7th International Symposium on Ultrafine Particles,
Air Quality & Climate, Brussels 2019

Persistent pollution with dangerous nanoparticles in Austrian hospitality venues

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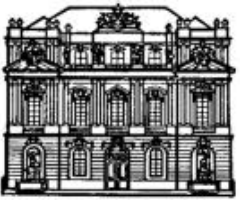

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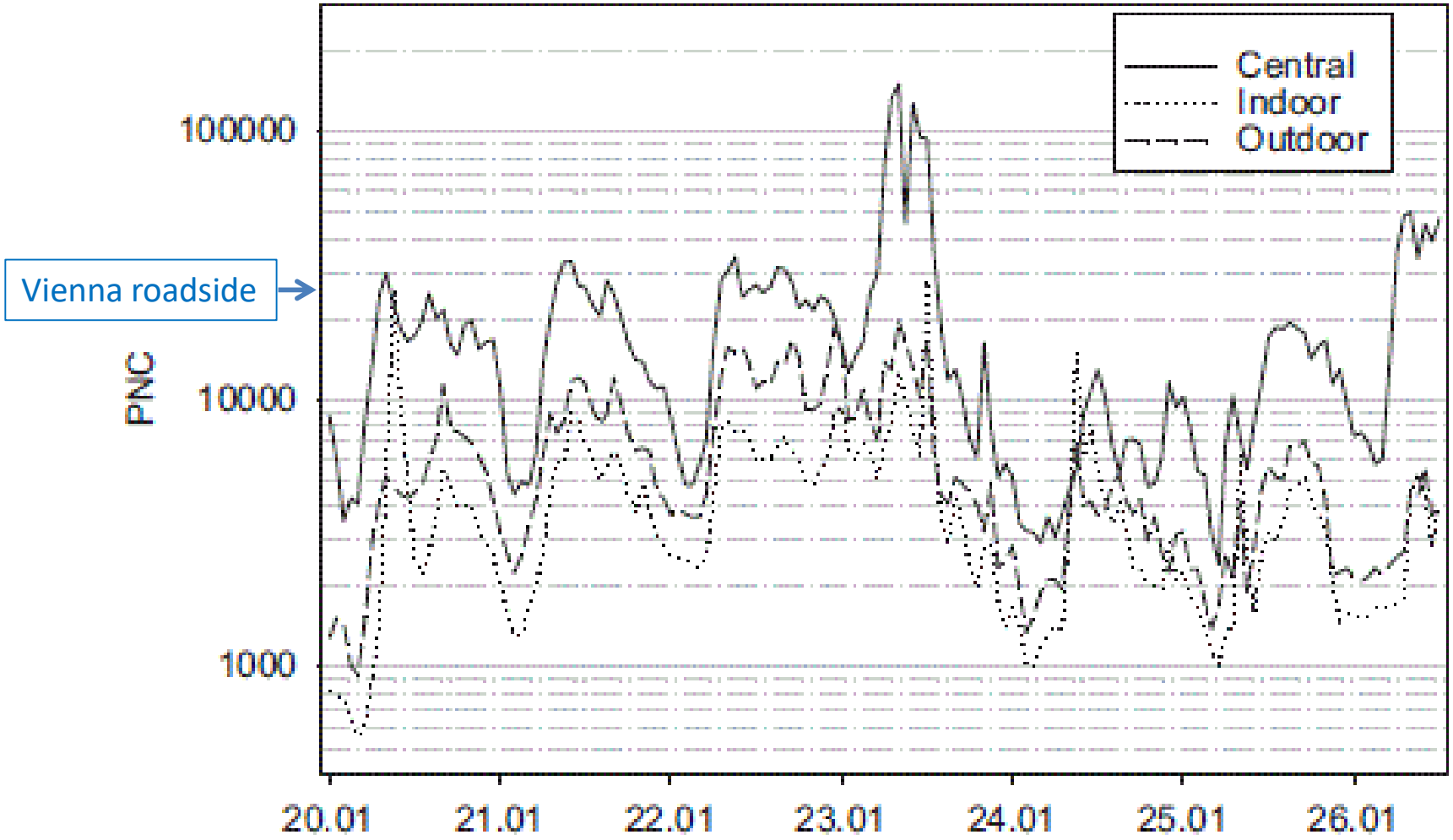


Particle number concentrations monitored by CPC in **Helsinki** (10^6 inhabitants, low traffic)
hourly concentrations, residential outdoor/ central background= 0.37, r = 0.89

Puustinen et al. Atmos Envir 41 (31): 6622-36

residential outdoor concentrations - living rooms (without smokers): **highly correlated**

Median of individual Pearson correlation coefficients between 24-h average *residential-outdoor and indoor* concentrations of particle mass, particle number and composition

	Helsinki	Athens	Amsterdam	Birmingham
PN	**0.41**	**0.80**	**0.58**	**0.50**
$PM_{2.5}$	**0.74**	**0.63**	**0.85**	**0.35**
PM_{10}	**0.57**	**0.68**	**0.72**	**0.52**
$PM_{10-2.5}$	**0.26**	**0.39**	**0.26**	0.10
Soot	**0.96**	**0.88**	**0.96**	**0.93**

Coefficients in bold, statistically significant ($p < 0.05$) in signed rank test.

roadside:
most < 30 nm → (nucleation mode)

