

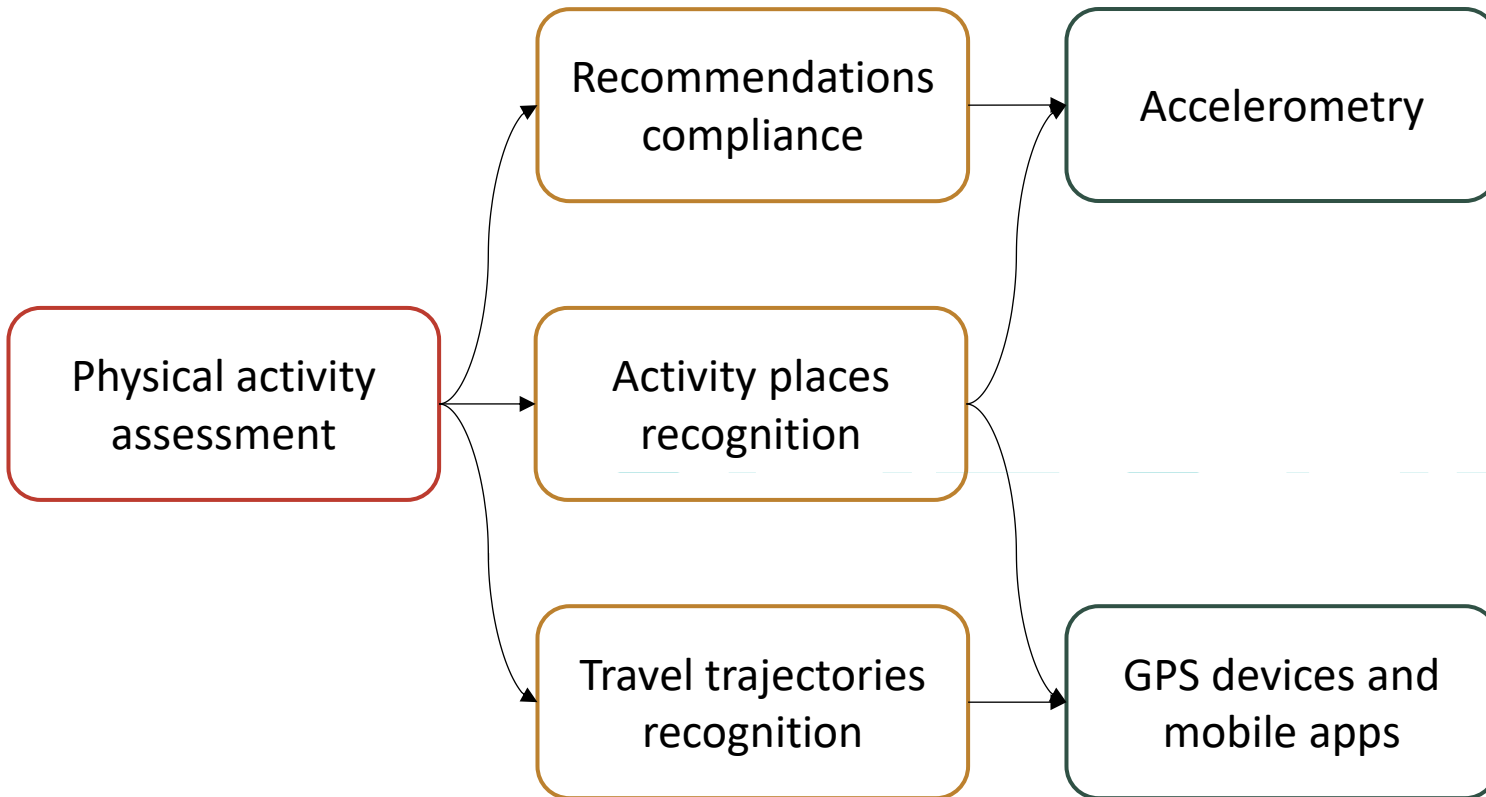
Development, validation, and use of a mobile app for detecting activity places and travel trajectories in Bogotá

**Maria A. Wilches-Mogollon, María Isabel Arévalo, Mario Linares-Vásquez,
Olga L. Sarmiento, María Alejandra Rubio, Alberto Florez-Pregonero,
Felipe Montes, Luis A. Guzman**

ICUH 2021

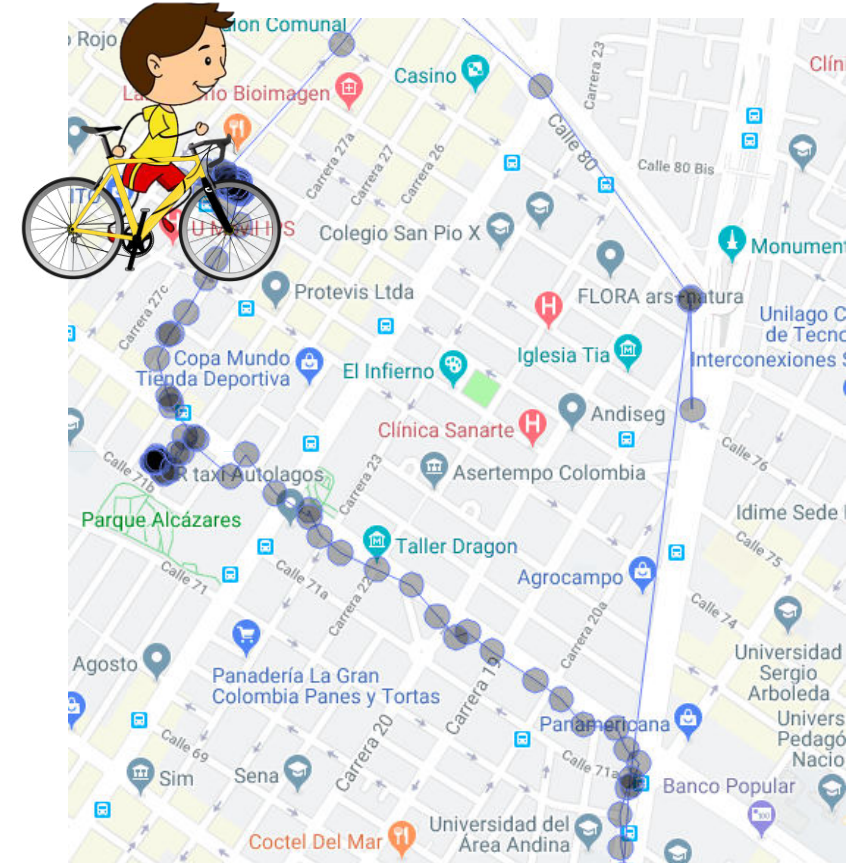
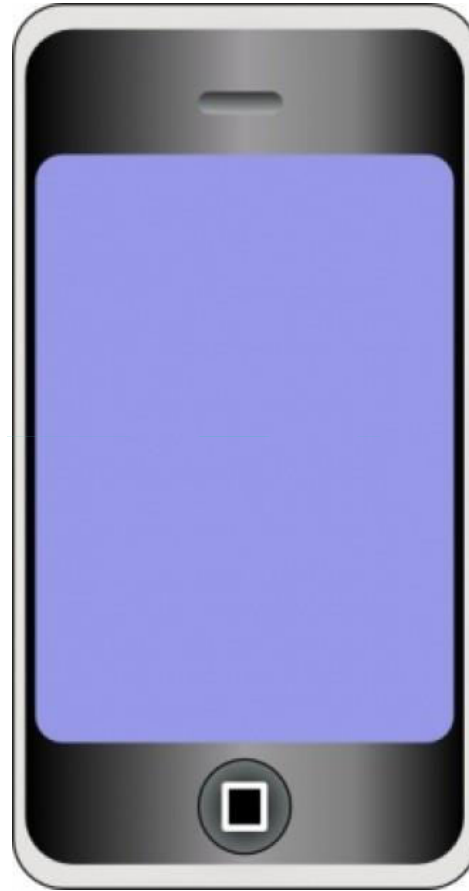


