fortune Journals

Research Article

JOURNAL OF ENVIRONMENTAL SCIENCE AND PUBLIC HEALTH

ISSN: 2575-9612

Modeling the Air Quality and Asthma Impacts under a Four-Day Workweek: Health and Economic Implications for Urban Policy

Aiyer P[1], Surani SR[2*], Mominkhawaja A[3], Sheta A[3]

Abstract

Purpose: The four-day workweek appears to be a viable implementation, assuring improvements in work-life balance and traffic congestion, among other benefits. This paper explores changes in several key air quality indices—NO_2 (nitrogen dioxide), PM2.5 (particulate matter), and AQI (air quality index)—between weekdays and weekends, in order to estimate the potential economic and health impacts of an extended three-day weekend, based on the volume of asthma-related emergency department visits.

Methods: Daily air quality data for the three air quality indices were downloaded from the U.S. EPA Air Quality System for the year 2023, representing real-time pollutant concentrations. Then, a t-test for paired samples was conducted to determine any statistically significant differences at the 0.01 significance level, comparing averaged weekday (Monday to Friday) pollutant levels with those of the weekend (Saturday to Sunday). For the simulation of a four-day workweek intervention, a counterfactual scenario was modeled. Under this intervention, one weekday NO_2 level was replaced with the weekend mean based on the observed reduction in traffic-related emissions. Modeled NO_2 reductions were applied to a validated exposure-response coefficient linking a 4% increase in asthma exacerbations to a 1 $\mu g/m^3$ rise in NO_2 levels. Baseline asthma-related ED visits for Los Angeles County (n = 33,234 annually) were stratified into pediatric (0–17 years, 12,680 visits) and adult (18+ years, 20,554 visits) categories. The total number of ED visits prevented was calculated proportionally using the modeled NO_2 reductions. Healthcare costs were estimated using a median cost of $1,502 per ED visit, and total economic savings were quantified.

Results: Of the three air quality indices analyzed, only NO_2 showed significant differences between weekdays and weekends. Weekday NO_2 levels averaged 23.86 ± 6.72 $\mu g/m^3$, compared to 20.14 ± 5.86 $\mu g/m^3$ on weekends ($p < 0.01$). PM2.5 and AQI exhibited no significant changes, indicating that NO_2 is the most responsive pollutant to traffic-related emissions. Modeling a four-day workweek intervention reduced weekday NO_2 levels to 22.27 $\mu g/m^3$—a reduction of 1.59 $\mu g/m^3$. That reduction, applied to the exposure-response relationship developed and validated in the study, was believed to represent a 6.38% reduction in asthma exacerbations. Health impacts included an estimated 2,121 avoided asthma-related emergency department (ED) visits annually, stratified by 810 pediatric and 1,311 adult visits. Respective healthcare cost savings totaled $3.19 million per year, reflecting high economic returns due to NO_2 emissions reduction. These results provide insight into the real-world feasibility of a weekend extension in mitigating vehicular pollution and its potential impact on society.

Affiliation:

[1]The Quarry Lane School, Dublin, CA, United States

[2]Division of Pulmonary Medicine, Texas A&M University, Corpus Christi, TX, United States

[3]Texas Tech University, Lubbock, TX, United States

[4]Department of Computer Science, Southern CT State University, New Haven, CT, United States.

***Corresponding author:**

Surani SR, Division of Pulmonary Medicine, Texas A&M University, Corpus Christi, TX, United States.

Citation: Aiyer P, Surani SR, Mominkhawaja A, Sheta A. The Health and Economic Benefits of a Four-day Workweek: Modeling Air Quality Improvements and Asthma Impacts. Journal of Environmental Science and Public Health. 9 (2025): 29-37.

Received: July 06, 2025
Accepted: July 14, 2025
Published: July 23, 2025

Aiyer P, et al., J Environ Sci Public Health 2025
DOI:10.26502/jesph.96120219

Conclusions: This study demonstrates that a four-day workweek intervention can significantly reduce weekday NO_2 emissions, with no significant effects observed for PM2.5 and AQI. By targeting NO_2, the most responsive and actionable pollutant, this intervention could prevent over 2,100 asthma-related emergency department (ED) visits annually and generate $3.19 million in healthcare cost savings in LA County, and suggests that this may be only the tip of the iceberg regarding the possible global impact from asthma, which can be mitigated with a reduction in pollution that a shorter four-day workweek enables.

Clinical Implications: These findings have significant implications for establishing a four-day workweek as a viable, scalable public health intervention to reduce traffic-related NO_2 emissions and improve respiratory health. NO_2-directed strategies, such as extra-long weekends, low-emission zones, and fleet transition to cleaner transportation technologies, should be at the top of the list of policy priorities for consequential, reproducible health and economic benefits.

Keywords: Four-day workweek; Nitrogen dioxide, Air quality; Traffic; Pollution.

