 2017). Physical activity plays a vital role in a healthy lifestyle (Götschi et al., 2016b). **Visitors often coming to spa and wellness destinations regularly engage themselves in physical activities e.g., cycling and hiking (Vuković et al., 2015). Through a recent survey, by the Wellness Tourism Association and the Global Wellness Institute, it was found that visitors are interested in a reconnection to nature, a sense of adventure and a need to safely socialize as they look forward to wellness travel post-COVID (Gibson, 2019).** National parks with adequate infrastructure for bikes provide a healthy opportunity for physical activity to locals and attract a large number of tourists, for example, installing lights in the Monsal trails in the Peak District National Park in England, significantly increased the number of tourists (Monsal Trail, 2020). It has been observed in most studies that the health benefits due to physical activity (PA) are significantly larger than the health risks caused by exposure to air pollution (Tainio et al., 2016a). Cycling is one of the economic sources of physical activity that benefits a healthy life and improves a quality lifestyle. When integrating mobility and physical activity, cycling offers benefits to a large population because it does not require a high level of skills. On the other hand, cycling is a relatively cheap physical activity that everybody can afford (Götschi et al., 2016b).

A common phenomenon is that an increase in visitors' numbers entails an increase of the level of congestion in counties surrounding the national parks (Shaker, Adnan, et al., 2020). In Europe, 72% of the European population lives in urban areas, resulting in an increase in noise and air pollution and a less healthy lifestyle

(Oldenziel & Albert de la Bruheze, 2016). Due to the increase in congestion, more people started to use a bicycle, which is an important step towards a healthy lifestyle and a more sustainable environment. Many European cities have started cycling projects to aim for health and prosperity (Oldenziel, Ruth, et al., 2016; Ritchie, 1998). The same mechanism is needed in urban counties within the proximity of national parks. Cycling is an economical mode of transport for some people, but it is also a fast mode of transportation for short distances. Cycling is beneficial for the environment as well as for individual health because it plays an important role in society's different issues of climate change and the increase in people's obesity levels (Su et al., 2010; Vujko et al., 2013).

In national parks, cycling is not only known for leisure time tourism, but it is also considered a good mode of transport and an environmentally friendly form of tourism (Koch, 2013). Other benefits of cycling include a higher level of fitness, longer life expectations, reduction in sick leaves, and reduced medical treatments' heavy cost (Genter & NZ Transport Agency, 2009; Gössling, Choi, et al., 2019). In a study by Huguet et al., (2018) it is revealed that multifactorial, interdisciplinary primary healthcare intervention with a focus on physical activity helps in the prevention of frailty in pre-frail elderly patients, and improves functional capacity. For any age, cycling is one of the safest ways of exercise for a healthy life (İçöz et al., 2018). However, for the elderly, it is essential to engage themselves in physical activities to maintain an optimal health and wellbeing in their life, as limited or moderate physical activity is better in terms of health and wellness than no activity (Ayenigbara, 2020). Currently, common causes behind all known diseases are obesity, anxiety, and hypertension (Vujko & Plavša, 2011). According to medical experts, cycling is a good form of exercise. According to medical experts' research, physical activity is considered one of the best treatments for obesity, hypertension, and stress (Pekka Oja et al., 2011; Vujko et al., 2017).