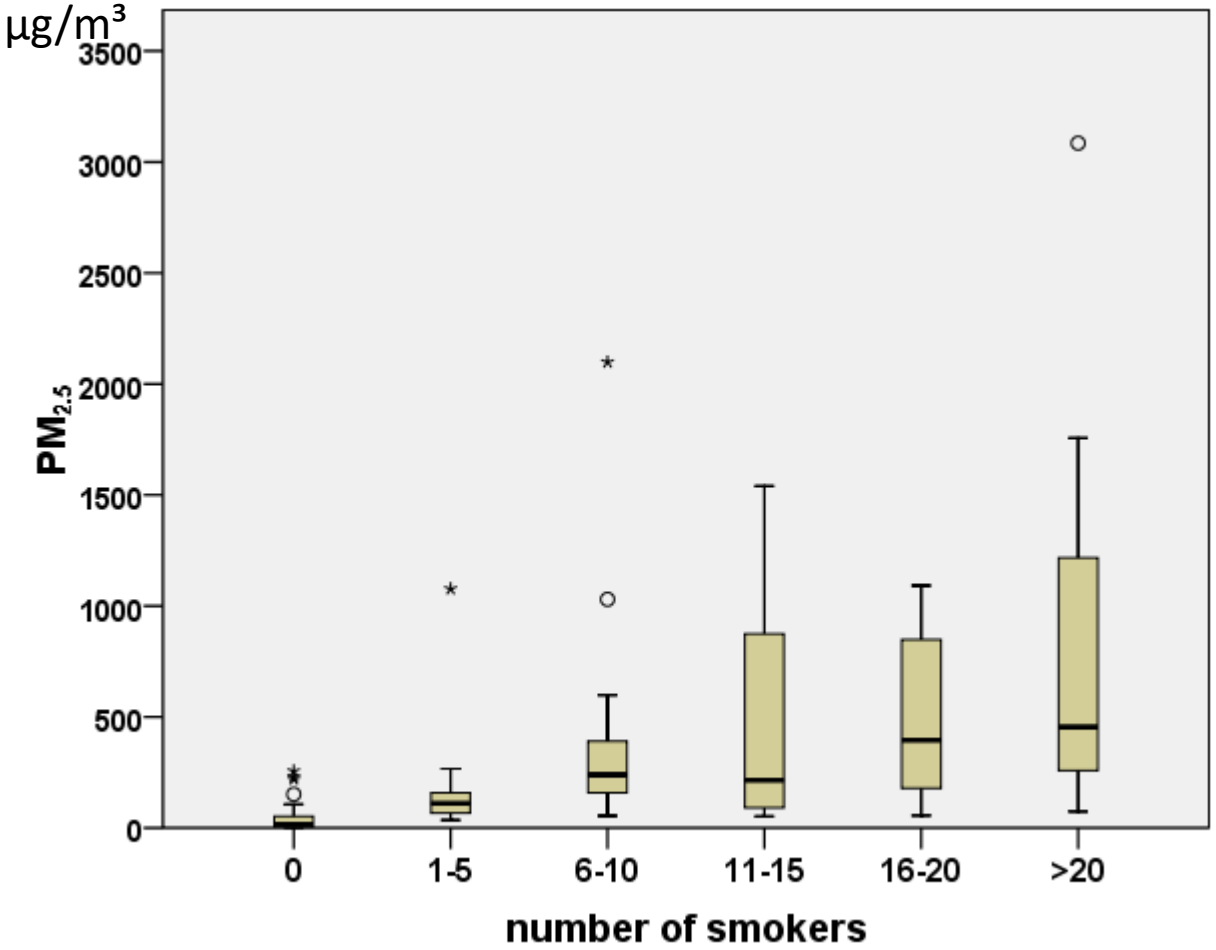
Kumar et al. 2014

Hoek et al. Atmos Envir 42: 156-69

First study in Vienna hospitality venues (Feb – Oct)

112 cafes, restaurants, bars and discotheques in central districts

Chance sampling during busy hours in central guest area **without prior notice**, usually while ordering and having a drink, placing OPC 1.108, Grimm® on table. No open doors, fireplaces, candles and immediate vicinity of active smokers.



Median PM2.5	(µg/m³)
non-sm. venue	6.9
non-sm. room	67.6
smoking room	235.4
smoking venue	316.6

Pletz & Neuberger 2011.
Atmosphere 2: 171-181

Second study in Vienna hospitality venues (Nov – June)

16 cafés, 51 bars & pubs, 14 restaurants, 7 discos, in districts 1,3,4,6-9,15,18-20
Chance sampling during busy hours in central guest area **without prior notice**
22 non-smoking, 20 smoking, 46 mixed (non-smoking adjacent to smoking room)
(6 non-smoking venues and 7 mixed excluded because of violations of ban)

