

Review

A Systematic Literature Review on Health Benefits, Incentives, and Applications to Promote Walking in Urban Areas

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Abstract: The transportation sector contributes significantly to global warming, as well as to urban fabric problems such as traffic congestion, traffic accidents, noise pollution, and air pollution. A shift from fossil fuels to renewable sources and from motorized to non-motorized modes is now considered essential to create sustainable communities. Walking is a sustainable transport mode and several studies have focused on factors affecting it, including travel behavior and sociodemographics. In this study, we conduct a systematic literature review to identify and record walking benefits, the financial incentives that encourage travelers to walk, and applications that support it. Financial incentives are found to have short-term effects, and their success depends on the level and structure of the incentives as well as the characteristics of the participants. In addition, non-financial incentives, such as improving infrastructure and pedestrian safety, or providing information and education about the benefits of walking, may also promote it as a main mode of transport.

Keywords: walking; active mobility; financial incentives; health benefits; short term impact



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1. Introduction

Urban areas face numerous challenges in promoting sustainable transport modes, including the need to reduce dependence on motorized vehicles and increase active transport options such as walking. Walking is a sustainable and cost-effective mode of transport that offers numerous health, social, and environmental benefits [1,2]. In recent years, there has been growing interest in the use of financial incentives as a strategy to promote walking in urban areas. Financial incentives may take various forms, including cash rewards, discounts, or subsidies, and may target different segments of the population, such as employees, students, or low-income individuals [3–5]. Such incentives are designed to motivate and reinforce walking behaviors by providing tangible benefits that can influence individual decision-making and encourage individuals to choose walking as their preferred mode of transport [6,7].

The literature on financial incentives to promote walking has focused on the effectiveness, equity implications, and implementation challenges of such incentives. A sample of these studies revealed a focus on the impact of road network design on walking behavior [8], the equity implications of financial incentives for active transport modes [9,10], and the role of financial incentives in promoting sustainable transport in diverse urban environments [7]. Additionally, there is a growing interest in transportation engineering and urban planning regarding infrastructure design [11,12].

Despite the growing interest in financial incentives to promote walking in urban areas, there is a need to understand the impact of financial incentives on walking. A systematic

literature review is a rigorous and structured approach that can help synthesize current knowledge and provide evidence-based insights for policymakers and researchers [13,14]. In this paper, we conduct a systematic literature review to examine the benefits and impact of financial incentives on walking in urban areas. With a critical evaluation of the available evidence, we aim to provide a comprehensive overview of the current state of knowledge in this field and offer recommendations for future research and policy considerations.

This paper is structured as follows: the methodological approach is presented in Section 2. Walking benefits are grouped and presented in Section 3. Financial incentives and their effectiveness are presented in Section 4, while Section 5 enriches this study by presenting applications that support walking. This study concludes with a discussion in Section 6.

2. Materials and Methods

2.1. Identification of Objectives

Researchers have increasingly recognized the importance of systematic reviews. The term “literature review” refers to the systematic process of locating and compiling all accessible information on a particular topic area [14,15]. Qualitative approaches are primarily used in a systematic literature review to assess the quality and strength of findings from various types of studies and to make comparisons [16].

Adapting this study’s goals and steps for performing a systematic literature review, the research questions (RQs) were shaped before commencing this review [14]. These research questions include:

- RQ1: What are the health benefits of walking?
- RQ2: What forms of incentives have been implemented to promote walking?
- RQ3: Are incentives effective in promoting walking?
- RQ4: How may tools be used to support, promote, and incentivize walking?

Based on these research questions, three main objectives were identified, which are of high relevance to understanding walking and incentives:

- Objective 1: To systematically review and synthesize the existing literature to comprehensively understand the health benefits of walking, encompassing its various advantages.
- Objective 2: To identify and categorize the diverse forms of walking incentives that have been implemented, including financial incentives, reward systems, and other motivational strategies, by conducting a thorough analysis of relevant studies.
- Objective 3: To examine the impact of incentives and mobility applications on promoting physical activity and healthy lifestyles, with a specific focus on their geographical coverage, duration, and types of rewards, to understand their effectiveness in encouraging active commuting.

These objectives align with the research questions and aim to provide a structured approach to exploring the benefits of walking and the impact of incentives on encouraging walking behavior.

2.2. Identification of Data Sources and Databases

The purpose of data collection is to compile the most representative research material and utilize the most recent available information. This process encompassed three sub-steps. In the first step, existing studies relevant to this research were identified, ensuring alignment of the research questions with existing knowledge and avoiding duplication of prior work.