Over the past 30 years, worldwide, most nations are seeing a large increase in obesity rates. Diseases such as diabetes, hypertension, fatty liver, cardiovascular diseases, and some types of cancers are found in more than 300 million adults due to obesity because obesity puts them at a higher risk of these diseases (Pucher et al., 2010). Physical activity reduces the increased risks of diabetes, hypertension and cardiovascular type diseases (Yang et al., 2010). Physical inactivity is considered to be the main reason for illness leading to death. Walking and cycling can be valuable daily physical activities. The degree of reliance on cycling for daily travel differs greatly among countries. European countries with high walking and cycling rates have lower obesity rates than Australia and countries in North America that are highly car-dependent (Pucher et al., 2010). A modal shift from motorized travel to cycling results in a more healthy and emission-free environment (Götschi et al., 2016b; Woodcock et al., 2014). Limited research has been carried out, which shows the e-/cycling influence and its results on physiological or psychological health (Peterman et al., 2016). However, rates of active traveling are low. Common obstacles to cycling contain the physical constraints related to hilly terrain, poor physical fitness, lack of time, and the distance to work or a particular destination (Gerike & Parkin, 2016). Cyclists are the ones most affected by motorized transportation air pollution. They had higher respiration rates in their respiratory system because of this pollution (Gössling, Choi, et al., 2019; Int Panis et al., 2010). Cyclists are identified to be involved in deviations to avoid the car's negative externalities at a significant time cost (Gössling, Humpe, et al., 2019).

The study's objective is to determine the health and wellbeing related advantages of cycling. Another focus of the study is to indicate measures to promote and enhance cycling by highlighting health-related benefits.

In this article, the author explores the ways to convince locals residing near national parks and national park visitors to use a bicycle to reach the destination based on extensive literature research. The research findings indicate how cycling can persuade locals to use bikes for work to home trips, and tourists to explore nature by bike by identifying the health benefits. The author provides a baseline to mobilize visitors to use cycling as a mode to end-up with journeys and reduce the effect of diseases.

Methods

This research note is based on a number of research articles and abstracts that were explored using a combination of the following keywords: physical activity, cycling promotion, cycle tourism, cycling advantages, mobility, health benefits from e-/cycling, national parks, tourist health, and air pollution. All acknowledged papers were classified according to relevance based on the title and/or abstract. Seale, 2018 also applied the same methodology in his study. In preliminary research, based on keywords, a total number of 255 articles were identified, sub-categorized into two categories, out of which 178 in category-1 (for health benefits, physical activity, advantages, and tourist health) and 77 in category-2 (for cycling promotion, mobility, national parks and air pollution). **Google scholar, the web of science, and Scopus were used as search engines/database.** In the end, the researcher separated 54 peer-reviewed articles (43 from category-1 and 11 from category-2) for an in-depth study (see Figure 2). The criteria defined for the inclusion of these articles are based on the impact of cycling in reducing mortality or morbidity, health and benefits of health (Pekka Oja et al., 2011). The research identifies a few of the successful strategies that were implemented in the past, along with outcomes achieved through these strategies. The research also gives a way forward to implement these strategies in national parks.

Figure 1 Research methodology

Findings

The findings of the research are divided into two parts. Part one gives results, containing the health benefits (that could be) achieved, when cycling/physical activity is promoted within and around national parks. The second part deals with a more practical implementation to promote and enhance cycling for both locals and visitors.

A growing body of literature indicates that physical activity also yields mental health and wellbeing benefits (Hosker et al., 2019). In different studies, it is found that cycling is a tool to maintain health, wellbeing and to reduce higher risks of other diseases such as obesity, anxiety, depression, etc. (Genter & NZ Transport Agency, 2009; Holm et al., 2012b; Litman, 2011). From a physiological point of view, physical activity through cycling is equivalent to other activities of equal intensity, duration, and frequency, such as manual labor, sports, exercise, or walking (Götschi et al., 2016b). Cycling is also beneficial in reducing overweight health-related problems (Bassett et al., 2008). In Denmark, benefits of cycling have been quantified; cycling is estimated to prevent about 3,000 deaths, >3,000 cases of type 2 diabetes, almost 6,000 cases of cardiovascular disease as well as more than 2,000 cases of cancer per year (L. B. Andersen et al., 2000; Blondiau et al., 2016; Rasmussen et al., 2016).