Motivation



How can we collect specific GPS data in studies with vulnerable population?

Muévelo app



Development requirements from users

Low battery consumption

Adaptive GPS sampling

Few disk space

Native language development

Adaptability to several android versions

Basic version connected with Google Services

Use requirements



Front-end engaging

Features and color scheme selection with designers and psychologists

Passive and off-line data collection

Use of only WI-FI for upload of data to servers and background functionality

Activity recognition

Use of Google API “Activity recognition”

Muévelo Front-end



Muévelo data collection

1561405239235

activityType: "WALKING"

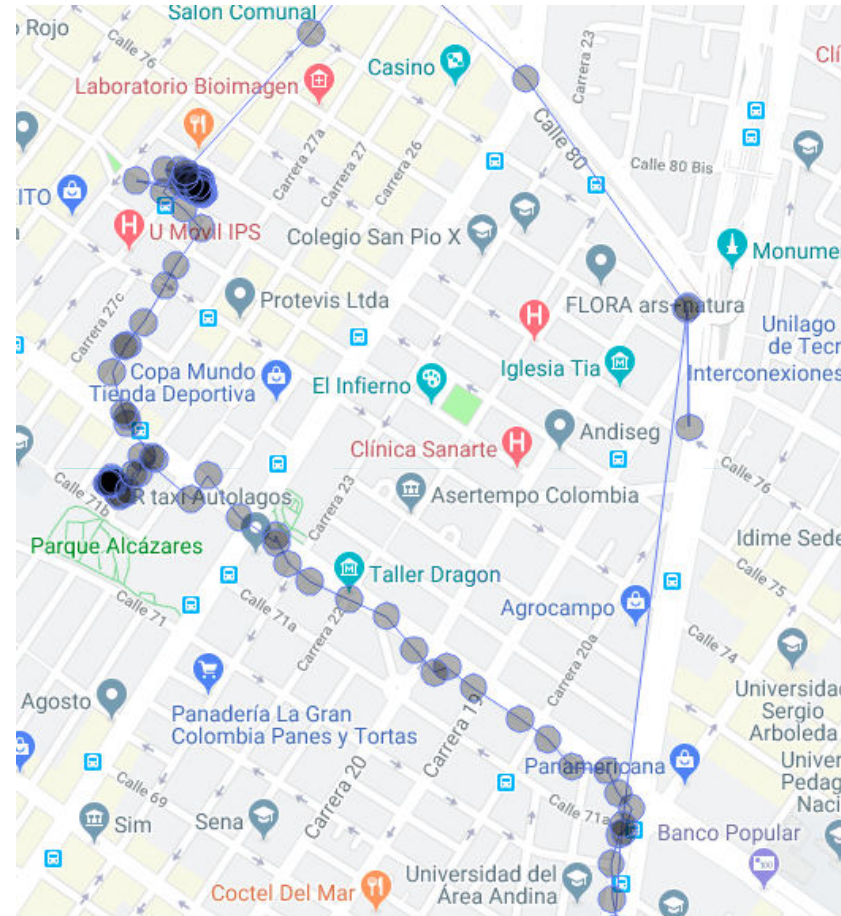
confidence: 90

location

0: -74.0672447

1: 4.6033505

2: 50.38399887084961



Validation of activity recognition

48 participants

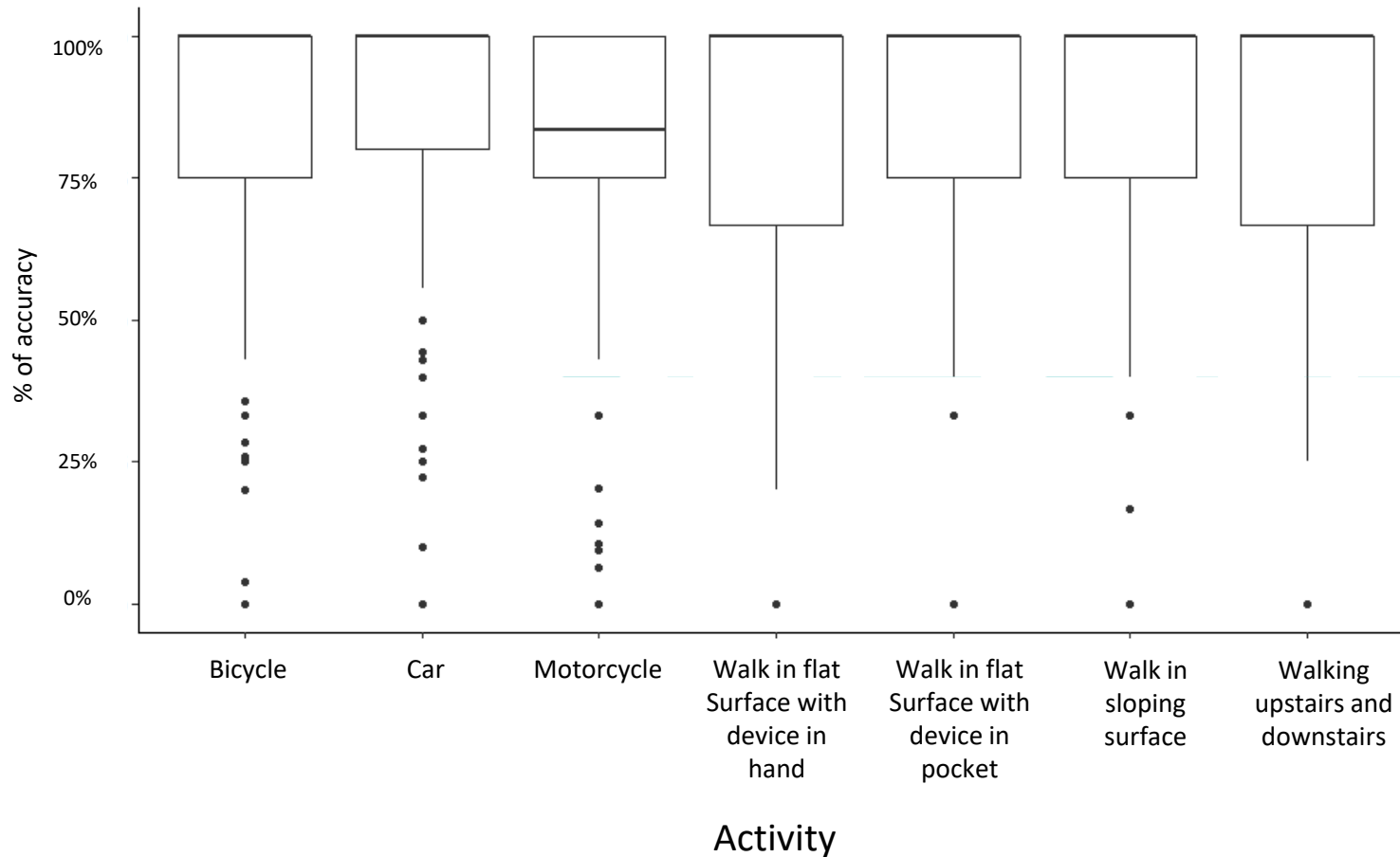
- 28 women
- 20 men
- Mean of 42 years old