Following the review of primary studies, appropriate keywords accurately representing the research concepts were selected. These chosen keywords served as guides for subsequent database searches. An initial search using the terms “walking AND health AND benefits” was conducted in “Google Scholar”, “ScienceDirect”, “SPRINGER LINK”, “IEEE Xplore”, “Taylor and Francis”, “SAGE Publishing”, and “PubMed”, resulting in over

8000 results. The results were subsequently narrowed down to the fields of social sciences, environmental sciences, and engineering, resulting in 915 relevant studies. A subsequent search for “walking AND incentives” yielded 276 results.

Using the chosen keywords, databases were searched by the researcher to retrieve the most recent and pertinent information. The selection of databases was influenced by the research focus and the chosen keywords.

Each publication was accurately documented, including details such as its title, authors, year of publication, and study location. Subsequently, a review was conducted to document specific attributes, when available, in order to construct the database. These attributes encompassed the benefits of walking, the types of walking incentives, the effectiveness of incentives in promoting walking, and applications that support walking.

The next task involved merging publications and excluding potential duplicates, theses, or dissertations, as well as publications unrelated to the advantages of walking and incentives. Duplicate publications were removed, and the ones that remained were exported to an Excel file for screening. Publications that did not pertain to the benefits of walking and incentives were eliminated with title screening.

The following step was to identify if these publications referred to research objectives. This was achieved by reviewing each publication’s abstract. Abstract reviewing was performed by the authors who are experts in the field of walking and incentives. In some cases, the definition of walking benefits and incentives used in a study was not clear, and the authors had to review the introduction and methodology of each publication (i.e., text review).

After rigorous screening, 39 papers related to health benefits and 14 on motivation to walk were included in this study. It should be noted that, although certain articles were devoid of peer-reviewed status, they were nonetheless deemed pertinent for acquiring a comprehensive understanding and kindling interest in this particular field. Those studies were included in the progress of snowball searching [17]. Most of the mobile apps were identified in the selected papers, and their features were then reviewed on the official websites of the respective companies. A small number of apps were recorded as “recommended apps” on the Internet when the first recoded set was reviewed. In order to uphold this study’s quality, all the chosen articles had to be written in the English language. Figure 1 depicts the process of elimination using a PRISMA flowchart, capturing the steps from the initial search for records to the ultimate count of studies included in the analysis phase.

To facilitate the data collection process, a template was developed. The template aimed to collect and organize information related to the benefits of walking and the impact of incentives on promoting walking, as provided in the selected articles from previous steps. The template included fields for the title of the study, authors, year of publication, location of the study, benefits of walking, forms of walking incentives, and the impact of incentives on promoting walking. The collected information was analyzed to support each of the three objectives. The data were tabulated, when possible, to support the objectives and are presented in the following sections.

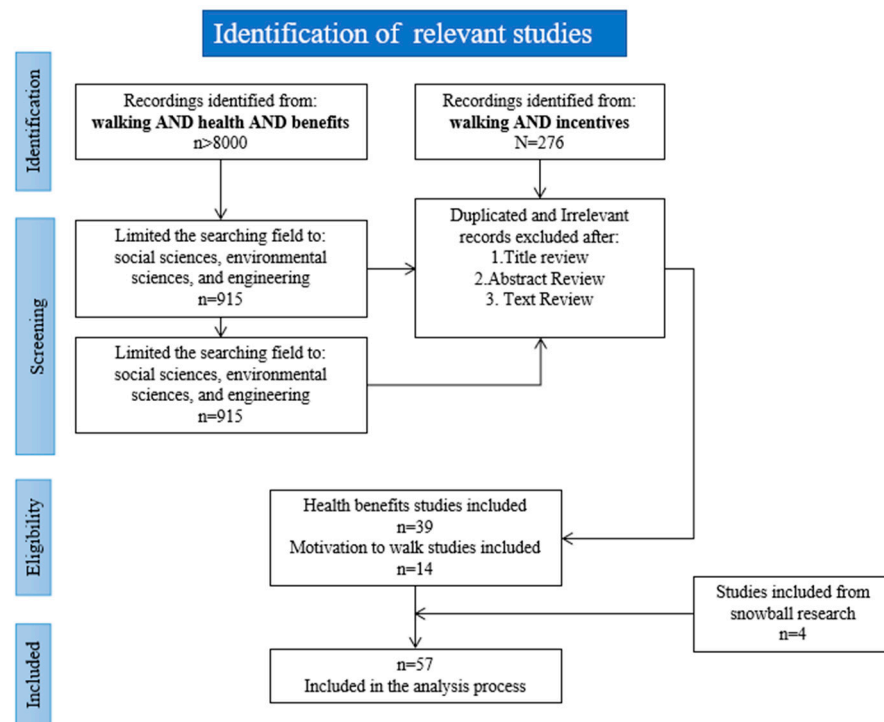


Figure 1. Systematic literature review procedures presented as PRISMA flowchart.