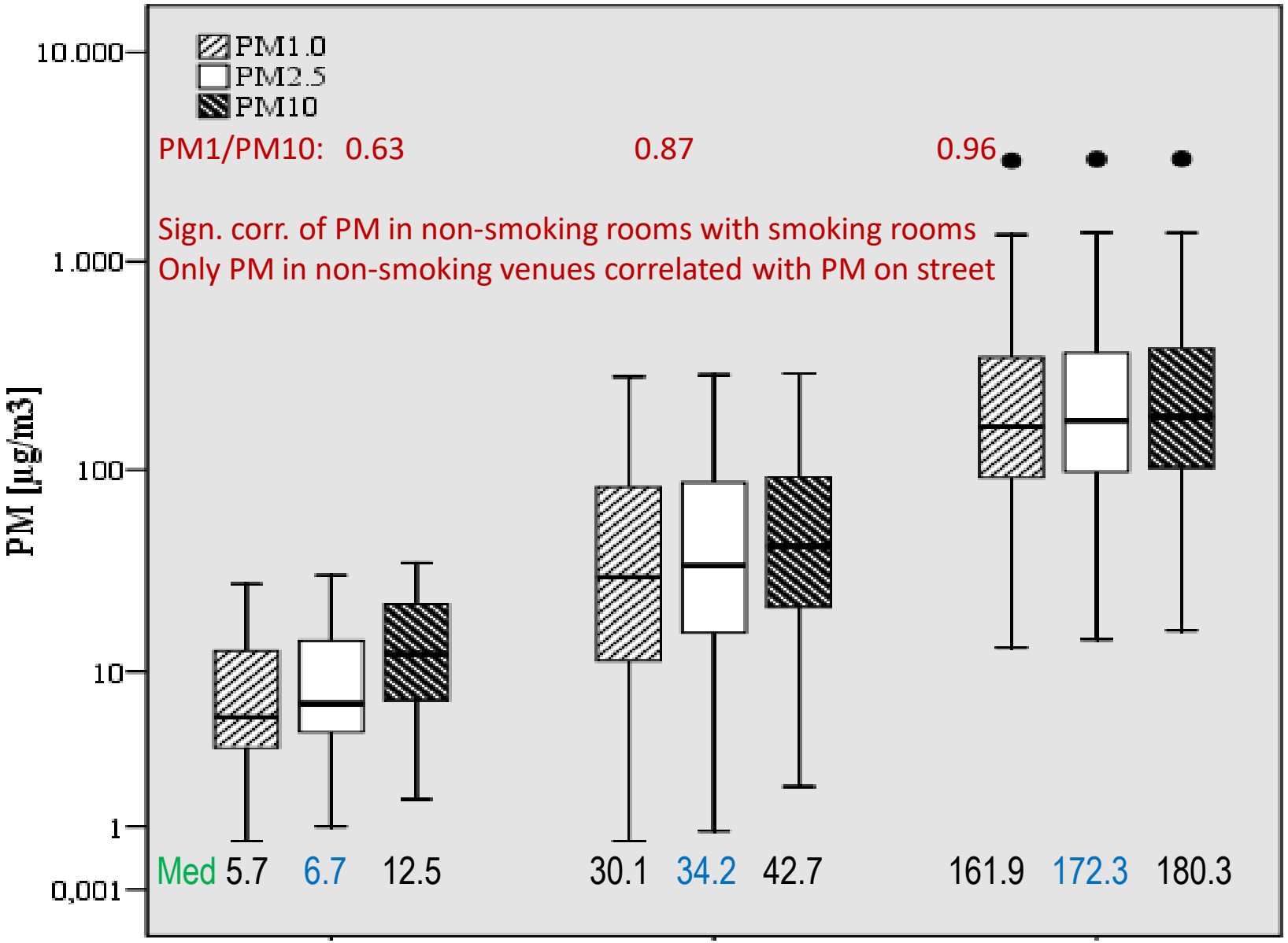
PM (300 nm – 2,500 nm): OPC (1.108, Grimm®);
PN (10 nm – 300 nm): Diffusion Size Classifier (G3_016 miniDiSC®)
Particle diameter, chargeable surface area,
LDSA estimated according to ICRP (Asbach et al. 2009)

Median PN (all 134 rooms): 34,075 pt/cm^3

PM1.0, PM2.5 and PM10 correlated to PN (Spearman $p<0.001$)
throughout all the inspected locations

Neuberger M, Schietz A. 2013:
J Expo Sci Environ Epidemiol 23: 519-24

Fine particle mass: sustainable differences (despite aging, scavenging)



