

## Field note

## Night entertainment venues comply poorly with the smoke-free law in Chile

Armando Peruga<sup>a,b,c,d,\*</sup>, Marcela Fu<sup>b,c,d,e</sup>, Xaviera Molina<sup>a</sup>, Esteve Fernández<sup>b,c,d,e</sup><sup>a</sup> Center for Epidemiology and Health Policy, Facultad de Medicina Clínica Alemana, Universidad del Desarrollo, Santiago, Chile<sup>b</sup> Tobacco Control Research Group, Bellvitge Biomedical Research Institute (IDIBELL), L'Hospitalet de Llobregat, Barcelona, Spain<sup>c</sup> Tobacco Control Unit, Cancer Control and Prevention Program, WHO Collaborating Centre for Tobacco Control, Institut Català d'Oncologia (ICO), L'Hospitalet de Llobregat, Barcelona, Spain<sup>d</sup> CIBER of Respiratory Diseases (CIBERES), Spain<sup>e</sup> School of Medicine and Health Sciences, Campus de Bellvitge, University of Barcelona, L'Hospitalet de Llobregat, Barcelona, Spain

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## ABSTRACT

The initial high level of compliance with the Chilean comprehensive national smoke-free law in 2013 is fading, particularly in the hospitality sector. This paper draws attention to how using a simple and low-cost surveillance inquiry may help focus on the use of scarce inspection resources to improve compliance with the law in the hospitality sector. We conducted a cross-sectional assessment of second-hand smoke exposure in night entertainment venues in Santiago, Chile, by measuring particulate matter of less than 2.5  $\mu\text{m}$  ( $\text{PM}_{2.5}$ ). Smoking where prohibited by law was observed in 36% of the venues visited. Venues where smoking was spotted at the time of the observation had a median  $\text{PM}_{2.5}$  concentration 13 times higher than background concentration on the street. The study shows that a targeted approach for inspection to find pockets of venues with suboptimal compliance is feasible and affordable.

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## Los locales de entretenimiento nocturno cumplen mal la Ley de ambientes libres de humo en Chile

## RESUMEN

El alto nivel inicial de cumplimiento de la Ley integral chilena de ambientes libres de humo de 2013 se está desvaneciendo, particularmente en el sector de la restauración. Este documento muestra cómo una encuesta de vigilancia simple y económica puede ayudar a mejorar el uso de recursos de inspección escasos para mejorar el cumplimiento de la ley en dicho sector. Se realizó una evaluación transversal de la exposición al humo de tabaco ajeno en locales de entretenimiento nocturno en Santiago, Chile, midiendo el nivel de partículas menores de 2,5  $\mu\text{m}$  ( $\text{PM}_{2.5}$ ). En el 36% de los locales visitados se fumaba donde lo prohíbe la ley. Los locales en los que se fumaba tenían una concentración mediana de  $\text{PM}_{2.5}$  13 veces mayor que la concentración en la calle. El estudio muestra que una vigilancia enfocada en la inspección de lugares con cumplimiento subóptimo es factible y asequible.

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## Introduction

A national comprehensive smoke-free legislation came into force in Chile in 2013.<sup>1</sup> It banned smoking in all enclosed and semi-enclosed areas of all workplaces and public places, including the hospitality sector.

The enforcement efforts during the year following the entry into force of the current smoke-free legislation led to a high compliance with the law, overall and in the hospitality sector,<sup>2</sup> which was associated with a sudden and significant decline of myocardial

infarction in 2014.<sup>3</sup> These efforts included a surge of inspections in 17,406 of the approximately 40,000 existing venues in the hospitality sector in the country.<sup>4</sup>

Presently enforcement efforts in Chile are fading. By 2016, last year for which governmental enforcement information is available, smoke-free law inspections in hospitality venues were cut in half (8196) while the number of annual public health control activities was in that year similar to that of 2013.<sup>4</sup> Moreover, the WHO reported that, compared to 2014, the compliance with the smoke-free law in the hospitality sector in 2018 remained substantial but had declined.<sup>5</sup> These data raise questions about how enforcement of the Chilean smoke-free law can be improved. This paper draws attention to how using a simple and low-cost surveillance inquiry may help focus the use of scarce inspection resources to improve compliance with the law in the hospitality sector.

\* Corresponding author.

E-mail address: [aperuga@udd.cl](mailto:aperuga@udd.cl) (A. Peruga).

## Approach

We suspected that there remained significant pockets of non-compliant places in the hospitality sector, where venues are expected to be less compliant, based on previous international evidence.<sup>6</sup> Within the hospitality sector, we assumed that the venues most likely to be non-compliant would be those catering to young adults and operating outside regular office hours in which inspectors are much less likely to conduct routine inspections.

We conducted a cross-sectional exposure assessment of night entertainment venues in two well-known areas of concentration of this commercial activity in the Greater Santiago, Chile, in November 2018. Eligible venues were establishments making their revenue mostly from the sale of beverages, including alcoholic drinks, although customers may also consume small dishes and appetizers. Venues included bars, pubs, cabarets, night-clubs, and discos, opened at least between 00:00 and 3:00 on Fridays, Saturdays, and Sundays.