8 different devices

3 API versions

3 Android versions

Validation of activity recognition

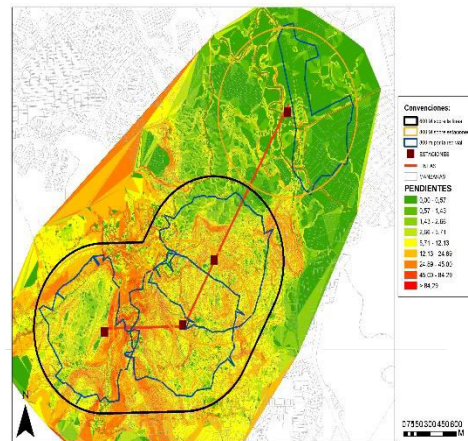


Activity	% of accuracy
Bicycle	0.789 (0.3165)
Car	0.8526 (0.2356)
Motorcycle	0.8232 (0.2411)
Walk in flat surface with device in hand	0.7919 (0.2838)
Walk in flat surface with device in pocket	0.7846 (0.3239)
Walk in sloping surface	0.8525 (0.2275)
Walking upstairs and downstairs	0.795 (0.3097)
Total	0.8137 (0.2790)

TrUST Study

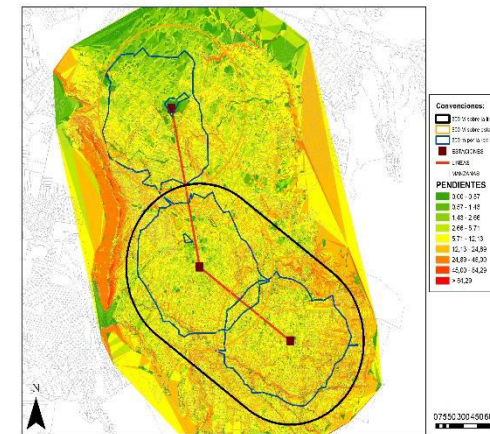
Intervention: Ciudad Bolívar

Neighborhoods: N=27 Blocks: N=225



Control : San Cristóbal

Neighborhoods: N=27 Blocks: N=227



Valid data

Validation criteria

Hours per day

8

Weekdays

3

Final number of participants

Ciudad Bolívar

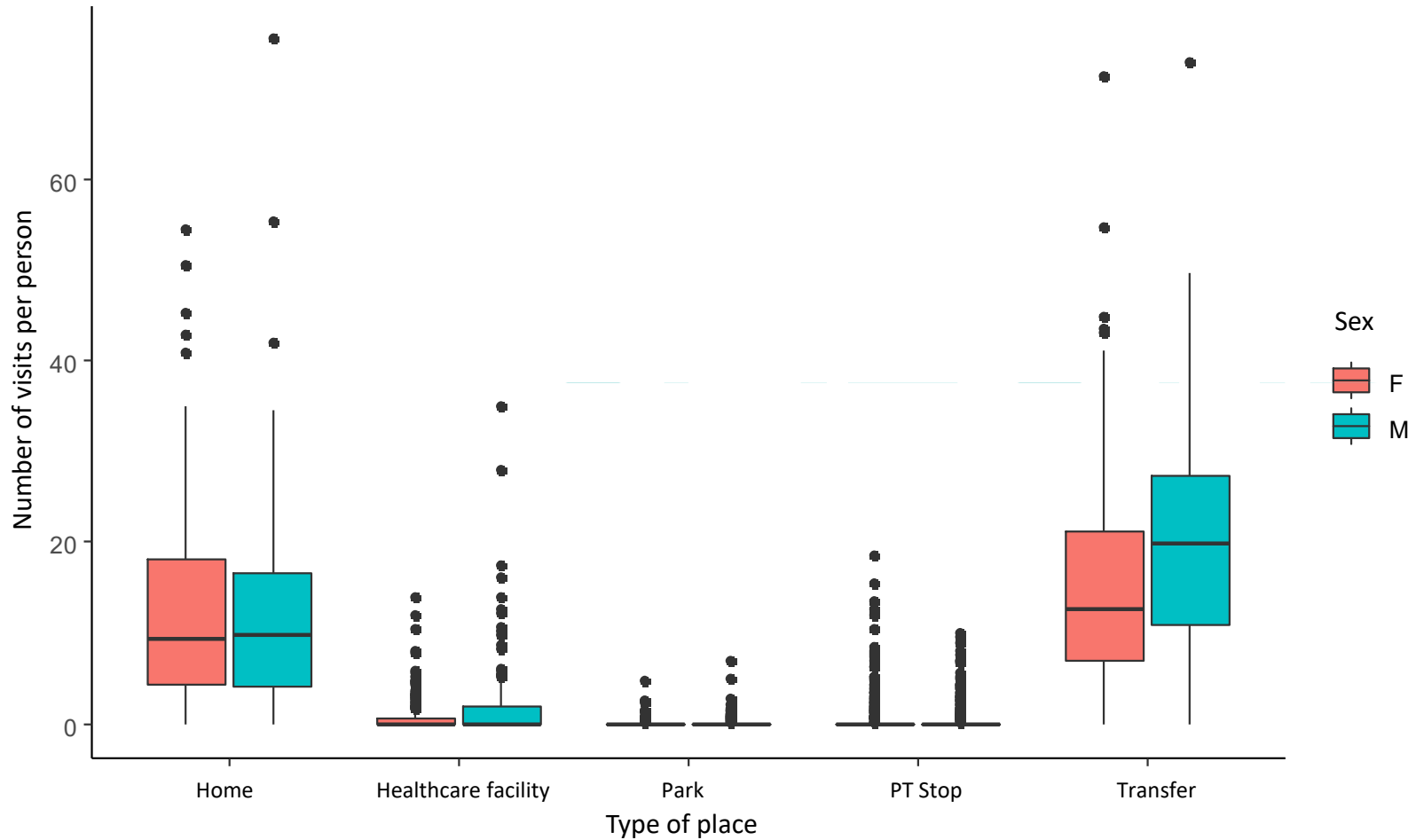
33.7%
(60)

