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Editorial correspondence
Laboratory of Land Use, Mobility and Environment
DICEA - Department of Civil, Building and Environmental Engineering
University of Naples Federico II
Piazzale Tecchio, 80
80125 Naples (Italy)

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e-mail: redazione.tema@unina.it

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Mobility changes occasioned by COVID-19 lockdown measures: evidence from an emerging economy

Ernest Agyemang [a*], Samuel Agyei-Mensah [a], Aruna Sivakumar [b], Ricky Nathavni [c] Majid Ezzati [c]

[a] School of Social Sciences
Department of Geography & Resource Development
University of Ghana, Legon, Accra
e-mail: eagyemang@ug.edu.gh;
sagyei-mensah@ug.edu.gh;
ORCID: https://orcid.org/0000-0003-3254-4611
* Corresponding author

[b] Centre for Transport Studies
Department of Civil & Environmental Engineering
Imperial College London, London
e-mail: a.sivakumar@imperial.ac.uk
ORCID: https://orcid.org/0000-0003-2721-8299

[c] School of Public Health
Department of Epidemiology and Biostatistics
Imperial College London, London
e-mail: r.nathavni@imperial.ac.uk;
majid.ezzati@imperial.ac.uk
ORCID: https://orcid.org/0000-0002-4488-5862

Abstract
The unprecedented and drastic emergency responses that accompanied the declaration of COVID-19 as a pandemic have highlighted and intensified mobility injustices worldwide. Most of the global interest in the impact of COVID-19 on mobility patterns has come from developed countries, leaving a gap in literature specifically focused on Africa. This paper aims to fill that gap by examining the effects of government-imposed travel restrictions on people's attitudes and mobility behavior in urban Ghana. Using a combination of data sources, including surveys and photographic evidence, we analyze the spatial variations in mobility patterns during the lockdown. Our findings from statistical analyses and time-lapsed images indicate that many young people, informal sector workers, and individuals living in disadvantaged neighborhoods largely ignored the lockdown order. In contrast, most formal sector employees utilized internet-enabled telecommuting, e-learning opportunities, and telephone communications during the lockdown period. The paper concludes with policy recommendations aimed at enhancing mobility justice for all in the face of future public health crises and social emergencies that may require physical mobility restrictions.

Keywords
COVID-19; Lockdown; Mobility; Accra; Ghana

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1. Introduction

Transport plays a crucial role in fostering socio-economic growth and development by providing access to people, goods, and services, ultimately enhancing the quality of life and well-being of users. However, traditional approaches to urban and transport planning often overlook the unique characteristics of individual users (Carpentieri et al., 2023). Coupled with systemic inequalities, infrastructural limitations, and socio-economic disparities, this has led to persistent mobility challenges, particularly for marginalized populations, including individuals with disabilities, the elderly, youth, economically disadvantaged groups, and rural dwellers (Di Roucco, 2025). Research shows that women, for example, do not have equal access to walk to various city areas (Carpentieri et al., 2023). Meanwhile, engaging in physical activities, such as walking and relaxing in urban greenspaces, can be linked to improved therapeutic and psychological well-being (Sari et al., 2023). Consequently, Di Ruocco (2024, p. 106) argues that "the economic development of the city and the attainment of excellent quality of life indicators of the city" remain elusive. To achieve Global Goal 11 — to "make cities inclusive, safe, resilient, and sustainable" (UN, 2023) — it is imperative not to ignore the injustices in transportation. As Martens (2017, p. xiv) cautions in the preface to his book 'Transport Justice,' "governments, as representatives of all persons in their jurisdictions, have a moral obligation to act as guardians of the interests of all individuals. Their actions should thus avoid pertinent injustices while promoting justice where practically feasible." By advocating for mobility justice, we can ensure that everyone has equal access to "safe, affordable, convenient, dignified, and reliable transportation options that allow them to lead joyful, meaningful, and fulfilling lives" (Karner et al., 2023, p. 5).

The unprecedented and drastic emergency responses following the declaration of COVID-19 as a pandemic—including lockdowns, physical distancing, frequent hand washing, face mask use, remote work, and border closures—have exposed and intensified levels of mobility injustices worldwide. This is especially true in low- and middle-income countries like Ghana, where existing challenges such as erratic power supply, limited internet connectivity, gender gaps in internet access, informality in work, and over-reliance on road transport contribute to transport poverty for many residents (Wrigley-Asante & Agyemang, 2019; Mogaji, 2020).

This paper aims to highlight how the COVID-19 pandemic and the strict lockdown measures implemented by the Ghanaian government may have exacerbated socio-economic gaps in accessibility in Accra. We chose Accra because, as the national capital of Ghana, it is the most densely populated city with diverse socio-economic and residential groups. Additionally, it was the site of the first COVID-19 case in Ghana, experiencing a significant increase in deaths and illnesses that led to government-imposed restrictions. As recently as July 1, 2025, Ghana's Ministry of Health confirmed 107 new cases and an additional 316 suspected cases of the Omicron sub-variant of COVID-19 in Accra (Addae, 2025).

In this context, as the COVID-19 pandemic enters a new phase of uncertainty, some commentators have begun referring to it as 'long COVID' or 'long-haul COVID' (Soriano et al., 2022; CDC, 2022). Indeed, as Nia (2021) warns, the number of pandemics has dramatically increased over the last 200 years, raising the likelihood of future pandemics. Therefore, it is critical to reflect on the effects of past policy responses to develop nuanced and contextualized scientific knowledge for decision-makers to combat the disease and its impacts. This paper makes two key contributions. Methodologically, we triangulate various data sources, including surveys and photographs, to map spatial variations in mobility patterns. Empirically, we provide evidence of how the pandemic has affected travel behavior differently across socio-economic groups in a developing country context, highlighting policy implications for post-COVID-19 planning of inclusive mobility options.

