

Air Quality Patterns Associated with Changes in Energy Use during the COVID-19 Pandemic in Kenya

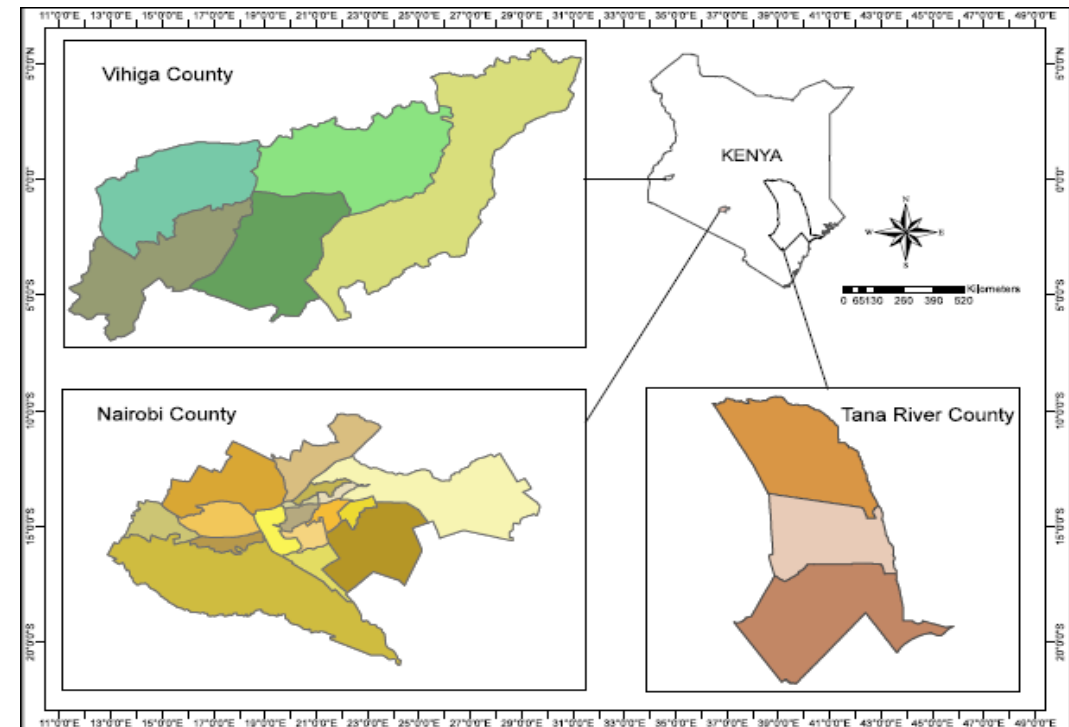
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Introduction

- Stringent measures were put in place by governments across the World to isolate cases and stop rapid transmission of the virus.
- These government policies have drastically altered patterns of energy demand around the world.
- Population confinement has led to drastic changes in energy use and is expected to have impacts on Carbon Monoxide (CO) and Nitrogen Dioxide (NO₂) emissions.
- The overall objective was to examine the effects of COVID-19 on atmospheric CO and NO₂ in urban and rural areas.

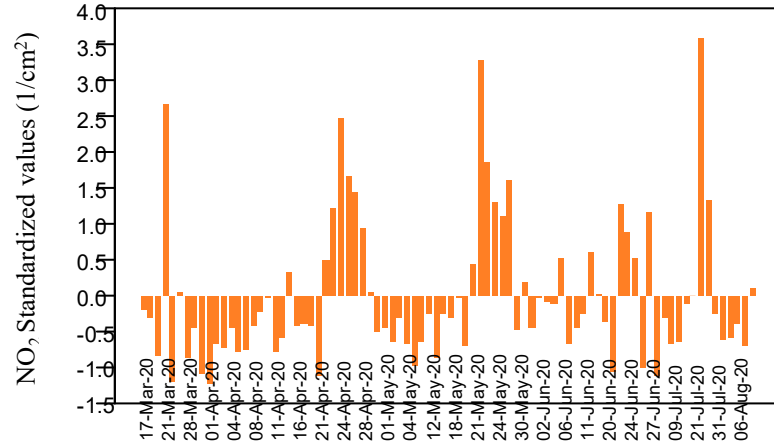
Methodology

- We utilized data on COVID-19 daily reported cases archived by the Ministry of Health from March 14 – June 30 2020.
- Satellite data on CO and NO₂ concentration, for the period 2010-2020, were extracted from MERA-2 model.
- The study areas were purposively selected to represent different demographic and environmental factors.