To identify potential participating venues, a sampling frame of establishments was constructed, based on information provided by students of our university or available on the internet. We listed a total of 128 potential venues, of which we selected randomly 30. In each selected venue, we measured levels of respirable particles  $\leq 2.5 \mu\text{m}$  in diameter ( $\text{PM}_{2.5}$ ), a well-established marker of tobacco smoke.<sup>7</sup> We used three TSI SidePak AM510 Personal Aerosol Monitors, hand-held optical instruments that monitor particle size and mass concentration in real-time. They were set to a one-second sampling interval. The three monitors were previously calibrated in an experiment with a gravimetric BAM-1020 instrument that measures and records airborne particulate concentration levels using the principle of beta-ray attenuation. The calibration factors derived from the experiments were 0.37, 0.39, and 0.39 for each of the monitors.

Six trained observers entered incognito each venue in pairs and sampled the air for at least 30 minutes, moving discreetly around the public areas of the establishment, avoiding getting too close to active sources of particulate matter, such as people actively smoking or kitchen entrances if there were any. Observers recorded if there was any tobacco smoking at the time of the visit. The total

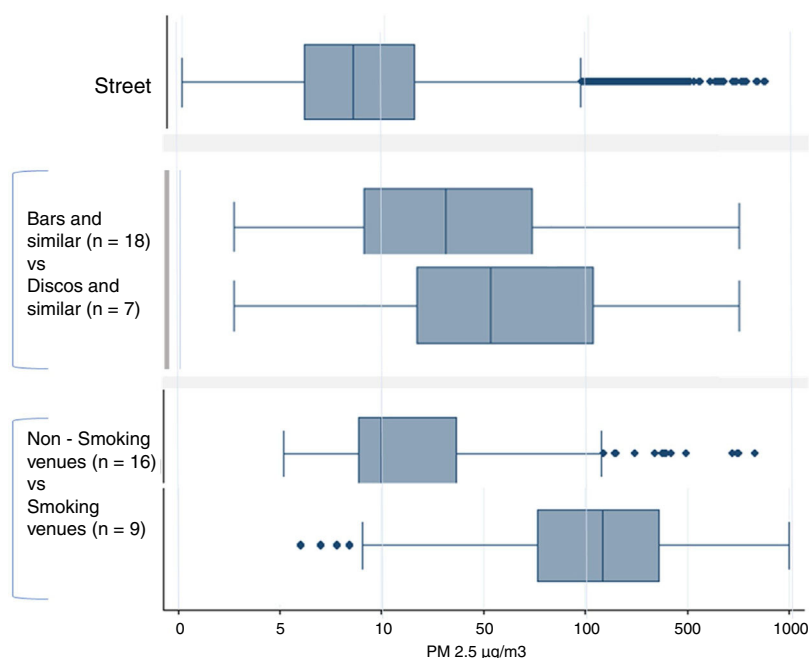
number of smokers could not be recorded, given that many venues were very dimly lighted, and not all areas of the venues could be visited without being noticed or causing security concerns. Only the data from 25 of the 30 selected venues are reported because the data from four venues were not logged-in appropriately, and the data from one was discarded since the air was contaminated with stage fog, which raised the level of particulate matter spuriously. The air from streets surrounding each of the venues was also sampled concurrently for about 20 minutes to set the background  $\text{PM}_{2.5}$  concentration for comparison purposes.

We used boxplots to describe medians (M) and interquartile ranges (IQR) of  $\text{PM}_{2.5}$  concentration ( $\mu\text{g}/\text{m}^3$ ) in the venues, overall and stratified by selected characteristics. We compared median  $\text{PM}_{2.5}$  concentration by these characteristics and with background levels using non-parametric Kruskal-Wallis and U-Mann Whitney tests, at a 5% significance level.

## Results

Smoking where prohibited by law was observed in 36% of the venues visited. Figure 1 presents the boxplots of  $\text{PM}_{2.5}$  concentration separately for venues where smoking was and was not observed, by type of venue (bars, pubs, and cabarets vs. discos and nightclubs) and on the street, which served as a reference benchmark. The median  $\text{PM}_{2.5}$  concentration on the street was  $9 \mu\text{g}/\text{m}^3$  (IQR:  $5\text{--}22 \mu\text{g}/\text{m}^3$ ). In non-smoking venues (those where smoking was not spotted at the time of the observation), the median  $\text{PM}_{2.5}$  concentration (M =  $13 \mu\text{g}/\text{m}^3$ ; IQR:  $7\text{--}26 \mu\text{g}/\text{m}^3$ ) was 1.4 times higher than on the street. In smoking venues (those where smoking was witnessed at the time of the observation), the median  $\text{PM}_{2.5}$  was more than 13 times higher (M =  $122 \mu\text{g}/\text{m}^3$ ; IQR:  $58\text{--}230 \mu\text{g}/\text{m}^3$ ) than on the street. Differences between median  $\text{PM}_{2.5}$  concentration in smoking and non-smoking venues were statistically significant.