3. Walking Benefits

Walking is the most common and one of the safest forms of physical activity [18]. It offers great potential for improving public health since it can be easily integrated into people's daily lives. Walking, as a form of safe physical activity, started to attract researchers' attention in the 1990s [19]. Since then, several studies have explored general and specific health benefits. The following subsections group and present the results of the literature review regarding health benefits, to understand how walking is associated with these. The decision to prioritize the analysis of health benefits over other potential advantages is based on recognizing the essential role of individual well-being in people's lives. By concentrating solely on the health benefits of walking, this research aims to address valuable dimensions. According to the literature findings, the authors suggest three types of health benefits: (1) physical, (2) cognitive, and (3) mental health benefits.

3.1. Physical Health

There are numerous studies in the literature that address the effects of walking and physical activity on mortality. Factors that characterize these studies are the user groups, the intensity of walking, and the effects of walking. Early studies concluded that regular walking has significant effects, as it benefits adults with diabetes [20], reduces mortality, and prevents cardiovascular disease [21].

Several studies concluded that regular physical activity reduces the risk of premature death [19,22]; however, they all used different metrics to relate walking distance to the effects of walking. For example, Morris et al. [23] concluded that walking 15 km per week reduced the risk of death in middle-aged men. Similarly, Diehr and Hirsch [24] concluded that walking 28 blocks per week was associated with significant health benefits for older adults. A large study by Matthews et al. [25], on more than 67,000 Chinese over an average of 5.7 years, concluded that men who walk or ride bicycles have a lower all-cause mortality rate than men who do not walk or ride bicycles.

Walking was also found to be associated with important cardiovascular health benefits [22,26–28]. Hamer and Stamatakis [29] found that walking is associated with a lower risk of death for Scottish men and for women who are diagnosed with cardiovascular

disease (CVD). However, Manson et al. [30] found an inverse association between walking intensity and cardiovascular events for older women.

Other related health benefits include a reduction in hypertension [31], cholesterol, blood pressure, and obesity [19], an increase of serum levels of high-density lipoprotein (HDL) cholesterol [32,33], treatment of elevated cholesterol [34], and a lower risk of developing diabetes [19,33]. It also positively affects musculoskeletal health [19,31], aerobic capacity, and trunk muscle endurance, as well as joint flexibility and stability [35]. It reduces the risk of osteoporosis [35] or slows the process of osteoporosis, increases bone mineral content or slows its breakdown [33], and reduces the risk of colon cancer [19], breast cancer, chronic obstructive pulmonary disease, and constipation [34]. In contrast, a lack of physical activity increases the risk of hypertension, osteoporosis, and osteoarthritis [34].

People with an active lifestyle have a reduced risk of developing coronary heart disease (CHD) Cavill [31], whereas a lack of physical activity increases the risk of chronic diseases such as cardiovascular disease, CHD, thromboembolism, heart failure, syncope, and stroke [34].

Walking also contributes to weight loss [19,33,34,36,37]. For example, at least 30 min of moderate activity per day promoted weight loss [38]. Walking improves insulin sensitivity, glycemic control, and cardiovascular disease risk factors [39], while the cardioprotective effect of walking is stronger in diabetics than in people with normal glucose tolerance [40].

3.2. Cognitive Health

In addition to physical health benefits, many of the reviewed studies showed that higher levels of activity are associated with better cognitive performance. Research has shown that improvements in cardiovascular fitness are associated with improvements in cognitive function, including motor function, memory, cognitive speed, and attention [38]. Physical activity also plays a role in the treatment of dementia [34]. Kramer et al. [41] found that individuals who received aerobic training showed significant improvements in performance on tasks requiring executive control compared with anaerobically trained subjects. Weuve et al. [42] compared older women with varying levels of physical activity and observed less cognitive decline in women who were more active. According to the results of their study, long-term regular physical activity, including walking, was associated with significantly better cognitive function and lower cognitive decline in older women. Finally, physical activity may prevent functional decline in the presence of multiple chronic diseases and delay death through other unexpected mechanisms [43,44].