Neuberger & Schietz
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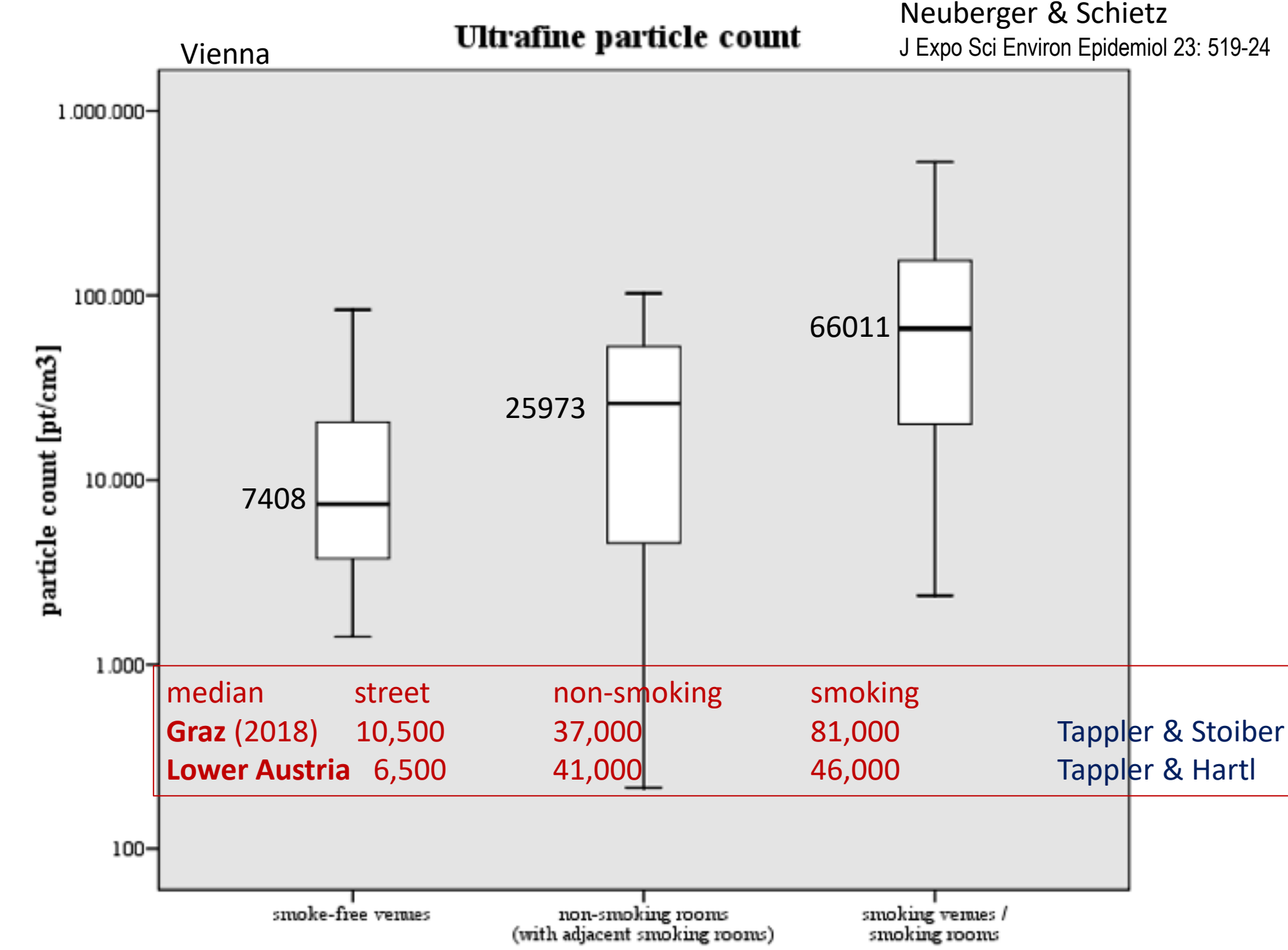
