Ahmedabad University

POLICY BRIEF

URBAN TRANSPORT & SDG 3: GOOD HEALTH & WELL BEING

This document is a part of series of six policy breifs that identify interactions of the urban transport with six UN Sustainable Development Goals (SDGs); SDG1: No Poverty, SDG3: Good Health & Well-being, SDG5: Gender Equtiy, SDG8: Economic Growth, SDG11: Sustainable Cities & Communities, and SDG13: Climate Action.

SUSTAINABLE DEVELOPMENT GOALS

About

This policy breif is part of the OPTIMISM (Opportunities for Climate Mitigation and Sustainable Development) project. OPTIMISM is an international multi-stakeholder partnership and research network funded by the UK Natural Environment Research Council as part of the research council's "Towards a Sustainable Earth" program. The international team consists of four partners: (i) Imperial College London, UK, (ii) Lund University, Sweden, (iii) Waseda University, Japan; and (iv) Ahmedabad University, India. Dr. Darshini Mahadevia (Principal Investigator-India) and Dr. Minal Pathak (Co-Principal Investigator) lead the project team placed in India that is supported and funded by the Department of Biotechnology (DBT), Government of India. The project team in India consisted of Dr. Chandrima Mukhopadhyay, Saumya Lathia, Amitkumar Dubey, Kanika Gounder, Bandish Patel, and Saleem Yatoo.

Adopting a whole-systems perspective, the OPTIMISM project uses the United Nations Sustainable Development Goals framework to analyze (i) the change in human development and the environment amidst rapid and extensive climate action and (ii) the role of insights from sectoral-SDG interaction in creating policies and practices that enable a transformational change. This document is a part of series of six policy breifs that identify interactions of the urban transport with six UN Sustainable Development Goals (SDGs); SDG1 - No Poverty, SDG3- Good Health & Well-being, SDG5 - Gender Equtiy, SDG8 - Economic Growth, SDG11- Sustainable Cities & Communities, and SDG13 - Climate Action. The document stems from a literature review of over 250 publications.

Authors: Darshini Mahadevia, Saumya Lathia, Shaurya Patel, Kanika Gounder, Minal Pathak, Chandrima Mukhopadhyay

Contributors: Bhavya Patodi, Isha Iyer and Kanika Bajaj.

Suggested Citation: Mahadevia, D., Lathia, S., Patel, S., Gounder, K., Pathak, M., & Mukhopadhyay, C. (2023). Policy Brief - Urban Transport & SDG 3: Good Health & Well-Being. Ahmedabad, Gujarat, India: Ahmedabad University.

SDG 3: Good Health & Well-being

What's the Goal & Why Does It Matter?

The Goal: Ensure healthy lives and promote well-being for all at all ages.

Significant strides in improving life expectancy, increasing access to reproductive healthcare, and child and maternal healthcare, made since the Millennial Development Goals (MGDs) are likely to be halted or reversed due to the pandemic. Child mortality has decreased by 50% in the last 15 years, maternal mortality has also decreased by 50% since 1990; measles vaccines have averted nearly 15.6 million deaths since 2000; and 13.6 million people had access to antiretroviral therapy by the end of 2014 [i]. Yet, child and maternal mortality continue to be one of the leading causes of death globally; in 2015, about 3 million women died from preventable causes related to pregnancy and childbirth, amounting to about 830 women daily [ii], 90% of these deaths occurred in low-and middle-income countries [iii]; in 2018, 6 million children died from preventable causes, every four out of five children were from Sub-Saharan Africa and South Asia [iii]. In 2019, 10 million people fell ill with Tuberculosis, 44% of these cases were in South Asia (iv). Apart from these, deaths due to malaria, air pollution, road accidents, and cardiovascular diseases continue to increase in the global South rapidly. Over 40% of countries have less than ten medical doctors per 1000 people (v). The pandemic shortened life expectancy across the world, amplified health inequities, disrupted healthcare systems, and strained healthcare providers; at least 90% of countries continue to report disruption in their healthcare systems (vi); parts of the global South report shortages of healthcare workers to the extent of 10 healthcare workers per 10,000 people [vii]. A global health emergency like the pandemic has drawn attention to the importance of healthcare emergency preparedness, making SDG3 critical to progress.

What is its relationship with Transportation?

Urban transport planning has multiple direct implications on health and well-being: emission reduction from transport improves local air quality, affordable public transport systems improve access to healthcare services, and safe networks of non-motorized transport (NMT) promote physical activity in individuals. Hence, transport provision that maximizes access via low-carbon pathways would improve urban opportunities as well as meet climate change mitigation requirements in rapidly urbanizing countries. The intersection of urban transport and health becomes even more important in the Global South for two main reasons: it experiences more exacerbated impacts of climate change as it hosts more than half of the global population living in poverty, and it is rapidly motorizing and increasing dependence on conventional automobiles.