San Cristóbal

46.9%
(121)

Use of activity places

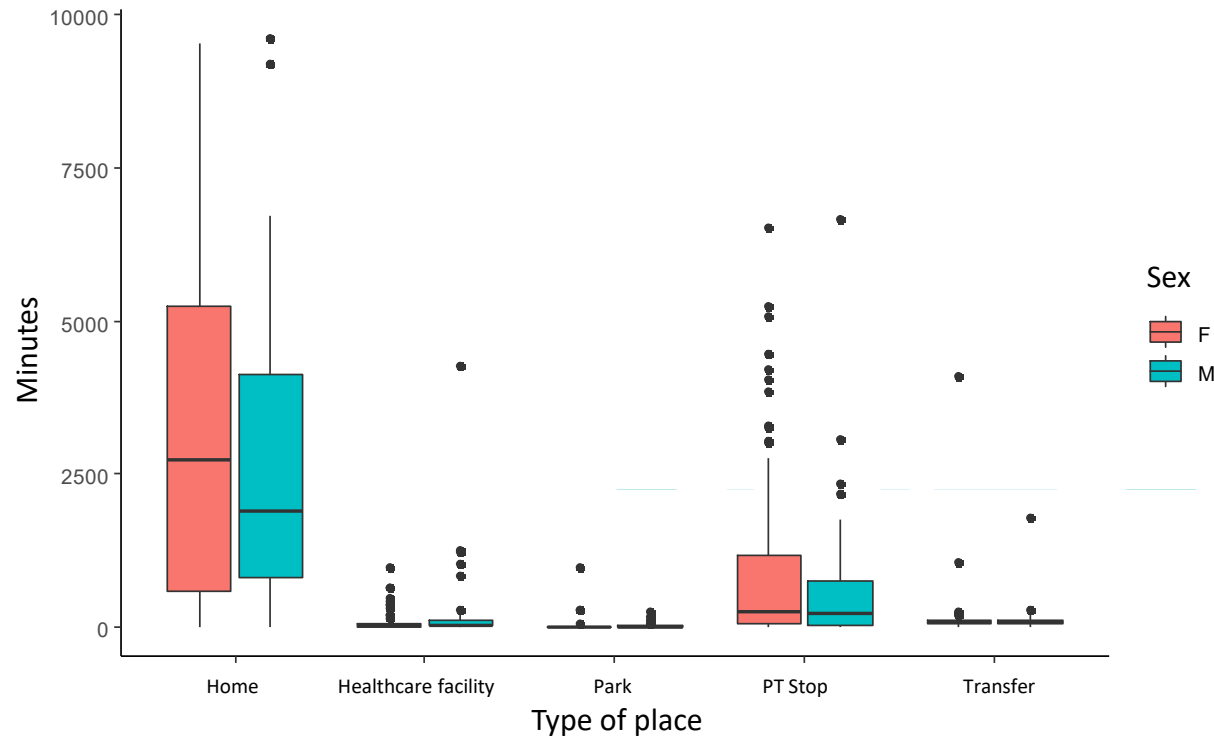
Number of recognized visits per week, type of place and sex



	Women	Male
Home	12.9641 (11.9325)	13.6482 (13.5716)
Healthcare facility	0.7809 (1.9176)	2.1154 (4.9547)
Park	0.0671 (0.3794)	0.1722 (0.6954)
Public transport stop	0.604 (1.8754)	0.5866 (1.5393)
Transfer	15.7781 (12.5984)	21.1340 (13.1098)

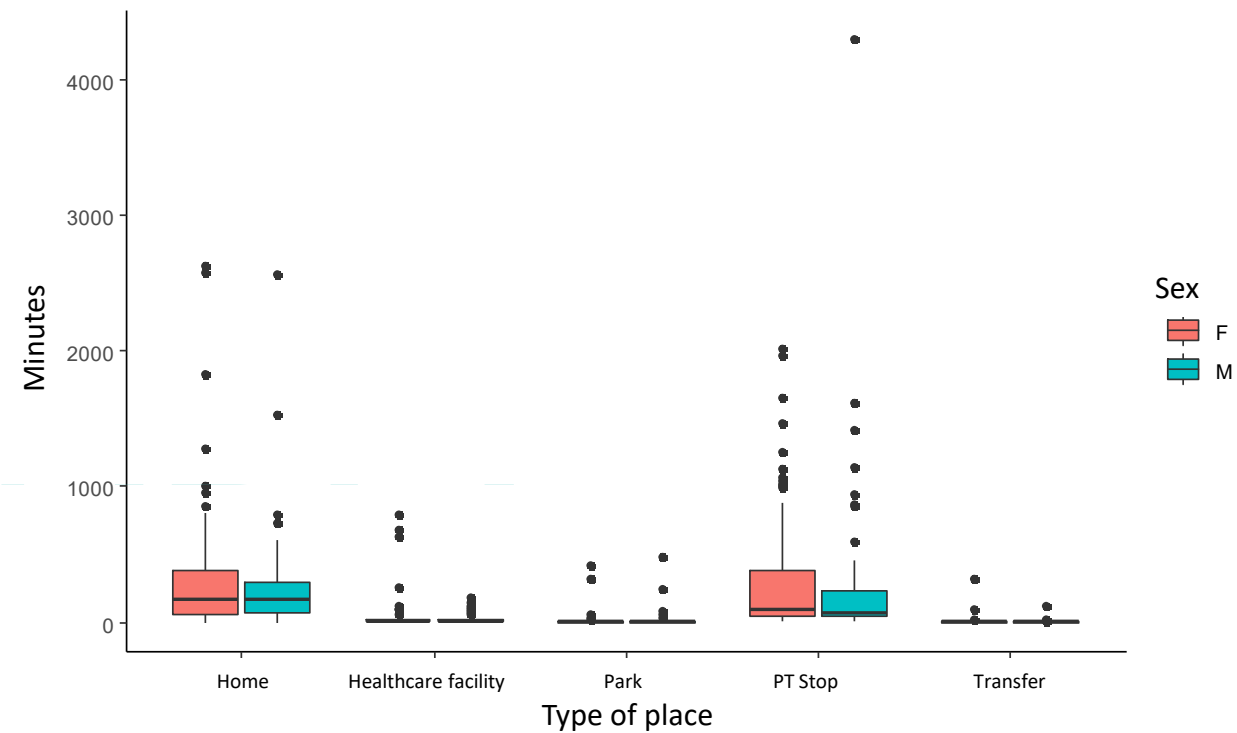
Time spent in activity places

Minutes per week, type of place and sex



	Women	Men
Home	3208.2437 (2794.1964)	2625.5573 (2334.5373)
Healthcare facility	90.3681 (182.6130)	202.1733 (618.9600)
Park	76.5096 (211.7450)	27.5942 (56.2248)
Public transport stop	829.6408 (1272.3934)	547.2458 (936.8777)
Transfer	127.5819 (424.0256)	113.5853 (215.3228)