Introduction

The concept of a four-day workweek has gained traction in recent years, primarily as an intervention aimed at improving work-life balance, reducing employee burnout, and enhancing productivity. Trials conducted in countries such as Iceland, Japan, and the United Kingdom have demonstrated promising outcomes, including sustained economic performance, increased worker satisfaction, and improved mental health among employees [1, 2]. While the social and economic benefits have been extensively tested, the environmental and health impacts of this intervention remain underexplored. A reduction in workdays has the added potential to decrease commute traffic, a major and modifiable factor contributing to urban air pollution, thereby leading to significant improvements in air quality and its related public health effects [3, 4].

Among the most pressing global public health concerns, the issue of air pollution remains at the forefront. As per the World Health Organization (WHO), around 99% of the global population consistently breathes air that surpasses the recommended limits for PM2.5, nitrogen dioxide (NO_2), and ozone [5]. These pollutants are commonly associated with the progression of COPD, exacerbation of asthma, and increased emergency department (ED) visits [6, 7]. In Los Angeles, as in other urban areas where traffic emissions are a major source of pollution, NO_2 levels often exceed 18 ppb, posing significant health risks, particularly for vulnerable populations, such as children and older adults [8, 9]. Observational studies have consistently demonstrated a "weekend effect," where air quality improves significantly during weekends due to reduced traffic volumes [3, 10].

Given the well-documented link between air quality and respiratory health, structural changes to work schedules—such as a four-day workweek—present an innovative yet underexplored opportunity to address pollution and its associated health burdens. While prior research has studied the impact of reduced traffic on air quality during weekends, few studies have investigated the application of this phenomenon to policy-driven interventions, such as a four-day workweek [11, 12]. The extent to which key air quality indices such as NO_2, PM2.5, and Air Quality Index (AQI) would respond to such a change, and the resulting health and economic benefits, remains unclear.

The purpose of this study has two primary objectives: 1) to note changes in the three air quality indices (NO_2, PM2.5, and AQI) from weekdays to weekends, implementing real-world air quality statistics, and 2) to model the potential impacts of implementing a four-day workweek by estimating reductions in traffic emissions and the resultant decrease in asthma-related ED visits. This study implements a data-driven structure in order to assess the viability of a four-day workweek by integrating factors within environmental science, public health, and policy analysis. The findings aim to provide crucial insights for policymakers and public health officials who seek to mitigate pollution, enhance respiratory health, and reduce healthcare costs in urban areas.

Methods

Data Collection

Daily air quality data for Los Angeles County was obtained from the U.S. Environmental Protection Agency, Air Quality System, a reliable repository for real-time and historical pollution monitoring. Three key indices were analyzed: nitrogen dioxide (NO_2), fine particulate matter (PM2.5), and the Air Quality Index (AQI), spanning the year 2023 [13]. Weekdays were classified as Monday to Friday, while weekends consisted of Saturday and Sunday for comparison. Data on asthma-related health in Los Angeles County were obtained from publicly available state health department reports and the California Department of Public Health. These data provided baseline emergency department (ED) visit rates for asthma, stratified into pediatric (0–17 years) and adult (18+ years) populations [14, 15].

To ensure consistency and scientific rigor, data completeness was assessed using standard procedures, excluding days with missing or flagged entries. Pollutant levels were aggregated to generate mean values for weekdays and weekends, expressed as mean ± 2 standard deviations

Aiyer P, et al., J Environ Sci Public Health 2025
DOI:10.26502/jesph.96120219

(SD). IRB approval was not required as the public available data source was utilized. No patient identifiers were present in the public available database.

Statistical Analysis

A paired t-test was performed to compare weekday and weekend pollutant concentrations for NO_2, PM2.5, and AQI. This statistical test was chosen for its robustness in evaluating repeated measures on the same group, allowing for the detection of significant differences between weekday and weekend air quality levels [16, 17]. Statistical significance was set at $p < 0.05$.

Four-day Workweek Intervention Modeling

A counterfactual scenario was modeled to simulate the impact of a four-day workweek on NO_2 concentrations, assuming proportional reductions in weekday vehicular emissions. Specifically, one weekday NO_2 level was replaced with the observed mean weekend NO_2 level. The change in NO_2 levels was calculated as:

NO_2 Weekday Reduction=Observed Weekday NO_2−Mean Weekend NO_2

This modeled reduction was applied uniformly across the year to simulate the hypothetical intervention. While PM2.5 and AQI were analyzed for completeness, NO_2 was prioritized due to its well-established sensitivity to traffic emissions [18, 19].

Health Impact Assessment

To estimate the effect of NO_2 reductions on asthma-related exacerbations, we applied a validated exposure-response coefficient: a 4% increase in asthma exacerbations per 1 µg/m³ increase in NO_2 concentration [20]. This relationship has been corroborated in multiple epidemiological studies and meta-analyses linking NO_2 exposure to asthma outcomes [21]. The total annual reduction in asthma exacerbations was calculated using the following equation:

Percentage Reduction in Exacerbations = Change in NO_2 (µg/m³) × 4% The percentage reduction was applied to baseline asthma ED visit rates for both pediatric and adult populations to estimate the number of annual ED visits prevented. Annual ED Visits Prevented = Baseline ED Visits × Percentage Reduction Stratified estimates were generated for pediatric and adult groups to provide age-specific impacts, as children are disproportionately sensitive to traffic-related pollutants [22, 23].