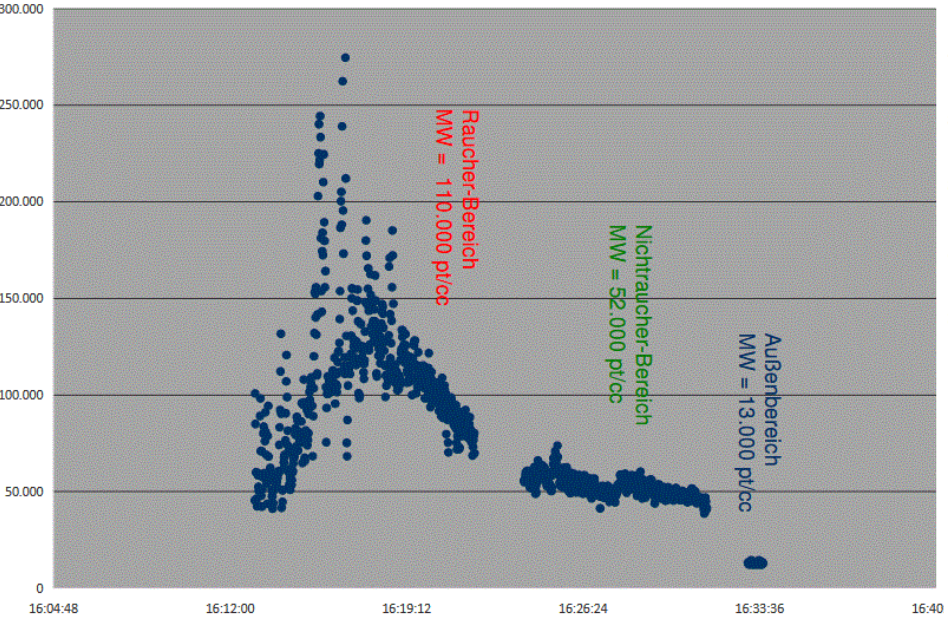
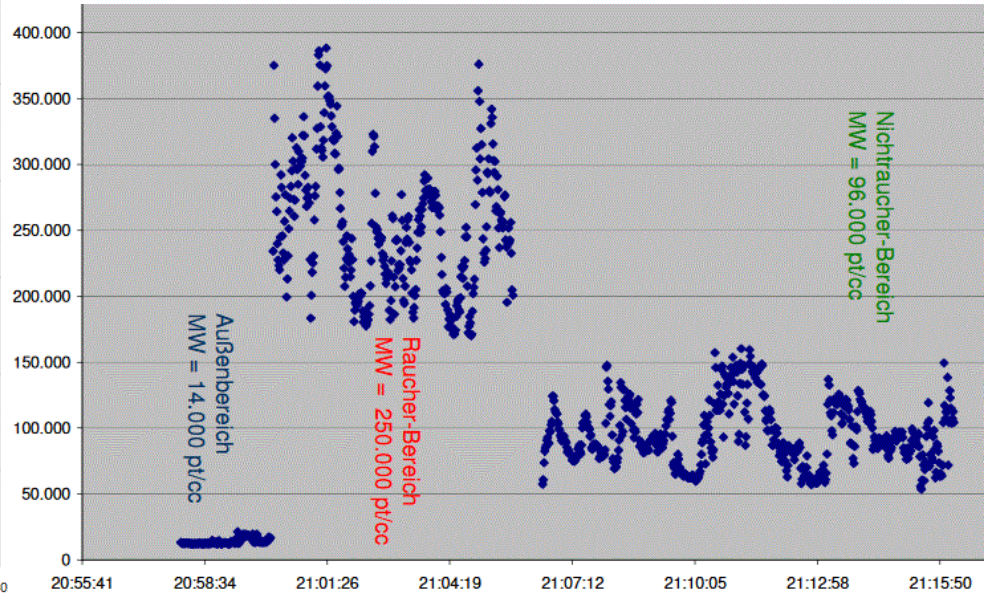
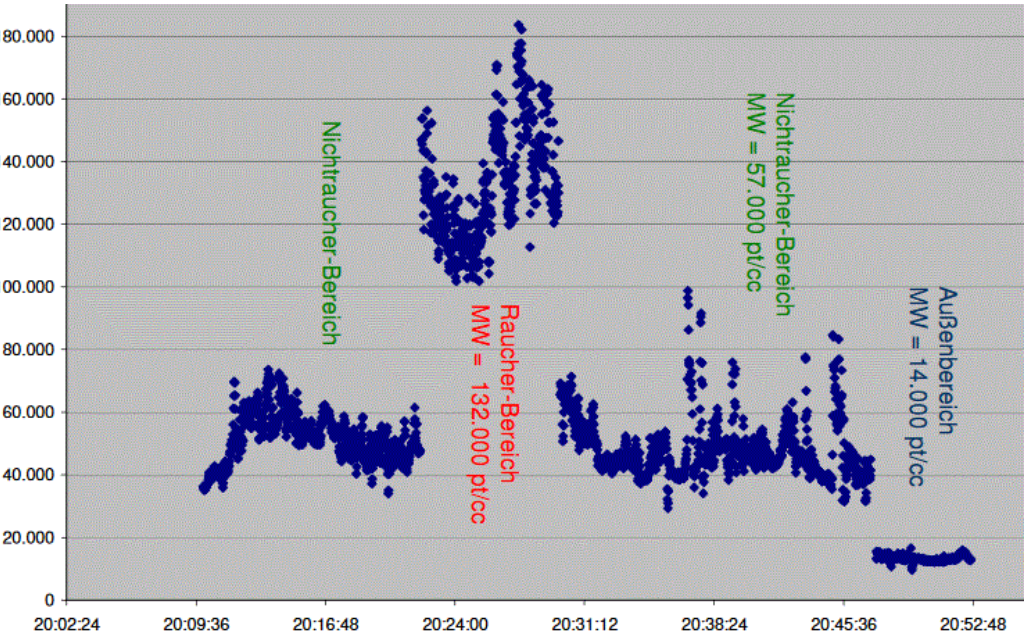


