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The efficacy of different models of smoke-free laws in reducing exposure to second-hand smoke: A multi-country comparison

Mark Ward[a,b,*], Laura M. Currie[a,c], Zubair Kabir[a,d], Luke Clancy[a]

[a] TobaccoFree Research Institute, The Digital Depot, Thomas Street, Dublin 8, Ireland
[b] School of Social Work and Social Policy, Trinity College Dublin 2, Ireland
[c] Division of Population Health Science, Royal College of Surgeons in Ireland, Mercer Street Lower, Dublin 2, Ireland
[d] Department of Epidemiology and Public Health, University College, Cork, Ireland

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ABSTRACT

Exposure to second-hand tobacco smoke is a serious public health concern and while all EU Member States have enacted some form of regulation aimed at limiting exposure, the scope of these regulations vary widely and many countries have failed to enact comprehensive legislation creating smoke-free workplaces and indoor public places. To gauge the effectiveness of different smoke-free models we compared fine particles from second-hand smoke in hospitality venues before and after the implementation of smoking bans in France, Greece, Ireland, Italy, Portugal, Turkey, and Scotland.

Data on $PM_{2.5}$ fine particle concentration levels were recorded in 338 hospitality venues across these countries before and after the implementation of smoke-free legislation. Changes in mean $PM_{2.5}$ concentrations during the period from pre- to post-legislation were then compared across countries.

While a reduction in $PM_{2.5}$ was observed in all countries, those who had enacted and enforced more fully comprehensive smoke-free legislation experienced the greatest reduction in second-hand tobacco smoke.

Comprehensive smoke-free laws are more effective than partial laws in reducing exposure to second-hand tobacco smoke. Also, any law, regardless of scope must be actively enforced in order to have the desired impact. There is continued need for surveillance of smoke-free efforts in all countries.

1. Introduction

Second-hand smoke (SHS), also known as Environmental Tobacco Smoke (ETS), contains over 4000 chemicals, more than 50 carcinogens and many toxic substances [1]. Increased exposure to SHS is associated with greater risk and there is no safe level of exposure [1,2]. Chronic exposure to SHS causes many of the same diseases as active smoking, increasing the risk of lung cancer by 20–30% and of coronary heart disease by 25–30% among non-smokers who live with smokers [3]. In addition, SHS is associated with respiratory diseases and exacerbates the symptoms of asthma, allergies, and chronic obstructive pulmonary disease. Infants, young children, and pregnant women are particularly vulnerable to the harm caused by SHS exposure. Within the EU25 in 2002, it was estimated that 79,449 deaths were attributable to SHS exposure, with a quarter (19,242) of these deaths occurring among non-smokers [4].

* Corresponding author at: School of Social Work and Social Policy, Trinity College, Dublin 2, Ireland. Tel.: +353 1 8962718.
E-mail addresses: wardm2@tcd.ie, wardm01@gmail.com (M. Ward), lauracurrie@rcsi.ie (L.M. Currie), z.kabir@ucc.ie (Z. Kabir), lclancy@tri.ie (L. Clancy).

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All EU Member States have enacted some form of regulation aimed at limiting exposure to SHS, however the scope of these regulations vary widely. Many countries have failed to enact comprehensive legislation compliant with Article 8 of the World Health Organisation's Framework Convention for Tobacco Control (FCTC) which obligates Parties, including the EU and many of its Member States, to take effective steps to provide protection from exposure to SHS [5].

Many of the strategies proposed for evaluating the effectiveness of smoke-free policies [2,6,7] recommend that levels of exposure to SHS be monitored in order to measure the anticipated reduction in environmental tobacco smoke. This is key to evaluating smoke-free policies as a means of protecting workers from exposure to harmful SHS. A number of countries adhered to these proposals and have recorded atmospheric particulate matter in various settings where individuals were exposed to SHS. Specifically, many of these studies have measured particulate matter with a diameter of approximately 2.5 micrometres ($PM_{2.5}$), which has become a widely used marker of ETS [8]. Of interest for this project were measurements taken in hospitality venues, such as bars/pubs, restaurants, night clubs/discos.