3.3. Mental Health

In recent years, more attention has been paid to the effects of walking on people's mental health and psyche. The literature shows a positive relationship between physical activity and the alleviation of depression and anxiety symptoms [19,33]. Farmer et al. [45] found that women who reported performing little to no physical activities were twice as likely to develop depressive symptoms as women who reported being moderately to vigorously active. Camacho et al. [46], based on a sample of 6928 men and women over nine years, concluded that individuals who reported low levels of physical activity had a higher risk of developing depressive symptoms at the end of their study.

In addition to depression and anxiety, other forms of mental well-being were also studied. For example, Morris and Hardman [23] mentioned several factors that are associated with walking and may improve the quality of life: enjoyment of the scenery, escape from boring work and dull surroundings, a mild adventure, good company, and good conversation. These findings were also supported by Cavill [31], who mentioned that reduced stress and increased relaxation during and after walking resulted in increased well-being. Walking outdoors was found to have a positive effect on mood and self-esteem compared with a walk in a shopping mall [47], to be beneficial regarding recovery compared with an urban walk [48] and a control day (i.e., no walk) [49], and to enhance the capacity for mental restoration. The walking conditions, such as walking by a tree-lined arboretum

shielded from traffic, significantly improved mental performance compared with an urban walk in the same area and of the same length [48,50]. Other features, including the greenery and water, affect walkers psychologically in a positive way [51].

In summary, walking—alone or under specific conditions—is considered a deceptively simple but obviously effective means of promoting psychological well-being. It becomes essential to promote strategies, such as cognitive engagement strategies, to support interaction and engagement with the external environment to improve multiple dimensions of psychological well-being [52]. It allows deep contemplation [53], and it can be used as a form of meditation to restore mental abilities, such as direct attention [54] and coping [55].

4. Financial Incentives

The health benefits of walking are widely acknowledged, and a strategy for promoting walking is the use of financial incentives, as demonstrated by research. Financial incentives have been found to be the most effective means of encouraging walking behaviors. The following section aims to explore the use of financial incentives and rewards to encourage walking as a healthy habit, highlighting their effectiveness and the need for long-term sustainability evaluation, while noting a gap in understanding their impact on health.

4.1. Financial Incentives and Types of Rewards

With the provision of monetary rewards or other financial incentives for walking, individuals are encouraged to prioritize their health and receive tangible rewards that reinforce this habit. Numerous studies have delved into reward methods, encompassing cash rewards, gift cards, redeemable points, and charitable donations. Furthermore, different reward systems have been explored, including those involving immediate gratification, lottery-based incentives, and mechanisms based on loss aversion. These investigations have also examined various reward levels, encompassing individual, group, and team-based approaches.

The distribution of cash rewards at fixed time intervals has emerged as the most effective incentive type, aligning with the findings of numerous other studies [56]. For example, cash incentives have been offered to participants in studies conducted by Finkelstein et al. [57] to increase their physical activity over a six-month period.

An additional strategy was found to be the use of bonding agreements, such as pledge contracts, in which participants deposit money and gradually receive it back upon achieving behavioral goals [58]. In another study by Omran et al. [59], participants were rewarded with gift cards as incentives for completing specific action plans aimed at increasing their physical activity levels. Their study compared the effectiveness of gift cards with other incentive strategies.

Furthermore, point-based reward systems were also used, where participants earned points for every minute of physical activity, which could be redeemed for various rewards [60]. Moreover, Patel et al. [61] conducted research to explore the impact of individual and team-based rewards. Participants received rewards based on their individual physical activity achievements, shedding light on the effectiveness of this incentive mechanism. In a different study in the U.S., the effectiveness of lottery incentives was assessed; participants had the chance to win rewards from random drawings based on their physical activity accomplishments [62].

In the same study [62], loss incentives were also examined. Participants committed a certain amount of money, with deductions made for failing to meet their physical activity goals. This loss-based incentive mechanism was evaluated alongside other approaches. Finally, participation in walking promotion programs has even shown the potential to reduce healthcare costs, further underscoring the pivotal role of attractive rewards in the successful implementation of motivational interventions [63].

4.2. Impact of Incentives

Table 1 outlines studies conducted on the subject of financial incentives and their impact on walking. It is worth noting that the existing literature on the connection between walking and financial incentives is rather limited.