2. Literature review

The COVID-19 pandemic had a profound impact on research activities (Sohrabi et al., 2021). Studies have specifically examined the policy implications of lockdown measures and their strict physical restrictions on

social interactions, particularly concerning transport travel behavior (de Haas et al., 2020; Rodríguez González et al., 2021; Munawar et al., 2021; Li et al., 2022; Gramsch et al., 2022; Gladwin & Duncan, 2022; Vallejo-Borda et al., 2022; Lu & Giuliano, 2023; Kroesen et al., 2023; Hintermann et al., 2023). Collectively, these studies show that transport users adapted dynamically during and after the pandemic. For example, due to concerns about contracting the virus, fewer people used public transport and instead chose less crowded, active modes of transport like cycling and walking. Telecommuting and online shopping also gained popularity among urban residents during the lockdown, particularly in high-income countries with accessible internet facilities. However, in poorer and ethnically marginalized areas, compliance with government stay-at-home orders was often lacking.

Additionally, other research highlighted how the lockdown measures reduced anthropogenic sources of pollution, including emissions from industries and transport, and their implications for public health risks (Venter et al., 2020). These studies were conducted in major European cities such as Rome, Milan, and London (Winkler et al., 2021; Aboagye et al., 2021; Llaguno-Munitxa & Bou-Zeid, 2023) and in North American cities like Boston and Atlanta (Terry et al., 2021; Huang et al., 2021). Similar studies in Asian cities, including Beijing, Nanjing, Lucknow, New Delhi, Peshawar, Karachi, Quetta, Lahore, and Islamabad (Srivastava et al., 2020; Lin et al., 2021; Tao, Diao & Cheng, 2021; Khan, 2021), unanimously concluded that transport-related NO2 and PM2.5 concentrations significantly decreased, improving ambient air quality, although indoor air quality deteriorated due to increased heating and cooking.

Some commentators have argued that much of the research on the pandemic's effects on mobility and environmental outcomes has primarily focused on high- and middle-income countries (Kutela et al., 2021). In fact, data on COVID-19 and mobility patterns in response to government interventions are scarce in low-income nations (Kim, 2021). Noteworthy studies from Africa include Sogbe (2021) in Ghana and Mogaji et al. (2022) and Mogaji (2022) in Nigeria. For instance, Mogaji et al. (2022) found that impoverished and marginalized residents of Lagos, who typically relied on jitney-type public transport known as "Danfo," faced higher costs because of limited bus space; opportunistic drivers took advantage of this scarcity to charge more. Their survey participants also indicated a willingness to change their travel behavior post-pandemic, particularly regarding telecommuting and online shopping.

Research from Ghana has primarily focused on the health and economic impacts of COVID-19 on vulnerable populations (Asante et al., 2021). Some studies have also examined the level of compliance with specific COVID-19 mitigation measures implemented by the government, such as the use of face masks and hygienic practices (Dzisi & Dei, 2020; Bonful et al., 2020; Agyemang et al., 2021). Additionally, there has been documentation regarding the mistrust in government mitigation measures (Owusu et al., 2022; Bisung et al., 2021). Nathavni et al. (2022) conducted a significant study that utilized intelligent sensing and analytics to analyze the spatial and temporal dynamics of Accra's environment, focusing on health, livability, safety, and sustainability before, during, and after the city's lockdown. However, they did not explore the social science aspects of transportation, particularly the impact of lockdown on the mobility patterns of different socio-economic groups living in various urban neighborhoods, as has been discussed in other studies (Lu & Giuliano, 2023; Daňková, & Dostál, 2011).

To address this gap in the literature, this paper aims to investigate how COVID-19-induced travel restrictions differentially affected attitudes and mobility behaviors in urban Ghana. The goal is to highlight and promote concepts such as 'urban environmental justice' (Llaguno-Munitxa & Bou-Zeid, 2023), 'socially sustainable transport' (Dankova & Dostal, 2011), 'transportation justice' (Karner et al., 2023), and 'eco-mobility justice' (Di Ruocco, 2024).

Socially sustainable transport acts as a bridge between various cultures and social groups, helping to reduce barriers to communication and fostering beneficial coexistence (Dankova & Dostal, 2011). The present authors draw inspiration from previous research, which asserts that "to achieve true justice, transportation researchers

from across the disciplinary spectrum need to continue to advance their work, engage with affected communities, and aim for transformative change" (Karner et al., 2023, p. 5).

3. Materials and methods

3.1 Research Design

In line with the research objectives of this paper, we conducted surveys to assess the lived mobility experiences and social interactions of residents in the Greater Accra Metropolitan Area (GAMA) during three distinct periods: before, during, and after the COVID-19 lockdown. With a population exceeding 5 million (GSS, 2021), GAMA comprises the Greater Accra Region and its contiguous areas, including Kasoa in the Awutu Senya East Municipality (Agyemang, 2017). For the specific age group of interest (18-80 years), the Ghana Statistical Service (2021) estimates the total population at approximately 3,046,719. For a population of over 100,000, a sample size of 400, at a 95% confidence interval and a 5% margin of error, is considered ideal and representative of the general population (Israel, 1992). To account for potential incomplete responses, we adjusted the sample size by 40%, resulting in a total of 560 participants.