Access to Healthcare Services

In the presence of inclusive healthcare services, urban transport directly influences health outcomes by providing access to them. The availability of adequate, affordable, and well-connected transport systems is linked to a reduced risk of premature deaths. Evidence [viii] also shows that access to reliable transport systems, especially better connectivity between rural and urban areas in Global South, reduces perinatal, neonatal & maternal mortality (SDG3.1 & SDG3.2).

Air Quality

The transport sector is one of the largest sources of urban and regional air pollution, a leading risk factor for deaths due to non-communicable diseases (SDG3.4). Along with CO2 emissions, Black Carbon and Benzopyrene (tailpipe emission) are associated with a range of cardiovascular and respiratory diseases, posing a major threat to human health [ix]. Ambient air pollution kills 4.2 million people around the world

every year [x]; about 90% of which occur in developing countries; for example, India as the second highest transportation-attributable PM2.5 and Ozone deaths in the world [xi]; as per World Air Quality Index 2019 Rankings, India is home to 21 of the 30 most polluted (PM 2.5) cities in the world [xii]. A study conducted in four Indian megacities indicated that 20-50% of PM2.5 emissions are generated from gasoline and diesel vehicle traffic [xiii]. Further evidence shows that neighborhoods along the highways and freeways are disproportionately exposed to negative externalities of air pollution, noise pollution, and increased urban heat island effect (due to large road mass), resulting in one of the poorest life expectancies [xiv] (SDG3.9). Urban history suggests that highways were typically carved through poor neighborhoods, with people of color (or other disadvantaged groups), making them prime victims of air pollution-related health issues and deepening social inequity [xv]. The life expectancy of children in Long Beach's Mid-City neighborhood, located amidst two major highways, is seven years less than the children living in neighborhoods away from the highways (SDG3.9).

Road Safety

Street design is crucial for the safe navigation of all users as it provides visual and physical cues of conduct [xvi] [xvii] [xviii] yet under-prioritization of street design principles, especially those that enable universal access, leads to compromised safety of the most vulnerable users (pedestrians and cyclists) and creates inequity in access [xix][xx] [xxi]. For example, prioritization of motorized traffic with negligence for non-motorized and public transport users in South Asian cities translates into inadequate coverage of footpaths and poorly designed pedestrian crossings [xxii] [xxiii]. This creates a hostile environment for non-motorized users and increases exposure to conflicts with motorized users and the risk of road accidents [xxiv][xxv]. Road fatalities take 1.35 million lives every year and are among the world's top 10 causes of death [xxvi]; for every fatality, ten people are seriously injured (SDG3.6). Of all global accidents, 92% occur in low- and middle-income countries [xxvi]. Road fatalities have increased in India by 58.7% from 1990 to 2017 [xxvii]. In spite of having a 1% share of the world's vehicles, India hosts 11% of the global road fatalities [xxviii]; pedestrians and bicycle users form the largest share of the victims (MORTH) [xxix]. Insensitive planning of 'world-class' highway infrastructure through peri-urban and rural communities within the past two decades led to a steep increase in the fatal cases amongst low-income communities, who were forced to risk their lives by crossing high-speed highways for daily activities like access to basic services and jobs, cultural and civic opportunities, etc.[xxx].

Mental and Physical Well-being

Cardio-vascular diseases- mainly caused by increased exposure to air pollution and inactivity- account for 5.3 million deaths annually (SDG 3.4). Rapidly motorizing countries in the Global South are experiencing a steep decline in physical activity and deteriorated air quality [xxxi][xxxii][xxxiii] . Additionally, stress and exhaustion caused by driving in high-volume traffic take a toll on mental health. Active transportation (switch to non-motorized and public transport) provides ample opportunities to improve air quality and increase physical activity, in turn improving cardiovascular and pulmonary health [xxxiv][xxxv][xxxvi]. The promotion of active transport, unaccompanied by the provision of safe and adequate non-motorized transport, endangers the health and safety of non-motorized transport users, a phenomenon common in countries like India [xxxvii][xxxviii][xxxix] and Malaysia [xl].