Table 1. Financial incentives to promote walking behavior.

Research	Nr of Participants	Participant Age/Status	Duration	Location	Intervention	Incentive
Adams et al., 2017 [64]	96	18–60	4 months	USA	Alteration in the number of steps/days	Gift cards/charity
Eric A. Finkelstein et al., 2008 [65]	51	50+	4 weeks	Durham, North Carolina	Number of weekly aerobic minutes	Fix payment
Kullgren et al., 2014 [66]	92	65	24 weeks	Pennsylvania	Daily walking goals	Enter to lottery
R. Burns and Rothman, 2018 [56]	153	Undergraduate students	8 weeks	USA	1000 steps per day goal	Cash reward/deposit contract
Komiya et al., 2022 [63]	16,816	40–75	17 months	Takaishi City, Japan	Number of daily steps	Gift certificates
E A Finkelstein et al., 2016 [57]	800	21–65/Full-time worker	12 months	Singapore	70,000 steps per week goal	Cash reward, charity payment
Hunter et al., 2018 [60]	853	18–65/Employees	13 months	Northern Ireland	1 point–1 min. of activity	Points to redeem
Omran et al., 2018 [59]	69	Employees	11 weeks	Canada	Alternation in the number of steps/days	Fix payment
Patel et al., 2016 [62]	304	Employees	26 weeks	Philadelphia	7000 steps per day goal	Fix payment
Patel et al., 2016 [61]	281	18+/Employees	26 weeks	Pennsylvania	7000 steps per day goal	Gain, lottery, loss
Harkins et al., 2017 [67]	94	65+/Retired	20 weeks	Philadelphia	50% increase in daily steps	Fix payment, donation, combined, or feedback

Notably, the majority of these studies were conducted for a short duration, typically less than a year. This choice of shorter-term interventions suggests a practical approach to assessing the impact of incentives on walking. Simultaneously, it reflects an interest in evolving strategies for promoting physical activity.

Geographical diversity is another feature of these studies. This underscores the significance placed on encouraging walking as a healthy behavior. An underlying theme that emerges is the commonality of interventions focused on altering the number of daily steps. This suggests that encouraging individuals to increase their step counts remains a prevailing strategy to incentivize walking behavior across populations.

Upon further examination of these research studies, a positive influence was consistently observed by the majority of the sample populations during the intervention periods due to the provision of financial rewards. However, as the programs reached their conclusion, a decline in behavior was noted as it deviated from the desired goal behavior. It is noteworthy that the post-incentive period was not specifically addressed in most of the studies, resulting in a gap in our understanding of how individuals reacted after the incentives stopped. Nevertheless, in those studies that did investigate this phase, a distinct regression to previous behaviors was observed, emphasizing the significance of considering the long-term sustainability of behavioral changes induced by financial incentives [56,57,59,61,66,67].

Furthermore, there is an imperative need to underscore the importance of evaluating the sustainability and impact of such programs, with an extension of the assessment period to at least 12 months beyond the incentive phase, as recommended by Luong et al. [68]. These insights, which incorporate financial incentives, shed light on the strategies aimed at promoting healthier and more active lifestyles.

In all the investigated studies, no connection was identified among the health benefits, incentives, and proposed interventions. Although the majority of the studies emphasize the significance of walking for human health, with some even factoring in BMI when selecting their sample, none of them revealed any noticeable changes in BMI or other health measurements as a result of the interventions. This lack of correlation highlights a critical gap in the existing body of literature. The research does not provide a comprehensive understanding of how and to what extent these interventions improve human health. This deficiency in empirical evidence necessitates in-depth investigations of the relationship between incentives, interventions, and their impact on human health.

Policymakers should acknowledge the wide availability and accessibility of walking apps. Leveraging the diversity of rewards they offer, including gift cards, discounts, cash rewards, charitable donations, and promotional items, provides an opportunity to incentivize and motivate users effectively. Furthermore, the synchronization of these apps with fitness apps enhances measurement accuracy, making it crucial for policymakers to encourage such integrations. Personalization and user-centric design to provide incentives based on travelers' needs and habits should also be considered and supported to enhance the walking experience and optimize the provision of incentives. To encourage broader adoption and maximize public health benefits, policymakers may consider supporting the development and promotion of these apps while also ensuring transparency of financial incentives within such platforms.

