Air pollution exposure in two Nairobi informal settlements

Kuboresha Afya Mitaani (KAM) Project

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JACARANDA HEALTH

POPULATION COUNCIL
Ideas. Evidence. Impact.

EXECUTIVE OFFICE OF THE PRESIDENT
REPUBLIC OF KENYA
NAIROBI METROPOLITAN SERVICES

SANERGY

BERKELEY AIR MONITORING GROUP

USAID
FROM THE AMERICAN PEOPLE

Kuboresha Afya Mitaani (KAM)

Project Overview

Executive Office of the President – Republic of Kenya – Nairobi Metropolitan Services

Jacaranda Health

Berkeley Air Monitoring Group

Population Council – Ideas. Evidence. Impact.

Sanergy

USAID – From the American People

Advancing MNH outcomes in Nairobi's Informal Settlements

2x

maternal mortality ratio in these settlements is twice that of the national average

53%

Increase in U5 mortality rate in these informal settlements compared with the national average

Project Ambitions

Contribute to better MNCH outcomes for **60,000 of Nairobi's most vulnerable women and children.**

Improve the understanding of drivers of poor health and test innovative solutions that will **catalyze political interest.**

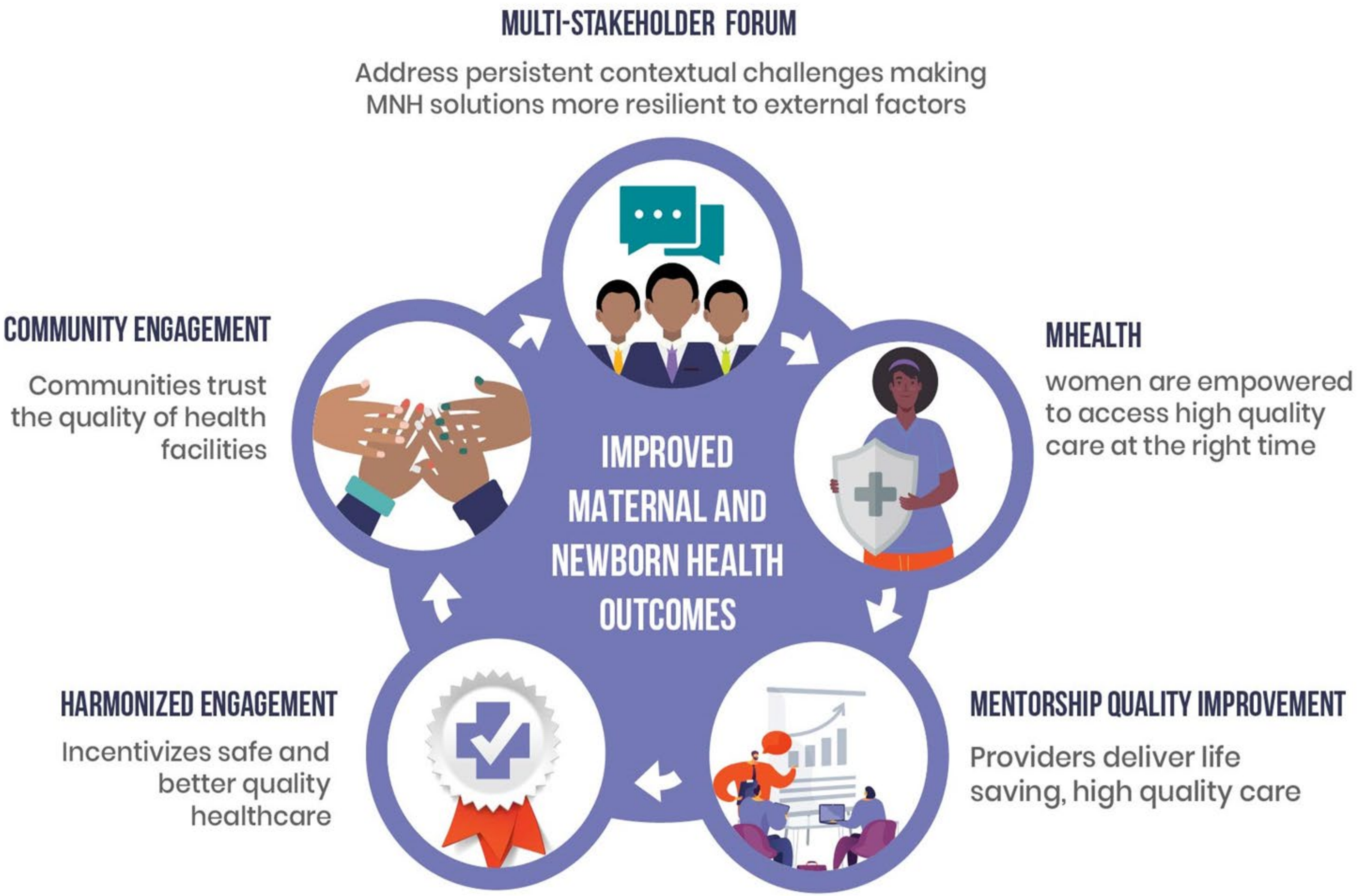
Show how approaches to tackling complex urban health challenges can be **replicable across other urban health environments**

The KAM

Quality Ecosystem

KAM is built around a 'Quality Ecosystem', which integrates typically siloed actors in the quality of care space around MNCH solutions.

