

Ges. f. Hygiene, Umwelt- u. Präventivmedizin 2011: „Gesunde Umwelt - Gesunde Bevölkerung“

### Feinstaubmasse, -oberfläche und Partikelzahl in Wiener Gaststätten

Mass, surface and number of particles in the hospitality industry of Vienna

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Pletz H, Neuberger M: No Borders for Tobacco Smoke in Hospitality Venues in Vienna. *Atmosphere* 2011, 2: 171-181.

Vienna (district 1-9), 112 well frequented venues, 133 unannounced air measurements in breathing zone of guests, during busy hours (20 min per sample), Feb to Oct 2010. Laser particle counter (OPC1.108, Grimm®): PM<sub>10</sub>, PM<sub>2.5</sub>, PM<sub>1</sub>; rel.humidity; floor space

PM<sub>2.5</sub> (µg/m<sup>3</sup>) WHO-AQG (99.perc.): 25 µg/m<sup>3</sup>

median	23.5	265.0	6.9	67.6	241.3	282.4
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PM<sub>2.5</sub> median (µg/m<sup>3</sup>) bars 443.7, clubs/discos 421.1, pubs 147.7, cafes 106.1, restaurants 23.4  
Increase with number of smokers (p<0.01). No sign. change with tea lights, open doors.  
48% of venues visited did not comply with the law: 93% of venues with 50 – 80 m<sup>2</sup> floor space  
64% of venues with > 80 m<sup>2</sup> floor space

Label	Percent
no label	~18%
non-smoking venue	~22%
mixed type venue	~38%
smoking venue	~22%

Type	Percent
non-smoking venue	~18%
mixed type venue	~25%
smoking venue	~57%

### PM<sub>2.5</sub> in a cafe restaurant in Vienna, measured simultaneously

by identical instruments

- Lokal indoor
- Straße outdoor

New, powerful ventilation system could not prevent PM<sub>2.5</sub> increase in the morning with first smoking guest. Ventilation does not work before the last smoker left: Outdoor conc. reached again at 4:00 a.m.

Day	Time	mean first floor indoor (smoking room) (µg/m <sup>3</sup> )	mean outdoor (street) (µg/m <sup>3</sup> )
Wednesday	12-24h	447.2	35.9
Thursday		258.3	31.9
Friday		282.8	17.1
Saturday	0-14h	82.7	5.4

µg/m<sup>3</sup> PM<sub>2.5</sub> in large, well ventilated non-smoking room, separated by glass door

table next to door: peaks like in smoking room

table most distant from door

### Parallel measurements of fine particles and nicotine in Viennese bars, pubs, cafes and restaurants (Moshhammer et al.)

PM10 - Nik (µg/m<sup>3</sup>)

$$y = 3.5819x + 71.238$$

$$R^2 = 0.4159$$

Surface µm<sup>2</sup>/cm<sup>3</sup> Oberfl. - Nik

$$y = 10.76x + 132.57$$

$$R^2 = 0.9354$$

PAH	0,28
PM10	0,42
P-surf.	0,81

Highest correlation of nicotin with active particle surface: **ultrafine particles**


→ supplement OPC (Grimm) by Diffusion Size Classifier (Matter Aerosol)

New series of parallel measurements (Schietz A, Slavik V):

- OPC 1.108 for mass only (PM<sub>1</sub>, PM<sub>2.5</sub>, PM<sub>10</sub>): 0.3 – 20 µm
- MiniDISC for particle number & chargeable surface area\*: 0.01 – 0.3 µm

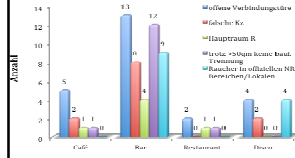
Nov. 2010 (4 months after deadline for separation of smoking/non-smoking rooms) to May 2011 (data shown for 114 rooms in 51 bars/pubs, 16 cafés, 14 restaurants, 7 discotheques)

\*Correlation with lung deposited surface area (particle surface area conc. per unit volume of air, weighted by the deposition probability in the lung, calculated according to ICRP 94 (Asbach et al. 2009. J Nanopart Res 11:101–109)