Survey participants were recruited via an online questionnaire created using the KoboCollect toolbox. We utilized a convenience sampling method and shared a link among the researchers' professional and non-professional networks, similar to previous studies (Sureshkumar, 2023; Zuiderwijk, 2024). The survey was disseminated through social media platforms, notably WhatsApp, Twitter, and Instagram, between September 25th and October 13th, 2020.

To ensure that participants were residents of GAMA and responding from the appropriate geographical area, they were required to provide the name of their neighborhood. Additionally, a GPS locator was embedded at the end of the questionnaire to automatically capture participants' locational coordinates. Participants were encouraged to share the survey link with their contacts using a chain sampling approach. To include views from individuals in the informal sector, who are generally offline, we allowed participants who completed the survey to explain the instrument to adult acquaintances who could not read but wished to participate. A reminder was sent to participants and, through them, to their contacts on October 1st, 2020, to increase the response rate.

3.2 Questionnaire survey data

The survey measured various aspects of the participants' socio-economic backgrounds, including gender, age, education, and occupation. It also assessed attitudes toward COVID-19, including participants' fear of the virus, compliance with lockdown directives, and commuting behaviors before, during, and after the lockdown. Of the 560 submissions received, 77 were discarded due to being incomplete, resulting in a response rate of 86.3% (i.e., 483 valid responses). Preliminary data treatment indicated that the sampled population did not accurately represent the demographic dynamics of GAMA. This discrepancy was partly due to the method of data collection. To address this, we adjusted the data to reflect the age and gender distribution of GAMA, as published by the Ghana Statistical Service, using MATLAB R2018b (version 9.5) software. We developed an algorithm based on the concept of iterative proportional fitting to generate weights for the sampled individuals. The weights for each category (age x gender) were calculated by dividing the general population categories normalized to the sampled respondents' demographic categories. The weighted data were further analyzed for consistency and reliability, resulting in a Cronbach's Alpha score of 0.72, indicating that the data is robust, consistent, and reliable (van Griethuijsen et al., 2014).

We used IBM SPSS software (version 20) to analyze our primary survey data. In addition to descriptive statistics, we performed Pearson's chi-squared tests to evaluate variations among different groups of

respondents regarding their mobility patterns and to assess statistical significance. Furthermore, we conducted correlation analyses to understand the strength of linear relationships among the socio-economic and demographic groupings.

3.3 Remotely-sensed data

Following the approval of the study protocol (ECH147/18-19) by the University of Ghana Ethics Committee for the Humanities, and with the permission of local residents, we installed Moultrie-M50 cameras at 145 sites throughout the Greater Accra Metropolitan Area (GAMA) over a 15-month period, capturing approximately 2 million time-lapsed images. As previously described (Nathavni et al. 2022), our research team labeled a subset of 1,250 images containing 20 contextually relevant distinct objects related to mobility, safety, leisure and play, daily life activities (such as shopping), air and noise pollution, and sanitation and hygiene. We stratified the images based on the frequency and size (measured by pixel count) of each object category. Additionally, we categorized the images as color or greyscale, corresponding to daytime and nighttime images. These strata were split into subsets of 60% for training, 20% for validation, and 20% for testing an adapted convolutional neural network (CNN) model. Further details concerning our image labeling protocol, the analysis code used for our model's basic parameters, and the calculations of mean and standard deviations for the images can be found at https://zenodo.org/records/7401005#.Y44cfi-l19c.