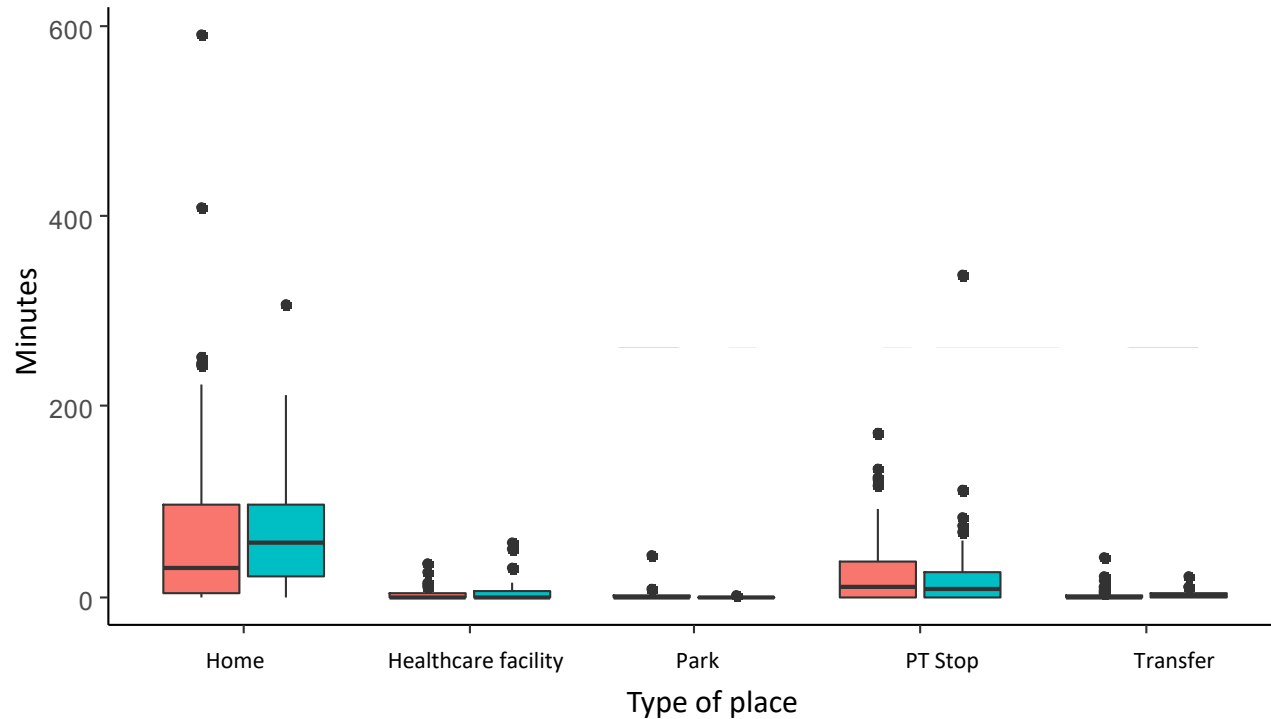
Minutes per visit, type of place and sex



	Women	Men
Home	324.3287 (461.5005)	227.2750 (381.6990)
Healthcare facility	52.7105 (149.9693)	26.8756 (39.8254)
Park	43.4180 (110.5648)	36.8038 (100.1454)
Public transport stop	287.3100 (403.7565)	248.0137 (550.6919)
Transfer	8.6148 (33.9578)	6.1776 (15.4068)

