Is Scotland Walking in the Right Direction? A Cross-Sectional Analysis of Trends in Walking by Socioeconomic Status

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Background: Walking is a key target behavior for promoting population health. This paper charts the 30-year history of walking policy in Scotland. We assess whether population walking levels among adults in Scotland have changed in recent years and identify the characteristics of those least likely to report any walking. Methods: We pooled 9 years (2012–2019 and 2021) of data from adult (≥16 y) respondents of the Scottish Health Survey (n = 41,470). The outcomes of interest were the percentage reporting (1) any walking and (2) any walking with an average pace that is of at least moderate intensity. We also investigated the contribution of walking to total nonoccupational moderate to vigorous physical activity. We used linear and logistic regressions to test linear trends over time and to identify inequalities by age, sex, and the Scottish Index of Multiple Deprivation quintile.

Results: There was an increase in all measures of walking over the period 2012–2021; for example, the percentage reporting any walking increased by 7 percentage points (81.4%–88.4%). Inequalities still exist by age, sex, and the Scottish Index of Multiple Deprivation but have not grown over time. Inequalities by sex and age are most pronounced in the least affluent quintile; less affluent older women are least likely to report any walking. Conclusions: Scotland appears to be walking in the right direction. Surveillance data support a positive trend after decades of policy and promotion efforts. The policies do not appear to be exacerbating existing inequalities, but narrowing them will require more concentrated efforts.

Keywords: policy, surveillance, health disparities

Physical activity has been described as the “best buy in public health.”1 Walking and wheeling (the action of moving as a pedestrian) are one of the most accessible forms of physical activity that the majority of the population can undertake as part of their daily routine with minimal adverse effects.2 It is also considered one of the most equitable activities to promote, requiring no specialist equipment or facilities beyond the mobility aids needed for everyday living. Literature reviews have established the physical and mental health benefits of walking,3–5 while the wider planetary health benefits of swapping motorized travel for active travel (predominantly walking or cycling) are being explored.6

Since the 1990s, walking-specific policies have never been far from the policy agenda in Scotland (Figure 1). However, it was not until 2014 that the necessary stakeholder support to align was achieved and resulted in the publication of the National Walking Strategy.7 This publication was created with a working group representing a number of sectors in Scotland including national and local government, health, walking and active travel, transport, sport, and nature, greenspace, and forestry. The 3 aims of that strategy were: to create a culture of walking; to develop better walking environments; and to support easy, convenient, and independent mobility for everyone.8 This has been followed up by an Action Plan in 20169 and a doubling of the active travel budget in 2019.10

An important question is the effect these policies and strategies have had on national/population walking levels. However, assessing changes in walking prevalence using national survey data is challenging as the published statistics are domain specific (ie, recreation or travel). The Scottish Household Survey showed that the percentage reporting walking for recreational purposes for at least 30 minutes in the last month has increased from 65% in 2007/08 to 78% in 2019 among the most affluent quintile, and from 44% to 57% among the least affluent quintile.11 Meanwhile, indicators of walking for travel show a mixed picture. The percentage reporting walking as their main mode of travel to work has ranged between 11.8% and 13.6% between 2009 and 2019 but with no clear trend.12 The percentage of journeys under 2 miles undertaken by foot showed a broadly decreasing trajectory from 51% in 2014 to 48% in 2019, but with fluctuations down to as low as 43% in 2018.13

The Scottish Health Survey (SHeS) asks respondents about the duration, frequency, and intensity of walking with no distinction by domain.14 Data on total walking levels are not published but instead combined with other types of reported activity to estimate the proportion meeting the physical activity guidelines. Therefore, the aim of this paper is to evaluate the levels and trends of walking for all purposes among adults in Scotland, highlighting differences by socioeconomic status, sex, and age. The focus on these characteristics aligns with the legal requirement for public bodies in Scotland to pay due regard to how they can reduce inequalities.15 Specifically, we will investigate the trends between 2012 and 2021 in

- the percentage reporting any walking (>0 min/wk),
- the percentage reporting any walking (>0 min/wk) with an average pace that is of at least moderate intensity,
- mean minutes per week of walking among those with an average pace of at least moderate intensity,
- the mean percentage contribution moderate-intensity walking makes to total nonoccupational moderate- to vigorous-intensity physical activity (MVPA).
Figure 1 — Part A: A timeline of policy, practice, surveillance, and other events relevant to walking policy in Scotland. Part B: A timeline of policy, practice, surveillance, and other events relevant to walking policy in Scotland. Created with biorender.com.
We will also identify the characteristics of adults least likely to have participated in walking over this period.