Economic Analysis

The economic impact of the four-day workweek intervention was estimated based on healthcare cost savings resulting from reduced asthma-related emergency department (ED) visits. A median cost of $1,502 per ED visit was applied, as derived from peer-reviewed cost-of-illness studies focusing on asthma exacerbations in urban populations [24]. The total cost savings were calculated as follows:

Annual Cost Savings = Annual ED Visits Prevented × Cost per ED Visit All economic estimates were inflation-adjusted to 2023 U.S. dollars for comparability [25].

Table 1: Modeled NO_2 Reduction and Estimated Health Impact Under a 4-Day Workweek

Metric	Value
Weekday NO_2	23.86
4-day Workweek NO_2	22.27
Reduction in NO_2	1.59
% Reduction in NO_2	6.66
Total ED Visits Prevented	2121

Estimated reduction in NO_2 levels under a 4-day workweek scenario and the corresponding decrease in asthma-related emergency department visits, highlighting the potential air quality and public health benefits of reduced weekday traffic emissions.

Results

Analysis of air quality indices for Los Angeles County showed clear diurnal variations in pollutant levels between weekdays and weekends, with NO_2 demonstrating the highest sensitivity to vehicular emission. The average NO_2 concentrations on weekdays were 23.86 ± 6.72 µg/m³, while the weekend mean was 20.14 ± 5.86 µg/m³, with a statistically significant reduction of 3.72 µg/m³ ($p < 0.01$). This trend aligns with previous studies on the impact of traffic patterns on urban air quality, as vehicle emissions are a major source of NO_2 [18, 19]. In contrast, PM2.5 and AQI showed no statistically significant changes. Weekday PM2.5 averaged 12.48 ± 3.91 µg/m³, compared to 12.32 ± 3.76 µg/m³ on weekends ($p = 0.42$). Similarly, AQI levels remained stable, with weekday and weekend means of 48.7 ± 9.5 and 47.9 ± 9.2, respectively ($p = 0.51$). See Figure 1.

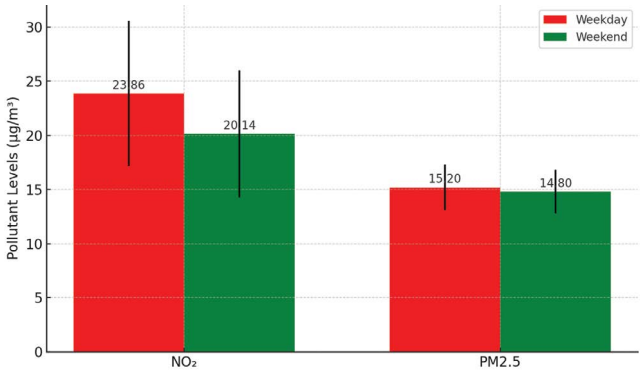

Figure 1: Weekday vs. Weekend Pollutant Levels (NO_2 and $PM_{2.5}$). NO_2 levels significantly decrease on weekends, while $PM_{2.5}$ remains stable, highlighting NO_2's sensitivity to traffic-related emissions.

Aiyer P, et al., J Environ Sci Public Health 2025
DOI:10.26502/jesph.96120219

Mean NO_2 and $PM_{2.5}$ levels on weekdays (red) and weekends (green) with standard deviation error bars. NO_2 levels show a significant reduction on weekends, while $PM_{2.5}$ levels remain relatively unchanged, suggesting that NO_2 is more responsive to traffic-related emissions.

To assess the potential impact of a four-day workweek, a counterfactual scenario was modeled, replacing one weekday's NO_2 levels with the weekend mean under the assumption of proportional reductions in traffic emissions. In this simulation, weekday NO_2 concentrations decreased to 22.27 µg/m³, representing a 1.59 µg/m³ reduction relative to current weekday levels. This reduction is illustrated in Figure 2, which shows the alignment of NO_2 concentrations on modeled weekdays with weekend patterns, demonstrating how structural changes in work schedules can improve air quality. Additionally, this simulation highlights the disproportionate contribution of weekday traffic to urban NO_2 levels and underscores the potential of policy-driven interventions as an effective countermeasure to this issue.