Moderate to vigorous physical activity

Minutes per week, type of place and sex

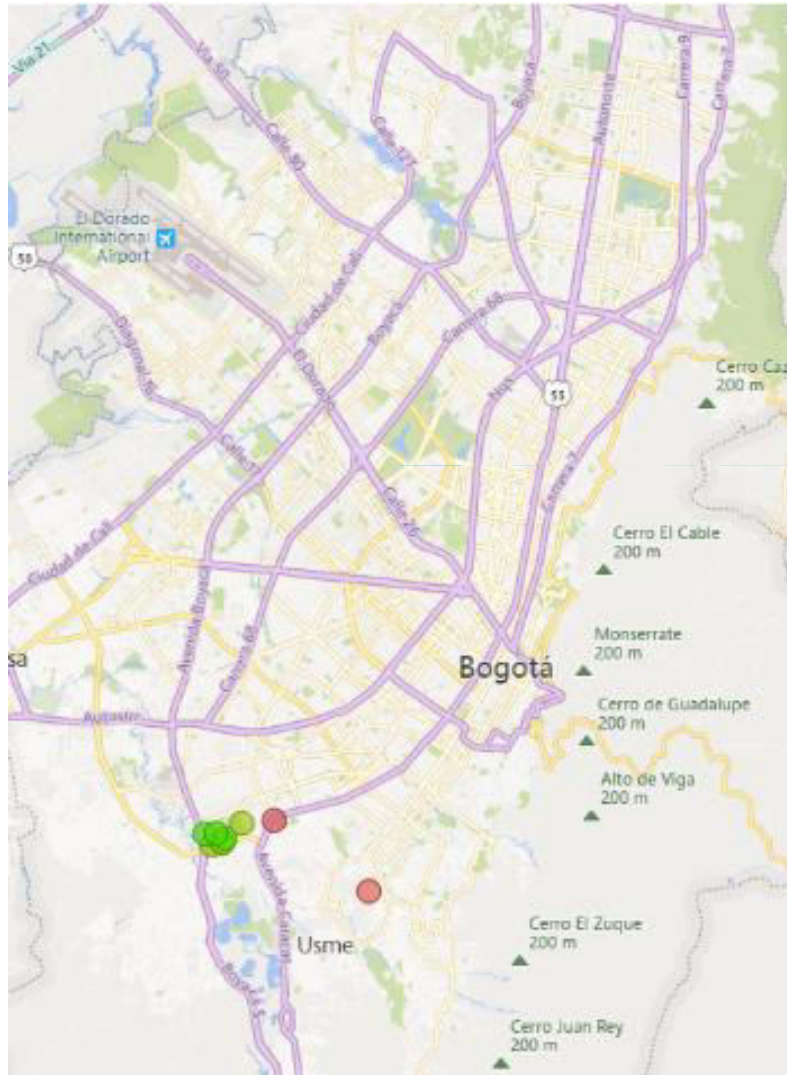


Sex
F
M

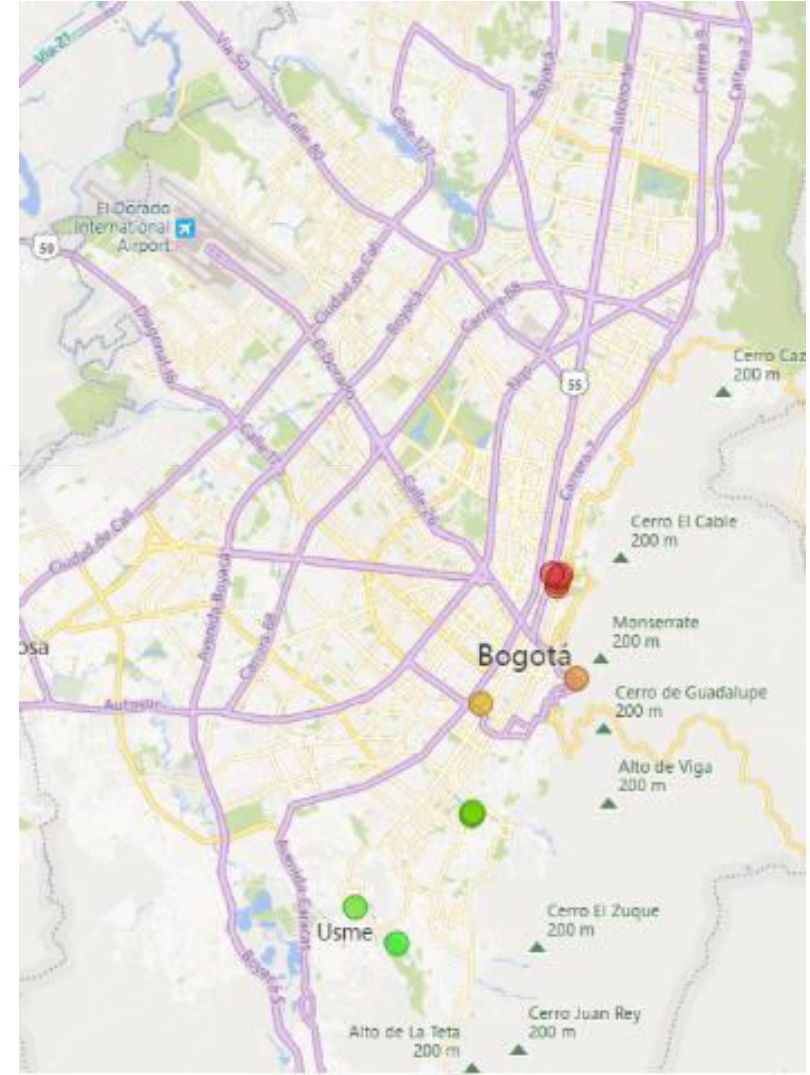
	Women	Men
Home	68.1624 (99.3283)	71.4114 (63.4023)
Healthcare facility	4.9533 (9.6834)	7.4093 (15.2778)
Park	6.3438 (15.3116)	0.3889 (0.9526)
Public transport stop	27.4529 (39.9489)	27.301 (57.4509)
Transfer	2.29 (6.6185)	2.6054 (4.1007)