All activities are underpinned by **research, documentation, and learning.**



Using evidence to understand and address the unique contextual factors affecting mums and babies in urban settings

Using Implementation Research to... → →

Better **understand unique, contextual needs** of individuals + communities in a fragmented health system

Develop **context-specific, human-centered solutions** that center the voices of mothers, and those that support them

Generate evidence to catalyse government interest in the adoption, implementation, & scale up of the interventions

Establish a **participatory forum of multiple stakeholders** to own these interventions, and ensure future sustainability

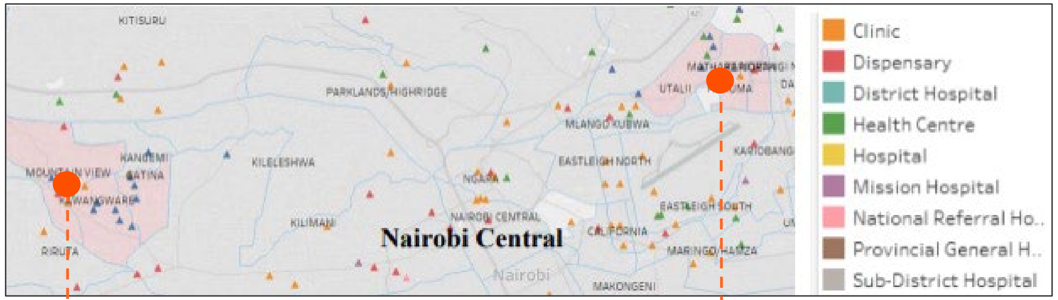
Objectives

Supporting KAM project to better understand air quality exposures for the target population:

- Characterize environments that contribute to fine particulate matter ($PM_{2.5}$) exposure for mothers and infants.
- Determine the factors associated with increased exposure to PM2.5 and prospects for mitigating that exposure through interventions.

Very little personal exposure data for residents of informal settlements

Methods: Approach



Kawangware **Mathare**

Target of 100 participants: New and expecting mothers

Subsample of KAM project study group

Sampled from two subcounty areas: Dagoretti (in Kawangware) and Starehe (in Mathare)

Sampling occurred from February 22, 2021, to March 26, 2021

Methods: Instrumentation

GPS logger

Purple Air PM2.5 monitor

Instrument insert/backpack

PM2.5 personal exposure: PurpleAir monitors along with GPS loggers for 24 hours

Ambient PM2.5: Purple Air's in the two sub-counties

PA's corrected via co-location with BAM at University of Nairobi (thank you AfriqAir!*)

Behavioral and housing characteristic survey

*James G. Gatari, Dan Westervelt, R Subramanian, Mike Giordano

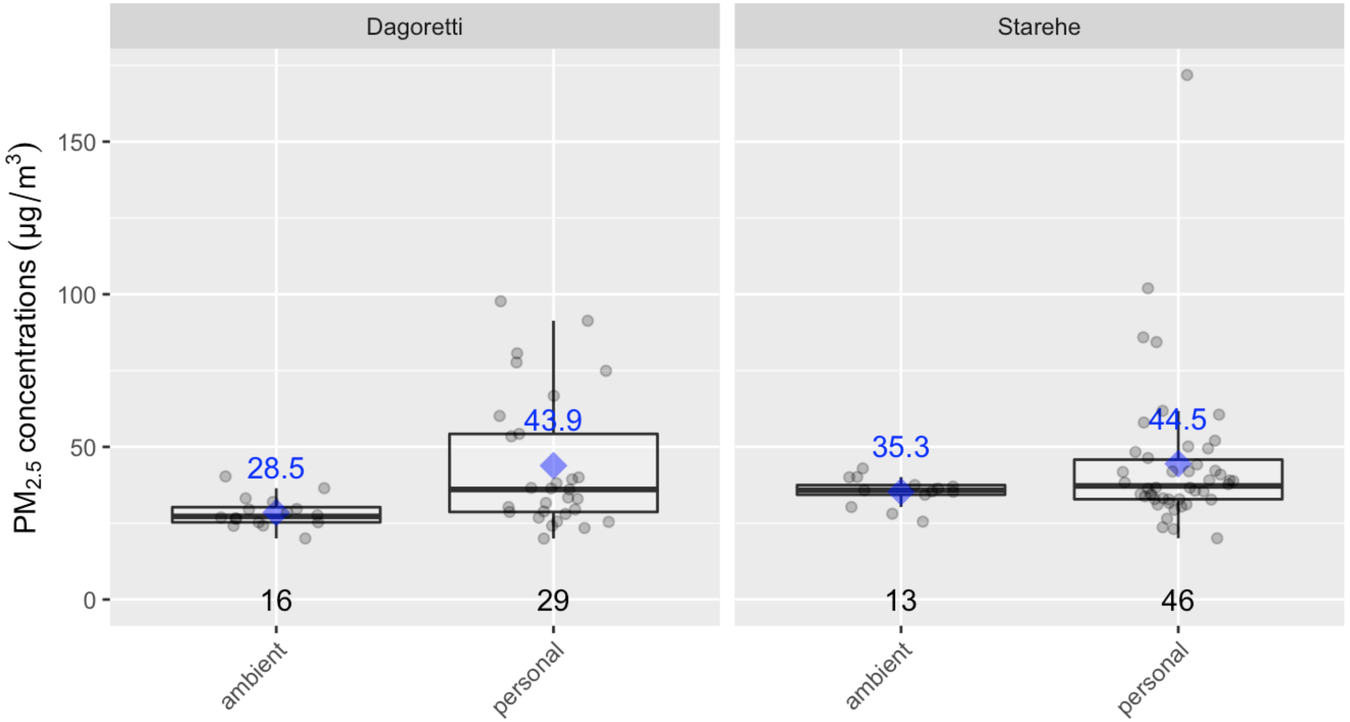
Results: Sample overview

STUDY SUBCOUNTY	AIR MONITORING SAMPLES	GPS SAMPLES	PRE-SAMPLING SURVEY	POST-SAMPLING SURVEY
STAREHE	47	47	48	48
DAGORETTI	29	30	30	29
TOTAL	76	77	78	77
DATA CLEANED FOR COMPLETENESS AND QUALITY				
TOTAL SAMPLES	71	71	71	71