Methods

Data Source

We pooled 9 years (2012–2019 and 2021) of the SHeS data obtained from the UK Data Archive.16 Earlier data are not comparable due to questionnaire differences. The SHeS is a multistage stratified survey that is nationally representative of the population living in private households. Data are collected throughout the whole year. Our sample consisted of n = 41,470 adult (aged ≥ 16 y) respondents over the 9 years. Respondents were excluded if they were missing any physical activity variable (n = 177) or had an implausible total equivalent to >16 hours per day (n = 8).

Walking Measurement

Data were collected via an interviewer-led computer-assisted interview undertaken in the respondent’s household.17 The same questionnaire was undertaken over the phone in the 2021 survey.18 Respondents were asked how many days they had walked continuously for at least 10 minutes in the last 4 weeks. They were also asked how many days they walked more than once and their average walk duration. Respondents were then asked whether their usual walking pace was slow, steady average, fairly brisk, or fast pace. Those ≥65 years old were also asked whether walking at their usual pace made them breathe faster, feel warmer, or sweat.

The average weekly duration of moderate-intensity walking was calculated in line with SHeS processing protocols. This multiplied the reported frequencies and durations for all those whose usual walking pace was fairly brisk or fast. Respondents were assumed to walk twice on days they walked more than once. If those ≥65 years reported that their usual walking pace made them breathe faster or sweat, their reported walking was included even if they reported it to be slow or steady average. The average weekly duration of all intensities of walking was also calculated without the intensity criteria described above.

Other Domains of Physical Activity

The full SHeS physical activity questionnaire has been described in detail elsewhere.14 Briefly, in addition to walking described above, respondents were asked to report the frequency and duration of activity in the past 4 weeks of all the following domains of activity: heavy housework, gardening, do-it-yourself home maintenance, sport, and exercise. We did not include occupational activity in this analysis as it is measured using a crude categorical question (see Strain et al14 for more discussion). Heavy housework, gardening, home maintenance, and DIY were all considered moderate intensity and combined with activity at work to form a domain of “work and household activity.” Sport and exercise activities were divided into sport, cycling, exercise and fitness, and leisure and outdoor (Supplementary Table S1 [available online]).

Certain sport and exercise activities were considered vigorous.18 These were determined by reference to the Compendium of Physical Activities19 with a follow-up question on relative intensity if the activity could span a range of intensity levels. Minutes of vigorous-intensity activity were doubled, in line with the equivalencies described in the UK Chief Medical Officers’ guideline on aerobic activity (150 min of moderate-intensity activity or 75 min of vigorous, or an equivalent combination).20

The relative contributions of the 3 domains to total activity were calculated. As per previous research,14,21 this was calculated for each individual before creating population and subgroup averages. This method ensures that the individuals contribute equally to population averages regardless of total physical activity. Other methods that pool all reported activity before calculating the relative contribution are disproportionately influenced by those reporting higher levels of activity. Note that those that report 0 minutes per week of activity do not have any influence on the average relative contributions.

Demographic Variables

Age and sex were reported during the interview. Age was divided into categories of 16–39, 40–64, and ≥65 years. The Scottish Index of Multiple Deprivation (SIMD) score was derived from the respondent’s postcode and reflects area deprivation across income, employment, health, access to services, crime, and housing.22 This score was divided into quintiles for analysis. There were no missing data in any of these covariates.

Statistical Analyses

We tested for linear trends over time using logistic regression (the percentage reporting any walking, the percentage reporting any walking with an average pace that is of at least moderate intensity, and the mean percentage contribution moderate-intensity walking makes to total nonoccupational MVPA) and linear regression (the mean minutes per week of walking among those with an average pace of at least moderate intensity). The contribution of walking to total MVPA was nonnormally distributed but no transformations dealt with the high zero spike. Surveys were grouped into bands of 2 years where possible to minimize volatility due to sampling. We repeated the analyses including main effect and interaction terms for SIMD, sex, or age.

Next, we pooled the data from all years to investigate the differences in the walking outcomes by SIMD and a 6-category variable profiling the different sex/age group combinations. We used logistic and linear regression as appropriate and included an interaction term between SIMD and the sex/age variable.