The seven countries considered in this study are classified as having implemented either comprehensive or partial smoke-free laws as defined by the EC Green Paper 'Towards a Europe free from Tobacco Smoke' [9]. Of the seven countries included in the current study, five (France, Ireland, Italy, Scotland, and Turkey) were classified as having comprehensive smoke-free laws in place at the time $PM_{2.5}$ measurements were recorded and two (Greece and Portugal) were classified as having partial laws in place. According to the criteria, France and Italy should both be defined as having partial laws given allowances in their legislation for designated smoking areas in hospitality venues. However, their regulations to permit a business to designate a smoking area were prohibitive making the provision of smoking rooms impractical.

There have been a number of studies conducted that have illustrated the positive impact of smoke-free laws on concentrations of SHS [10–22]. In the main studies to date have focused on individual countries, though a comparison of reported results are suggestive of a greater impact from comprehensive smoke-free laws on levels of indoor ETS compared to partial laws. The aim of the current study is to compare the impact that comprehensive and partial models of smoke-free legislation in different European countries have on exposure to SHS, particularly in the hospitality sector. A secondary aim is to gauge whether support for the notion that France and Italy have de facto comprehensive laws is warranted.

The current study is one of the first to directly compare measured SHS concentrations across European countries with the explicit intention of gauging the relative impact of the various levels of smoke-free laws that have been implemented across these states. It is hoped that the findings presented here will be of considerable value not only to countries that are contemplating introducing smoke-free laws for the first time but also to countries where less than comprehensive laws exist and who recognise the need to comply with the EC regulations and Article 8 of WHO FCTC and may therefore be considering changing their laws.

2. Materials and methods

2.1. Data

The current paper draws together data from studies which have sought to measure the impact of smoke-free laws on reducing exposure to SHS in hospitality venues in six EU Member States and Turkey [10–22]. Data on $PM_{2.5}$ concentrations were identified in France, Greece, Ireland, Italy, Scotland and Portugal. For each of these countries, local tobacco control experts who were involved in the data collection provided the Tobacco Free Research Institute (TFRI) research team with original datasets containing $PM_{2.5}$ concentration levels as well as other details on how the data were gathered. In the case of Turkey, local tobacco control experts were also commissioned by TFRI to measure $PM_{2.5}$ concentrations in 12 hospitality venues in Ankara and Izmir in September 2010.

In France, Ireland, Italy, and Scotland there were two data collection points, one before the introduction of smoke-free legislation and follow-up measurements taken after implementation. There was no data on $PM_{2.5}$ concentrations available from Portugal before the implementation of their smoke-free laws. The two data points that were available are from April 2009 and July 2010, both after implementation of smoke-free legislation.

While a study protocol and sample information sheet was provided to the data collection team in Turkey, the other data had already been collected and this resulted in different methodological detail being available from different countries. For example, it is important to have information on the number of customers smoking at the time $PM_{2.5}$ concentrations are recorded as this is of course useful when attempting to explain the level of SHS present. While this information is more obviously important in countries with partial smoke-free laws as it helps distinguish between venues where smoking is permitted and those where it is prohibited, it is equally important for countries with comprehensive smoke-free laws to report this information. Table 1 provides information on the date smoke-fee was introduced in each country; classification of the ban as comprehensive or partial; the date(s) of pre-ban data collection; the date(s) of post-ban data collection; the number and type of venues included; the sampling strategy employed; the type of air monitor used; the length of time over which measurements were recorded; and the source of data from each country. Details of the calibration factor used to convert the logged nominal instrument readings from uncorrected milligrams per cubic metre to actual micrograms per cubic metre ($\mu g/m^3$) of $PM_{2.5}$ are also shown.

Data for Ireland were collected as part of a study by Goodman et al. [13] that examined the impact of the legislation on both the air quality of 42 pubs in Dublin and respiratory health effects in bar workers. Venues were representative of the different types of public houses found in the city of Dublin having been selected to encompass a wide variety of building structures and clientele, size,