In research, the health risks of air pollution were estimated, and it was found that air pollution causes a large burden of diseases all over the world (Burnett et al., 2014). Since motorized vehicles are an important source of air pollution, mode shifts from motorized transport to active travel would improve health in active travelers and reduce air pollution exposures for the whole population (De Hartog et al., 2010). Although the case of air pollution is different for protected areas, the policyholders are worried because of the large number of cars moving towards national parks (Shaker, Hermans, et al., 2020). Protected areas provide an environment with relatively low air pollution; however, the question arises about the pollution level that will be higher with the increase in motor-vehicles. For example, if the concentration of fine particles or PM_{2.5} concentrations increases to 100 µg/m³, then the harms of cycling in PA would exceed benefits (Tainio et al., 2016b). Epidemiological evidence found that cycling has positive health effects, even in a highly polluted environment (Z. J. Andersen et al., 2015). It is essential to motivate locals and visitors, to switch from cars to bikes, to prevent future disadvantages of motorized vehicles. One of the motivational tools is the development of a mobility app. Mobility apps with guided cycling routes and assistance for visitors would significantly affect the visitors' behavior towards a mode switch (Shaker, Hermans, et al., 2020).

Reviewers have consistently identified tourists' preferences towards parks and green spaces. It is found that cycling in a national park/nature is directly related to visitors' health benefits. Cycling can also reduce the level of different diseases like adverse mental health, obesity, cardiovascular disease, type 2 diabetes, and reduction in death rate (Egorov et al., 2016; Fong et al., 2018; James et al., 2015; Müller-Riemenschneider et al., 2020). Nature, such as parks and open spaces is the main source to find peace, silence, and interaction with nature, but it is also useful in reducing stress and anxiety. Cycling serves not only to improve physical wellbeing but also to improve emotional wellness as described in the La Sierra pilot program article (Estrella et al., 2019). Cycling can be an outstanding therapeutic and stress relieving activity, particularly when it is an enjoyable and consistent activity (Estrella et al., 2019). So, combining cycling and nature is directly related to mental health and wellbeing, which shows the curative health benefits (Bedimo-Rung et al., 2005; Chiesa, 2004; Kuo et al., 1998; Maller et al., 2006; Ward Thompson et al., 2012; Wolch et al., 2014).

In another article, the author explains research through quantitative measures of cycling for any purpose (stationary cycling excluded), estimates of mortality or morbidity (including disease risk factors) and/or measures of health and function (e.g., fitness). One of the most-cited prospective cycling studies reported pooled data from three epidemiological surveys from Copenhagen, Denmark (L. B. Andersen et al., 2000). This study addressed physical activity during leisure time, work, sports, and cycling to work. The cohorts included 13,375 women and 17,265 men, with a mean follow-up time of 14.5 years. The analysis of cycling to work consisted of 783 women and 6,171 men. The relative risk of all-cause mortality in the cyclist group was 0.72 (95% confidence interval, 0.57–0.91) compared to non-cyclists after adjustment for multiple confounders, including leisure-time physical activity. The study results proved a consistent positive relationship between cycling, health and functional benefits in young boys and girls. The analysis also showed improvements in cardiorespiratory fitness and disease risk factors as well as a significant risk reduction for all-cause mortality, cancer mortality, cardiovascular disorders, cancer, and morbid obesity in middle-aged and older men and women (Pekka Oja et al., 2011). It is highlighted by Brehme et al. (2018) that older visitors visit the park more often compared to younger visitors; however, if younger people visit protected areas, it is often for active recreation such as cycling. It is also indicated that many of the visitors walk and cycle within the park. Significant advantages could be achieved if cycling is promoted for leisure and work trips within and around national parks.

In another study, it was found that, by doing e-cycling for four weeks, there was a decrease in 2-h plasma glucose in an oral glucose tolerance test (Peterman et al., 2016). Research findings revealed that there is an influence of workout on obese persons on 2-h post-workout glucose concentration. Still, this finding is new in the background of e-cycling and conventional cycling, and also, there were no metabolic changes found in the same study (Little et al., 2014; Rynders et al., 2014). According to the studies on conventional cycling by Geus et al. (2008) and Oja et al. (1991) there were zero effects on the metabolism. The use of e-cycling is useful for young individuals' health (Bourne et al., 2018). However, research also shows that e-cycling produced reasonable energy or strength for elderly persons who recovered due to coronary artery (Hansen et al., 2018).