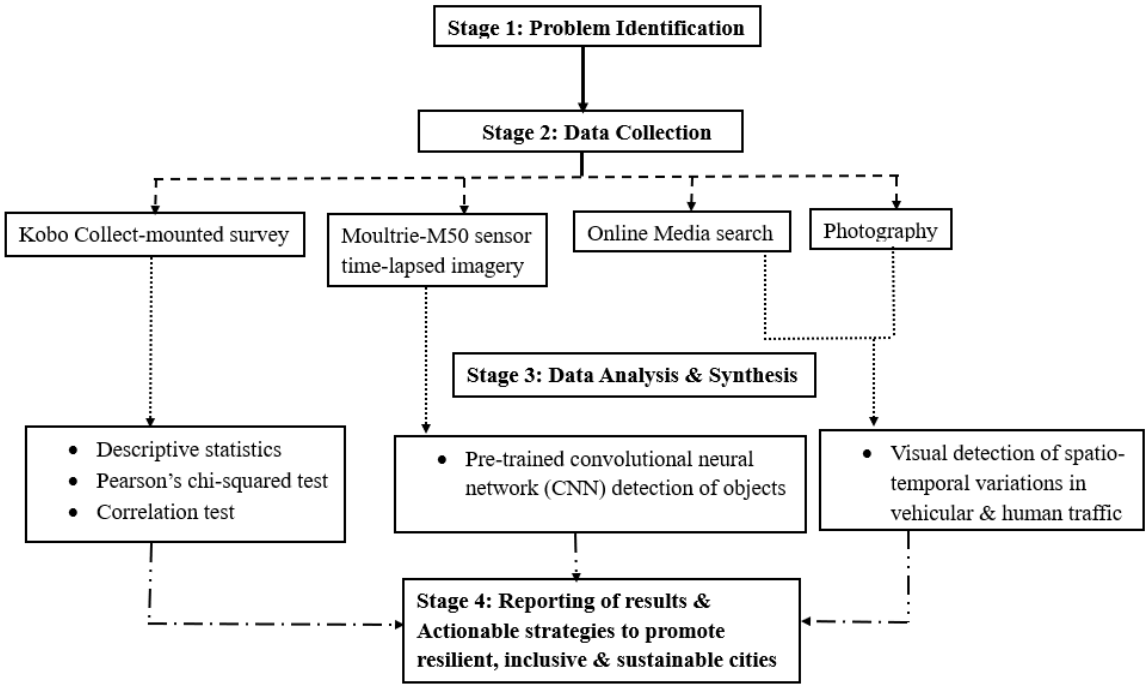

Fig.1 The research flow chart process

To study the impacts of the lockdown order in the time-lapsed images, we carefully selected data from four distinct neighborhoods in Accra: Nima, Asylum Down, East Legon, and Labadi. Nima is a densely populated and culturally diverse community featuring a mix of residential and commercial areas, located in the Ayawaso West Municipal District of Accra. Asylum Down is situated in the heart of the Accra Metropolis, characterized by a blend of old and new residential buildings and commercial activities. East Legon is an upscale residential area that includes luxury homes, apartments, and gated communities. Labadi, commonly referred to as La, is in the La Dade-Kotopon Municipal District of Accra and is known for its popular beachfront area, combining residential and commercial properties. We also included data from the University of Ghana and the Accra-Tema Motorway for our analysis. The algorithm used in our study categorized the presence of the objects of interest into three distinct time frames. The 'pre-lockdown' period is defined as the 21 days prior to the

declaration of lockdown in Accra (March 9th - March 29th, 2020). The 'lockdown' period is defined as the 21 days during which Accra and surrounding districts were under quarantine (March 30th - April 19th, 2020). The 'post-lockdown' period is defined as the 21 days following the announcement of the easing of the lockdown by the President of Ghana (April 20th - May 10th, 2020).

Finally, we gathered internet media reports and photographs taken by journalists along some major, busy corridors of Accra one day after the lockdown was announced. After the lockdown was lifted, and while following all COVID-19 safety protocols, we conducted field observations and documented the level of traffic activity in those same locations photographically.

The photographs taken during and after the lockdown were placed side-by-side for analysis to identify the settings, including geographic areas, time of day, and the surrounding environment. This analysis aimed to gauge the level of vehicular traffic and human activities during the specified periods. A summary of the research flow is presented in Fig.1.

4. Results

4.1 Data characteristics

The data indicates that just over half of the surveyed population were females, comprising 51.1%. In terms of age, the majority of participants were millennials (42.9%) and post-millennials (24.6%). These gender and age demographics reflect the population structure of Ghana and many African countries, which typically have a higher proportion of youth and females.

More than two-thirds of the sampled population were highly educated, including those who were tertiary students at the time of the survey (24.6%), those who had obtained diplomas and degrees (26.5%), and individuals with postgraduate degrees (23.2%). Regarding occupational status, over half of the participants (55.5%) reported being employed in the formal sector, while nearly a quarter (24.8%) were still students. Employees in the informal sector represented the smallest group at 19.7%.

Most survey participants (62.3%) identified themselves as regular users of public transport, with around 30% indicating they used cars. Additional information about the survey participants can be found in Tab.1.

Variable	**Category**	**Frequency**	**Percent**
Gender	Male	236	48.9
	Female	247	51.1
Age	18-24 (Post-millennials)	119	24.6
	25-39 (Millennials)	207	42.9
	40-54 (Generation X)	100	20.7
	55 + (Baby-Boomers)	57	11.8
Education	No formal education	15	3.1
	Basic (Primary & Junior High)	46	9.5
	Senior High	63	13
	Tertiary (currently enrolled)	119	24.6
	Tertiary (Completed)	128	26.5
	Postgraduate (Masters & higher)	112	23.2
Occupation status	Formal sector	268	55.5
	Informal sector	95	19.7
	Student	120	24.8
Commute Mode share	Motor taxi (Okada)	1	0.2

Bus	2	0.3
Traditional taxi	11	2.3
App-based taxi	28	5.7
Car	141	29.2
Trotro	301	62.3

Tab.1 Overview of survey participants

4.2 Attitudes towards Covid-19 and lockdown compliance

When asked, "Did you visit family and friends outside of your home during the lockdown period, and how often?" the data revealed that a majority (88%) of participants complied with the directive to stay indoors. However, a weak statistical variation (p=0.037) was observed in terms of full compliance with the lockdown directive based on the age of the participants. Fig.2 illustrates that millennials and post-millennials were more likely to violate the lockdown order compared to other age groups, having visited individuals outside their immediate households a few times. Interestingly, while individuals over 55 years largely complied with the directive, approximately 14% of them reported visiting other locations "about one or two times".