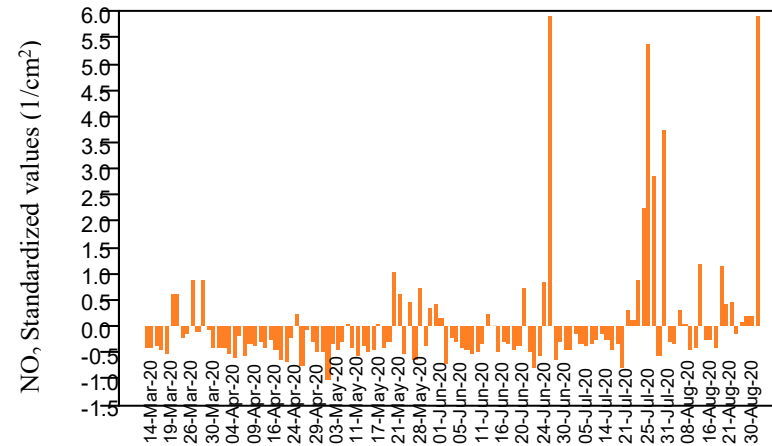


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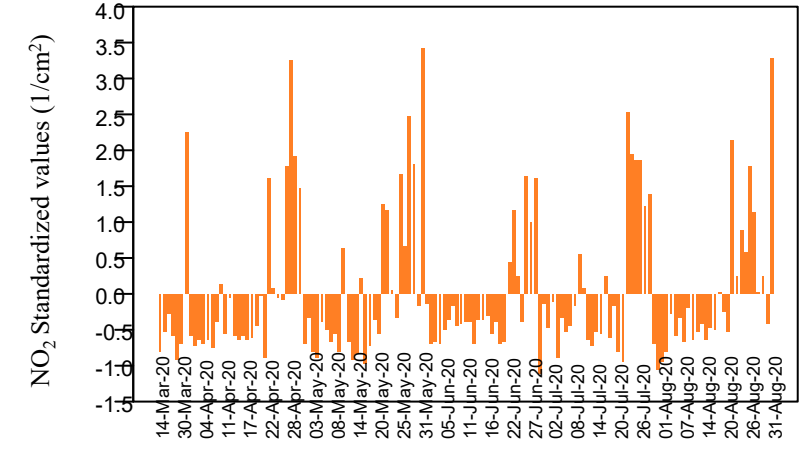
Results



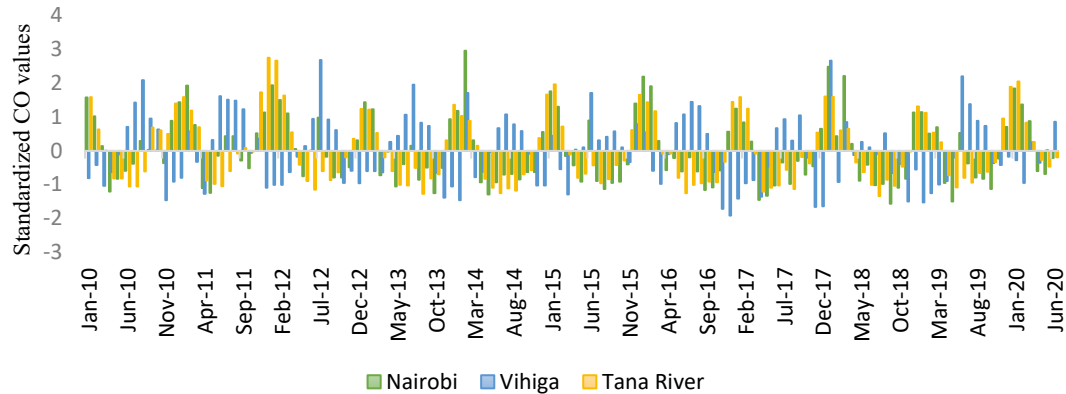
Normalised NO2 total column for Nairobi County