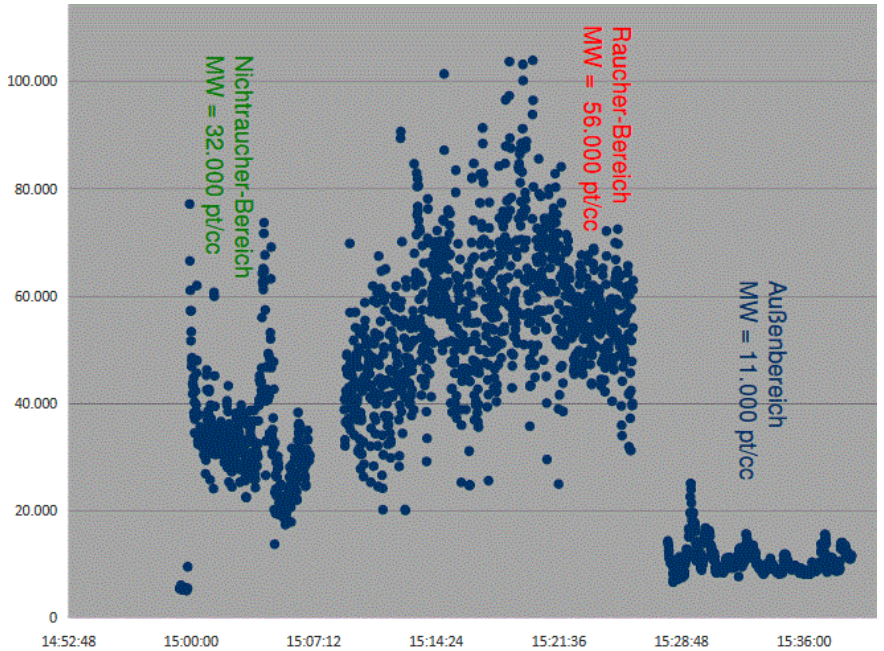
median	street	non-smoking	smoking	
Graz (2018)	10,500	37,000	81,000	Tappler & Stoiber
Lower Austria	6,500	41,000	46,000	Tappler & Hartl

GRAZ, Sept. – Nov. 2018: in 21 of 26 venues (81%) a significant transfer of UFP was seen from smoking room to non-smoking room, exceeding PNC at street by a factor >2