We also compared the median  $\text{PM}_{2.5}$  concentration in venues where dancing is their signature activity, such as discotheques and nightclubs, with that in the rest of venues. Compared to the street, the median value of  $\text{PM}_{2.5}$  was three times higher in bars and similar venues (M =  $27 \mu\text{g}/\text{m}^3$ ; IQR:  $10\text{--}78 \mu\text{g}/\text{m}^3$ ) and more than five



**Figure 1.** Distribution of  $\text{PM}_{2.5}$  concentration ( $\mu\text{g}/\text{m}^3$ ), on a logarithmic scale, by type of venue compared to baseline street levels.

times higher in disco and night club venues ( $m = 47 \mu\text{g}/\text{m}^3$ ; IQR:  $19\text{--}165 \mu\text{g}/\text{m}^3$ ) (all  $p$  values  $< 0.001$ ).

## Discussion

Chile introduced a comprehensive smoke-free law when the smoking prevalence was still high ( $>35\%$ ) compared to when other countries introduced similar national or subnational laws that were almost self-enforcing. Countries with higher smoking prevalence, although having reasonable overall compliance with smoking bans, tend to have more compliance issues<sup>8</sup> in some sectors or pockets of venues, particularly in the hospitality sector. Hence the importance of an effective enforcement infrastructure and effort.

The results of our approach show that finding pockets of venues with suboptimal compliance is possible. In the case of Chile, we were able to point out the night entertainment venues not only as a type of business with a significant proportion of noncompliant venues (36%), but also with harmful levels of  $\text{PM}_{2.5}$ , 13 times above the background street levels. WHO Air Quality Guidelines consider that long-term breathing of air with  $\text{PM}_{2.5}$  concentration above  $10 \mu\text{g}/\text{m}^3$  (annual outdoor average) significantly increases the mortality of exposed persons.<sup>9</sup>

The same approach can be followed to find additional pockets of non-compliance. For example, anecdotal evidence points to the need for finding such pockets in higher education institutions and small-size workplaces, or among specific administrative subnational jurisdictions.

Until now, a massive effort to inspect all types of venues in the hospitality sector has had limited results in decreasing the self-reported proportion of exposure to second-hand smoke at workplaces.<sup>10</sup> However, this study shows that a simple and affordable approach—the cost of this study, personnel expenses, and entry fees to venues, was approximately USD 700—targeting clusters of venues at high risk for violation of the smoke-free law may improve the use of scarce local inspection time and resources.

## Editor in charge

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## Authorship contributions

A. Peruga: conceptualization, investigation, formal analysis, and writing original draft preparation. M. Fu: methodology, resources, and writing, reviewing and editing. X. Molina: conceptualization,

investigation, data curation, and writing, reviewing and editing. E. Fernández: methodology, resources, and writing, reviewing and editing.

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## Conflicts of interest

None.

## References

- Ley por la que se modifica la ley n.º 19.419, en materia de ambientes libres de humo de tabaco. L. N.º 20660/2013 (8 de febrero de 2013).
- World Health Organization. Report on the global tobacco epidemic 2015. Geneva: World Health Organization; 2015. 103 p.
- Nazzari C, Harris J. Lower incidence of myocardial infarction after smoke-free legislation enforcement in Chile. *Bull World Health Organ.* 2017;95:674–82.
- DEIS. Actividades de la Autoridad Sanitaria (SEREMI) registradas en el sistema Rakin. Años 2011–2017. Santiago (Chile): Departamento de Estadísticas e Información de Salud. (Accessed 18/03/2020.) Available at: <http://www.deis.cl/estadisticas-seremi/>.
- World Health Organization. Report on the global tobacco epidemic 2019. Geneva: World Health Organization; 2019. 209 p.
- International Agency for Research on Cancer. Handbooks of cancer prevention, tobacco control, volume 13. Evaluating the effectiveness of smoke-free policies. Lyon Cedex: IARC; 2009. 335 p.
- Fu M, Martínez-Sánchez J, Galán I, et al. Variability in the correlation between nicotine and  $\text{PM}_{2.5}$  as airborne markers of second-hand smoke exposure. *Environ Res.* 2013;127:49–55.
- Perkins R, Neumayer E. Adoption and compliance in second-hand smoking bans: a global econometric analysis. *Int J Public Health.* 2014;59:859–66.
- World Health Organization. Air quality guidelines—global update 2005. Geneva: WHO; 2005. 484 p.
- MINSAL. Encuesta Nacional de Salud 2016–2017: primeros resultados. Santiago (Chile): Ministerio de Salud Pública. (Accessed 18/03/2020.) Available at: <https://www.minsal.cl/wp-content/uploads/2017/11/ENS-2016-17.PRIMEROS-RESULTADOS.pdf>.