Götschi et al., (2016a) conclude in their research that cycling's health impacts play a central role in considerations about bicycle promotion. Benefits from cycling are of such magnitude that they are worth pursuing by individuals, as well as by society, even though locally, safety issues may need to be addressed simultaneously. In many aspects, cycling's health benefits are more tangible than other reasons to promote cycling and provide a quantifiable case for investments in this mode of transport (Götschi et al., 2016a). Cycling and walking present a benefit of 0.18 € and 0.37 per km compared to car use, which relates to a cost of 0.11 euro per km (Holm et al., 2012a). A study by Smiley et al. (2020) indicated that cycling more than 22 kilometers per week is significantly linked to a steeper rise in wellbeing and health than biking less than 21 kilometers per week.

It should be noted that cycling could have negative impacts on health and wellness as well, particularly related to the infrastructure level of cycling lanes. Roughness caused by large cracks, bumps, potholes and loose gravel could cause undesirable vibrations and put cyclists at risk of falling. Bicycle stress level indicators that have been proposed in literature show that the condition of the pavement surface is also an issue for these unpleasant vibrations (Nuñez et al., 2018). Vertical acceleration by cyclists can also be a reason for various health problems. These problems and discomfort are produced when these vibrations are strong and long lasting (Bernhard, 1997; Parkin & Sainte Cluque, 2014). These health problems include fatigue, headaches, sleep disturbances, irritability, forgetfulness and impotence (Bernhard, 1997), carpal tunnel syndrome and tendinitis, hand-arm vibration syndrome, back musculoskeletal disorders (Dupuis & Gemne, 1985; Griffin & Bovenzi, 2002), hand and arm blood flow issues (numbness and white fingers), knee pain, and back pain (Parkin & Sainte Cluque, 2014). Accelerometers can be used to measure vertical acceleration by cyclists (Arpinar-Avsar et al., 2013; Du et al., 2009; Giubilato & Petrone, 2012; Macdermid et al., 2014; Ayachi et al., 2015; Takahashi et al., 2015; Ambrož, 2017) and characteristics of vibrations on cycling lanes. However, slight improvements in the infrastructure of cycling lanes can negate the aforementioned effects on health.

Based on the aforementioned findings and literature research, the author considers that cycling can help users achieve a number of health-related benefits. Apart from the aforementioned findings, in Table 2, different strategies are highlighted. These were already applied in the context of urban and national parks. These strategies had a significant impact on health and attracted a decent number of tourists to national parks. The outcomes achieved through these methods are also highlighted. The stepwise approaches are recommended in Table 2 to implement these strategies in national parks.

Table 1 Implementation of successful strategies to promote cycling to achieve numerous health benefits

Conclusions

Literature research study indicates that physical activity, especially cycling, generates health and wellbeing benefits, e.g., a reduction in the risk of cardiovascular diseases, diabetes, and obesity health-related problems. If the physical activity is carried out in national parks away from densely polluted areas, it would definitely have significant health and wellbeing benefits. Compared to a cost of 0.11€ per km by car, cycling and walking benefits can be quantified as 0.18€ respectively 0.37 per km (Holm et al., 2012a). Implementation of strategies like healthy cycling streets, the provision of cycling allowances, and the infrastructure development of cycling tracks associated with a number of health benefits would help to obtain a modal shift. It will minimize the risk of various diseases and attract a significant number of tourists who enjoy biking in a peaceful environment. Especially, it would be a nice gesture to visitors coming to wellness destinations. The benefits of cycling are not only limited to an individual's health, but this physical activity also has long-term benefits for the environment and society. The need of the hour is to motivate users to cover more kilometers by bikes. Extensive research is required to determine the locals' and visitors' behavior towards biking for multipurpose trips towards national parks.