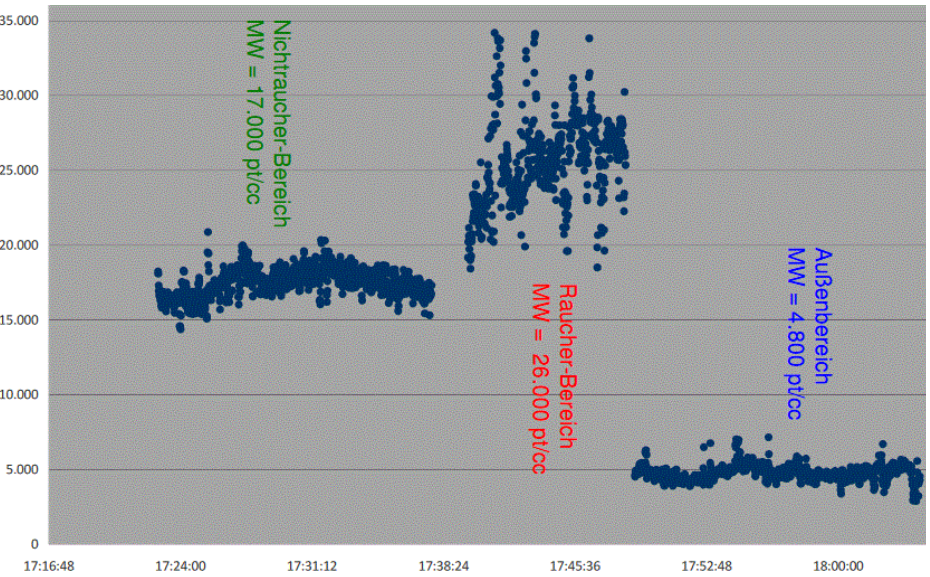


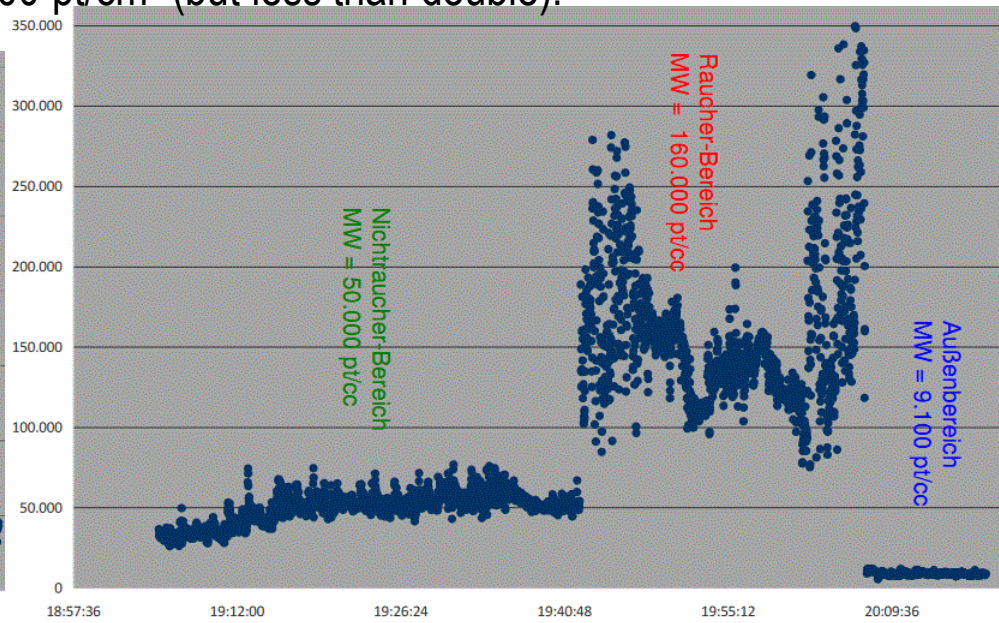


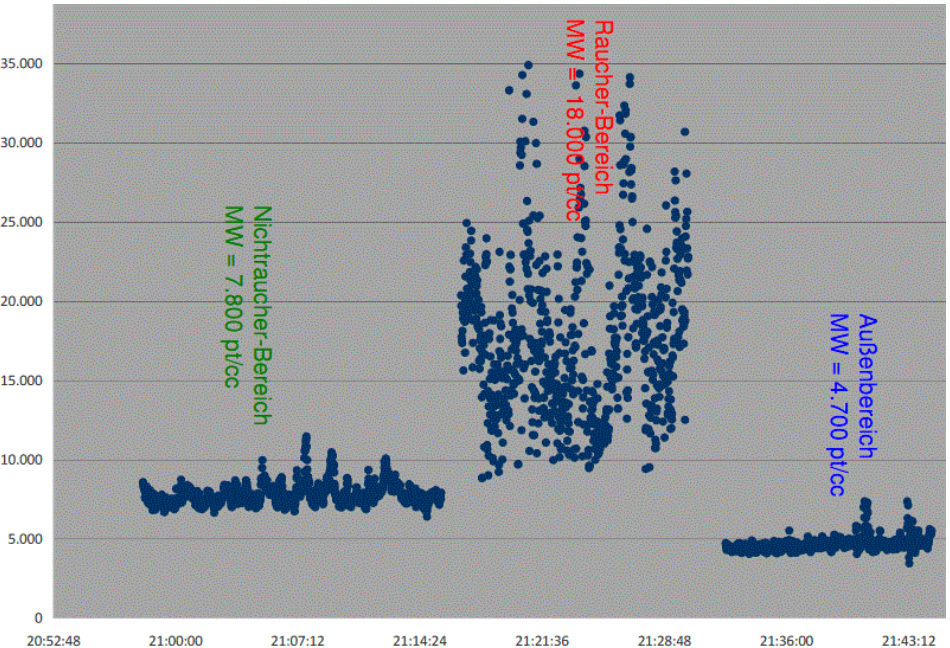


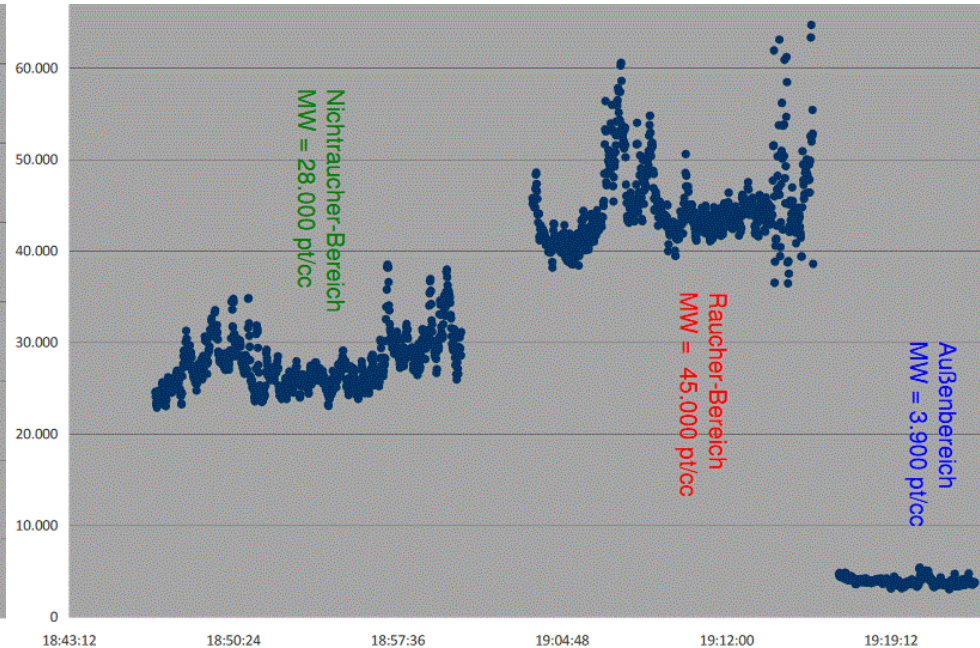


Lower Austria, Nov.-Dec. 2018. In 14 of 20 venues (70%) high transfer of UFP (> double street PNC) and in 5 venues PNC exceeded street level by > 3000 pt/cm³ (but less than double).