The proportion of green and open space is linked to self-reported levels of mental well-being [xli][xlii][xlii] Yet equal access to green and open spaces for all remains a challenge most cities worldwide [xliii][xliv][xlv]. Studies show people from more deprived areas have less access to green/ open/ public spaces [xlvii][xlviii][xlix]; children in deprived areas are nine times less likely to have access to green/ public spaces to play [l][li][lii]. Urban transport has a crucial role in enabling access to public spaces, especially for vulnerable user groups like women, children, the elderly, the socio-economically deprived, and the

differently-abled [liii][liv][lv] . In the case of adequate public space provision across all neighborhoods, safe non-motorized transport networks enable access to all, while robust public transport networks enable access to large, city-level open and green spaces [lvi][lvii][lvii]. In the absence of the availability of public spaces- as observed in cities during the pandemic- streets and parking lots have the potential to act as recreational spaces for the community [lix][lx][lxi]

Resilience during Extreme Weather Events & Pandemics

In the wake of the climate crisis, where more frequent and more severe extreme weather events continue to disrupt people's lives and mobility, urban transport is key in providing relief. In case of severe calamities, transport networks enable rescue and relief functions [lxii][lxiii][lxiv]. While ability and convenience of using transport during extreme weather events like heatwaves and floods are vital for the resilience of urban communities (SDG3.D). But since transport infrastructure is likely to be the worst-hit system during such events, there is an increasing emphasis on creating more resilient transport systems [lxv][lxvi][lxvii].

Urban transport played a crucial role in providing relief from the pandemic, as well as escalating the virus spread (SDG3.3). While agglomeration and contact via public transport (stations and vehicles) spiked the virus spread, non-motorized transport offered access to essential services with safe social distancing in all cities across the globe [lxviii][lxix][lxx]. Moreover, during the stay-at-home orders, cities reclaimed streets for outdoor activities and recreation [lxxi][lxxii][lxxiii] Post-lockdown, the majority of cities subscribed to the 'slow-streets' model, where streets and parking lots were used as outdoor seating for restaurants and cafes [lxxiv][lxxv][lxxvi]. Hence, the pandemic highlighted the need to build resilient public transport system and reimagine/ repurpose existing transport networks [lxxviii][lxxix][lxxx]

How can transport promote health and well-being?

Low-carbon transport planning holds the potential to mitigate health-related negative externalities via a drastic reduction in transport sector emissions and air pollution.

What can states do?

Although the implementation of transport planning and design is anchored by cities, the state has a vital role to play:

- Introduce campaigns that spread awareness of the health benefits of using active and public transport.
- Encourage active transportation (walking, cycling, and public transportation) with investments in non-motorized transport.
- Encourage employers and businesses to incentivize active and public transportation among their employees.
- Revisit built environment by-laws to encourage compact, mixed-use development in cities.
- Promote cities for creating and implementing Active Transport Plans and Strategies.
- Create financing mechanisms that enable local bodies to upgrade public transport network.
- Create a monitoring and evaluation framework to measure the impact of transport on health and well-being.
- Incentivize monitoring mechanisms for environmental pollution such as air, water, noise, etc.
- Promote cities to develop detailed greenhouse gas emissions inventory by sectors (especially transport).
- Increase investments in early warning systems (Heat-wave warning system, Flood Warning System, Air-Pollution Warning System), enabling commuters to make an informed choice.
- Enable inter-sector partnership to forward the achievement of SDG3.

What can cities do?

Transport planning at the city level can create healthy communities and foster health and well-being for its citizens:

- Revisit land-use regulations to encourage compact, mixed-use development and reduce dependence on personal vehicles.
- Promote active transportation via quality infrastructure provision for improved air quality and physical activity.
- Upgrade and extend non-motorized transport infrastructure, with a focus on the safety and comfort of the users.
- Introduce public bike-sharing programs, especially around densely populated neighborhoods, institutions, and tourist areas.
- Prioritize road-space allocation for non-motorized and public transport users via mechanisms like pedestrian-only streets, bus-only lanes, etc.
- Reclaim streets periodically (ex., Happy Streets, Raahgiri, Cyclavia, etc.) for community activities.
- Re-designing street sections with Universal Design and "Complete Streets" design principles along all arterial, sub-arterial, and collector streets.
- Provide safe intersections with signalized junctions, crosswalks, traffic islands, signage, etc., to reduce conflicts.
- Increase roadside canopy cover; tree-lined streets are safer and more comfortable for pedestrians and cyclists; they regulate speed for motorized traffic[iv]; they improve air quality; they reduce noise pollution.
- Increase permeable surfaces around streets to prevent flooding during extreme monsoons.
- Conduct road-safety awareness drives and road-safety audits.
- Enforce traffic regulations that prioritize the safety of non-motorized transport users.
- Sanitize public transport infrastructure regularly to reduce the spread of communicable diseases.
- Increase the frequency of public transport to improve resilience during extreme weather events and pandemics.
- Creating early warning systems for better adoption of air pollution (ex. SAFAR), heat, and floods (ex., Surat Flood Early Warning System), etc.
- Prepare dedicated Action Plans for extreme weather events (ex., Ahmedabad Heat Action Plan), with a focus on transport systems.
- Prepare detailed greenhouse gas emissions inventory for the transport sector to inform decarbonization goals and strategies.
- Prepare monitoring and evaluation frameworks to evaluate the impact of transport interventions on public health.

What can Communities and Individuals do?