Sampling cut short by COVID-19 restrictions (78 homes reached)

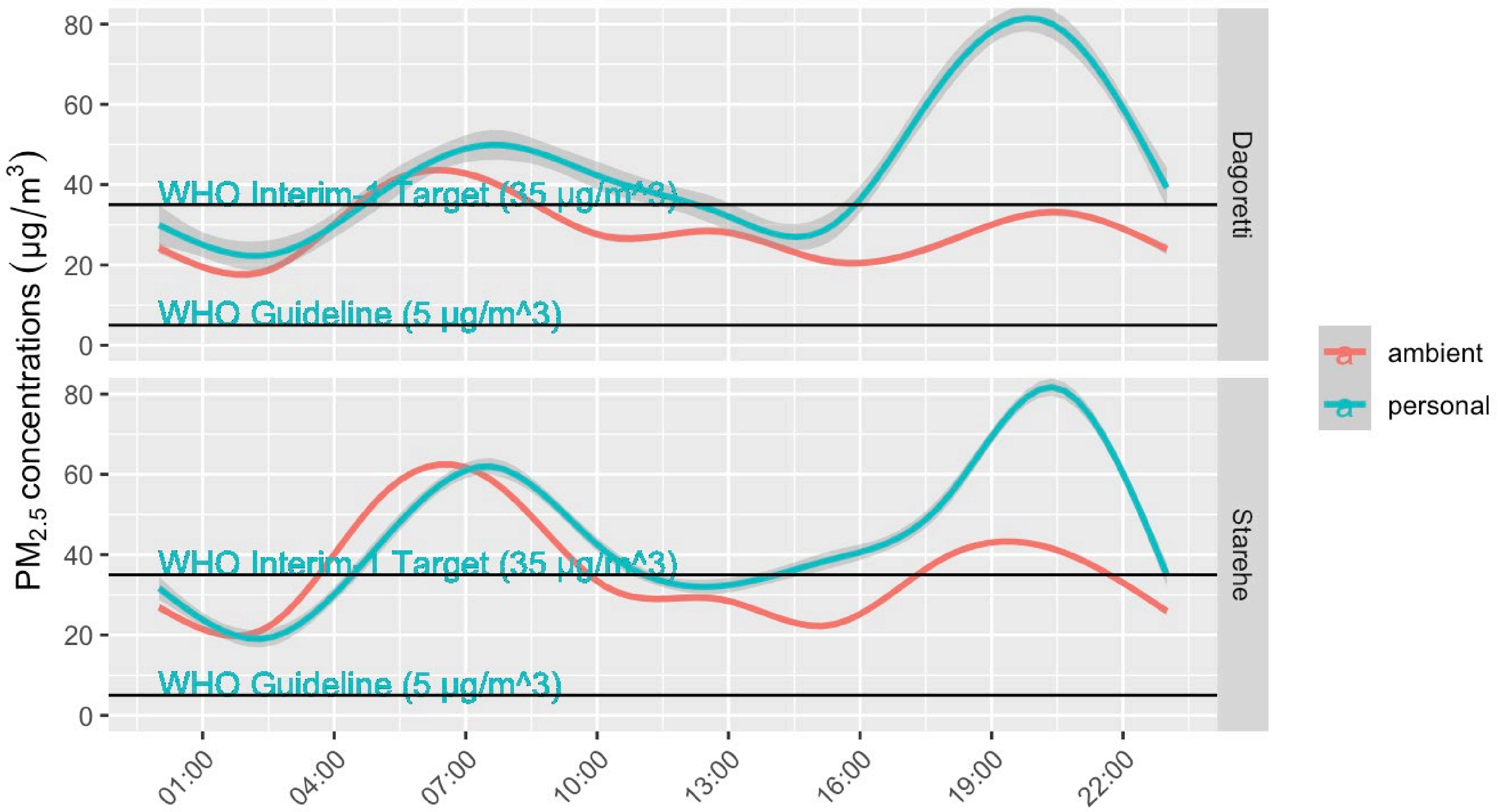
~90% data completeness

Results: 24-hour Personal Exposure and Ambient PM2.5

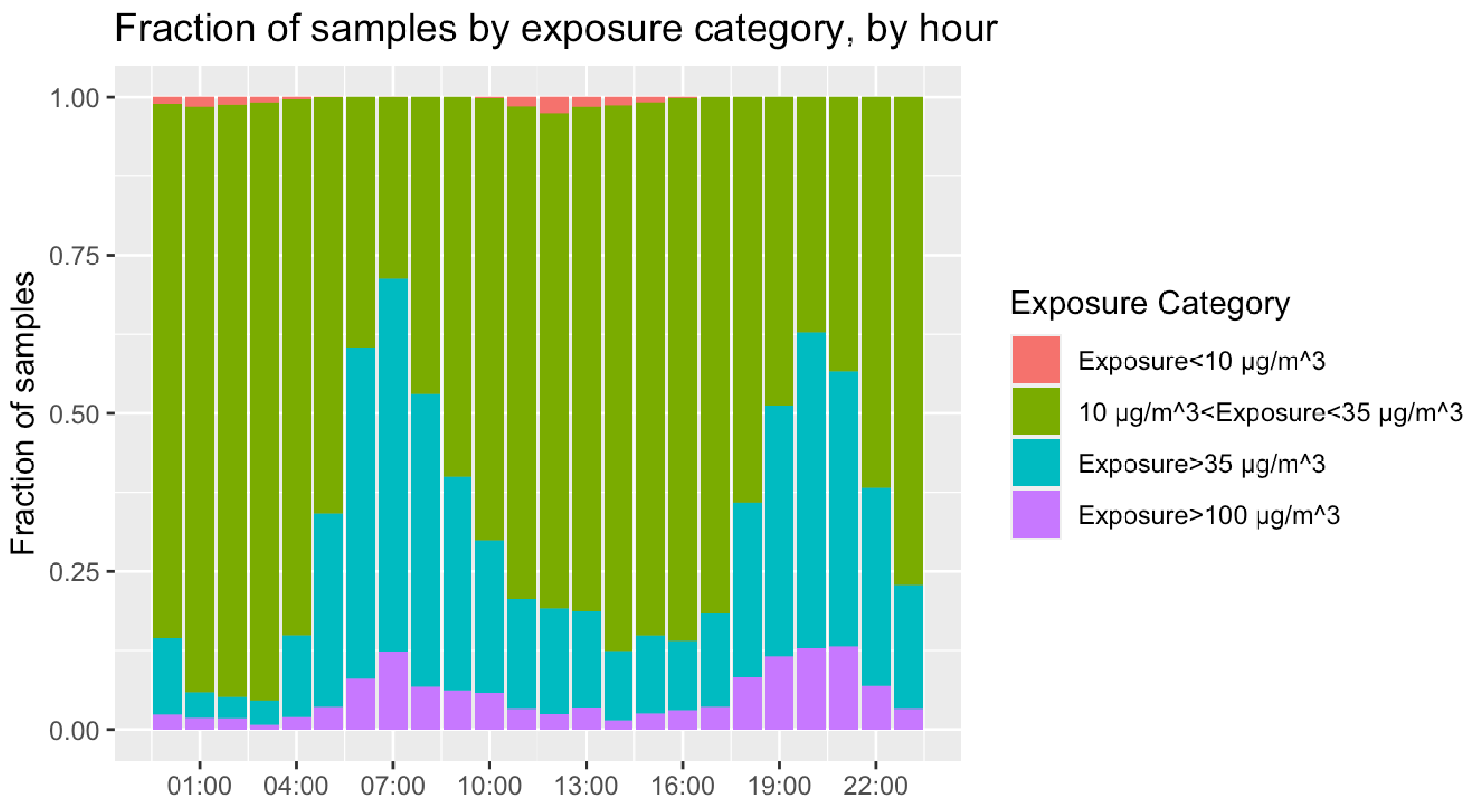


Sample type	Sub-county	N (days)	N greater than 35 µg/ m³	Min pm (µg/m³)	Median pm (µg/m³)	Mean pm (µg/m³)	Max pm (µg/m³)	SD pm (µg/m³)	Mean home pm (µg/m³)	Mean away pm (µg/m³)
ambient	Dagoretti	16	2	27.2	27.2	28.5	40.3	5.0	NaN	NaN
ambient	Starehe	13	9	25.5	35.8	35.3	42.9	4.9	NaN	NaN
personal	Dagoretti	29	15	20.0	36.0	43.9	97.7	22.1	43.1	35.5
personal	Starehe	46	28	20.1	37.2	44.5	171.8	25.0	46.1	32.3