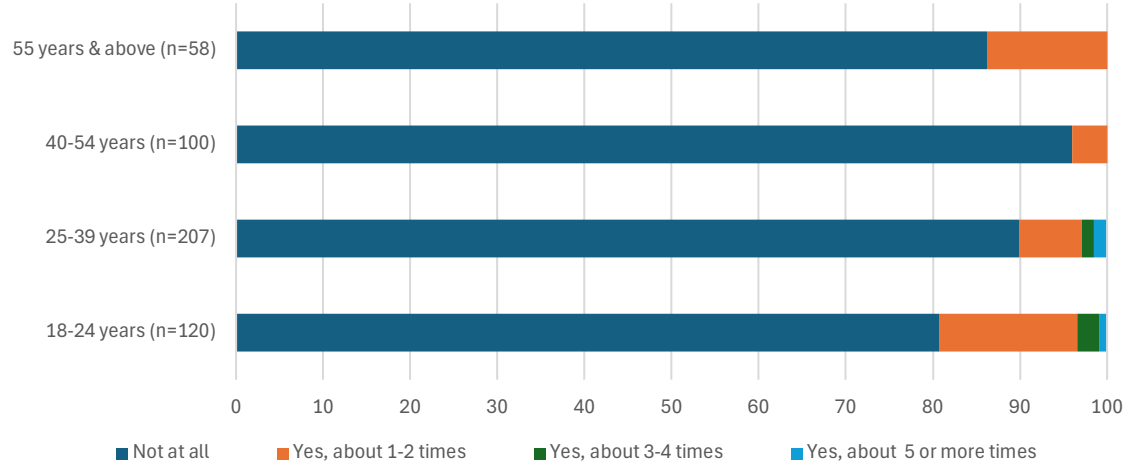

Fig.2 Compliance with lockdown directive by the age of participants

4.3 Adaptation to Covid-19 mobility restrictions

To overcome geographic barriers and stay connected during the lockdown period, many participants utilized telephone and internet-enabled services. Data revealed that a significant portion of survey participants (40%) engaged in internet-based telecommuting and e-learning opportunities during the lockdown.

However, following the relaxation of social restrictions, there was a 47.8% decrease in the use of telecommuting and e-learning. Conversely, physical movements for work-and-study-related trips increased by 31.8% after the lockdown period, as shown in Fig.3.

A Chi-square test for independence (with Yates continuity correction) indicated a statistically significant association [X^2 (5, n=484), p =0.001, phi=0.38] between the educational status of participants and their choice of mode of transport (i.e., physical or virtual) during and after the lockdown measures. The results showed that, during the lockdown, all respondents with no formal education (100%) and a majority of those with basic education (93.6%) or senior high education (88.9%) continued to physically commute to their destinations. This trend persisted even after the government lifted the ban on physical mobility. In contrast, about 50% of respondents who had completed their degrees or were pursuing degree programs primarily relied on telecommuting or e-learning during the lockdown. The data revealed that most students (51.7%)

utilized virtual technologies for e-studying or telecommuting in response to the lockdown, although there was a notable decline of about 58% in internet use for these purposes following the easing of restrictions.
Similarly, the type of occupation [X^2 (2, n = 483), p = 0.001, phi = 0.34] was statistically associated with transport mode choices during both periods under consideration. As expected, informal sector employees primarily commuted physically during the lockdown (94.7%) and continued to do so after restrictions were eased (92.6%). In contrast, 45% of formal sector employees used the internet to perform their functions during the lockdown, but this figure dropped by 44% once the lockdown was lifted.

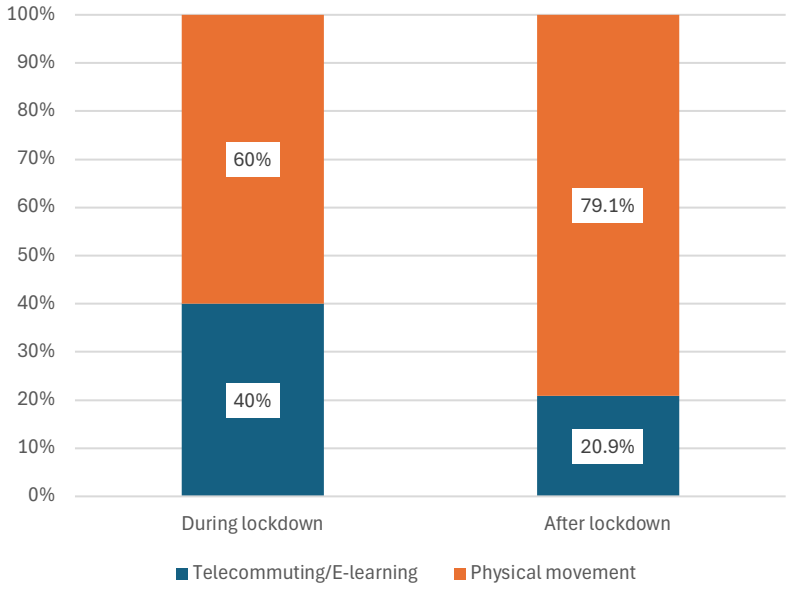

Fig.3 Modal share dynamics during and after lockdown for work/study-related trips

Furthermore, the age predictor variable was only statistically significant during the lockdown period [X^2 (3, n = 482), p = 0.001, phi = 0.34)], indicating it played a role in mode choices (i.e., physical or virtual transport) only during this time. During the lockdown, 61% of Generation X respondents reported a significant increase in their internet use for social activities. However, older individuals from the Baby Boomer generation primarily continued to commute physically and did not rely on telecommuting during the lockdown.
Interestingly, the perception of increased internet use to bridge geographic distances during the lockdown period was unexpectedly low among many younger respondents. Tab.2 provides further details on the relationship between transport mode choice and lockdown orders among various sample populations.

Variable	Category	DURING LOCKDOWN		P-value	AFTER LOCKDOWN		P-value
		Virtual Access	Physical Access		Virtual Access	Physical Access	
Age	18-24	45 (37.4%)	74 (62.2%)	0.000	21 (17.6%)	98 (82.4%)	0.187
	25-39	79 (38.3%)	127 (61.7%)		43 (20.8%)	164 (79.2%)	
	40-54	61 (61.0%)	39 (39.0%)		27 (27.0%)	73 (73.0%)	
	55 +	0 (0.0%)	57 (100%)		8 (13.8%)	50 (86.2%)	
Education	No formal education	0 (0.0%)	15 (100%)	0.000	0 (0.0%)	15 (100%)	0.000
	Basic (Primary & Junior High)	3 (6.4%)	44 (93.6%)		5 (10.6%)	42 (89.4%)	