5. Supporting Applications

Numerous apps and reward programs that encourage walking and the use of public transport modes or/and other forms of active mobility exist at the global level. One of these programs is "Bicycle Benefits" [69], which was first introduced in Bozeman, Montana, and later expanded to other states, including California, Michigan, Oregon, and Utah. The main goal of this program is to motivate people to choose bicycling or walking instead of relying solely on motorized transport. Participants can purchase a sticker to enjoy benefits in the form of discounts, reduced fares, or even free tickets for public transport in certain cities. These initiatives aim to promote sustainable transport, reduce traffic congestion, and encourage physical activity. In Helsinki, Finland, a program called "Whim" or "MaaS" (Mobility as a Service) was launched by Helsinki Regional Transport (HSL), which manages the public transport network [70]. It encourages users to choose sustainable transport by rewarding them with Whim points when they choose to walk to their preferred transport mode. These points can be redeemed for discounted fares or even free tickets for public transport within the HSL-managed network. The Whim application aims to encourage active commuting, reduce car use, and provide flexible transport options for residents of the greater Helsinki area.

Based on the above studies, it appears that economic incentives may be effective in promoting walking behavior among older adults, but their effectiveness may be short-term, regardless of the level of the incentive. The usefulness of behavioral economics in promoting healthy lifestyles and the role of technological advancements in monitoring and incentivizing physical activity were highlighted by Mitchell et al. [71]. The incentives offered today depend partly on data received by smartphones or wearable devices and health trackers [72]. For example, the launch of Apple's iOS Health Kit application, which converts accelerometer data into health information, has enabled the measurement of a wider range of physical activity outcomes, such as the number of steps per day. Financial incentives are correlated with increased active mobility, specifically for commuting by walking or cycling [6]. As a result, many applications have been developed to encourage walking by rewarding users in various ways. These applications aim to provide incentives that motivate users to engage in regular physical activity and improve their overall health and well-being. Table A1 placed in the Appendix A summarizes reward apps in the literature and aggregates information regarding the type of exercise for which app users are rewarded, the country in which it can be used, the operating system, the type of reward,

the connectivity/synchronization with other fitness apps, and payment options to own the app or participate in a reward program.

In total, 18 rewarding walk apps were identified. All these apps are designed for recording walking and other physical activities such as running and biking. Among them, 17% exclusively record walking. In terms of geographical coverage, the majority of the apps were found to operate globally (61%), while the remainder primarily serve users in the US, UK, or Canada. Overall, 94% of these apps are accessible on both Android and IOS platforms, ensuring accessibility for a wide range of users.

An important aspect is the type of rewards they offer, which serve as incentives for users. Many of these apps provide a combination of incentives, and the percentages represent how many apps offer each type of incentive, without considering combinations. Specifically, 44% of the apps reward users with gift cards, 39% with discounts, 28% with cash rewards, 22% with donations to charities, and 22% with offers for promotional items. Furthermore, 83% of the apps synchronize with fitness apps, enhancing the accuracy of measurements. In terms of pricing models, the majority of them are free to use (61%), while 22% include paid upgrades, and 17% require money to participate similar to betting money.

In summary, these apps that reward walking offer flexibility, accessibility, and a range of incentives to encourage physical activity and promote healthy lifestyles among users. Users can choose apps based on their preferences for rewards, pricing models, and geographical coverage.

6. Discussion

The research presented in this study reviews the health benefits of walking while exploring the effectiveness of financial incentives in promoting walking behavior. This section discusses findings and highlights the role that existing applications may play in measuring the impact and sustainability of incentive-driven interventions to promote regular walking.

The findings indicate that walking, as a common and easily integrated form of physical activity, has the potential to improve public health. The literature shows that mortality rates decrease, especially among individuals with pre-existing conditions such as diabetes, and that walking may be used as a prevention strategy against cardiovascular disease. Moreover, health benefits including reduced hypertension, cholesterol levels, and obesity, as well as improved musculoskeletal health, aerobic capacity, and joint flexibility, have been consistently related to walking. Furthermore, walking appears to have a positive impact on osteoporosis and colon cancer. In addition, a sedentary lifestyle is associated with the risk of several health problems, highlighting the importance of regular physical activity. Furthermore, the literature indicates that the promotion of walking, the provision of incentives, and the simultaneous monitoring of participants' activity can be effectively achieved with the use of apps [6].