Normalised NO2 total column for Vihiga County



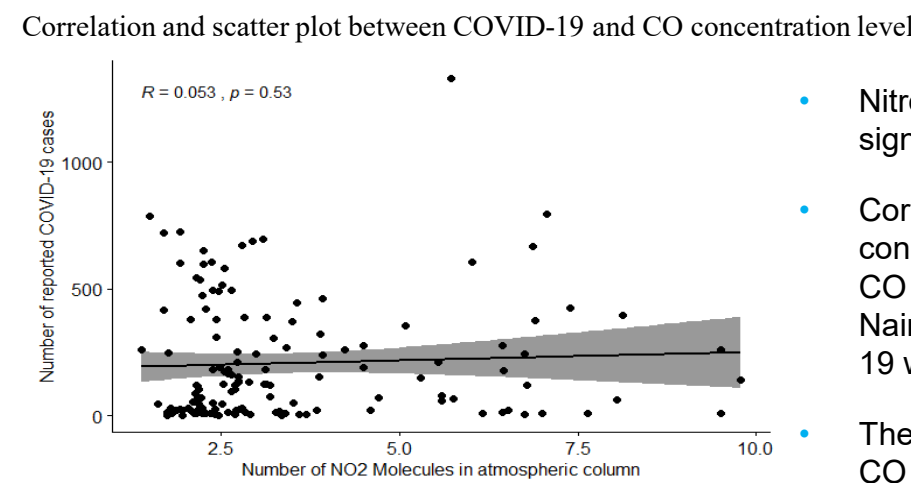
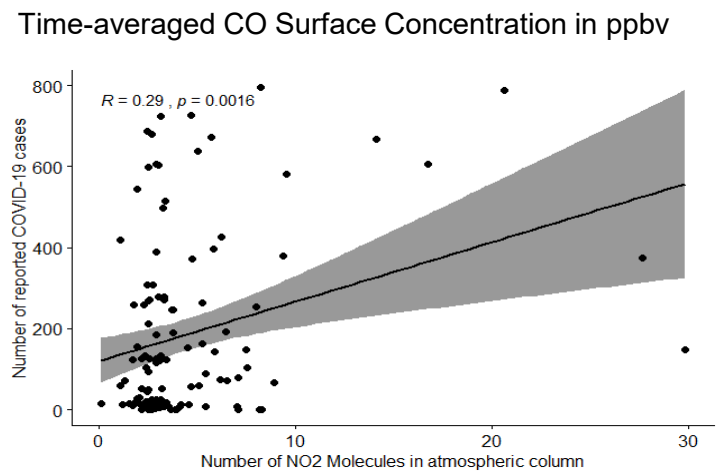
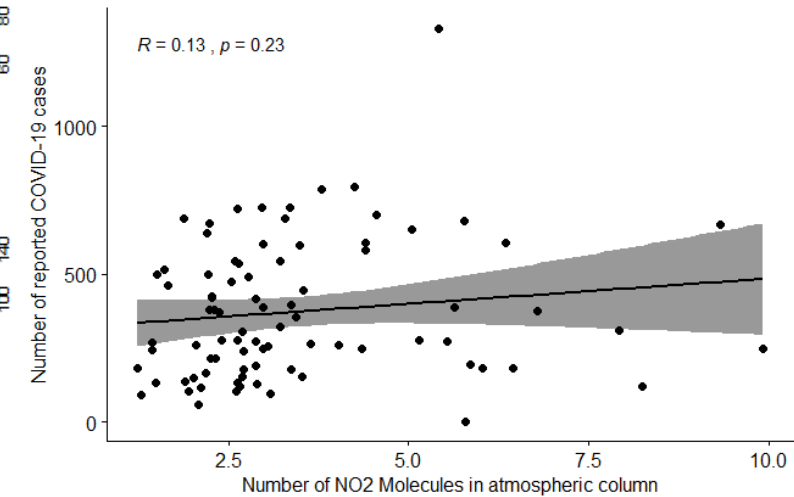
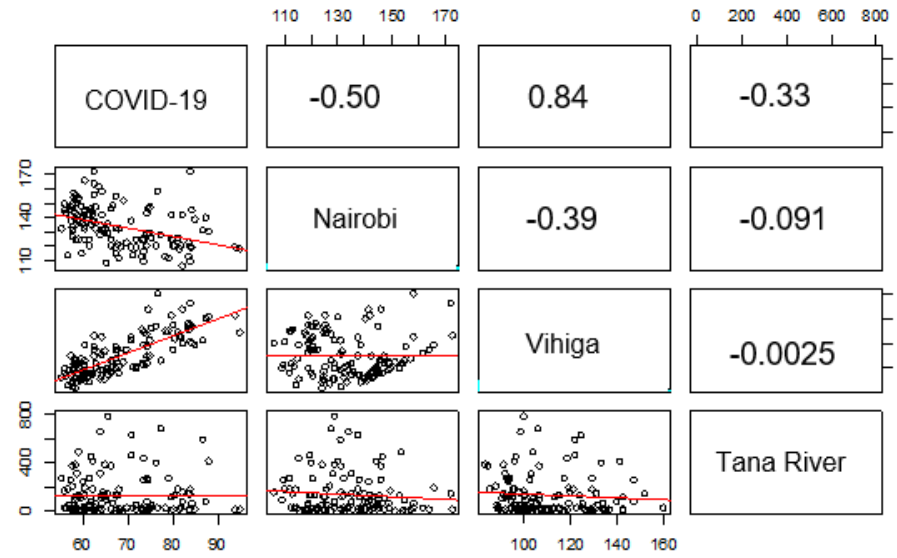
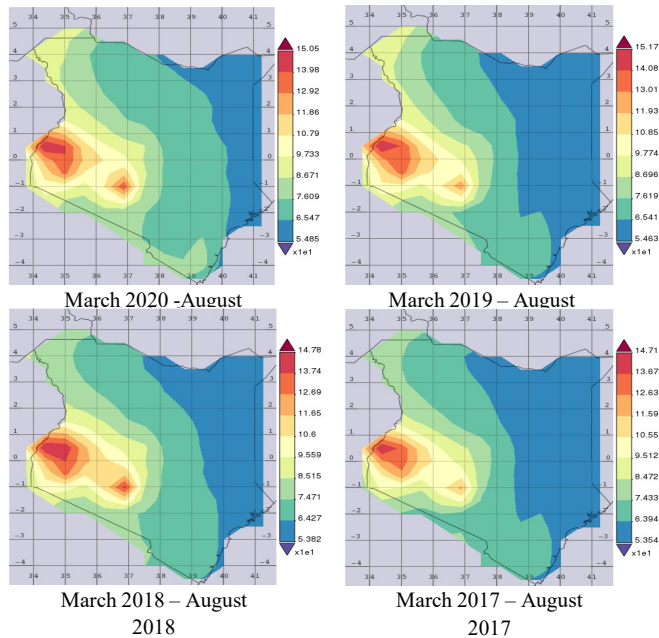
Normalised NO2 total column for Tana River County