Communities and individuals can fast-track the achievement of SDG3 by:

- Choose non-motorized transport (walking and cycling) for shorter distances as much as possible.
- Choose public transport for longer distances as much as possible
- Choose public transport for longer distances, and for first-last mile connectivity, choose intermediate public transport (IPT) (auto-rickshaws, E-rickshaws, or shared rickshaws, etc.)
- Avoid using personal vehicles and give preference to carpooling.
- Select Mobility-as-a-Service or Ridesharing for the intercity commute (Preference could be given to lesser-emitting modes like rickshaws and 2-wheelers over cars).
- Actively engage in organizing car-free street movements to reclaim streets for group activities and recreation.
- Provide feedback to urban local bodies about the challenges & barriers of using public transport and non-motorized transport in your neighborhoods.
- Work with urban local bodies and non-government organizations in enabling a behavioral shift towards sustainable transport such as walking, cycling, public transport, and IPT.

References

[i] Goal 3: Good Health and Well-Being. (2022). UN. https://www.un.org/sustainabledevelopment/wp-content/uploads/2018/09/Goal-3.pdf

[ii] SDG 3: Ensure healthy lives and promote well-being for all at all ages. (n.d.). UN Women. https://www.unwomen.org/en/news/in-focus/women-and-the-sdgs/sdg-3-good-health-well-being

[iii] Baker, J. (n.d.). SDG 3 – Good Health and Well-being – Introduction to the Sustainable Development Goals (SDGs). Pressbooks. https://ecampusontario.pressbooks.pub/sdgintro/chapter/sdg-3-good-health-and-well-being/

[iv] Fukunaga, R., Glaziou, P., Harris, J. B., Date, A., Floyd, K., & Kasaeva, T. (2021). Epidemiology of Tuberculosis and Progress Toward Meeting Global Targets — Worldwide, 2019. MMWR. Morbidity and Mortality Weekly Report, 70(12), 427–430. https://doi.org/10.15585/mmwr.mm7012a4

[v] Dunn, A. (2020, August 21). These countries have the most doctors and nurses. World Economic Forum. https://www.weforum.org/agenda/2020/08/healthcare-doctors-nurses-covid-19/

[vi] WHO. (2021, April 23). COVID-19 continues to disrupt essential health services in 90% of countries. https://www.who.int/news/item/23-04-2021-covid-19-continues-to-disrupt-essential-health-services-in-90-of-countries

[vii] Haakenstad, A., Irvine, C. M. S., Knight, M., Bintz, C., Aravkin, A. Y., Zheng, P., Gupta, V., Abrigo, M. R. M., Abushouk, A. I., Adebayo, O. M., Agarwal, G., Alahdab, F., Al-Aly, Z., Alam, K., Alanzi, T. M., Alcalde-Rabanal, J. E., Alipour, V., Alvis-Guzman, N., Amit, A. M. L., . . . Lozano, R. (2022). Measuring the availability of human resources for health and its relationship to universal health coverage for 204 countries and territories from 1990 to 2019: a systematic analysis for the Global Burden of Disease Study 2019. The Lancet, 399(10341), 2129–2154. https://doi.org/10.1016/s0140-6736(22)00532-3

[viii] Avery, L., Regmi, M., Joshi, G., & Mohanty, C. (2017). Rural-Urban Connectivity in Achieving Sustainable Regional Development. In UNCRD. Intergovernmental Tenth Regional Environmentally Sustainable Transport (EST) Forum in Asia. https://www.uncrd.or.jp/content/documents/5048Final%20Background%20Paper%20for%20EST%20Plenary%20Session%203%20(1)-rev-3.pdf

[ix] Fransen, T., Song, R., Tankou, A., Welle, B., & Mccall, M. (2019). ENHANCING NDCs: OPPORTUNITIES IN TRANSPORT. World Resources Institute. https://www.wri.org/research/enhancing-ndcs-opportunities-transport

[x] WHO. (2022, December 19). Ambient (outdoor) air pollution. https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health

[xi] Anenberg, S. C., Miller, J., Henze, D. K., Minjares, R., & Achakulwisut, P. (2019). The global burden of transportation tailpipe emissions on air pollution-related mortality in 2010 and 2015. Environmental Research Letters, 14(9), 094012. https://doi.org/10.1088/1748-9326/ab35fc

[xii] IQAir. (2019). 2019 WORLD AIR QUALITY REPORT: Region & City PM2.5 Ranking.