All analyses were weighted and accounted for the sample design in the variance estimation. Analyses were performed in Stata (version 16), and figures were produced in R Studio using ggplot2.23

Results

Participant Characteristics

The total weighted sample size was n = 41,832 (unweighted n = 41,470), of which 51.9% were female. There were 36.4% aged between 16 and 39 years, 41.5% between 40 and 64 years, and 22.1% over 65 years in the weighted sample.

Trends in Walking Between 2012 and 2021

All measures of walking indicate an increase over the period 2012–2021 (Table 1). The percentage reporting any walking has increased from 81.4% to 88.4%, while the percentage reporting any walking with an average pace that is of at least moderate intensity has increased from 40.8% to 47.4%. The mean minutes per week of walking among those with an average pace of at least moderate intensity have increased from 126.4 to 186.6, and the mean relative
contribution of walking to total nonoccupational MVPA has increased from 25.3% to 31.7%.

Trends in Walking by SIMD, Sex, and Age Between 2012 and 2021

Figure 2 and Supplementary Table S2 (available online) show the trend in the percentage reporting any walking (for all walking speeds and for those reporting an average pace that is of at least moderate intensity) across the SIMD quintiles, sex, and age groups between 2012 and 2021. For almost all SIMD, sex, and age subgroups, there was an increasing trend over time across both measures. This is evident from the significant trend over time in the reference categories and the lack of significant interactions between subgroup and time. The main exception was the stable percentage of those reporting walking with an average pace of at least moderate intensity among 16- to 39-year-olds; the significant interaction terms for the older 2 age groups suggest an increasing trend in these age groups. Another exception was a significant interaction between the third SIMD quintile and the trend in the percentage reporting any walking. On closer inspection, this appears to be due to a J-shaped trend over time rather than the monotonically increasing pattern that is evident across other quintiles.

There was a clear gradient in both measures of walking participation by SIMD quintile with the highest participation levels evident in the most affluent quintile. There was no evidence of a difference in the percentage reporting any walking between men and women when all walking paces were considered; when restricted to those reporting an average pace that is of at least moderate intensity, men reported significantly higher participation levels. Meanwhile, there was a clear age gradient in the percentage reporting any walking. The difference between the oldest 2 age groups disappeared when restricting the analysis to those with an average pace of at least moderate intensity. This is likely due to the additional criteria allowing the over 65 seconds to count slower paces as moderate intensity if it made them feel out of breath.

Trends in the Absolute and Relative Contributions of Walking to Total MVPA by SIMD Quintile

Figure 3 and Supplementary Table S3 (available online) show the mean minutes per week of walking among those with an average pace of at least moderate intensity and the mean percentage contribution moderate-intensity walking makes to total nonoccupational MVPA by SIMD quintile. Other domains are shown for context. As with walking participation metrics described above, both of these walking metrics increased between 2012–13 and 2021. Again, the more affluent quintiles reported higher levels of moderate-intensity walking (mean minutes per week) compared to the less affluent, but there was limited statistical evidence of a difference in the relative contributions. These ranged between 25% and 27% in 2012–13 and 27% and 35% in 2021.

Identification of Subgroups Least Likely to Report Participation in Walking

Figure 4 and Supplementary Table S4 (available online) show that the subgroup least likely to report any walking was women over 65 years in the least affluent quintile (all data from 2012 to 2021 combined). Women aged 16–39 years in the most affluent quintile were most likely to report any walking. The difference in the percentage reporting any walking between women aged 16–39 years and women over 65 years was widest in the least affluent group and narrowest in the most affluent group.

Men aged 16–39 years in the most affluent quintile were the most likely to report any walking with an average pace of at least moderate intensity. Men and women over 40 years in the least affluent quintile were the least likely. However, the age-related differences must be interpreted with caution given the different criteria for the over 65 seconds in determining whether their average pace was of moderate intensity. Again, the differences in participation between sex/age subgroups were narrower in the most affluent quintile and wider in the less affluent quintiles.

Supplementary Figure S1 (available online) and Supplementary Table S5 (available online) indicate that while the mean minutes per week of walking with an average pace of at least moderate intensity are lowest among women over 65 years in the least affluent quintile, the relative contribution walking makes to total nonoccupational MVPA is highest in this group out of all SIMD–sex–age subgroup combinations.