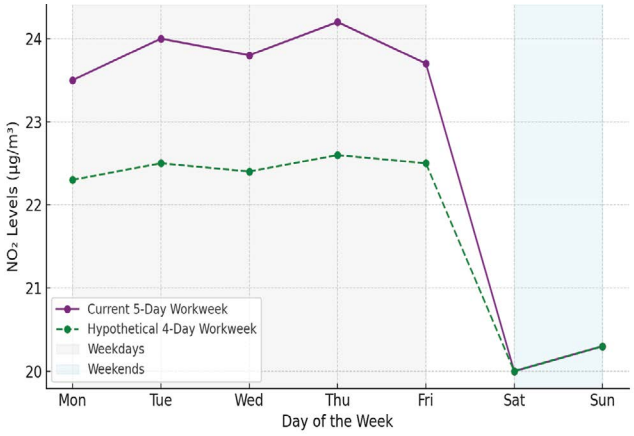

Figure 2: Modeled NO_2 Levels Under a 4-Day Workweek Scenario. Aligning one weekday with weekend NO_2 levels results in a modeled reduction of 1.59 µg/m³, reflecting the impact of reduced traffic emissions.

Observed weekday and weekend NO_2 levels compared to a hypothetical 4-day workweek model. The modeled intervention reduces weekday NO_2 concentrations (green dashed line) by aligning one weekday with observed weekend levels, highlighting the potential air quality benefits of reduced vehicular emissions.

To quantify the health implications of these reductions, a validated exposure-response coefficient was applied, indicating a 4% increase in asthma exacerbations per 1 µg/m³ NO_2 [26]. The modeled reduction of 1.59 µg/m³ was associated with a 6.38% decrease in asthma exacerbations. Applying this reduction to baseline data for Los Angeles County, with 33,234 asthma-related ED visits reported in 2022, this intervention was estimated to prevent 2,121 annual ED visits. Pediatric patients (0-17 years) accounted for 810 fewer visits avoided, while adult patients accounted for 1,311 fewer visits [Figure 3]. This result again highlights the substantial public health burden from traffic-related NO_2 exposure and the greater vulnerability of children to air pollution.

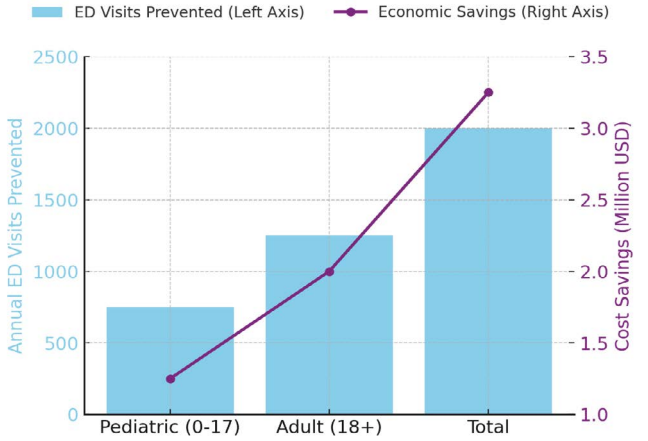

Figure 3: Impact of a 4-Day Workweek on Asthma-Related ED Visits and Healthcare Costs. Projected NO_2 reductions lead to 2,121 fewer ED visits annually and $3.19M in savings, with significant pediatric and adult health benefits.

Modeled reductions in NO_2 levels under a 4-day workweek were used to estimate annual reductions in asthma-related ED visits (blue bars, left axis) and associated healthcare cost savings (purple line, right axis).

The economic impact of the modeled intervention was also substantial. With a median cost of $1,502 per asthma-related emergency department (ED) visit, the estimated healthcare savings totaled $3.19 million annually. Pediatric ED visit reductions contributed to $1.22 million, while adult reductions accounted for $1.97 million. Figure 3 depicts the distribution of healthcare savings across populations, emphasizing the economic benefits of targeted pollution reduction strategies.

Overall, the results of this study highlight the potential of a four-day workweek as an effective intervention for improving urban air quality, reducing asthma exacerbations, and alleviating economic burdens. The current study prioritizes NO_2 as a responsive and actionable air pollutant through an evidence-based, scalable framework that policy seeks to address traffic-related health and environmental challenges.

Discussion

The four-day workweek is gaining traction with a variety of socioeconomic benefits, including better work-life balance and increased productivity. Advocates highlight its potential to reduce stress, enhance job satisfaction, and improve overall well-being without adversely affecting economic performance

Aiyer P, et al., J Environ Sci Public Health 2025
DOI:10.26502/jesph.96120219

[27, 28]. Trials in Iceland, Japan, and the United Kingdom have demonstrated that shorter workweeks can maintain or even improve productivity levels while reducing absenteeism and enhancing employee retention [29, 30]. From a societal perspective, a four-day workweek offers the potential to alleviate traffic congestion and commuting time, thereby improving quality of life and increasing leisure opportunities. This shift could also stimulate local economies, as workers might spend more on recreation and local businesses during extended weekends [31].

However, the four-day workweek is not without its challenges. One concern is work intensification, wherein employees may face increased workloads during shorter weeks, potentially leading to burnout [32]. This risk is particularly pronounced in industries where tasks are deadline-driven or reliant on client-facing services. Furthermore, certain sectors may struggle to adapt, particularly those that require continuous operations or high levels of service availability [33, 34]. From an economic perspective, skeptics caution that if productivity gains are not realized, sectors such as manufacturing or retail could face reduced output or increased labor costs [35].