	Senior High	7 (11.1%)	56 (88.9%)		7 (11.1%)	56 (88.9%)	
	Tertiary (currently enrolled & completed)	176 (49.0%)	183 (51.0%)		88 (24.5%)	271 (75.5%)	
Occupation status	Formal sector	118 (45.0%)	150 (55.0%)	0.000	66 (24.6%)	202 (75.4%)	0.002
	Informal sector	5 (5.3%)	90 (94.7%)		7 (7.4%)	88 (92.6%)	
	Student	62 (51.7%)	58 (48.3%)		26 (21.7%)	94 (78.3%)	

Tab.2 Modal share dynamics of participants during and after the lockdown

4.4 Spatio-temporal patterns in human and vehicular traffic in response to Accra's lockdown

Our observations indicate a general decrease in social activity, as reflected by the reduced presence of people due to lockdown measures. Fig.4 illustrates the mean daily trends in the number of people recorded through images taken before, during, and after the lockdown in Accra. The shaded bands represent the standard deviation variation at specific times of day before the lockdown, allowing for a comparison of subsequent trends relative to pre-COVID periods.

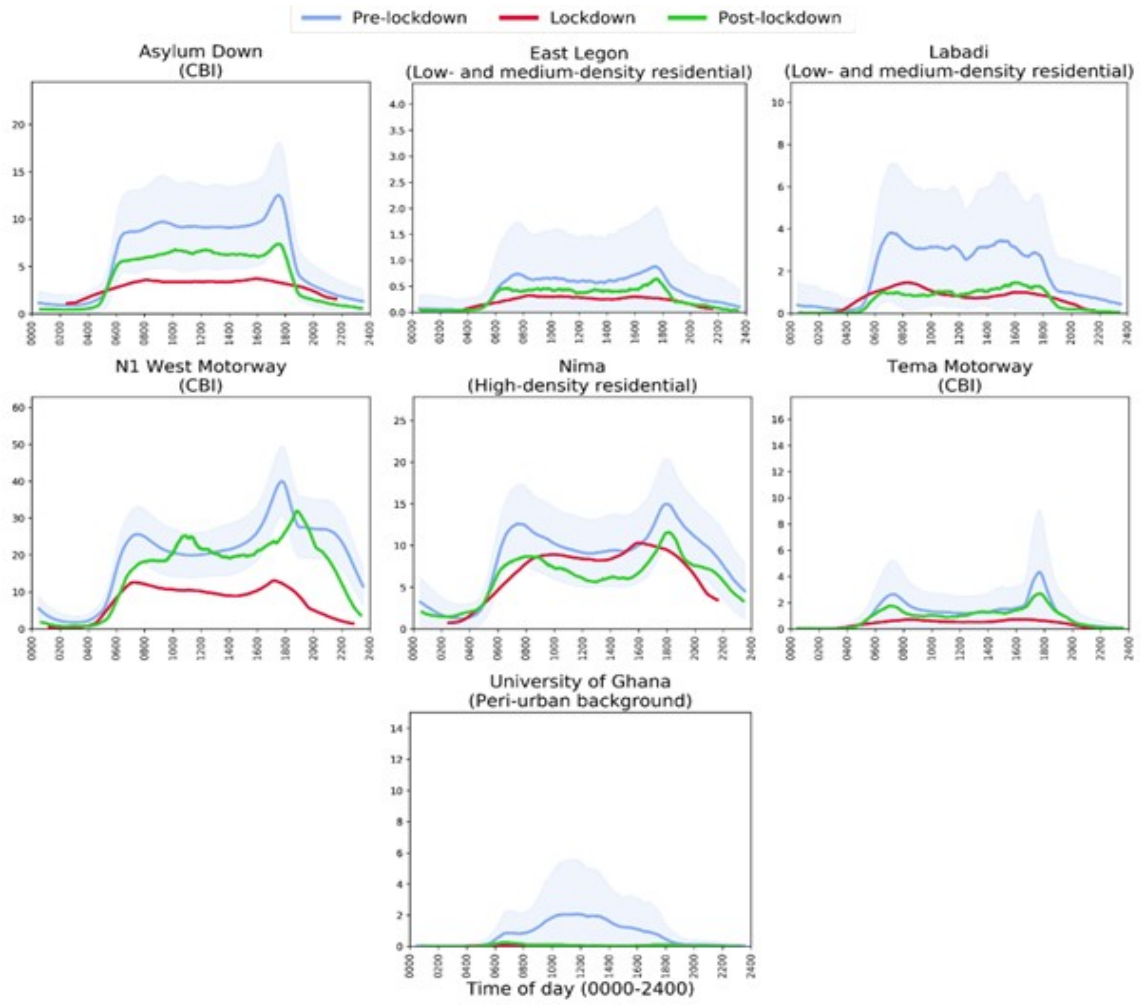

Fig.4 Average daily trends of counts of people in imagery (smoothed) in before, during and after the COVID-19 lockdown

During the lockdown, the data reveal a significant reduction in the presence of people during daylight hours (approximately 6 am to 6 pm) across all observation sites, compared to average levels before lockdown.

However, in Nima, the observed reduction was proportionally smaller. In contrast, at Asylum Down, East Legon, and Labadi, the number of people present in the early morning hours (around 12 am to 5 am) was slightly higher than during the pre-lockdown period, though still within the range of variation observed earlier. In higher-income neighborhoods like East Legon and the nearby major public university, the visible presence of people was minimal. After the lockdown was lifted, the number of people returned to just below pre-lockdown levels at all observation sites except for two locations—Labadi and the public university campus—where the presence remained at lockdown levels immediately following the easing of restrictions.