Spatial use of parks

Ciudad Bolívar

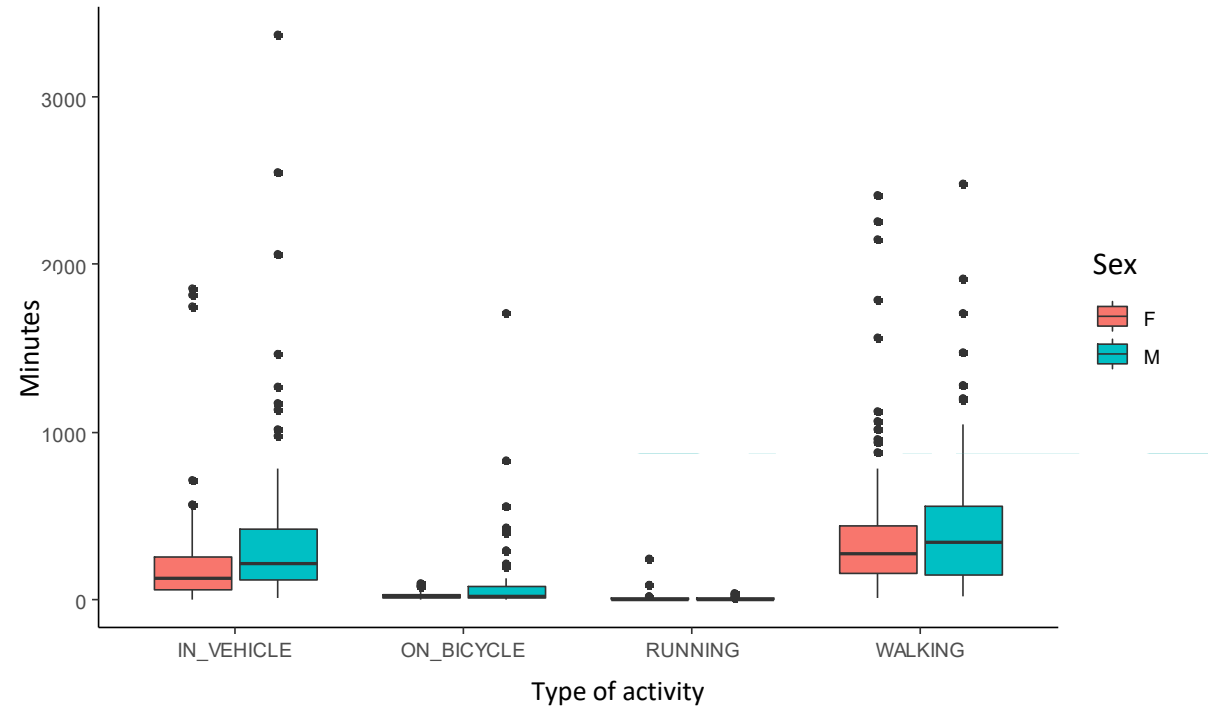


San Cristóbal



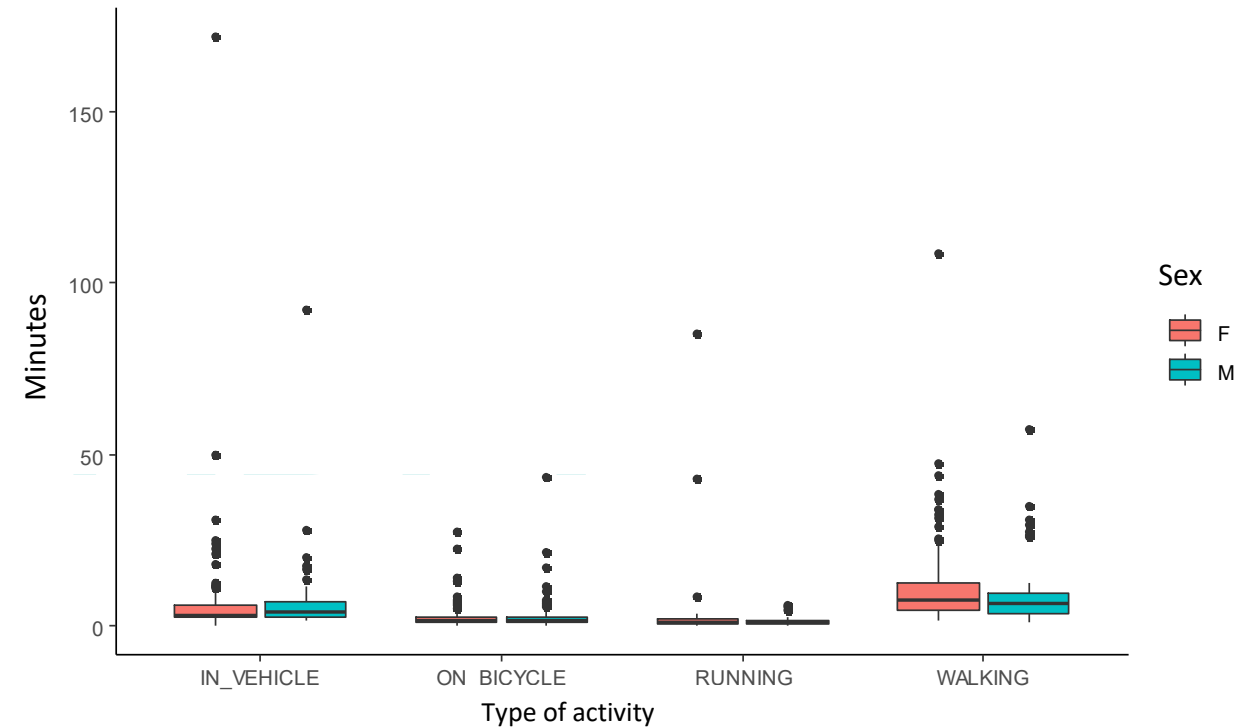
Time spent per activity

Minutes per week, type of activity and sex



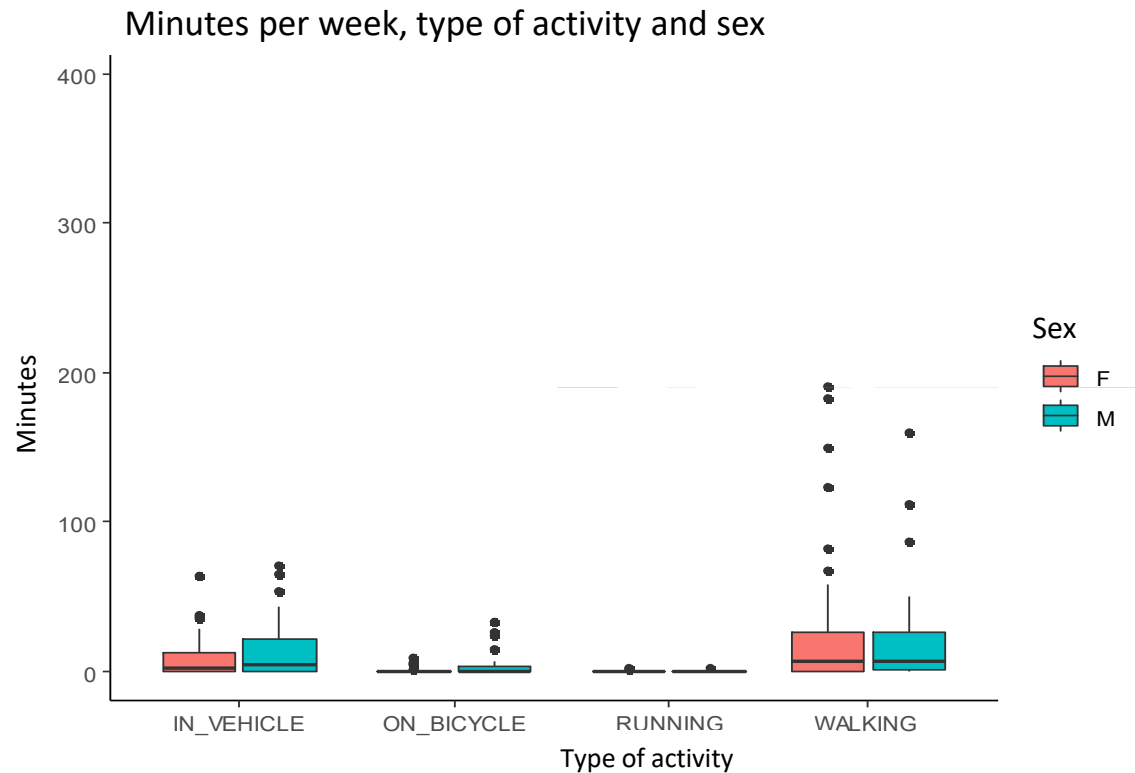
	Women	Men
In vehicle	207.9259 (314.3381)	417.2505 (589.1616)
Bicycle	18.5211 (19.8693)	104.988 (255.1684)
Running	9.4208 (35.5869)	4.1607 (7.6858)
Walking	398.7991 (446.0392)	470.5073 (468.4944)

Minutes per week, type of activity and sex



	Women	Men
In vehicle	7.0838 (17.8551)	6.7386 (11.5126)
Bicycle	2.4137 (4.0201)	3.3088 (6.3875)
Running	3.5937 (13.2863)	1.0183 (1.3052)
Walking	11.4422 (13.686)	8.788 (9.4343)