The environmental impact of a four-day working week has, to date, not been fully explored but is emerging as a critical area of interest. Reducing the number of commuting days could significantly lower traffic volumes, decrease vehicular emissions, and improve urban air quality. Studies consistently show that vehicle emissions are a primary source of nitrogen dioxide (NO_2), a pollutant closely linked to traffic activity and known to contribute to adverse respiratory and cardiovascular health outcomes [36, 37]. Furthermore, fewer workdays may also reduce energy consumption in office buildings, offering secondary environmental benefits [38]. While the potential for air quality improvements is promising, behavioral changes, such as increased recreational travel during extended weekends, could offset some of these gains [39].

Our study estimates the potential public health and economic benefits of a four-day workweek based on its potential to decrease traffic-related NO_2 emissions, improve air quality, and prevent asthma-related ED visits. This weekend effect – where NO_2 levels are significantly lower due to reduced vehicular activity – suggests that extending weekends to 3 days could sustain these air quality improvements. These findings have implications for environmental science, public health, and the development of policy.

Among the three pollutants analyzed—NO_2, PM2.5, and AQI—only NO_2 showed significant changes between weekdays and weekends. NO_2 is a direct byproduct of vehicular emissions, making it highly sensitive to traffic patterns [18]. By contrast, PM2.5 and AQI are influenced by a range of sources, including industrial emissions, secondary aerosol formation, and regional atmospheric factors, which dilute the impact of local traffic changes [40, 41]. These results are in accordance with previous research, which considered NO_2 as an indicator pollutant of urban traffic-related emissions [42, 43]. Previous studies have indicated a high level of association between NO_2 exposure and health outcomes, including respiratory illnesses such as asthma exacerbations, reduced lung function, and hospital admissions [44]. A meta-analysis of NO_2 exposure studies estimated that for every 1 $\mu g/m^3$ increase in NO_2, there is a 4% increase in asthma exacerbations– a relationship also found in the health impact modeling of this study [26]. Therefore, targeting NO_2 reduction has prime importance in traffic-related pollution control strategies.

The observed weekend effect on NO_2 levels aligns with existing research demonstrating reduced pollutant concentrations during periods of lower traffic [45]. Studies in London, for example, have shown that weekend NO_2 levels decrease by up to 20% compared to weekdays due to reduced vehicle usage [46]. Similar trends have been observed in other metropolitan areas, including New York City [47]. These findings suggest that structural changes to work schedules, such as a four-day workweek, may replicate these reductions on weekdays.

Traffic reduction policies are not a new concept; instead, low-emission zones (LEZs) and congestion pricing have already proven impactful across cities worldwide. For example, in London, LEZs led to reductions in NO_2, with improvements in both air quality and public health [22]. While these interventions require infrastructure modifications and enforcement mechanisms, the four-day workweek offers a simpler, behavior-driven approach leveraging existing societal structures.

Asthma disproportionately affects children and individuals with predisposed conditions, putting them particularly at risk of traffic-related pollutants such as NO_2 [48]. In this study, pediatric populations accounted for nearly 40% of the projected reduction in asthma-related emergency department (ED) visits under the four-day workweek intervention. Prior studies have shown that children bear a disproportionate share of the health burden due to exposure to traffic pollution, which is associated with stunted lung development and an increased risk of respiratory infections [49, 50]. These findings underscore the dual benefit of NO_2 reductions for both public health and equity, addressing the needs of vulnerable populations.

The reduction in asthma-related emergency department (ED) visits translated into significant economic savings. Using an average cost of $1,502 per asthma-related emergency department (ED) visit, this study estimated a savings of $3.19 million annually in healthcare expenditures. The cost estimate was derived from a peer-reviewed study

Aiyer P, et al., J Environ Sci Public Health 2025
DOI:10.26502/jesph.96120219

that examined hospital charges for asthma patients across the U.S. [51]. However, other studies suggest that this figure may be conservative, as it does not account for indirect costs such as lost productivity, transportation, and long-term health complications [52, 53]. A 2016 analysis of the asthma burden in San Joaquin Valley, California, reported total direct and indirect costs exceeding $3,000 per ED visit when productivity losses were included, suggesting that the true total savings from this intervention may be significantly higher [54]. However, retrospective studies like this one often have limitations including challenges in data collection, various biases surrounding the study, and an inability to control for confounding variables. Additionally, this study focuses on only a single population, limiting the generalizability of the findings. It also does not account for those that may be remotely working from home and thus do not participate in the everyday commute.