Similarly, photographs taken the day after the lockdown was enforced showed deserted streets and public transport terminals. However, shortly after the lockdown was lifted, traffic activity levels returned nearly to pre-lockdown volumes, as shown in Figs.5 (a & b) and 6 (a & b).

(a) (b)

Fig.5 Changes in vehicular and human traffic at the Kaneshie-Odorkor stretch of the Busia Highway in Accra: (a) during the lockdown (31/03/2020 at 4:50 pm; Photo credit: Adomonline, 2020) and (b) after lockdown (28/10/2020 at 4:50 pm; Photo credit: Field data, 2021)

(a) (b)

Fig.6 Changes in vehicular and human traffic at the Kaneshie Market Trotro station in Accra: (a) during the lockdown (31/03/2020 at 4:50 pm; Photo credit: Adomonline, 2020) and (b) after the lockdown (28/10/2020 at 4:50 pm; Photo credit: Field data, 2021)

5. Discussion

The role of transportation in sustainable development was first recognized at the 1992 United Nations Earth Summit (UN, 2025). Effective and efficient transportation is essential for achieving inclusive, resilient, and sustainable cities for all, as outlined in Global Goal 11 (UN, 2023). The COVID-19 pandemic and its related mobility restrictions helped keep the public safe but also exacerbated existing socio-economic disparities in accessibility for various socio-economic groups, hindering progress toward the goal of leaving no one behind.

It is critical that governments and city authorities ensure mobility justice, aiming to provide equal access to transportation benefits for all individuals during both normal and crisis situations.

Focusing specifically on Accra, our data indicates that as many as 88% of survey participants complied with the announced lockdown order. This high level of compliance may be partly due to the fact that over half of the sampled population consists of formal sector employees in government or private organizations. Aside from a few essential service providers, educational and formal institutions were ordered to shut down during the lockdown. Most academic and work-related interactions were conducted online, with a significant 40% of survey participants relying on internet-enabled telecommuting, e-learning opportunities, and telephone calls during this period. This finding aligns with an earlier study showing that workers in areas with established COVID-19 mitigation cultures, including regular health monitoring and encouragement to self-quarantine when exposed to the virus, were more likely to comply with mitigation protocols (Probst et al., 2021).

Conversely, we observed that many young people (ages 18 to 39) largely disregarded the lockdown order. This behavior is understandable, as younger individuals generally perceive themselves to be healthier and thus more resilient than older populations. Previous studies have confirmed that older individuals are more likely to follow social distancing regulations (Durizzo et al., 2021) and other COVID-19 mitigation measures (Agyemang et al., 2021). In our study, a larger percentage of older formal sector workers reported a significant increase in internet usage during the lockdown.

Moreover, most respondents from the informal sector seldom utilized the internet as a safe and efficient means of social interaction and livelihood during the lockdown in Accra. The nature of informal sector jobs, especially in food services and hospitality, requires workers' physical presence. Street vendors, market traders, and porters, who make up a substantial portion of the urban informal economy, typically earn their livings in public spaces (WIEGO, 2024). When quarantines prevented them from engaging with clients physically, they faced significant livelihood losses. Research shows that the pandemic's impacts in the global South have been severe on lower-productivity enterprises and lower-paid workers, particularly women (Mukhtarova, 2020; ILO, 2021). It is not surprising that systemic inequalities and socio-economic disparities, along with urban planning methodologies that frequently overlook the specific requirements of women, contribute to ongoing mobility challenges for marginalized populations (Di Ruocco, 2025; Carpentieri et al., 2023). Access to technology for economic purposes could have significantly contributed to the resilience of female informal sector employees during the lockdown. However, a significant gender disparity exists regarding access to and use of internet resources for economic activities (Mumporeze & Prieler, 2017). Both genders face challenges such as poor internet connectivity, high data costs, and internet fraud. Nevertheless, studies have indicated that male informal traders have a competitive advantage over their female counterparts in accessing the benefits of ICT applications, such as reaching wider market bases on social media or saving time and commuting costs via online banking (Wrigley-Asante & Agyemang, 2019, p. 45). As a result, women's economic prospects in the informal sector may have been further compromised due to a lack of affordable internet access for running their businesses during the COVID-19 lockdown. Our data also reveal spatial variations in movement across the city. Human activity was significantly reduced in wealthier neighborhoods, such as East Legon, and was entirely absent near the local public university, which had shut down after a reported COVID-19 case among students, with all educational activities moving online. In contrast, there was relatively high human movement in low-income, high-density neighborhoods like Nima. Low-income earners typically need to leave their homes almost daily to earn a living and support their often-large families. This situation underscores the critical importance of equitable access to transportation and resources for all residents during emergencies.

6. Conclusion

Over the past 200 years, there have been dramatic and frequent occurrences of major epidemics and pandemics. During such emergencies, governments often adopt strict mitigation measures that, while intended

to protect the general public, can expose and worsen existing systemic inequalities and mobility injustices. The current study found that tertiary students, formal sector employees, and wealthy residents largely remained insulated from the economic impacts of lockdown orders because they could continue using technology for socio-economic interactions and activities. However, for many young people (aged 18 to 39), residents in poor, high-density neighborhoods, and women working primarily in informal sectors, compliance with lockdown orders was nearly impossible.