Improved cognitive function has consistently been linked to walking, beyond its physical advantages. Evidence in the literature suggests that improvements in memory, cognitive speed, attention, and motor skills are associated with increased cardiovascular fitness resulting from walking. Furthermore, a pivotal role in addressing cognitive decline is played by walking, with the preservation of cognitive function being demonstrated with long-term regular physical activity, including walking, particularly among older individuals. Regarding mental health, a positive correlation was found between walking, anxiety, and depression symptoms. Additionally, enjoyment of the environment during walks contributes to reduced stress, increased relaxation, and improvements in mood and self-esteem.

Our review of the incentives for promoting walking aimed to explore their effectiveness and record the duration of potential changes in walking behavior. Among the different types of incentives studied, cash rewards were found to be the strongest motivator for regular walking activities. Cash rewards, distributed at fixed intervals, have demonstrated remarkable effectiveness in numerous studies. These incentives provide individuals with

tangible monetary benefits, reinforcing their commitment to walking as a positive habit. In addition to cash rewards, the literature also explores other incentive mechanisms, including immediate gratification, lottery-based rewards, bonding agreements, and loss incentives. These different approaches address different motivational factors and highlight the flexibility of financial incentives in promoting walking behavior.

Another notable trend in the literature is the relatively short duration of financial incentives, typically lasting less than a year. Researchers often opt for short-term interventions to assess the immediate impact of incentives on individual walking habits. There is a limited number of studies that look at the period after financial incentives end. While incentives consistently yield positive results during the intervention phase, there is a gap in our understanding of how individuals maintain their walking habits once incentives are no longer in place. Therefore, a critical implication for policy is the need to develop strategies that support the sustainability of walking habits once these incentives are no longer in place. Policymakers should focus on post-incentive interventions and explore mechanisms to ensure that individuals maintain their walking routines, thereby realizing enduring health and well-being benefits.

Finally, a major gap in the existing literature is the lack of correlation between incentives, interventions, and their effects on health. Despite the emphasis on the health benefits of walking, including factors like BMI in sample selection, none of the studies found noticeable changes in health measurements. This highlights the need for further in-depth research to fully understand how incentives improve human health beyond economic benefits.

7. Conclusions

The present literature review aimed to collect and present data regarding walk benefits and incentives. The results were grouped into benefit categories, financial incentives, and joint incentives (i.e., financial and other incentive types) and their effectiveness. This presentation provides a better understanding of walking and the mechanisms that have been used in the literature to promote walking to achieve the desired benefits.

In summary, physical activity in natural environments is associated with improved physical health and mental well-being. As walking benefits are now recognized not only by scientists in various disciplines but also by the general public, one of the greatest challenges is to achieve effective cross-sector collaboration between the health and transport sectors. Clearly, the transport sector has the most direct impact on shaping and improving the environment and conditions for walking, and optimized infrastructure design should integrate user sensitivity to walk to different city opportunities [73].

The plethora of walking apps that currently exist is an additional source of data that can be used to understand walking behavior at the local level and encourage people to walk with the information they provide (i.e., step counts). The provision of incentives, however, is an additional mechanism that appears to contribute significantly to walking, at least for the time that these incentives are active.

The results of this study suggest that the use of financial incentives to promote walking among older adults should be carefully designed, taking into consideration factors such as the amount of the incentive, the duration of the intervention, and combinations with other types of incentives. Further research is needed to better understand the most effective strategies for promoting physical activity among different group ages and to tailor interventions based on individual characteristics and preferences.

To conclude this literature review, it is essential to recognize the existing gaps and suggest future research directions for the interplay among walking, health benefits, and financial incentives in urban areas. In particular, current research linking walking to financial incentives is relatively scarce. This gap underscores the need for future studies that shed more light on this relationship and allow for the development of more effective incentives. Such research will help to develop strategies that not only encourage walking but also match individual preferences and motivations.

In addition, there is a need for rigorous research both before and after the implementation of demonstration or pilot studies. This approach is crucial to establish a solid empirical link between health benefits, incentives, and proposed interventions. By comparing pre- and post-intervention data, researchers can gain invaluable insights into the effectiveness of different strategies, driving the development of more effective interventions to promote walking in urban environments.

Another important area for future research is the conduct of stated preference experiments. These experiments are essential to estimate the value of time, a key component in assessing urban dwellers' willingness to choose walking over other modes of transportation. Understanding individuals' perception of the value of time at a local level can lead to the development of tailored algorithms, which in turn can be used to provide local incentives for walking that are both attractive and practical for the target group.