Discussion

Our results suggest that there has been an increase in walking in Scotland between 2012 and 2021. This is the case no matter what metric of walking is used. The relative contribution of moderate-
Figure 2 — Trends in walking participation by SIMD, sex, and age among adults in Scotland, 2012–2021. Data including CIs and \( P \) values are shown in Supplementary Table S2 (available online). A brisk or fast average walking pace is considered of moderate intensity for all age groups; slower paces reported by those over 65 years are also considered if it makes them sweat or out of breath. Number of symbols indicates the magnitude of the \( P \) value: *** \( P < .001 \), ** \( P < .01 \), * \( P < .05 \) (applies to all symbols). Symbol type indicates the comparison: *linear trend over time is significant (applies to reference category only); ^model predicted prevalence in 2012–13 (may differ from observed values shown in table) significantly different from reference category; #interaction is significant indicating a different trend over time to the reference category. SIMD indicates the Scottish Index of Multiple Deprivation.
Figure 3  Trends in the absolute and relative contribution of walking and other domains to non-occupational MVPA by SIMD among adults in Scotland, 2012–2021. MVPA indicates moderate to vigorous physical activity; SIMD, Scottish Index of Multiple Deprivation. 
Figure 4 — Levels of walking participation among age and sex groups by SIMD status, combining data from 2012 to 2021. Data including CIs and P values are shown in Supplementary Table S4 (available online). A brisk or fast average walking pace is considered of moderate intensity for all age groups; slower paces reported by those over 65 years are also considered if it makes them sweat or out of breath. Number of symbols indicates the magnitude of the P value: ***P < .001, **P < .01, *P < .05 (applies to all symbols). Symbol type indicates the comparison: *prevalence is significantly different from most affluent quintile (applies to reference category of men 16–39 y only); ^prevalence in most affluent quintile significantly different from reference category of men 16–39 years; #interaction is significant. This can be interpreted as either the difference between the specific age/sex category and the reference (men 16–39 y) is not the same as in the most affluent quintile, or the difference between the specific SIMD quintile and the reference (most affluent) is not the same as in men 16–39 years. SIMD indicates the Scottish Index of Multiple Deprivation.
intensity walking to total nonoccupational MVPA has also increased over this period. These increases have been consistent across almost all socioeconomic, sex, and age groups, meaning the existing inequalities still persist even if they have not worsened. Differences by sex are only evident when considering those reporting an average walking pace of at least moderate intensity. Our results show that the inequalities by sex and age are most pronounced in the least affluent quintiles, with less affluent older women the least likely to report any walking.

It is not appropriate to attempt to conclusively link the positive trends in walking to the concurrent policy developments. However, it is likely that having consistent policy developments and implementation initiatives over multiple decades has enabled the trends identified in this paper. We acknowledge that several members of the authorship team have advocated for and been involved in the development and implementation of walking policies over a number of decades, but these experiences offer unique insights that may assist those wishing to learn from Scotland’s trajectory.

While the 2014 National Walking Strategy is a key landmark that has encouraged and enabled numerous walking promotion initiatives, one could see it as the inevitable product of decades of walking promotion efforts, rather than being a catalyst itself. This view is somewhat supported by our data that show an increasing trend in walking levels before 2014. Scotland first consulted on a walking strategy in 2004. The year before, Scotland had published its first physical activity strategy and had also passed a Land Reform Act establishing the “right to roam” (responsible public access to most land in Scotland for recreational purposes). The potential for walking to contribute to increasing physical activity levels seemed obvious. On the other hand, there was resistance from stakeholders feeling they were already doing enough to develop the core path infrastructure and that people did not need to be told how to walk. It was challenging to get the health service, local authorities, and transport planners to work together on this issue. Despite this, there remained considerable efforts to promote walking across Scotland despite the nonpublication of the strategy.

One could see the National Walking Strategy publication in 2014 as an exemplar of Kingdon’s multiple streams framework of policymaking. In his theory, Kingdon suggests that change happens when a good policy idea combines with the recognition of a situation that can and needs to be solved and there is the political will to do so. In 2014, there were increasingly numerous examples of walking-specific promotion initiatives such as the Step Count Challenge from Paths for All (a walking charity receiving Scottish Government funding) and the expansion of the Daily Mile, suggesting both the recognition of the situation and policy solutions. The crux, however, was the alignment of a walking strategy with the ministerial agenda. For this reason, we suggest that a walking strategy on its own may not be enough to invoke population-level change. However, it has been an efficient way for Scotland to align existing promotion efforts and encourage cross-sectoral partnerships.