To promote social justice and create pandemic-resilient urban spaces while minimizing transportation-related disparities, policymakers must intentionally bridge the digital divide in accessing essential services. We concur with Di Ruocco (2025, p.106) who argues that "addressing mobility poverty requires a comprehensive approach…that promote inclusion and equity". To this end, strategies for promoting digital inclusion in Ghana should be both pro-poor and gender-sensitive. Specifically, the government should leverage existing strategic partnerships with donors and development partners to enhance the activities of the Ghana-India Kofi Annan Centre of Excellence in ICT (AITI-KACE). This partnership aims to improve digital skills among all Ghanaians, particularly targeting marginalized groups and communities to foster their inclusion in the digital economy.

Furthermore, the government should invest directly or encourage partnerships with the private sector to strengthen broadband internet infrastructure. The Ministry of Communications and Digitalization must effectively monitor the activities of communication service providers to ensure fair competition and prevent opportunistic behaviors among operators. These measures will lower internet data prices, making it more affordable and accessible for small-scale informal business operators and marginalized groups, enabling them to engage in business activities during normal times. This will also enhance their resilience during future events that may necessitate physical mobility restrictions.

Additionally, governments in the Global South should strategically invest more resources in formal mass transit options, including bus services, to improve urban mobility while also preparing for potential future emergencies.

Unlike governments, private transport service providers showed little interest in continuing service for the public good during the height of the COVID-19 pandemic. Valuable lessons can be learned from the Ghanaian government's use of high-occupancy buses operated by GAPTE to transport frontline health workers to health facilities during the lockdown. Therefore, the government must address the bottlenecks hindering the full implementation of its mass transit policy.

Moreover, there should be intentional community engagement between authorities, opinion leaders, women groups and community-based organizations working in low-income and densely populated areas, such as Nima, as identified in the study. This engagement is crucial for building trust and prioritizing the mobility needs of community members during normal times. Such a participatory and inclusive approach will provide a relevant knowledge base that can be effectively used during crisis periods, like lockdowns, to encourage compliance from all.

While this study offers valuable insights into how the government's lockdown affected attitudes and mobility behaviors differently in urban Ghana, it has several limitations that readers should be aware of. The use of convenience sampling techniques, reliance on social media platforms to recruit and remind participants about the study, and the short observational period may limit the generalizability of the research findings. Additionally, the reliance on self-reported data may pose another limitation. Future researchers should address these limitations by using larger, more diverse samples and objective measures.

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Image Sources

Fig.1: Authors' construct

Fig.2: Field data

Fig.3: Field data

Fig.4: Field data

Fig.5: (a) Adomonline, 2020 https://www.adomonline.com/covid-19-accra-empty-as-lockdown-begins-photos/

Fig.5: (b) Field data

Fig.6: (a) Adomonline, 2020 https://www.adomonline.com/covid-19-accra-empty-as-lockdown-begins-photos/

Fig.6: (b) Field data

Author's profile

Ernest Agyemang

He is presently an Associate Professor in Transportation Geography at the Department of Geography and Resource Development at the University of Ghana. His main area of research is the geography of transportation systems with a particular focus on transport and the organisation of human space/land use, sustainable urban mobilities, emerging technology-driven transport network services, and road safety. He is a 2017-award-winning China-Ghana Urban Development Forum author and is a member of the Steering Committee of the International Geographers Union (IGU) Transport & Geography Commission.

Samuel Agyei-Mensah

He is a distinguished professor at the University of Ghana and has held several significant administrative positions, including being the former Head of the Department of Geography and Resource Development, past Dean of the Faculty of Social Sciences, and the Foundation Provost of the College of Humanities. His varied research interests focus on population and health geography, demography, epidemiology, energy, air pollution, health and development studies. He is a member of the Population Association of America, the Union of African Population Studies, and the International Union for the Scientific Study of Population.

Aruna Sivakumar

She is an Associate Professor in consumer demand modelling and urban systems at the Centre for Transport Studies, Imperial College London. She is director of the Urban Systems Lab, and leads several smart city and systems modelling initiatives including, for example, the monitoring and evaluation work package of the EU Sharing Cities project, decentralised modelling of energy demand in the EPSRC-funded IDLES project, accessibility framework for equity analysis in the Wellcome Trust-funded Pathways project. Aruna has been member of several scientific committees, including the Travel Behaviour and Values subcommittee of the Transportation Research Board (TRB) in the US, and the 'Infrastructure Operation and Traffic Management in Developing Countries' committee of the World Conference on Transport Research Society (WCTRS). She is an editorial board member of Transportation Letters, and a founding stakeholder of the Zephry Foundation for Advancing Travel Analysis Methods.

Ricky Nathavni

He has a PhD in High Energy Physics, studying the internal structure of the proton for applications at the Large Hadron Collider, at University College London. His current research involves the application of machine learning techniques towards the mapping and interpretation of urban health inequity, as part of the Pathways to Equitable Health in Cities (PEHC) project. He is also a keen science communicator, having been a contributor to Quantum Diaries and co-producing a radio show on nuclear physics for the Naked Scientists on BBC Cambridgeshire. More recently, he has written scripts for several videos of the popular YouTube series SciShow and co-wrote the PBS Digital series Crash Course Engineering, an educational show that covered a variety of engineering topics aimed at a broad audience. I have also hosted various outreach stalls at public events and given talks in schools.

Majid Ezzati

He is a Professor at Imperial College London, where he serves as the Chair in Global Environmental Health within the Faculty of Medicine, School of Public Health. His research focuses on the intersection of environmental, health, social, and quantitative sciences to address public and global health issues. Currently, he is the Principal Investigator in the Pathways to Equitable Healthy Cities project, which is a global initiative aimed at improving health equity and environmental sustainability in cities like Vancouver, London, Beijing, Dhaka, Accra, and Tamale.