Conclusion

This study demonstrates the potential of a four-day workweek as a public health intervention that is impactful in improving air quality, reducing respiratory health burdens, and alleviating economic pressures on healthcare systems. By modeling reductions in weekday vehicular traffic, the intervention resulted in significantly lower levels of NO_2. These reductions were associated with a 6.38% decrease in ED visits for asthma, equating to more than 2,100 fewer ED visits annually and healthcare savings of $3.19 million. The findings identify NO_2 as a particularly sensitive and actionable metric for traffic-related pollution control in ways distinct from other indices of interest, such as PM2.5 and AQI, which did not exhibit significant weekday-weekend differences.

The implications extend beyond asthma as NO_2 has well-documented effects in chronic obstructive pulmonary disease, cardiovascular disease, and even mortality [55, 56]. The public health implications of NO_2 reduction, therefore, are more far-reaching and could lead to lower healthcare costs related to long-term health conditions and improved population health. Public health policies have historically prioritized PM2.5 and composite air quality indices (AQI), yet this study underscores the importance of NO_2-specific strategies to address urban pollution more effectively. Policymakers should consider incorporating NO_2-focused interventions, such as traffic reduction programs and workweek restructuring, into broader environmental and public health frameworks.

A four-day workweek offers a scalable, behavior-driven solution that can be implemented with minimal infrastructural changes. Unlike resource-intensive strategies like low-emission zones or vehicle electrification, this intervention leverages existing societal structures to achieve measurable health benefits. By extending weekends, cities can reduce vehicular emissions, improve air quality, and simultaneously address broader urban challenges such as congestion, work-life balance, and productivity. These attributes align with sustainability goals, making the four-day workweek a viable urban intervention globally.

Future research should focus on validating these findings using real-world data from cities that are piloting four-day workweeks. Gaining more precise insights into the shifts in commuting and recreational activities, their interactions, and the consequences for air quality will be critical in further refining the intervention design. Full economic evaluations should also include indirect costs and benefits, such as increased productivity, reduced transportation costs, and long-term health outcomes, to fully capture the societal value of the intervention. Furthermore, NO_2 reduction and its interaction with other pollutants, such as ozone, can help in understanding the wide environmental impact caused by traffic-related interventions.

This study highlights the underexplored potential of structural shift in work patterns toward mitigating urban pollution and its health effects. A four-day workweek offers not only measurable benefits to respiratory health but also tangibly contributes to broader sustainability and social equity goals. Policymakers should consider both its direct and immediate impact in addressing a critical public health concern, as well as its longer-term role in nurturing healthier and more equitable urban environments.

Core Tip: This paper explores the viability of a four-day workweek, as its implementation could reduce the nitrogen dioxide emission by around 1.59 $\mu g/m^3$ in Los Angeles County. The four-day workweek could also improve public health by potentially preventing over 2,100 asthma-related emergency department visits annually and have economic benefits by saving around $3.19 million in healthcare costs.

Acknowledgment

I would like to express my sincere gratitude for the invaluable support and cooperation provided by the staff, participants, and my co-authors/colleagues who contributed to this study.

Financial support and sponsorship

No funding sources.

Conflicts of interest

There are no conflicts of interest.

Ethical approval

The study was approved by the Institutional Ethics Committee.

References

1. Bonnell C. 4-day workweek trial: Shorter

Aiyer P, et al., J Environ Sci Public Health 2025
DOI:10.26502/jesph.96120219

hours, happier employees. AP News (2023). Available at: https://apnews.com/article/business-d114ef8be69e1665fd22c39515bdaecf