An interesting aspect of our results is the relatively consistent increase in walking across all socioeconomic, sex, and age subgroups. This may be due to the relatively accessible nature of walking in terms of equipment and cost—it is easier for more people to respond to a promotion message or make use of new walking infrastructure compared, for example, to sports requiring specialist equipment or facilities. It is worth noting that the data presented in this paper (Supplementary Table S3 [available online]) suggest sport has not seen such increases over the last decade. Nonetheless, the existing inequalities have persisted suggesting more targeted policies and promotion efforts may be needed. The consistent socioeconomic gradient across all measures of walking is in line with other countries, for example, England, the United States, and China. This is likely to be a result of a combination of individual and environmental factors ranging from self-efficacy and social support to neighborhood esthetics and safety. It may be that more time is needed to detect differences made by programs such as the active travel funding available for social housing providers, launched in 2019. However, efforts should be made to understand why certain combinations of age, sex, and socioeconomic status are such a barrier to walking.

Further insights could be gained from a detailed comparison of the policy landscape and prevalence data in similar countries, such as England or Ireland. A recent critical analysis of walking policy in Ireland suggested a degree of disconnect between national and local level policies. The links between national policy and local level implementation appear to be relatively strong in Scotland with the Scottish Government involving delivery partners in the policy development process. This current situation could be attributed to Scotland regularly taking on board the latest global physical activity policy recommendations: a relevant example could be the efforts made over the last decade to develop cross-departmental partnerships at the national and local levels to support physical activity promotion, as recommended in the Toronto Charter in 2010. Adding to this, Scotland has recently developed its own system-based approach to physical activity based on the World Health Organization’s recommendations in the Global Physical Activity Plan (GAPPA). Milton and Grix analyzed England’s walking strategy using Kingdon’s multiple streams framework and suggested there was a moment in 2008 that resulted in considerable investment in walking. However, it is interesting to note that it took until 2020 for England to publish its own Walking and Cycling Strategy.

It may be instructive for readers to briefly consider the factors that supported Scotland to address actions within GAPPA, specifically in relation to GAPPA strategic objective 4: Create active systems. We speculate that there are a number of factors including multisectoral and organizational collaboration supporting more coherent and aligned national and local policy (GAPPA 4.1) with strong, long-term relationships between research and delivery organizations (GAPPA 4.2). This has in turn supported effective advocacy through multiple channels (GAPPA 4.4). It may also be important that health is a devolved power in Scotland supporting policy development and financing mechanisms (GAPPA 4.5). Further national and regional health surveillance systems have been in place since the 1990s supporting monitoring and evaluation (GAPPA 4.3). Understanding these factors in more detail is an area that warrants further empirical investigation.

**Strengths and Weaknesses**

The strengths of this research are that it is based on data obtained from consistent national surveillance methods, and that we have considered several measures of walking to understand the full picture. One of the key limitations is the imprecision in walking durations given the assumptions that need to be made to sum to weekly totals. Also, only an average walking pace is self-reported, meaning that either individuals count all or none of their walking as moderate intensity, according to the standard processing protocols.
The lack of domain-specific information on walking means there is a need to triangulate between the Scottish Household and Health Surveys to infer changes in purpose-specific walking. Another limitation is the change in the method of survey administration for the 2021 survey (telephone as opposed to face-to-face interview). Although debated, it is thought that remote interview methods are less susceptible to social desirability bias.35,36 As we see an increase in walking in 2021, this does not seem to have strongly influenced the results. Declining response rates over time are also a consideration for all surveys, and there is the potential for this to introduce bias if those who respond are healthier than nonrespondents. To counterbalance this, the SHES used additional recruitment strategies in 2021 (in-person visits to encourage response).18 Furthermore, the weighting strategies used to adjust for nonresponse are extensive and consider numerous covariates that may account for nonresponse rates.

Implications

Based on our results and our experience of the policy landscape over the last 3 decades, our assessment is that the following important lessons may apply: (1) sustained action can lead to population change; (2) there are no silver bullets or single actions that can be said to have led to this, long-term investment is needed; (3) responding quickly and meaningfully to global policy recommendations is worthwhile; (4) change may be incremental and may take a number of years to become obvious through high-quality and consistent surveillance systems; and (5) a range of actions from strategy, to advocacy, to guidelines and policy may be required from a motivated workforce with a diverse set of skills.

Conclusions

Our results suggest that Scotland is walking in the right direction with the surveillance data supporting decades of policy and promotion efforts. The policies do not appear to be exacerbating existing inequalities but more concentrated efforts will be necessary to narrow them.

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