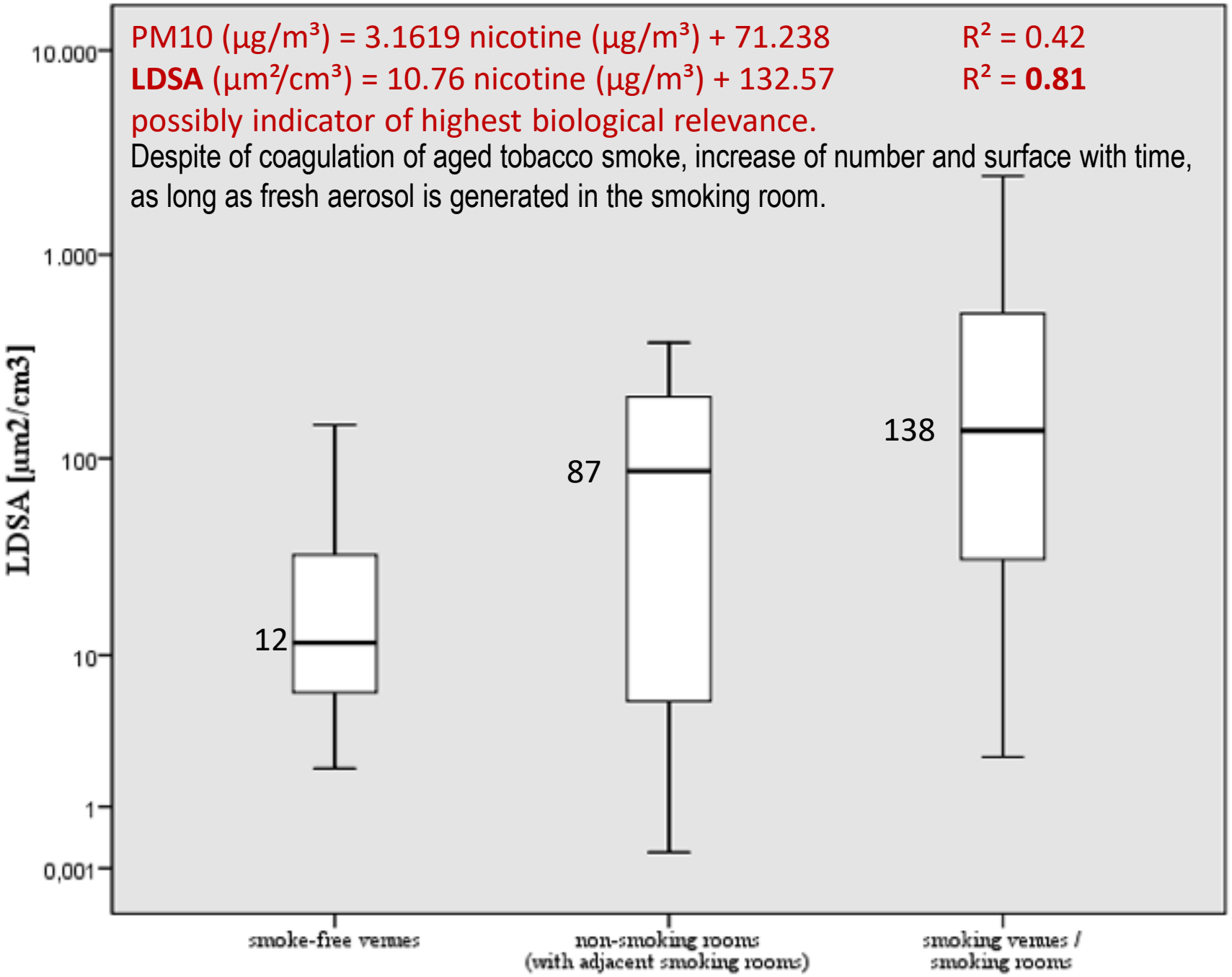


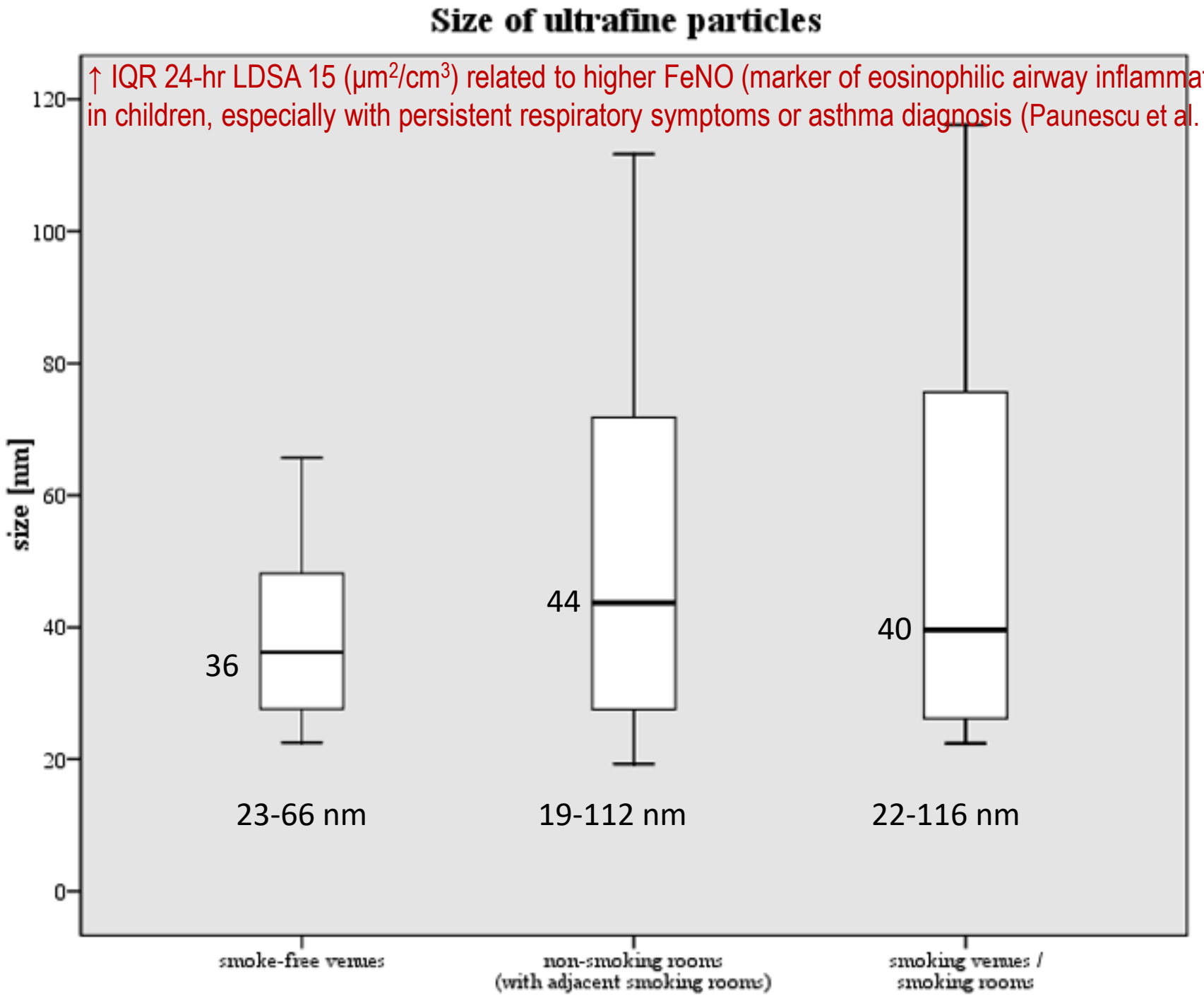






Lung deposited surface area (LDSA) of ultrafine particles




Size of ultrafine particles
↑ IQR 24-hr LDSA 15 (μm²/cm³) related to higher FeNO (marker of eosinophilic airway inflammation) in children, especially with persistent respiratory symptoms or asthma diagnosis (Paunescu et al. 2019).
size [nm]
120
100
80
60
40
20
0
36
44
40
23-66 nm
19-112 nm
22-116 nm
smoke-free venues
non-smoking rooms (with adjacent smoking rooms)
smoking venues / smoking rooms

CONCLUSIONS

Fine particle mass, UF particle number & surface increase with number of smokers

Outdoor $PM_{2.5}$ concentrations in busy streets are exceeded ~10-fold in smoking rooms

~ 2-fold in nonsm. rooms

Compared to median concentrations in non-smoking venues :

$PM_{2.5}$ outdoors ~ 2-fold, nonsm. room ~ 5-fold, smoking room ~ 25-fold

particle surface: nonsm. room ~ 7-fold, smoking room ~ 11-fold

particle number: nonsm. room ~ 3-fold, smoking room ~ 9-fold

Significant correlations: $PM_{2.5}$ outdoor / non-smoking venue

PN, LDSA, $PM_{2.5}$ smoking room / non-smoking room

LDSA / air nicotine

CONCLUSIONS FOR POLICY

Partial smoking bans failed

Chronic exposure dangerous for healthy persons (waiters)

e.g. doubling lung cancer risk within 8 years

Acute exposure dangerous for risk groups (guests + children)

highest risk for patients with coronary disease or asthma

Separation insufficient, second hand smoke in „smokefree“ rooms

non-smoking sign pretends a safety, which is not given, nicotine, cotinine, NNAL in urine of guests (+ children), guests of non-smoking hotel rooms: 3-ethenylpyridine

Cardiac,cerebrovascular & respiratory disease decrease post-ban

Crystal & Glantz 2012, Millet et al. 2013, Sims et al. 2013, Been et al. 2014, Hoffmann & Tan 2015, Fischer et al. 2015, Frazer et al. 2016, Faber et al. 2017, Mayne et al. 2018, Xiao et al. 2019,….

Vienna filed a lawsuit against the Austrian government at the Institutional Court