[xiii] Singh, V., Singh, S., & Biswal, A. (2021). Exceedances and trends of particulate matter (PM2.5) in five Indian megacities. Science of the Total Environment, 750, 141461. https://doi.org/10.1016/j.scitotenv.2020.141461

[xiv] Ulpiani, G. (2021b). On the linkage between urban heat island and urban pollution island: Three-decade literature review towards a conceptual framework. Science of the Total Environment, 751, 141727. https://doi.org/10.1016/j.scitotenv.2020.141727

[xv] Manisalidis, I., Stavropoulou, E., Stavropoulos, A., & Bezirtzoglou, E. (2020). Environmental and Health Impacts of Air Pollution: A Review. Frontiers in public health, 8, 14. https://doi.org/10.3389/fpubh.2020.00014

[xvi] MoUD. (2014). National Urban Transport Policy, 2014. Ministry of Urban Development, Government of India. https://www.changing-transport.org/wp-content/uploads/E_K_NUMP_India_2014_EN.pdf

[xvii] Jansson, C. (2019). Factors important to street users' perceived safety on a main street. KTH SKOLAN FÖR ARKITEKTUR OCH SAMHÄLLSBYGGNAD.

[xviii] Babić, D., Fiolić, M., Babić, D., & Gates, T. (2020). Road Markings and Their Impact on Driver Behaviour and Road Safety: A Systematic Review of Current Findings. Journal of Advanced Transportation, 2020, 1–19. https://doi.org/10.1155/2020/7843743

[xix] Allen, H. (2017). Approaches for Gender

Responsive Urban Mobility. GIZ-SUTP.

[xx] Tabone, W., De Winter, J., Ackermann, C., Bärgman, J., Baumann, M., Deb, S., Emmenegger, C., Habibovic, A., Hagenzieker, M., Hancock, P., Happee, R., Krems, J., Lee, J. D., Martens, M., Merat, N., Norman, D., Sheridan, T. B., & Stanton, N. A. (2021). Vulnerable road users and the coming wave of automated vehicles: Expert perspectives. Transportation Research Interdisciplinary Perspectives, 9, 100293. https://doi.org/10.1016/j.trip.2020.100293

[xxi] Ackermann, C., Beggiato, M., Schubert, S., & Krems, J. F. (2019). An experimental study to investigate design and assessment criteria: What is important for communication between pedestrians and automated vehicles? Applied Ergonomics, 75, 272–282. https://doi.org/10.1016/j.apergo.2018.11.002

[xxii] Wanner, T. (2014). The New 'Passive Revolution' of the Green Economy and Growth Discourse: Maintaining the 'Sustainable Development' of Neoliberal Capitalism. New Political Economy, 20(1), 21–41. https://doi.org/10.1080/13563467.2013.866081

[xxiii] Jain, Deepty & Tiwari, Geetam. (2013). NMT Infrastructure in India: Investment, Policy and Design.

[xxiv] Uzondu, C., Jamson, S., & Lai, F. (2019). Investigating unsafe behaviours in traffic conflict situations: An observational study in Nigeria. Journal of Traffic and Transportation Engineering (English Edition), 6(5), 482–492. https://doi.org/10.1016/j.jtte.2018.06.002

[xxv] Jain, Deepty & Tiwari, Geetam. (2016). Sustainable Cities and Society Volume 22, April 2016, Pages 1–10 Cover image How the present would have looked like? Impact of non-motorized transport and public transport infrastructure on travel behavior, energy consumption and CO2 emissions – Delhi, Pune and Patna. Sustainable Cities and Society. 22. 10.1016/j.scs.2016.01.001.

[xxvi] World Health Organization. (2018, June). Global status report on road safety 2018. World Health Organization. Retrieved February 3, 2023, from https://www.who.int/publications-detail-redirect/9789241565684

[xxvii] Dandona, R., Kumar, G. A., Gururaj, G., James, S., Chakma, J. K., Thakur, J. S., Srivastava, A., Kumaresh, G., Glenn, S. D., Gupta, G., Krishnankutty, R. P., Malhotra, R., Mountjoy-Venning, W. C., Mutreja, P., Pandey, A., Shukla, D. K., Varghese, C. M., Yadav, G., Reddy, K. S., . . . Dandona, L. (2020). Mortality due to road injuries in the states of India: the Global Burden of Disease Study 1990–2017. The Lancet Public Health, 5(2), e86–e98. https://doi.org/10.1016/s2468-2667(19)30246-4

[xxviii] World Bank. (2021). Traffic Crash Injuries and Disabilities: The Burden on Indian Society. https://www.worldbank.org/en/country/india/publication/traffic-crash-injuries-and-disabilities-the-burden-on-indian-society

[xxix] Tiwari, Geetam. (2015). Role of Nonmotorized Transport and Sustainable Transport in Indian Cities. 10.1007/978-81-322-2310-8_7.

[xxx] Dehghani, M. H., Karri, R. R., & Roy, S. (2022). COVID-19 and the Sustainable Development Goals: Societal Influence. Elsevier Gezondheidszorg.