Until now, most of the studies (Marks et al., 2020; Sibi & Abraham, 2017; Traskevich & Fontanari, 2018) have a limited focus on the impact of cycling on health and wellbeing. However, this study identifies the benefits of cycling, not only on health but also for wellbeing. The study finds that cycling has the potential to improve physical health and mental wellness. In the past, various measures have been proposed; however, these studies do not recommend implementation strategies. This study indicates feasible measures, health and wellness benefits, and recommends implementation steps to motivate managers and key stakeholders to implement these strategies successfully.

From a managerial point of view, a way forward is given to understand the benefits of promoting and enhancing cycling within and around protected areas. The managers need to start working on the implementation of these measures to reduce pollution and congestion caused by the growing number of cars. In that way, visitors can also benefit in terms of their health and wellbeing. The measures have been

implemented in urban case studies with highly polluted areas. However, by applying these measures in national parks, more health-related benefits could be achieved.

Apart from the advantages associated with cycling, research can also be carried out to investigate the impact of a particular cycling stimulating measure on health and wellbeing through a before-and-after study. Furthermore, comprehensive research can be carried out to compare the stress level of visitors coming by bike with other modes.

Declaration of interest statement

We hereby declare that the work is original, and it is also stated that no potential conflict of interest was reported by the authors.

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Table 2 Implementation of successful strategies to promote cycling to achieve numerous health benefits

Case studies	Outcomes achieved through the implementation	Health benefits linked to these strategies
<p>The Healthy Streets Approach London, United Kingdom (Boschetti, 2017)</p> <p>The plan targets Londoners to use their cars less and walk, cycle, and use public transport more.</p> <p>Provision of improved local environments. By providing more space for walking and cycling and better public spaces where people can interact.</p>	<p>This plan helped a large share of the London's population to use an active mode of transport such as cycling for their daily physical activity. This plan predicts that in 2041, 80% of the population trips will be made by cycle, foot, and public transport (which is 64% at this stage).</p>	<p>The greatest health benefits through London's increases in cycling relate to 1,210 fewer premature deaths (95% CI: 447–1,972) each year (Mueller et al., 2018). Cycling can fire up users' neurotransmitters, can improve the ability to concentrate and retain information. On the environmental side, cycling can provide faster access to destinations in urban areas than traveling by car, thus saving you time and money (Seale, 2018).</p>
<p>Recommended implementation approach in national parks</p>		
<ol style="list-style-type: none"> 1. Identify the potential bike paths connecting to national parks 2. Provide connectivity via bike routes connecting urban counties and POIs of national parks 3. Illuminate required paths and ensure visibility and safety 4. Highlight the health and wellbeing benefits associated with biking within and around national parks, e.g., through awareness campaigns, seminars, etc. 		
<p>Cycling kilometric allowance (Boschetti, 2017)</p> <p>In 2017, France launched a new action plan dedicated to active travel (walking and cycling). Part of this was a kilometric cycling allowance for commuters cycling to work. Those using their own bike will receive €0.25 per kilometre cycled and up to €200 annually.</p>	<p>Out of 10,600 employees of these firms, 380 employees got benefits from this project allowance. People recorded as being 'new cyclists' had mostly switched from public transport; 20% were former car users, and 9% previously drove mopeds or motorcycles. The number of inactive people halved, whilst over 80% of the participants reported engaging in extra physical activity.</p>	<p>During its six-month monitoring period, data gathered by ADEME estimated a 2.7-ton reduction in CO₂ emissions, which works out at an average of 0.03 tons per new cyclist per year (Boschetti, 2017). The higher the distance travelled using a bicycle, the higher the chances of reducing blood pressure (Chavarrias et al., 2019).</p>
<p>Implementation approach in national parks</p>		
<ol style="list-style-type: none"> 1. Develop a mobility app to register the number of visitors that reach the park by bike 2. Link the app to health parameters 3. Use the app to track the distance travelled by bike and monitor health and wellbeing benefits achieved by physical activity 4. Introduce rewards based on distance travelled by bike, e.g., free participation in (yoga) exercises, discounts on (fitness) activities, etc. 		
<p>Cycle Superhighways in Copenhagen, Denmark (Boschetti, 2017)</p> <p>Development of superbike paths. Provided connectivity between residential areas and workplaces.</p>	<p>A 30% increase was recorded in the use of cycles after the launch of the first cycle superhighway track. An annual reduction of approximately 856 ton of CO₂. A reduction of 34,000 days in sick leave annually.</p>	<p>Car drivers who opted to use the Cycle Superhighways and take the bike instead experienced health benefits associated with a decrease in body fat of 0.6 to 2%. An annual reduction of approximately 856 tons of CO₂ was achieved (Boschetti, 2017).</p>
<p>Implementation approach in national parks</p>		
<ol style="list-style-type: none"> 1. Motivate commuters to use bikes on their home to work trips, convince companies to provide bike loans up to 200 £ for employees 2. Infrastructure development, e.g., remove uneven patches, holes and surface levelling to overcome negative impacts of cycling 3. Ensure bike lane segregation on connecting highways 4. Monitor, control, and disseminate the information about health and wellbeing benefits achieved by reducing car usage 		