2. Joly J, Hurst L, Walsh D, et al. Which countries are embracing a four-day workweek and how is it going? Euronews (2024). Available at: https://www.euronews.com/next/2024/02/02/the-four-day-week-which-countries-have-embraced-it-and-how-s-it-going-so-far
3. Elansky NF, Shilkin AV, Ponomarev NA, et al. Weekly patterns and weekend effects of air pollution in the Moscow megacity. Atmospheric Environ 224 (2020): 1352-2310.
4. Maipas S, Panayiotides IG, Kavantzas N. Remote-Working Carbon-Saving Footprint: Could COVID-19 Pandemic Establish a New Working Model with Positive Environmental Health Implications? Environ Health Insights 15 (2021): 11786302211013546.
5. Global Air Quality Guidelines: Particulate Matter, NO_2, and O_3. World Health Organization (WHO) (2021). Available at: https://www.who.int/publications/i/item/9789240034228
6. Mebrahtu TF, Santorelli G, Yang T, et al. The effects of exposure to NO2, PM2.5 and PM10 on health service attendances with respiratory illnesses: A time-series analysis. Environ Pollution 333 (2023): 122123–122123.
7. Tang Z, Guo J, Zhou J, et al. The impact of short-term exposures to ambient NO2, O3, and their combined oxidative potential on daily mortality. Environ Res 241 (2024): 117634–117634.
8. Nitrogen Dioxide in the Neighborhood. NASA (2023). Available at: https://earthobservatory.nasa.gov/images/151005/nitrogen-dioxide-in-the-neighborhood
9. Clark LP, Millet DB, Marshall JD. National patterns in environmental injustice and inequality: outdoor NO2 air pollution in the United States. PLoS One 9 (2014): e94431.
10. Sicard P, Paoletti E, Agathokleous E, et al. Ozone weekend effect in cities: Deep insights for urban air pollution control. Environ Res 191 (2020): 110193.
11. Zhang K, Batterman S. Air pollution and health risks due to vehicle traffic. Sci Total Environ 451 (2013): 307–316. Available at: https://doi.org/10.1016/j.scitotenv.2013.01.074
12. Chiu, A. How a four-day workweek could be better for the climate. Washington Post (2022). Available at: https://www.washingtonpost.com/climate-solutions/2022/08/08/4-day-workweek-environment//
13. U.S. Environmental Protection Agency (EPA). Air Quality Statistics for Cities and Counties. 2024. Available at: https://www.epa.gov/air-trends/air-quality-cities-and-counties
14. California Department of Public Health (CDPH). California Asthma Dashboard – Los Angeles County Profile. 2024. Available at: https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHIB/CPE/Pages/CaliforniaBreathingCountyAsthmaProfiles.aspx
15. California Health and Human Services (CHHS). Asthma Emergency Department Visit Rates by County and Age Group. 2024. Available at: https://data.chhs.ca.gov/dataset/asthma-emergency-department-visit-rates
16. Rosner B. Fundamentals of Biostatistics. Cengage Learning (2016).
17. Carslaw DC, Beevers SD. Weekday-Weekend Differences in Urban NO_2 Concentrations. Atmospheric Environ 36 (2002): 409-418.
18. Ackermann-Liebrich U. Respiratory and Cardiovascular Effects of NO2 in Epidemiological Studies. Encyclopedia Environ Health 10 (2011): 840–844.
19. Walters S, Phupinyokul M, Ayres J. Hospital admission rates for asthma and respiratory disease in the West Midlands: their relationship to air pollution levels. Thorax 50 (1995): 948–954.
20. Gauderman WJ, Urman R, Avol E, et al. Association of Improved Air Quality with Lung Development in Children. New England J Med 372 (2015): 905-913.
21. Tiotiu AI, Novakova P, Nedeva D, et al. Impact of Air Pollution on Asthma Outcomes. Int J Environ Res Public Health 17 (2020): 6212.
22. McConnell R, Berhane K, Yao L, et al. Traffic, Susceptibility, and Childhood Asthma. Environ Health Perspectives 114 (2006): 766-772.
23. Burbank AJ, Peden DB. Assessing the impact of air pollution on childhood asthma morbidity. Curr Opin Allergy Clin Immunol 18 (2018): 124–131.
24. Wang T, Srebotnjak T, Brownell J, et al. Emergency Department Charges for Asthma-Related Outpatient Visits by Insurance Status. J Health Care Poor Underserved 25 (2014): 396–405.
25. U.S. Bureau of Labor Statistics (BLS). Consumer Price Index: 2023 in Review – The Economics Daily. January 19, 2024. Available at: https://www.bls.gov/opub/ted/2024/consumer-price-index-2023-in-review.htm
26. Singh A, Morley GL, Coignet C, et al. Impacts of ambient air quality on acute asthma hospital admissions during the COVID-19 pandemic in Oxford City, UK: a time-series study. BMJ Open 14 (2024): e070704.

Aiyer P, et al., J Environ Sci Public Health 2025
DOI:10.26502/jesph.96120219

27. Abrams Z. The rise of the 4-day workweek. American Psychological Association (2025). Available at: https://www.apa.org/monitor/2025/01/rise-of-4-day-workweek

28. First Session Editorial Team. Can 4-Day Work Week Solve Your Employees' Burnout? First Session (2024). Available at: https://www.firstsession.com/resources/can-4-day-work-week

29. Paul K. Microsoft Japan tested a four-day work week and productivity jumped by 40%. The Guardian (2019). https://www.theguardian.com/technology/2019/nov/04/microsoft-japan-four-day-work-week-productivity

30. Tapsfield J. Four-day working week trial in Iceland deemed an 'overwhelming success'. Daily Mail (2021). Available at: https://www.dailymail.co.uk/news/article-9756713/Four-day-working-week-trial-Iceland-deemed-overwhelming-success.html

31. Hyatt D. What Would Happen to the economy if Thursday became the new Friday? Investopedia (2024). Available at: https://www.investopedia.com/economic-impact-of-four-day-workweek-8630936

32. Travers M. A Psychologist Explores The 'Shorter Workweek Paradox.' Forbes (2024). Available at: https://www.forbes.com/sites/traversmark/2024/02/07/a-psychologist-explores-the-shorter-workweek-paradox/

33. Navigating the 4-day Workweek: Is It Right for Your Business? City Personnel (2024). Available at: https://citypersonnel.net/navigating-the-4-day-workweek/

34. The Rise of the Four-Day Workweek: Productivity vs. Practicality. Morgan McKinley (2025). Available at: https://www.morganmckinley.com/article/rise-four-day-workweek-productivity-vs-practicality

35. Vige W. Four-Day Workweek: The Good, The Bad & The Reality. Asana (2025). Available at: https://asana.com/resources/4-day-work-week.