[xxxi] World Health Organization. (2018, June). Global status report on road safety 2018. World Health Organization. Retrieved February 3, 2023, from https://www.who.int/publications-detail-redirect/9789241565684

[xxxii] Liu, F., Wang, M., & Zheng, M. (2021). Effects of COVID-19 lockdown on global air quality and health. Science of the Total Environment, 755, 142533. https://doi.org/10.1016/j.scitotenv.2020.142533

[xxxiii] Beaudoin, J., & Lawell, C. (2017). Is Public Transit's 'Green' Reputation Deserved? : Evaluating the Effects of Transit Supply on Air Quality. https://clinlawell.dyson.cornell.edu/transit_airquality_paper.pdf

[xxxiv] Koszowski, C., Gerike, R., Hubrich, S., Götschi, T., Pohle, M., & Wittwer, R. (2019). Active mobility: bringing together transport planning, urban planning, and public health. In Towards User-Centric Transport in Europe (pp. 149-171). Springer, Cham.

[xxxv] Chaix, B., Kestens, Y., Duncan, S., Merrien, C., Thierry, B., Pannier, B., Brondeel, R., Lewin, A., Karusisi, N., Perchoux, C., Thomas, F., & Méline, J. (2014). Active transportation and public transportation use to achieve physical activity recommendations? A combined GPS, accelerometer, and mobility survey study. International Journal of Behavioral Nutrition and Physical Activity, 11(1). https://doi.org/10.1186/s12966-014-0124-x

[xxxvi] Litman, T. (2013). Transportation and Public Health. Annual Review of Public Health, 34(1), 217–233. https://doi.org/10.1146/annurev-publhealth-031912-1

14502

[xxxvii] Mahadevia, D., & Advani, D. (2016). Gender differentials in travel pattern–the case of a mid-sized city, Rajkot, India. Transportation Research Part D: Transport and Environment, 44, 292-302.

[xxxviii] Chant, S. (2013). Cities through a "gender lens": a golden "urban age" for women in the global South? Environment and Urbanization, 25(1), 9–29. https://doi.org/10.1177/0956247813477809

[xxxix] Anand, A., & Tiwari, G. (2006). A Gendered Perspective of the Shelter–Transport–Livelihood Link: The Case of Poor Women in Delhi. Transport Reviews, 26(1), 63–80. https://doi.org/10.1080/01441640500175615

[xl] Xu, F., Jin, L., Qin, Z., Chen, X., Xu, Z., He, J., ... & Jia, P. (2021). Access to public transport and childhood obesity: a systematic review. Obesity reviews, 22, e12987.

[xli] Barton, J., & Rogerson, M. (2017). The importance of greenspace for mental health. BJPsych. International, 14(4), 79–81. https://doi.org/10.1192/s2056474000002051

[xlii] Zhang, Y., Mavoa, S., Zhao, J., Raphael, D., & Smith, M. (2020). The Association between Green Space and Adolescents' Mental Well-Being: A Systematic Review. International Journal of Environmental Research and Public Health, 17(18), 6640. https://doi.org/10.3390/ijerph17186640

[xliii] Houlden, V., Weich, S., Porto De Albuquerque, J., Jarvis, S., & Rees, K. (2018). The relationship between greenspace and the mental wellbeing of adults: A systematic review. PLOS ONE, 13(9), e0203000. https://doi.org/10.1371/journal.pone.0203000

[xliv] Haaland, C., & Van Den Bosch, C. K. (2015). Challenges and strategies for urban green-space planning in cities undergoing densification: A review. Urban Forestry &Amp; Urban Greening, 14(4), 760–771. https://doi.org/10.1016/j.ufug.2015.07.009

[xlv] Ngom, R., Gosselin, P., & Blais, C. (2016). Reduction of disparities in access to green spaces: Their geographic insertion and recreational functions matter. Applied Geography, 66, 35–51. https://doi.org/10.1016/j.apgeog.2015.11.008

[xlvi] Rigolon, A., Browning, M., Lee, K., & Shin, S. (2018). Access to Urban Green Space in Cities of the Global South: A Systematic Literature Review. Urban Science, 2(3), 67. https://doi.org/10.3390/urbansci2030067

[xlvii] WRI India. 2015. "Women's Safety in Public Transport - A Pilot Initiative in Bhopal"

[xlviii] Hoffimann, E., Barros, H., & Ribeiro, A. (2017). Socioeconomic Inequalities in Green Space Quality and Accessibility—Evidence from a Southern European City. International Journal of Environmental Research and Public Health, 14(8), 916. https://doi.org/10.3390/ijerph14080916

[xlix] Fleming, L., Leonardi, G., White, M., Medlock, J., Alcock, I., Macintyre, H., Maguire, K., Nichols, G., Wheeler, B., Morris, G., Taylor, T., Hemming, D., Iacono, G., Gillingham, E., Hansford, K., Heaviside, C., Bone, A., & Duarte-Davidson, R. (2018). Beyond Climate Change and Health: Integrating Broader Environmental Change and Natural Environments for Public Health Protection and Promotion in the UK. Atmosphere, 9(7), 245. https://doi.org/10.3390/atmos9070245