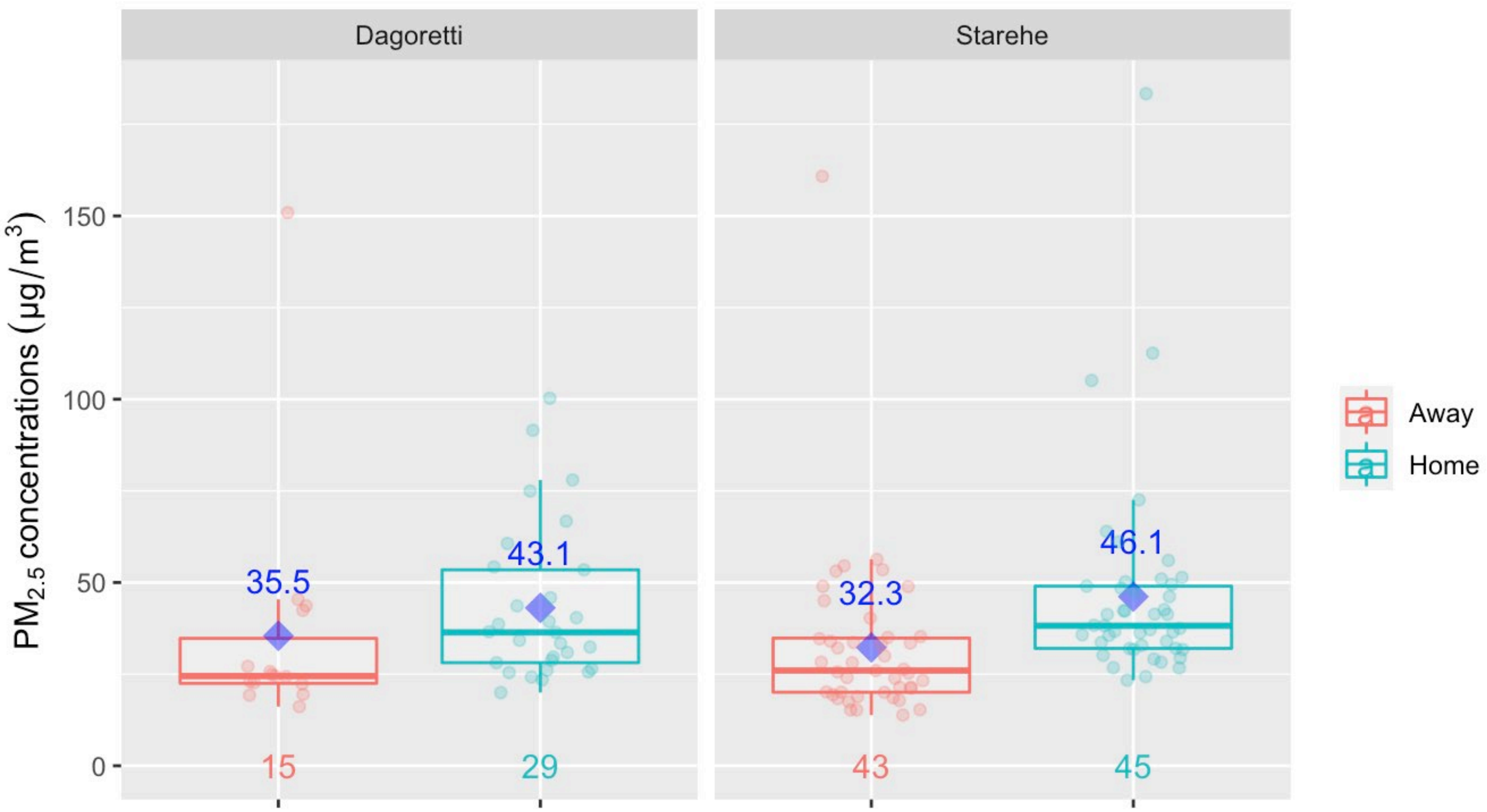
Results: Diurnal patterns



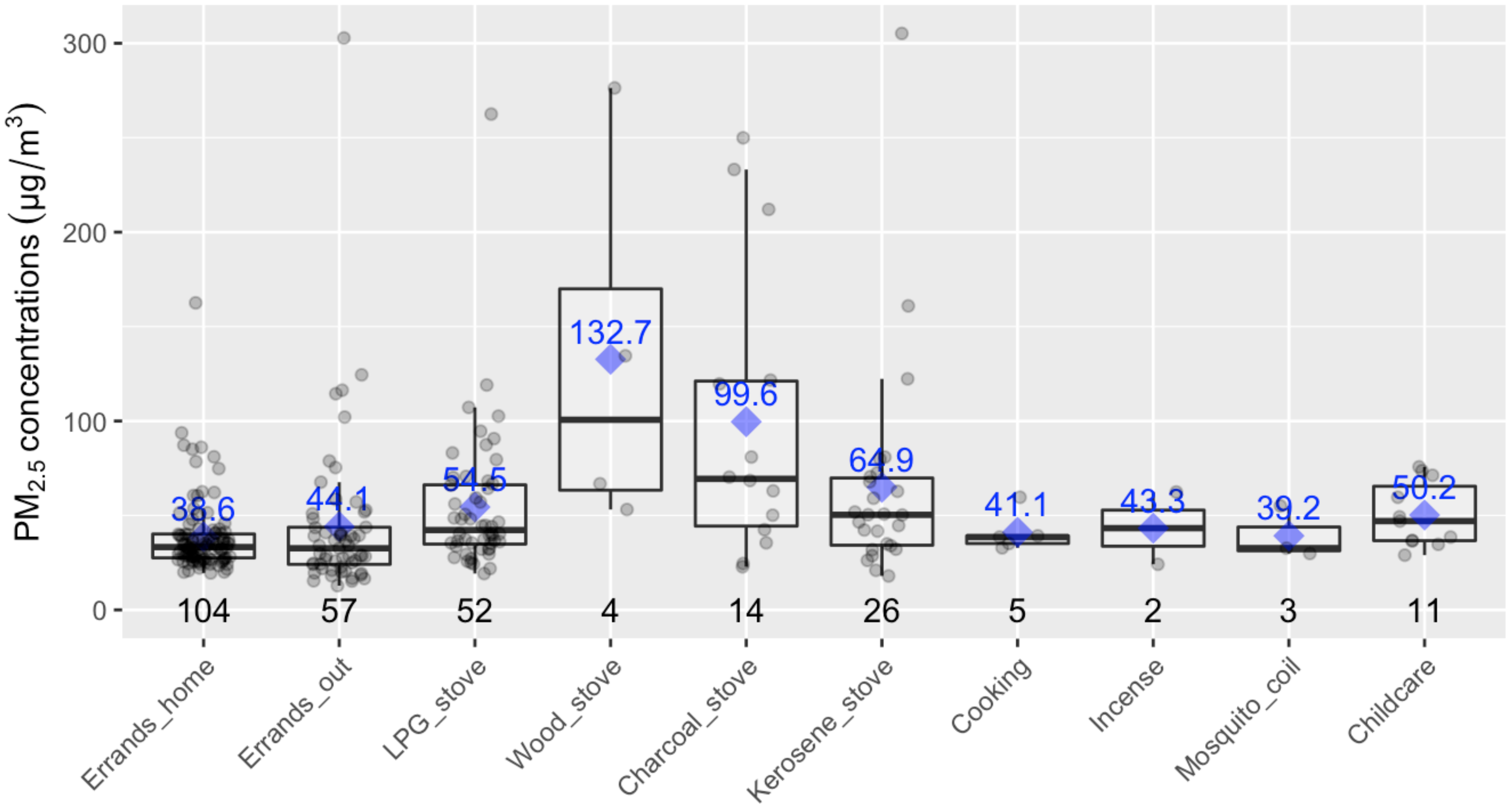
Results: temporal contributions



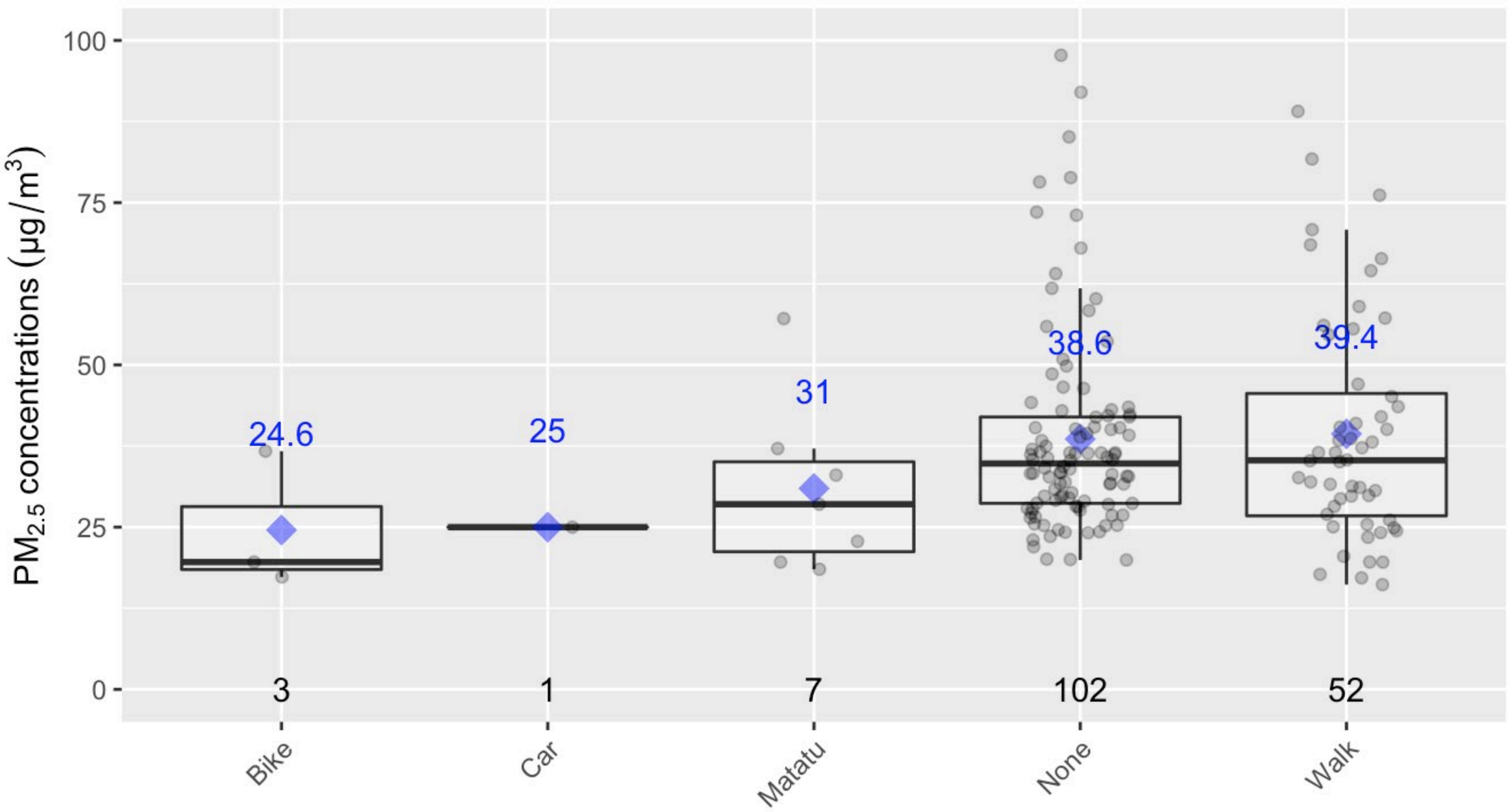
Results: Exposure and time-location



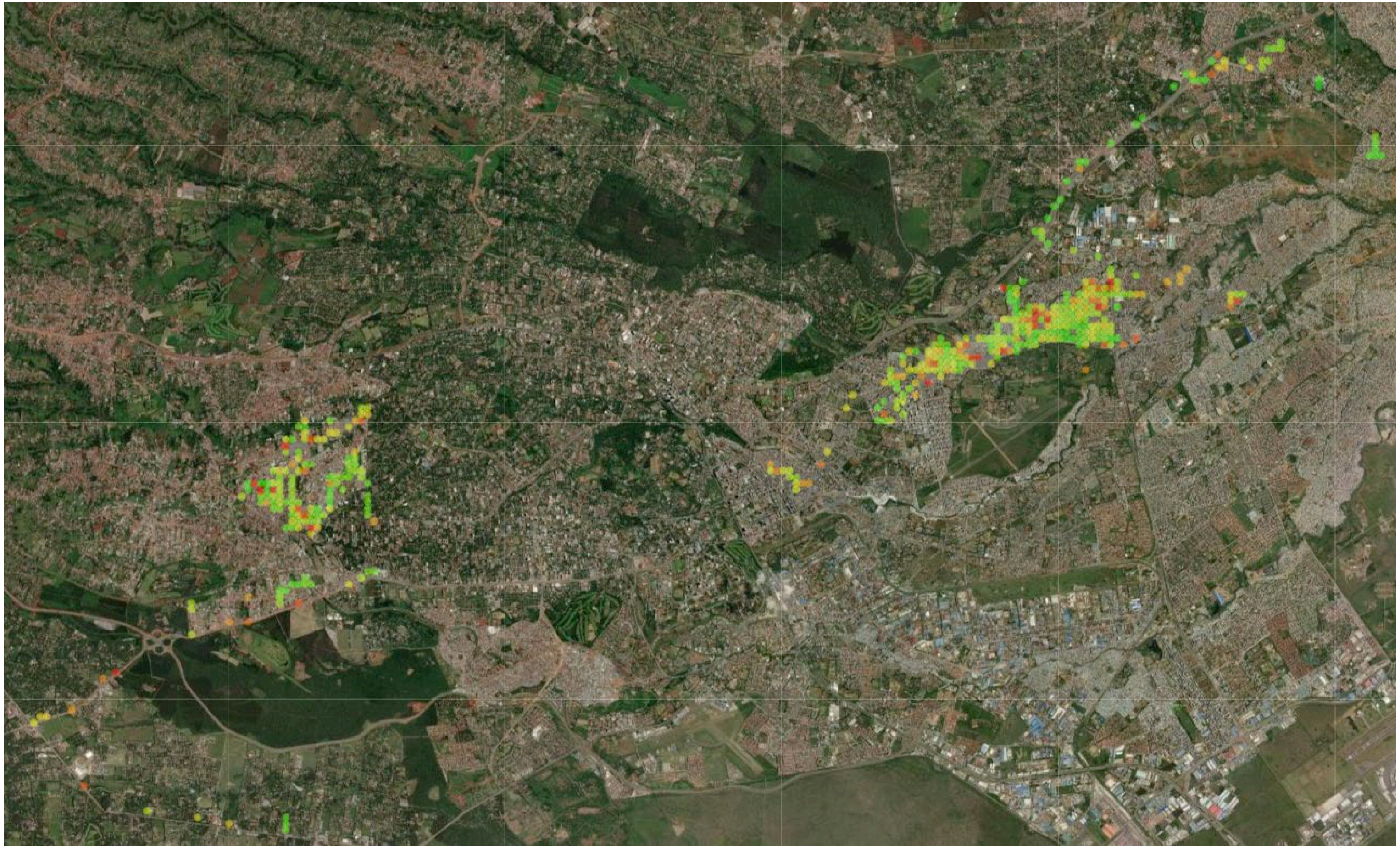
Results: Exposure and activities