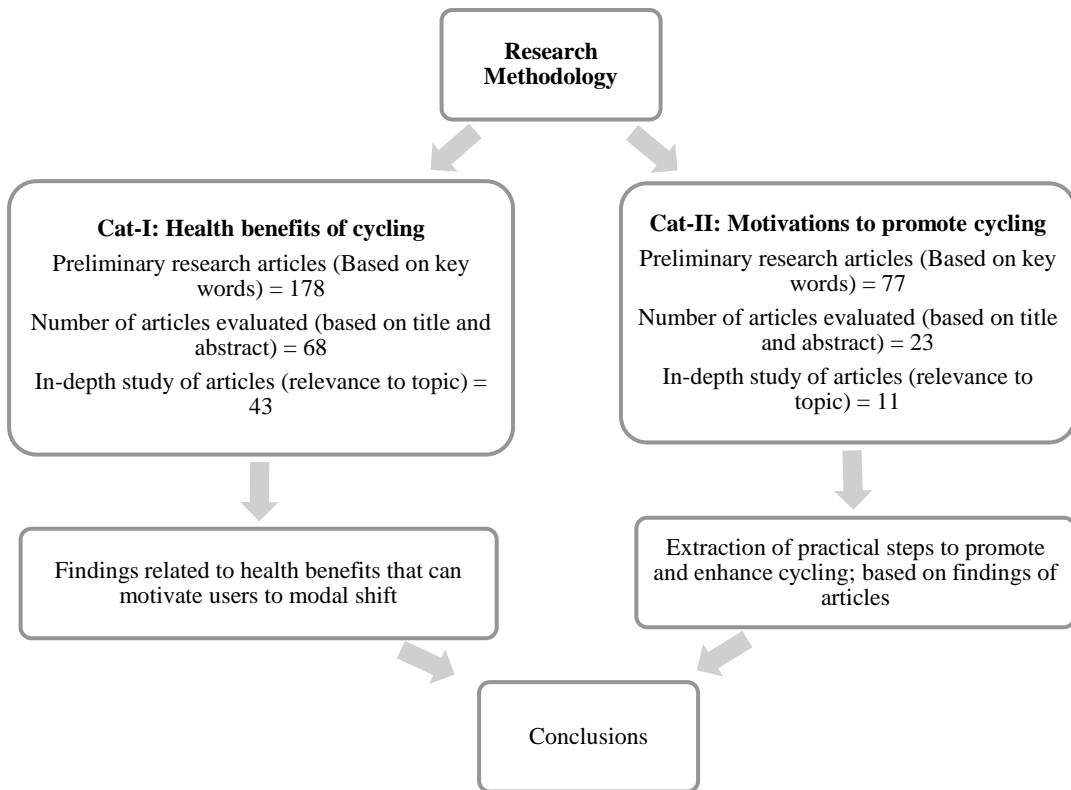


Figure 2 Research methodology