[l] Mytton, O. T., Townsend, N., Rutter, H., & Foster, C. (2012). Green space and physical activity: An observational study using Health Survey for England data. Health &Amp; Place, 18(5), 1034–1041. https://doi.org/10.1016/j.healthplace.2012.06.003

[li] McEachan, R. R. C., Yang, T. C., Roberts, H., Pickett, K. E., Arseneau-Powell, D., Gidlow, C. J., Wright, J., & Nieuwenhuijsen, M. (2018). Availability, use of, and satisfaction with green space, and children's mental wellbeing at age 4 years in a multicultural, deprived, urban area: results from the Born in Bradford cohort study. The Lancet Planetary Health, 2(6), e244–e254. https://doi.org/10.1016/s2542-5196(18)30119-0

[lii] Who benefits from nature in cities? Social inequalities in access to urban green and blue spaces across Europe. (n.d.). European Environment Agency. https://www.eea.europa.eu/publications/who-benefits-from-nature-in

[liii] Azevedo, G. A., Sampaio, R. R., Filho, A. S. N., Moret, M. A., & Murari, T. B. (2021). Sustainable urban mobility analysis for elderly and disabled people in São Paulo. Scientific Reports, 11(1). https://doi.org/10.1038/s41598-020-80906-w

[liv] Lucas, K. (2012). Transport and social exclusion: Where are we now? Transport Policy, 20, 105–113. https://doi.org/10.1016/j.tranpol.2012.01.013

[lv] Dempsey, N., Bramley, G., Power, S., & Brown, C.

(2009). The social dimension of sustainable development: Defining urban social sustainability. Sustainable Development, 19(5), 289–300. https://doi.org/10.1002/sd.417

[lvi] Tiwari, G., Jain, D., & Ramachandra Rao, K. (2016). Impact of public transport and non-motorized transport infrastructure on travel mode shares, energy, emissions and safety: Case of Indian cities. Transportation Research Part D: Transport and Environment, 44, 277–291. https://doi.org/10.1016/j.trd.2015.11.004

[lvii] Wang, F., Zheng, Y., Wu, W., & Wang, D. (2022). The travel, equity and wellbeing impacts of transit-oriented development in Global South. Transportation Research Part D: Transport and Environment, 113, 103512. https://doi.org/10.1016/j.trd.2022.103512

[lviii] Westerink, J., Haase, D., Bauer, A., Ravetz, J., Jarrige, F., & Aalbers, C. B. M. (2013). Dealing with Sustainability Trade-Offs of the Compact City in Peri-Urban Planning Across European City Regions. European Planning Studies, 21(4), 473–497. https://doi.org/10.1080/09654313.2012.722927

[lix] Sepe, M. (2021). Covid-19 pandemic and public spaces: improving quality and flexibility for healthier places. URBAN DESIGN International, 26(2), 159–173. https://doi.org/10.1057/s41289-021-00153-x

[lx] Marcelo, G. T., Constance, B., Joseph, M., Kay, A., David, Z., Maarten, V. S., & Adrienne, G. R. (2022). Do we have enough recreational spaces during pandemics? An answer based on the analysis of individual mobility patterns in Switzerland. Landscape and Urban Planning, 221, 104373. https://doi.org/10.1016/j.landurbplan.2022.104373

[lxi] Bereitschaft, B., & Scheller, D. (2020). How Might the COVID-19 Pandemic Affect 21st Century Urban Design, Planning, and Development? Urban Science, 4(4), 56. https://doi.org/10.3390/urbansci4040056

[lxii] Guzman, L. A., & Oviedo, D. (2018). Accessibility, affordability and equity: Assessing 'pro-poor' public transport subsidies in Bogotá. Transport Policy, 68, 37–51. https://doi.org/10.1016/j.tranpol.2018.04.012

[lxiii] Banister, D. (2019). The climate crisis and transport. Transport Reviews, 39(5), 565–568. https://doi.org/10.1080/01441647.2019.1637113

[lxiv] Satgar, V., Abarca, M. M., Acosta, A., & Ashley, B. (2018). The Climate Crisis: South African and Global Democratic Eco-Socialist Alternatives. Amsterdam University Press.