Normalised CO concentration for Tana River, Vihiga and Nairobi counties

- Carbon Monoxide normalised values for Vihiga county were above average during the COVID-19 period
- Nairobi, Vihiga and Tana River Counties experienced below long-term average NO2 column concentration values for most of the period under consideration

Results & Discussions



- Nitrogen Dioxide tropospheric column does not portray significant spatial variation as CO concentration
- Correlation analysis of COVID-19 cases and CO concentration showed a positive effect of COVID-19 on CO levels in Vihiga county at 0.84 (p-value, 0.00), while Nairobi CO levels were negatively affected by COVID-19 with a correlation coefficient of -0.50 (p-value, 0.05)
- These results suggest an increase and a decrease in CO concentration levels in Vihiga and Nairobi counties, respectively, during the COVID-19 pandemic.

Conclusions

- COVID-19 effects on CO concentration levels were most potent in densely populated rural areas than urban areas and sparsely populated rural areas.
- Densely populated rural areas exhibited a stronger positive correlation between COVID-19 cases and CO concentration levels.
- The negative association between COVID-19 and CO levels in urban areas is attributed to decreased mobility
- During the COVID-19 pandemic (March 2020 – August 2020) NO₂ anomalies were mostly below the long term average. This is primarily due to a reduction in emissions in the transport sector. However, satellite images highlight the constant spatial and temporal variation of NO₂
- The association between COVID-19 cases and NO₂ turned insignificant for Nairobi and Tana River, but it turned significant for Vihiga county.
- The results highlight the need for demographic and economic considerations in CO and NO₂ assessment
- These findings also allude to the possibility of public health risk mitigation by a reduction in emissions from economic activities in urban areas.
- The findings also provide a baseline for needed efforts to enhance the incorporation of climate-smart bioenergy agenda in Kenya.
- In densely populated rural areas, a policy question is whether clean energy should be effectively promoted during this COVID-19 pandemic.
- This study's limitation is the unaccounted for meteorological and environmental factors that could affect ambient CO and NO₂ concentration levels.