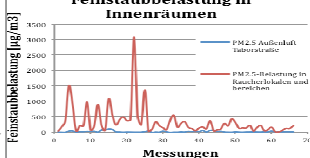


PM calibrated by FH 62 I/R (Beta attenuation) used outdoors

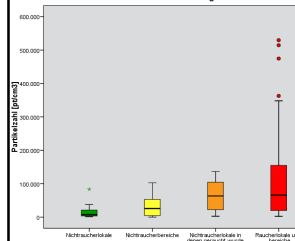
**Gesetzesverstöße**



**Einfluss der Außenluft auf die Feinstaubbelastung in Innenräumen**



**Ultrafeinstaubbelastung**



	NR-Lokal	NR-Raum	R-Lokal	R-Raum
Median	7 408	25 973	66 011	
UFS (pt/cm <sup>3</sup> )				
PM2.5 (µg/m <sup>3</sup> )	6,7	34,2	172,3	

WHO-Leitwert 25 (TMW) nur in 36% der NR-Räume

Im Raucherbereich bis >500 000 pt/cm<sup>3</sup>  
Angrenzender NR-Bereich bis >100 000 pt/cm<sup>3</sup>


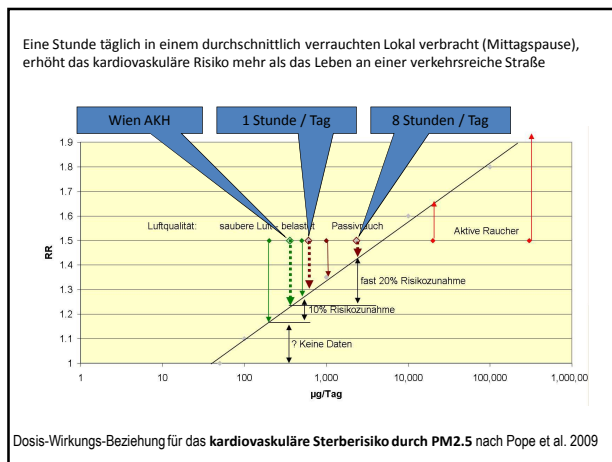
	diameter (nm)			surface (µm <sup>2</sup> /cm <sup>3</sup> )			PM <sub>1</sub> (µg/m <sup>3</sup> )			
	perc.	25.	50.	75.	25.	50.	75.	25.	50.	75.
Smoking	27	40	76	33	163	579	93	180	390	0.96
„Smokefree“ room	28	44	72	6	87	201	16	34	88	0.87
venue	28	36	47	7	12	33	4	6	14	0.63

PM<sub>1</sub>/PM<sub>10</sub>

Some overestimation of diameter, but only particles <300 nm counted

lung deposited surface area: possibly indicator of highest biological relevance. Despite of coagulation of aged tobacco smoke increase of number and surface with time, as long as fresh aerosol is generated in the smoking room

Most discriminative. Some underestimation

### Conclusions

**Partial smoking bans failed** (Spanish tobacco law amended 2010)

Austria violates article 8 of the WHO - FCTC

Separation insufficient, second hand smoke in „smokefree“ rooms

PM<sub>1</sub> most discriminative. PM<sub>2.5</sub> shows health risk: chronic (waiters) acute: asthma, heart attack, stroke

Chronic cardiovascular mortality (Pope et al. 2009) from PM<sub>2.5</sub> dose in Vienna:

- + 7% from outdoor pollution in inner districts
- +19% from 8 hours in average hospitality venue for smokers

More use should be made in epidemiological studies from number concentration and lung deposited surface area

- Fuchs' surface – acute lung function impairments in pupils, increase of symptoms in children with asthma.
- (Moshammer & Neuberger 2004. Atmos Environ 37: 1737-44)

Conclusions for policy: [www.aerzteinitiative.at](http://www.aerzteinitiative.at)

**INITIATIVE ÄRZTE GEGEN RAUCHERSCHÄDEN**  
AUSTRIAN COUNCIL ON SMOKING AND HEALTH