[lxv] OECD. (2021, February 22). COVID-19 and a new resilient infrastructure landscape. OECD.org. https://www.oecd.org/coronavirus/policy-responses/covid-19-and-a-new-resilient-infrastructure-landscape-d40a19e3/

[lxvi] World Health Organization: WHO. (2021, October 30). Climate change and health. https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health

[lxvii] Parry, M. a. J., Canziani, O., Palutikof, J., Van Der Linden, P. D., & Hanson, C. (2007). Climate change 2007: impacts, adaptation and vulnerability. Cambridge University Press EBooks. https://assets.cambridge.org/97805217/05974/copyright/9780521705974_copyright_info.pdf

[lxviii] Hák, T., Janoušková, S., & Moldan, B. (2016). Sustainable Development Goals: A need for relevant indicators. Ecological Indicators, 60, 565–573. https://doi.org/10.1016/j.ecolind.2015.08.003

[lxix] Rietveld, P. (2000). Non-motorised modes in transport systems: a multimodal chain perspective for The Netherlands. Transportation Research Part D: Transport and Environment, 5(1), 31–36. https://doi.org/10.1016/s1361-9209(99)00022-x

[lxx] Bamberg S, Fujii S, Friman M, Gärling T (2011) Behaviour theory and soft transport policy measures. Transp Policy 18(1):228–235

[lxxi] Rice, W. L., Mateer, T. J., Reigner, N., Newman, P., Lawhon, B., & Taff, B. D. (2020). Changes in recreational behaviors of outdoor enthusiasts during the COVID-19 pandemic: analysis across urban and rural communities. Journal of Urban Ecology, 6(1). https://doi.org/10.1093/jue/juaa020

[lxxii] Larson, L. R., Zhang, Z., Oh, J. I., Beam, W., Ogletree, S. S., Bocarro, J. N., Lee, K. J., Casper, J., Stevenson, K. T., Hipp, J. A., Mullenbach, L. E., Carusona, M., & Wells, M. (2021). Urban Park Use During the COVID-19 Pandemic: Are Socially Vulnerable Communities Disproportionately Impacted? Frontiers in Sustainable Cities, 3. https://doi.org/10.3389/frsc.2021.710243

[lxxiii] Venter, Z. S., Barton, D. N., Gundersen, V., Figari, H., & Nowell, M. (2020). Urban nature in a time of crisis: recreational use of green space increases during the COVID-19 outbreak in Oslo, Norway.

Environmental Research Letters, 15(10), 104075. https://doi.org/10.1088/1748-9326/abb396

[lxxiv] Macfarlane, G., Turley Voulgaris, C., & Tapia, T. (2022). City parks and slow streets: A utility-based access and equity analysis. Journal of Transport and Land Use, 15(1), 587–612. https://doi.org/10.5198/jtlu.2022.2009

[lxxvi] Landgrave-Serrano, M., & Stoker, P. (2022). Increasing physical activity and active transportation in an arid city: Slow Streets and the COVID-19 pandemic. Journal of Urban Design, 1–19. https://doi.org/10.1080/13574809.2022.2112512

[lxxvii] Douglas, G., & Moore, D. (2022). Analyzing the Use and Impacts of Oakland Slow Streets and Potential Scalability Beyond Covid-19. SJSU Scholar Works. https://doi.org/10.31979/mti.2021.2152

[lxxviii] Mahadevia, D., & Mukhopadhyay, C. (2021). COVID-19 and the public transport conundrum in India. The Town Planning Review, 139-147.

[lxxix] Przybylowski, A., Stelmak, S., & Suchanek, M. (2021). Mobility Behaviour in View of the Impact of the COVID-19 Pandemic—Public Transport Users in Gdansk Case Study. Sustainability, 13(1), 364. https://doi.org/10.3390/su13010364

[lxxx] Espiner, S., Orchiston, C., & Higham, J. (2017). Resilience and sustainability: a complementary relationship? Towards a practical conceptual model for the sustainability–resilience nexus in tourism. Journal of Sustainable Tourism, 25(10), 1385–1400. https://doi.org/10.1080/09669582.2017.1281929

Appendix

SDG 3 Targets

3.1 By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births.

3.2 By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births.

3.3 By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases.

3.4 By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being.

3.5 Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol.

3.6 By 2020, halve the number of global deaths and injuries from road traffic accidents.

3.7 By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes.

3.8 Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all.

3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.

3.A Strengthen the implementation of the World Health Organization Framework Convention on Tobacco Control in all countries, as appropriate.

3.B Support the research and development of vaccines and medicines for the communicable and noncommunicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the Agreement on Trade Related Aspects of Intellectual Property Rights regarding flexibilities to protect public health, and, in particular, provide access to medicines for all.

3.C Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing States.

3.D Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.

Ahmedabad University

Contact Us

School of Arts & Sciences, Ahmedabad University, Commerce Six Roads, Navrangpura, Ahmedabad – 380009, Gujarat, India; Email: artsandsciences@ahduni.edu.in; Phone: +91.79.61911502

OR

Global Centre for Environment and Energy, Ahmedabad University, GICT Building, Central Campus, Navrangpura, Ahmedabad 380009, Gujarat 380009 Email: gcee@ahduni.edu.in; Phone+91.79.61911000