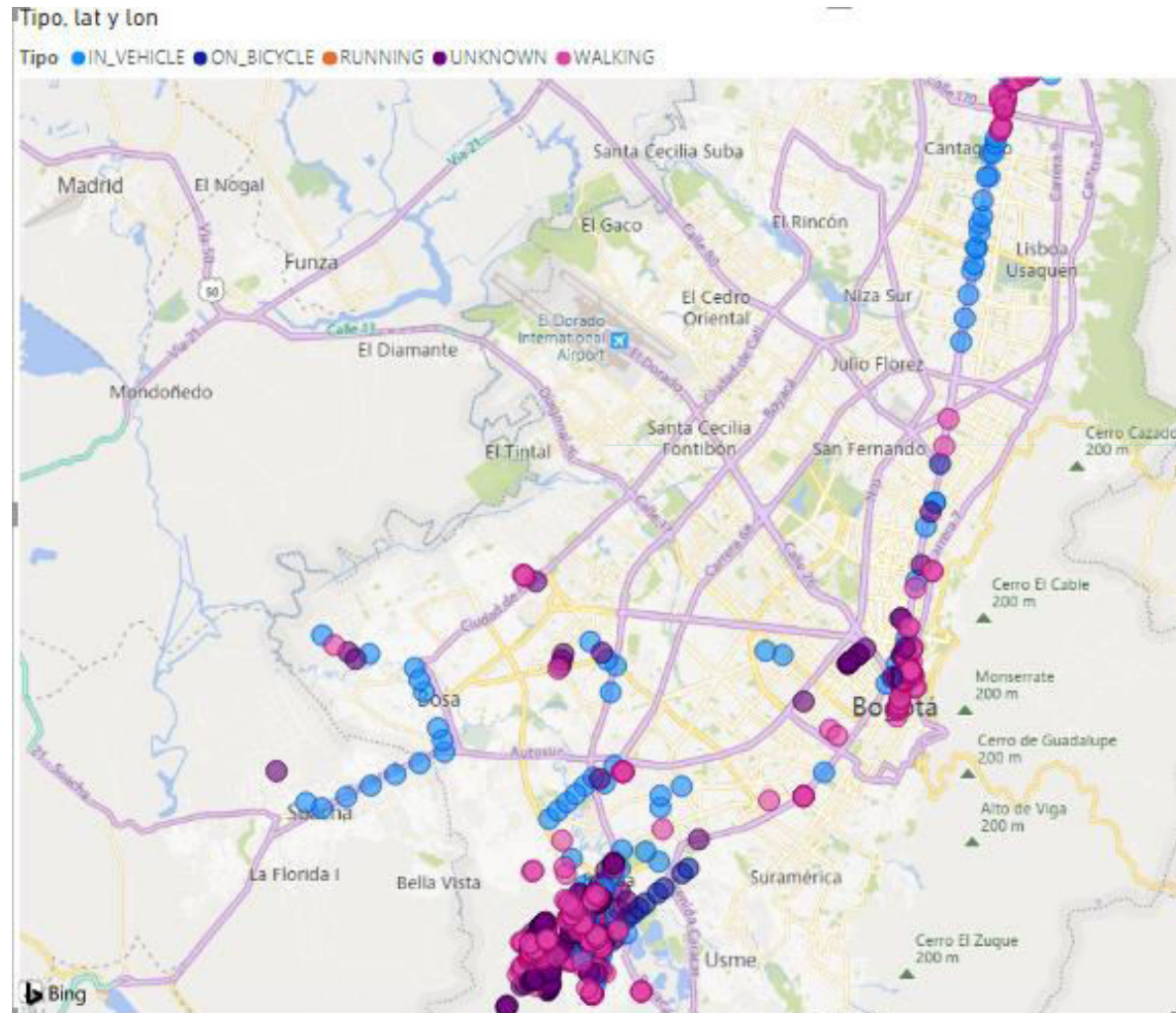
Moderate to vigorous physical activity



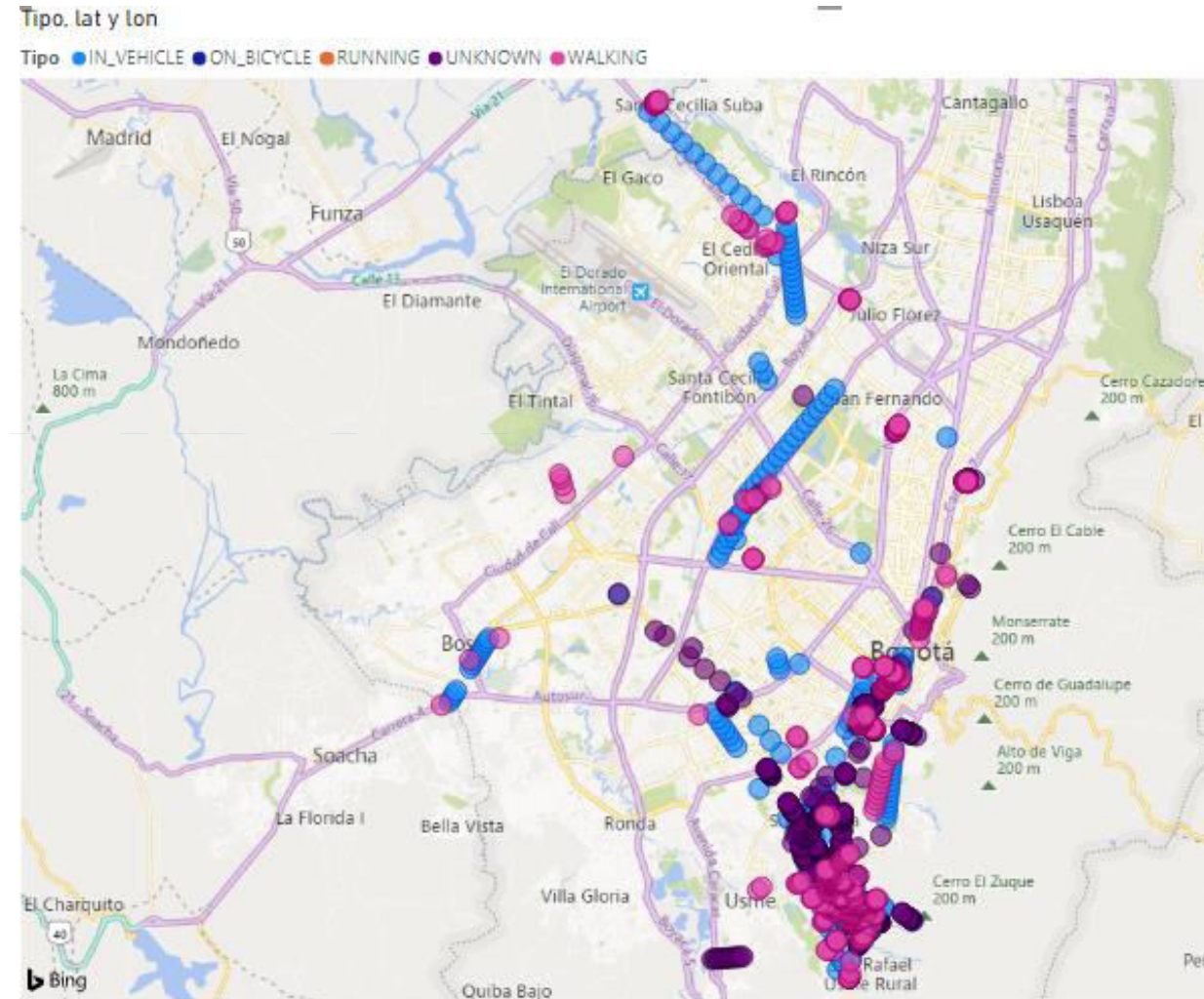
	Women	Men
In vehicle	7.7786 (12.208)	12.8527 (17.7865)
Bicycle	0.4236 (1.6624)	4.1023 (8.2413)
Running	0.3182 (0.7544)	0.2121 (0.7035)
Walking	20.4318 (36.8301)	17.9848 (29.052)

Women MVPAs movements

Ciudad Bolívar



San Cristóbal



Conclusions

- Activity places and type of activity can be detected with the use of mobile apps and accelerometer.
- Muévelo app detects 81% of movements correctly.
- Home is the most recognized activity place.
- More than 70% of the minimum MVPA minutes recommended per week are performed in an activity place.
- Walk is the most recognized activity.
- About 33% of the minimum MVPA minutes recommended per week are performed in a recognized activity.

Thank you

Questions?

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