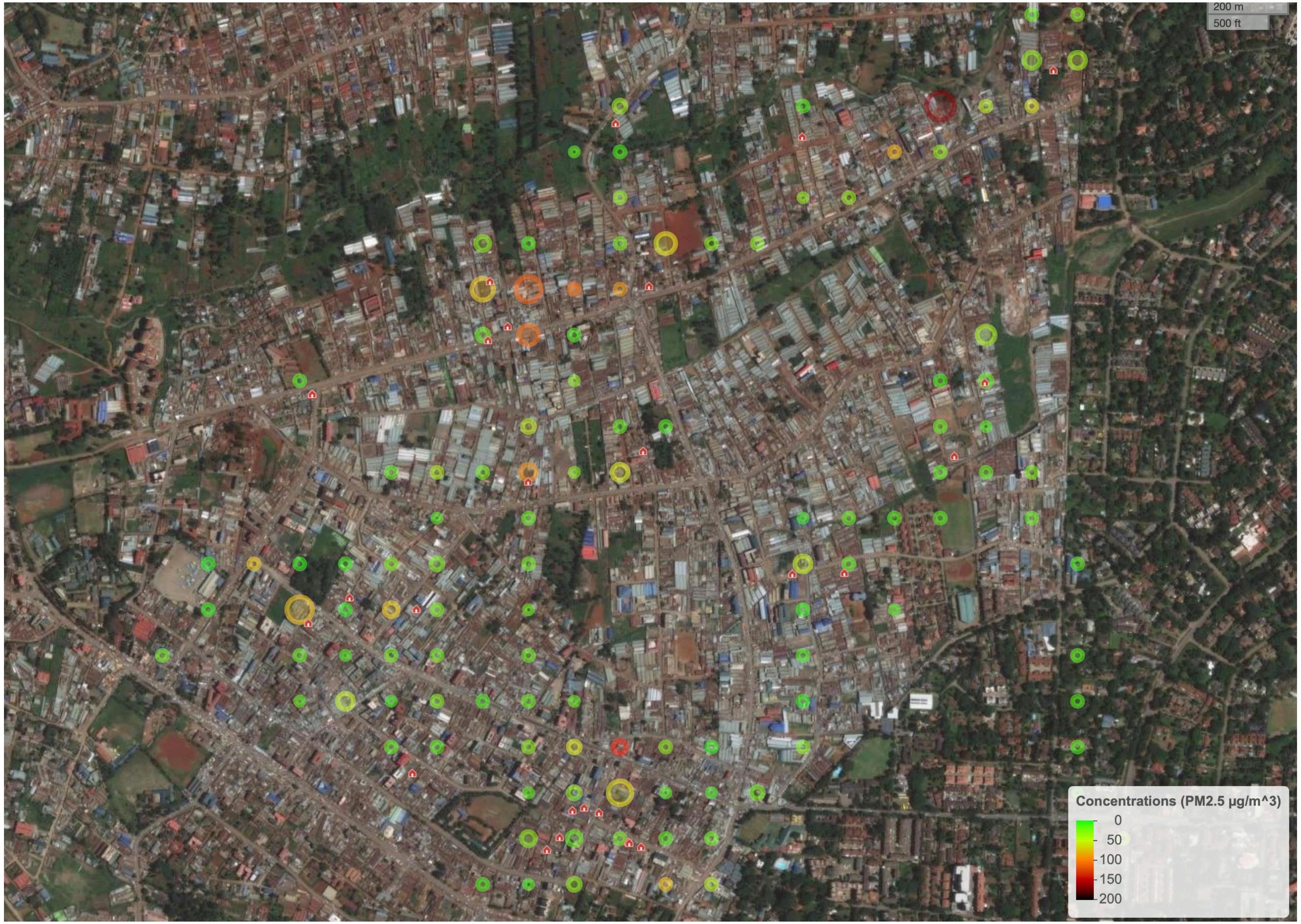
Results: Exposure and Transportation



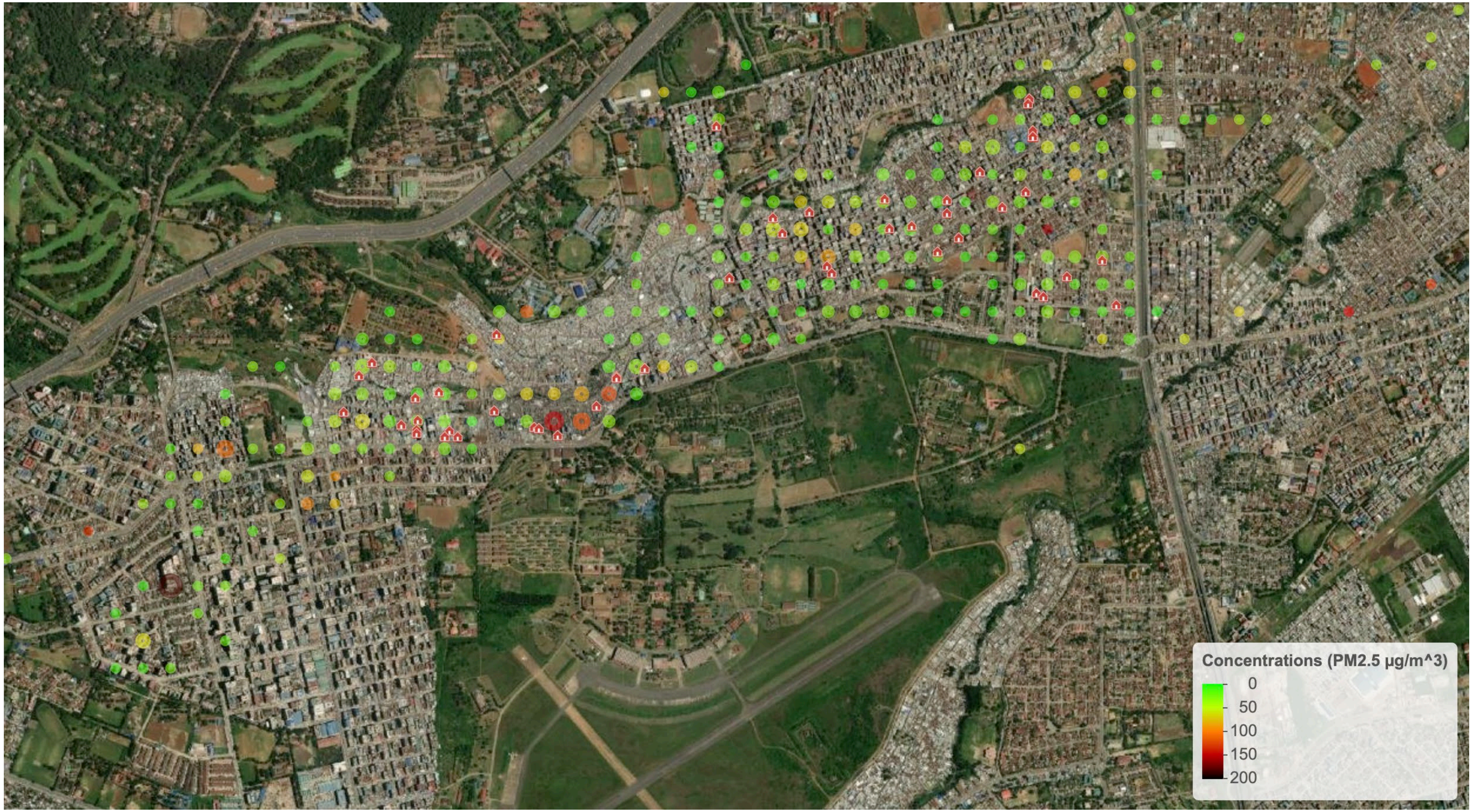
Spatial hotspots?



Dagoretti



Starehe



Key takeaways

Results:

- $PM_{2.5}$ exposures exceeded the WHO annual interim target 1 of 35 µg/m^3 in 57% of samples
- Other exposure studies in Nairobi have reported exposure estimates at ~20-40 µg/m^3
- Wood and charcoal use associated with higher exposures (potential for intervention)
- Higher exposures occurred during evening periods – elevated above ambient
- Ambient pollution likely the largest contributor to exposure

Approach:

- Successful deployment of PA’s as personal monitors (relatively little data loss)
- Backpack inserts made instrument management and deployment straightforward and mitigated COVID-19 risks
- Network of reference and low-cost monitors provided simple way to adjust instrument response for personal exposures

Thanks!