Finally, the use of customized algorithms to create incentives should be a priority in the development of future applications. These algorithms should be sophisticated enough to take into account individual differences in preferences, lifestyles, and motivations. Using such technology, urban planners, and policymakers can offer more personalized and effective incentives, promoting walking as a viable and attractive mode of transport in the urban environment. This approach not only holds promise for improving public health but also contributes to the broader goals of sustainable urban development and environmental protection.

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Appendix A

Table A1. Summary of popular fitness reward applications.

App Name	Tracking Activities	Country	Operating System	Reward Type	Syncs with Fitness Apps	Price
Charity Miles [74]	Walking, running, and bicycling	Global	Android (2.8/5.0); IOS (4.8/5.0)	Money for donation to charities	Yes (e.g., Apple HealthKit, Fitbit, and Garmin)	Free
Evidation [75]	Walking, running, bicycling, swimming, weightlifting, meditating, sleep tracking, and food logs	Global	Android (3.9/5.0); IOS (4.6/5.0)	Points for cash, direct deposit, gift cards, and donation to charities	Yes (e.g., Samsung Health, and RunKeeper)	Free
HealthyWage [76]	Any weightloss activities	Global	Android (4.6/5.0); IOS (4.8/5.0)	Cash prizes	Yes (e.g., Apple Health, Garmin, and Google Fit)	Money to participate in weight loss fitness challenges
FitPotato [77]	Walking	Global	Android (3.0/5.0); IOS (4.2/5.0)	Cash for reaching step goals	Yes (e.g., Apple Health)	USD 5 to receive a cash award
Walgreens Balance Rewards [78]	Walking, running, gym workouts, weight, and other health data	USA	Android (3.9/5.0); IOS (4.8/5.0)	Points redeemable at Walgreens stores or online	Yes (e.g., Walgreens Activity Tracker, Lifesum, and Health Kit)	Free
PK Rewards [79]	Walking, running, biking, and all Apple Watch workouts	Global	Android (4.0/5.0); IOS	Rewards from brands, coins in exchange for prizes such as trips, apparel, and gift cards	Yes (e.g., Monitor, Scosche Rhythm +, Fitbit, and Garmin)	Free, but paid upgrades available
Sweatcoin [72]	Walking and running	Global	Android (4.4/5.0); IOS (4.6/5.0)	Cryptocurrency rewards converted into physical cash or coins to redeem as various products or gift cards	Apple Watch	Free, but paid upgrades available
Higi [80]	Any physical activity and other health data	USA	Android (4.1/5.0); IOS (4.4/5.0)	Discounts and promos	Yes (e.g., RunKeeper, Omron, Garmin, and iHealth)	Free
BetterPoints [81]	Walking and other physical activities	UK	Android; IOS (3.5/5.0)	Gift cards, charity donations, and prize-draw entries	No (the app tracks steps or activity with the phone's GPS)	Free
Runtopia [82]	Walking and running, step counting	Global	Android (4.2/5.0); IOS (4.7/5.0)	Points for Paypal cash prizes, gift cards, and fitness gear to buy from an app store	Yes (e.g., Garmin and TomTom)	Free, but paid upgrades available
Stepbet [83]	Walking and any other step counting exercise	Global	Android (4.6/5.0); IOS (4.7/5.0)	Money for achieving step goals	Yes (e.g., Apple Watch, Fitbit, and Garmin)	Money betting
MapMyFitness [84]	Walking, running, bicycling, and other workouts	Global	Android (4.7/5.0); IOS (4.8/5.0)	Discount on Under Armor products	Yes (e.g., Strava and RunKeeper)	Free, but paid upgrades available
Carrot [85]	Walking	Canada	Android (3.5/5.0); IOS (4.5/5.0)	Points for retail goods, travel rewards, and groceries	Yes, but not necessary (e.g., Apple Watch)	Free
Lympo [86]	Walking, running, and gym workouts	Global	Android (3.0/5.0); IOS (4.5/5.0)	LYM Tokens in exchange for tech, sports products, and services	No	Free
FitFetti [87]	Walking, active minutes	Global	IOS (4.5/5.0)	Money to spend on goods or services on Amazon	Yes (e.g., Apple Watch and Fitbit)	Free
MOVES + [88]	Walking, running, bicycling, and swimming	University of Nottingham	Android (no rankings); IOS (2.2/5.0)	Points redeemed for prizes within the app	Yes (e.g., Withings, Fibit, Strava, and App health app)	Free
Bitwalking [89]	Walking	UK, US Japan, Malawi, and Kenya	Android (4.8/5.0); IOS (3.7/5.0)	Money for spending in the Bitwalking store	Yes	Free

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