36. Dockery DW, Pope CA, Xu X, et al. An Association Between Air Pollution and Mortality in Six U.S. Cities. New England J Med 329 (1993): 1753-1759.

37. American Lung Association (ALA). Nitrogen Dioxide. 2023. Available at: https://www.lung.org/clean-air/outdoors/what-makes-air-unhealthy/nitrogen-dioxide

38. Bolden-Barrett V. 3-day weekend could reduce energy use by 20%, say economists. Smart Cities Dive (2017). Available at: https://www.smartcitiesdive.com/news/3-day-weekend-could-reduce-energy-use-by-20-say-economists/439251/.

39. Ferraglioni G, Colombo S. The climate benefits of a four-day workweek. BBC (2016).

40. World Health Organization (WHO). WHO Global Air Quality Guidelines: Particulate Matter ($PM_{2.5}$ and PM_{10}), Ozone, Nitrogen Dioxide, Sulfur Dioxide and Carbon Monoxide. Geneva: WHO, 2021.Available at: https://www.who.int/publications/i/item/9789240034228.

41. Delbari SH, Shahne MZ, Hosseini V. An Analysis of Primary Contributing Sources to the PM2.5 Composition in a Port City in Canada Influenced by Traffic, Marine, and Wildfire Emissions. Atmospheric Environ 334 (2024): 120712–120712.

42. Environmental Protection Agency (EPA). Urban Environmental Indicators. (2019). Available at: https://www.epa.gov/report-environment

43. Perkins, L. NO_2 Concentration Over the United States: September 24 – November 7, 2004. NASA Scientific Visualization Studio (2004). Available at: https://svs.gsfc.nasa.gov/3073

44. Moshammer H, Poteser M, Kundi M, et al. Nitrogen-Dioxide Remains a Valid Air Quality Indicator. Int J Environ Res Public Health 17 (2020): 3733.

45. Hudda N, Simon MC, Patton AP, et al. Reductions in traffic-related black carbon and ultrafine particle number concentrations in an urban neighborhood during the COVID-19 pandemic. Sci Total Environ 742 (2020): 140931.

46. UK Department for Environment, Food & Rural Affairs (DEFRA). Accredited Official Statistics: Nitrogen Dioxide (NO_2) (2024). Available at: https://www.gov.uk/government/statistics/air-quality-statistics#nitrogen-dioxide

47. Tzortziou M, Kwong CF, Goldberg D, et al. Declines and peaks in NO2pollution during the multiple waves of the COVID-19 pandemic in the New York metropolitan area. Atmospheric Chemist Physics 22 (2022): 2399–2417.

48. Tiotiu AI, Novakova P, Nedeva D, et al. Impact of Air Pollution on Asthma Outcomes. Int J Environ Res Public Health 17 (2020): 6212.

49. Dondi A, Carbone C, Manieri E, et al. Outdoor Air Pollution and Childhood Respiratory Disease: The Role of Oxidative Stress. Int J Mol Sci 24 (2023): 4345.

50. Aithal SS, Sachdeva I, Kurmi OP. Air Quality and Respiratory Health in Children. Air Quality Respiratory Health Children 19 (2023): 230040–230040.

51. Wang T, Srebotnjak T, Brownell J, et al. Emergency Department Charges for Asthma-Related Outpatient Visits by Insurance Status. J Health Care Poor Underserved 25 (2013): 396–405.

52. Nurmagambetov T, Kuwahara R, Garbe P. The Economic Burden of Asthma in the United States, 2008-2013. Ann American Thoracic Soci 15 (2018): 348–356.

Aiyer P, et al., J Environ Sci Public Health 2025
DOI:10.26502/jesph.96120219

53. Bahadori K, Doyle-Waters MM, Marra C, et al. Economic burden of asthma: a systematic review. BMC Pulmonary Med 9 (2009): 24.

54. Zarate-Gonzalez G, Brown P, Cisneros R. Costs of Air Pollution in California's San Joaquin Valley: A Societal Perspective of the Burden of Asthma on Emergency Departments and Inpatient Care. J Asthma Allergy 17 (2024): 369–382.

55. Huangfu P, Atkinson R. Long-term exposure to NO2 and O3 and all-cause and respiratory mortality: A systematic review and meta-analysis. Environ Int 144 (2020): 105998.

56. Chen X, Qi L, Li S, et al. Long-term NO2 exposure and mortality: A comprehensive meta-analysis. Environ Pollution 341 (2023): 122971.

Citation: Aiyer P, Surani SR, Mominkhawaja A, Sheta A. Studying the Impact of Air Pollution on Google Search Trends for Asthma. Journal of Environmental Science and Public Health. 9 (2025): 29-37